

# Thank you for the privilege

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Thank you for the privilege to serve as the EFOST President.

I am deeply humbled for having been selected to serve as the new President of EFOST: this is not for the work that I have undertaken, but for what others around me have done.

I hope that my past duties as President of BOSTAA, and as president of the Sports and Exercise Medicine of the Royal Society of Medicine will help me in performing these my new duties.

It all started in 1992, and the EFOST is now just leaving its adolescent phase, with all its teenager problems.

There is truth in Newton's quote about standing on the shoulders of giants. Francois, you and the other leaders at EFOST have generated the momentum to keep moving EFOST forward, and the wisdom to keep it moving in the right direction. We all benefited from your contributions, dedication and volunteerism.

To step into this role feels a little like steering a train. EFOST operates under a strategic plan which sets our direction and controls how the changing succession of leaders navigates. This plan is critical to helping us maintain focus, direction, and purpose.

It is crucial that we focus on our strategic direction. However, we must continue to monitor the environment around us. We must recognize the changing influences so that we can respond appropriately. Europe is in a state of flux, with great challenges, both scientifically and economically. Strategically, we recognized all this a while ago, and we have tried, and succeeded, to be inclusive. The policy has worked, and we have embraced, and we have been embraced, by several countries during Dr Kelberine's tenure. I can only thank him and the Board for this vision, and can confirm that I wish this train to continue to move in this direction.

A train can only move if it is on the right tracks: I look forward to work with the great engineers of the organization, and welcome the help of the Board of Trustees to keep us on track.

EFOST was born as a get together of a group of friends, and is the baby that was born from the ideas and ideals of several individuals who are in this room today. To them, my thanks for such ideas and ideals, and an assurance: I wish to uphold them. EFOST will need to move forward, and to ensure that the needs of the Sports Trauma Societies which form, sustain, foster and nurture it are satisfied. For this, one of the charges given to me was to change the bylaws. The process was thorny, but the results have been here for all to see: a flexible, dynamic Executive Board, and a Board at Large which is really representative of all Europe. From you, I expect support. To you, I offer dedication.

The life of a President is often lonely. I am a social animal, and I do not wish to be lonely. I intend to use the help and advice of my Past President, Francois, and to have the support of my Vice President, Gernot. I take this opportunity to thank them in advance, and to apologise to them in advance: I know that it is difficult to work with me. I want things yesterday, and, despite 28 years outside of Italy, my Italian quick fire temper can still surface.

EFOST is a great organization, and it has forged great links. You have all seen how the work that Burt has undertaken and the endless meetings that Francois has held have borne fruits: the EFOST-AOSSM traveling fellowship is now a reality, and the support given by all of you on the Board has been superb: many thanks.

One of our Past Presidents, Paco Biosca, is now the Chief Medical Officer of Chelsea: with him, we have succeeded in establishing a football Team Physician fellowship, and we look forward to strengthening these ties.

More on fellowships during the years of my tenure. But remember: it will not be my doing, it will be the work of all of you, of all of us.

EFOST will need to speak with one voice to the world and the sister organizations. In Europe, we have all too often projected the wrong image of weak leadership and of having more than one train controller. The work that Francois has undertaken has ensured that everybody on the Executive Board sang from the same hymn sheet, and that the front that EFOST presents is united and strong. I intend to continue along these lines: too many at the helm is never too good. Each two years, there can only be one.

No doubt somebody and some organizations will feel challenged. Let me remind all of you that EFOST was never on a conquest trip: EFOST wants to build bridges, not to burn them. EFOST wants to have friends, not enemies. EFOST wants a friendly efficient network, not destructive wars.

We are grateful to our mother, EFORT, and we thank it for its support.

We are close to our sister organisation, ESSKA, and we welcome its President to our Congress: Thank you, Joao.

ISAKOS has graced us with unending support: we thank Philippe Neyret, the President Elect, for having graced us with such great scientific input.

ECOSEP is a natural sister organisation and ally: Nikos, you are welcome amongst us today.

Communication is always important: my thanks will have to be conveyed to Dr Doral and Dr Mann and their team for

the Newsletter. Only if you have never read it will you ignore the endless hours that Mahmut and Gideon put into it: to them, my vote of thanks.

A scientific organization cannot progress without a journal. You all know about Muscles, Ligaments and Tendons Journal (MLTJ), the official journal of EFOST and ISMuLT. I intend to continue to be the Chief Editor of MLTJ, and I can just see the challenges ahead. Let me tell you: the first two years have been hard, and only now we are starting to see the evidence of the hard work that my Associate Editor, Dr Oliva, has undertaken. It is a baby. Its nourishing milk is the high quality work that it publishes. Unless EFOST and its members nurture it, it will not thrive. Unless we send work to it, it will not flourish. Unless we find funds to keep the spirit of EFOST going through it, it will not be: as the President of EFOST and as the Editor in Chief of MLTJ, I prompt you to keep it going. Please remember that all the abstracts of this congress are available, for free, on the MLTJ platform: please visit it, and contribute to the Journal.

An organization cannot survive without appropriate finances: many thanks, Jose, for having put in place the infrastructure for our safety and financial survival. I am sure that you will keep us right, and that you will reassure the membership that their dues are well spent.

We would not have been able to mount such a great congress without the help of our trade partners: to them, my thanks for the continuing support of EFOST.

We are now coming to the end of the WSTC – EFOST congress. GCO has helped us, and will continue to do so. Claudine, Simon: my thanks to you. In difficult personal circumstances, you have been close to EFOST, and you have believed in us. We look forward to continuing to work with you.

I look forward to continuing to work with the organisation of which I have been President, BOSTAA: the deep friendship that ties me to Roger, the outgoing president, and Mike, who will be president starting in a couple of hours, will make things easier.

This is an exciting time. Not just for me, as the new leader EFOST, but for all of you, for all of us. The opportunities are endless. I will work to ensure that, when my tenure is over and the new President will step into this role, he can see even farther down the tracks. The goal is to help usher the EFOST to a new place; not because we changed direction, but because we moved forward even faster.

Thank you again for this opportunity to serve you as president of EFOST. I appreciate your faith: I will do all I can to make these two years successful, enjoyable, and fun.

**Nicola Maffulli**

# High volume injection for Achilles tendinopathy

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**Introduction:** Achilles tendinopathy is a common cause of debilitating ankle pain, stiffness, swelling and weakness. It is thought that the pain originates from neovascularisation of the paratenon. High volume injection (HVI) into the paratenon under ultrasound guidance is thought to improve pain.

**Material and methods:** 24 patients underwent HVI at a university teaching hospital. Of these, 21 were available for follow up. Using the VISA-a questionnaire, differences in pain scores prior to and after HVI were obtained. All procedures and follow up ultrasound scan at 2-3 weeks were undertaken by the same clinician. All patients underwent the same rehabilitation protocol following intervention including eccentric Achilles exercises.

**Results:** there was a statistically significant increase in average VISA-a score from 23.26 (range 5-33) pre-intervention to 45.48 (range 14-60) following intervention ( $p=0.01$ ). 19/21 of patients (90%) felt they were very happy with the overall results. 1 patient relapsed and went on to have surgical decompression of the tendon.

**Conclusions:** the results show that the majority of patients were very satisfied with the procedure and follow up ultrasound demonstrated that the neo-vascularisation was markedly reduced in all cases, correlating with functional scores. Larger, prospective trials are needed to further quantify the effect of HVI.

# Achilles tendon ruptures: an analysis of a new physiotherapy rehabilitation programme at the Royal Devon and Exeter Hospital

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There are longstanding debates regarding surgical versus conservative management of Achilles tendon ruptures, however there is limited focus on rehabilitation. The authors initiated a specific rehabilitation programme in 2008 to unify the management and improve patient outcomes. We present the results at three and a half years.

In October 2008 management was streamlined under the foot and ankle surgeons and a dedicated physiotherapy service. Operative management used mainly the Achillon device (Integra) and the VACOPed boot with a specific rehabilitation protocol. We prospectively collected data on all patients with Achilles tendon ruptures from October 2008 to March 2012. There were 246 patients in total with four lost to follow up. 80 were treated with the Achillon system, 18 had an open repair and 144 were treated conservatively (of which 56 were partial or musculocutaneous junction tears).

Three patients sustained a re-rupture (1.2%), all initially treated conservatively: two due to further trauma and one twisting in the boot. They all then underwent Achillon fixations with good clinical outcomes. There were two operative complications (2%), both wound breakdowns. One patient required single wound debridement and closure whilst the second patient needed extensive VAC and plastic surgery intervention. Two patients suffered PE's (0.8%), confirmed on VQ scan or CTPA (one operative, one conservative). One non-compliant patient healed functionally long and required a shortening procedure.

The authors experience has been that using the VACOPed boot with our custom rehabilitation programme in dedicated physiotherapy clinics has produced improved results.

# Proprioception level after endoscopically guided percutaneous Achilles tendon repair

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**Purpose:** to evaluate ankle function following endoscopically guided percutaneous Achilles tendon repair. The hypoth-

esis of this study was that patients with percutaneous repair of the Achilles tendon would still display impaired involved side ankle proprioception.

Methods: nineteen male patients with percutaneous Achilles tendon surgery were tested for bilateral ankle active angle reproduction at 10° dorsiflexion and 15° plantar flexion, peak concentric isokinetic ankle dorsi- and plantar flexor torque, one-leg hop for distance, single leg vertical jump height.

Dominant sides of age and sex matched 19 healthy controls were evaluated for ankle active angle reproduction at 10° dorsiflexion and 15° plantar flexion, peak concentric isokinetic ankle dorsi- and plantar flexor torque. Results: peak isokinetic torque, one-leg hop for distance, single leg vertical jump for height and ankle joint position sense at 10° dorsiflexion did not differ between the affected and unaffected side. Ankle joint position sense for active angle replication at 15° plantar flexion revealed a significant side-to-side difference. Joint position sense at 10° dorsiflexion and at 15° plantar flexion at affected side was poor in patients compared with the controls while joint position sense at 10° dorsiflexion and at 15° plantar flexion at unaffected side was same in patients compared with the controls.

Conclusions: it has revealed a significant difference in joint position sense at plantarflexion of the patients at least one year after percutaneous Achilles tendon surgery compared to their unaffected limb. Large prospective longitudinal studies are needed to evaluate therapeutic interventions designed to improve proprioception.

## Arthroscopic treatment of the arthritic ankle of the soccer player at the end of his career: is it worth?

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Background and objectives of the study the arthroscopic treatment of arthritic ankle has been debated in the literature with few specific reports. Purpose of this study is to evaluate the outcomes of this treatment in a group of former football players with arthritic changes into the joint and anterior bone impingement.

Methods 17(seventeen) former active football players all males. Age 33-58, amatorial and semi professional including indoor soccer with pain and limited ankle function for both sports and daily living activities, who underwent arthroscopic treatment, were evaluated at follow-up of a minimum 2 years (2 to 9.1 years mean 4,7). In all the cases the orthopaedic surgeon arthroscopically removed the anterior tibial spur and the osteochondral lesions were treated using microfractures. Associated synovial pathologies were treated using radiofrequency (arthrocure device, Naples, FI). All the patients underwent a similar post-op program with protected weight bearing of 6 weeks and return to light sport activities including jogging no sooner than 3 months and were examined by an independent examiner with a minimum 2 year follow-up. AOFAS and SF 36 were administered in the pre-op and at follow-up.

Results AOFAS and SF36 scores were both significantly improved compared to the pre-op values with no significant complication related to the procedure. Sf 36 values were significantly improved compared to the pre-op values ( P< 0.01) with a mean bodily pain of 36 in the pre-op compared with a 57 post op AOFAS values were statistically different between the pre-op and post post -op values (P< 0.01) 26 vs 71. Conclusions arthroscopic treatment of the footballer ankle at the end of his career can lead to improved function and quality of life.

## Partial tears of the anterior cruciate ligament: diagnostic performance of Isotropic 3D-FSE-Cube MRI

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Introduction: diagnosing partial tears is difficult and is based on a combination of test results. The accuracy of conventional 2D-MRI in diagnosing partial tears is low. Isotropic three-dimensional Fast Spin-Echo (3D-FSE-Cube) MRI is a new sequence with infra-millimeter accuracy which allow to visualize small anatomical structures and their anomalies.

The main purpose was to compare the performance of 3D-FSE-Cube MRI to arthroscopy, the reference test for the diagnosis of partial Anterior Cruciate Ligament (ACL) tears.

Material and methods: a retrospective study was performed including all patients who underwent surgery for an ACL tear in our Sports Surgery Unit from January 2008 to December 2009. All patients underwent a preoperative MRI, conventional 2D or 3D-Cube. The diagnosis of a partial tear was based on the appearance of the ligament bundles and signal quality on MRI, and on the continuity of the fibers on arthroscopy and the quality of the remaining ligament. Sixty-four of the 312 included patients underwent MRI-3D-Cube and 248 conventional 2D MRI. The series included 82 women and 223 men, mean age  $33.3 \pm 19.6$  years. Arthroscopy did not reveal any normal ACL, 247/312 (79.2%) complete tears, and 65/312 (20.8%) partial tears, with 50/65 (76.9%) involving the anteromedial bundle and 15/65 (23.1%) the posterolateral.

Results: the results of MRI 3D-Cube were: sensitivity 95%CI= $62.5 \pm 23.7\%$ , specificity 95%CI= $93.7 \pm 6.9\%$ , likelihood ratio LR(+)=9.9, LR(-)=0.4, accuracy 85.9%. Results of conventional 2D-MRI were: sensitivity 95%CI= $10.2 \pm 8.5\%$ , specificity 95%CI= $96.5 \pm 2.5\%$ , LR(+)=2.9, LR(-)=0.9, accuracy 79.4%. The diagnostic performance of MRI 3D-Cube was better than conventional 2D-MRI.

Conclusion: the diagnostic performance of MRI 3D-Cube in partial ACL tears was good and significantly better than conventional 2D-MRI. The likelihood of having a positive test was 9.9 times higher in a patient with a partial tear. A negative result did not exclude this diagnosis.

## Utilization of Prp in orthopaedic practice: clinical and biological analysis of therapeutic effectiveness

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Objectives: PRP is obtained by centrifugation of whole blood with the aim of producing plasma with high concentration of platelets. The literature provides little information about the variability of the clinical efficacy of PRP in relation to the biological characteristics of the product. Objectives of the study in question are: clinical evaluation of effectiveness of PRP "home made" a group of 89 patients, analysis of cytokine profile and concentrations of growth factors in a 10 patients homogeneous group, during treatment with intra-articular and peritendinous injections of PRP; description of possible correlation between changes in cytokine pattern and concentration of growth factors with clinical response to treatment in the same group of patients.

Methods: 89 patients were selected and declared fit to receive treatment with PRP "home made". In view of the underlying disease, (Tendinopathy, Epicondylitis, Chondral Lesions, Degenerative lesions of grade I-II-III-IV, Rotator Cuff Lesions) patients underwent to 3-5 cycles of intra-articular or peritendinous injections of PRP, at intervals of 7 or 15 days apart.

Scores of clinical evaluation were administered to each patient before treatment, before any infiltration, and six months after the last injection. The concentration of growth factors, and inflammatory cytokines present in the PRP, were evaluated in a homogeneous group of 10 patients with degenerative lesions of the knee cartilage of grade III-IV sec. Kellgren-Lawrence century.

Finally correlation between growth factors, cytokine and haematological parameters of the patient and PRP with clinical parameters was analyzed.

Results: Overall Response Rate (ORR) was noted in 69 of 83 patients (84%). In addition, all the scores used have shown a significant rate ( $P < 0.05$ ) in the period immediately after the second injection. Analysis of the growth factors showed a progressive increase in concentration than baseline, after the first application, with a peak level at the second (beginning of the period of clinical improvement statistically significant), and subsequent decrease at the third infiltration.

Several more ( $P=0.01$ ) or less ( $P=0.05$ ) significant correlations were identified, both with clinical scores and haematological index. The pattern of inflammatory cytokines, after a stable trend from time 0, showed a decrease after the second clinical application, at the peak of growth factors and beginning of the patient's clinical improvement.

Conclusions: the results reported clinical efficacy in 84% of patients treated. In addition, the biological analysis showed at the beginning of the clinical improvement the increase in growth factors and decrease in inflammatory cytokines. More level I studies are necessary to identify the best production methodology and application of the product.

# PRP treatment for PF overuse injury among athletes

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**Introduction:** almost 25% of all overuse injuries in sports, related to joint surfaces, affect patella-femoral joint. That kind of overuse injury may lead to the development of OA. Today nearly 1 of every 6 adults in the modern world is affected by OA in its different stages. Effective treatment of chondromalacia caused by overuse injury of the patella-femoral joint may postpone or avoid the OA in young age in this particular joint.

**Material and methods:** discuss treatment options available to overuse injury to the patella-femoral joint, focusing on PRP treatment.

**Results:** chondromalacia of patella, which in sports represents one of the most common overuse injury is related to a progression in tissue degradation that results in loss of cartilage structure and function. The treatment options should aim to restore normal cartilage and joint homeostasis, arresting the progression of degenerative process. Excluding biomechanical alignment problems, besides all available noninvasive treatment options and viscosupplementation, using PRP (platelet rich plasma) therapy has shown a reasonable effect in treating PF overuse injury including chondromalacia patella.

**Conclusions:** PRP therapy is relatively safe procedure performed in sterile conditions. Its effect in treating patella-femoral overuse injury, without biomechanical abnormalities, is promising. Yet additional research should be made to prove the compatibility of this method to treat different medical conditions of articular cartilage.

# Articular cartilage regeneration with autologous peripheral blood stem cells: a randomized controlled trial

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The purpose of this study was to evaluate the histological, MRI and clinical results of a randomized controlled trial involving articular cartilage regeneration. 50 patients with International Cartilage Repair Society grade III and IV cartilage lesions of the knee were enrolled based upon MRI findings. Both intervention and control treatments include full-thickness cartilage lesions with arthroscopic subchondral drilling and five intra-articular postoperative injections of hyaluronic acid (HA) begun one week postoperatively and continued at weekly intervals, with the intervention group having the addition of postoperative stimulation with human granulocyte colony-stimulating factor, harvest of autologous peripheral blood stem cells (PBSC) via apheresis, then PBSC in combination HA injections. International Knee Documentation Committee (IKDC) scores were obtained preoperatively and postoperatively at serial visits. Second-look arthroscopy was performed at 18 months with acquisition of 2 mm full-thickness biopsy from 16 patients per group. Biopsies were graded utilizing the International Cartilage Research Society Visual Assessment Scale II (ICRSII). MRI obtained at 18 months graded with a morphologic scoring system. IKDC scores for the 50 patients at the 18-month time point shows no statistical difference ( $p = 0.71$ ), whereas, ICRS II and MRI scores are statistically significant with the  $p$ -values of 0.020 and 0.0036 respectively. One patient in the control group developed a deep vein thrombosis; no other adverse event was reported. Results suggested regeneration of cartilage closer to hyaline cartilage with the intervention method and illustrate a significant improvement in the treatment of cartilage lesions within the setting of a level-I study.

# Treatment of osteochondritis dissecans of the knee with the nanostructured biomimetic scaffold combined with platelet-rich plasma gel

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**Introduction:** the present prospective study was designed to evaluate the use of MaioRegen scaffold combined with platelet rich plasma for the treatment of symptomatic osteochondritis dissecans (OCD) of femoral condyles defects in the knee.

Material and methods: ten patients were clinically prospectively evaluated with the use of the Lysholm, Tegner and ICRS scores, preoperatively and at 12 and 24 months of follow-up. For each patient MRI was performed preoperatively as well as 6 and 12 month postoperatively. MRI data were analyzed based on the original MOCART (Magnetic Resonance Observation of Cartilage Repair Tissue) scoring system.

Results: the statistically significant improvement comparing the pre-operative to the follow-up scores was observed for all patients. MRI showed good healing processes of the cartilage defects. Synovitis and adhesions were not observed in the study patients.

Conclusions: the use of MaioRegen scaffold combined with platelet rich plasma allow to obtain good results in the treatment of symptomatic osteochondritis dissecans of the knee in the short follow-up.

## Treatment of knee focal chondral lesions with matrix-induced autologous transplantation of adipose-derived mesenchymal stromal cells: preliminary results in ten patients

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Aim: the aim of this prospective consecutive case series study was to evaluate the results of this enhanced cell-based technique for the treatment of focal chondral lesions at six months after the intervention.

Methods: ten ICRS grade 3 and 4 focal knee articular cartilage defects with a mean size of 3.2 cm<sup>2</sup> in ten patients with an average age of 31.2 years were treated with matrix-induced autologous transplantation of adipose-derived mesenchymal stromal cells. Follow up was at least six months and their outcome analysis was based on the Knee injury and Osteoarthritis Outcome Score (KOOS) and the International Knee Documentation Committee (IKDC) forms, whereas the Student's t test was used to determine the statistical significance between the preoperative and postoperative values.

Results: at six months postoperatively no complications and/or adverse events had been reported and all five patients were found to be satisfied with the outcome; statistical analysis showed a significant increase in the mean values of the IKDC total score (from 33.2 to 63.0) and all five KOOS subscales (Symptoms and Stiffness from 54.8 to 78.8, Pain from 56.0 to 83.0, Daily Living from 55.6 to 90.8, Sports from 23.2 to 42.6, and Quality of Life from 21.0 to 52.4).

Conclusions: this study has shown promising preliminary results for the treatment of focal knee chondral lesions with a single-staged enhanced autologous cell-based technique as evidenced by the statistically significant improvement in patients' condition documented by established and highly relevant for cartilage defects outcome scores as early as six months postoperatively.

## Autologous Matrix - Induced Chondrogenesis (AMIC) for reconstruction of osteochondral lesions of the talus

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Introduction: surgical treatment of osteochondral lesions (OCL) of the talus remains a challenging task to orthopaedic surgeons and frequently concerns young sportive patients. Existing operative techniques show certain restrictions. We present the results of a novel one-step technique for these patients. The autologous matrix induced chondrogenesis (AMIC) – aided procedure combines debridement, spongiosa-plasty from the iliac crest and covering with a collagen I/III membrane.

Methods: twenty-six patients were prospectively assessed for OCL of the talus. Clinical examination included the American Orthopaedic Foot & Ankle Society (AOFAS) hindfoot scale and Visual Analogue Scale (VAS). Radiological imaging consisted of conventional radiographs and magnetic resonance imaging (MRI) using the magnetic resonance observation of cartilage repair tissue (MOCART)-Score. Clinical and radiological follow-up was performed after a minimum of 24 months postoperatively.

Results: both function and pain could be improved largely and remained stable over a mean of 31 months postopera-

tively. The mean preoperative AOFAS hindfoot scale increased significantly from 60.2 points pre-operatively to 89.2 points at final follow-up ( $p < 0.01$ ). Pain measured with VAS improved significantly ( $p < 0.01$ ) from 5.0 to 1.5. MRI showed intact cartilage covering the lesions in all cases with a mean MOCART-Score of 62.0 points. Conclusion: excellent clinical and radiological results were demonstrated after a mean follow-up of 31 months. The results are comparable with or superior to the results of ACI, OATS and MACI. The AMIC-aided technique is a readily available, economically efficient, and successful one step surgical procedure. Therefore it can be recommended as a treatment option for OCL of the talus.

## Platelets rich plasma: what do we inject?

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Use of PRP increases in the sport medicine. Independently of PRP efficacy, the injected product changes largely from one system to another. This study goal is to characterize the content of different PRPs (blood cells, quantity of growth factors).

Blood from six healthy volunteers was used simultaneously in 7 PRP systems following exactly each guideline. It served too as baseline for cells and to obtain normal plasma as daily done in hematology labs. Cell count was made in blood, normal plasma, PRPs. Concentration of 5 growth factors was analyzed by ELISA after activation which released maximum of GF.

Reported cell count (rate above baseline  $\pm$  sd).

Platelets: Biomet  $x3.8 \pm 0.54$ , BTI  $x1.85 \pm 0.13$ , Plasma control  $x1.43 \pm 0.07$ , Regenlab  $x1.42 \pm 0.14$ , Arthrex  $x1.31 \pm 0.11$ , Vivostat  $x0.51 \pm 0.24$ , Plateltext  $x0.3 \pm 0.06$ .

Leucocytes: Biomet  $x4.9 \pm 0.43$ , Vivostat  $x2.89 \pm 0.73$ , Regenlab  $x0.59 \pm 0.09$ .

Few leucocytes for Arthrex  $x0.08$ , none for BTI, Plateltext.

Erythrocytes: Biomet  $x0.12$ .

Curasan extracts straight GF without serum.

Amount of VEGF, TGF $\beta$ , PDGF is correlated with degranulation (so with platelets) as FGF, IGF1 are not meaning there are mainly circulating.

Curasan is selective: no IGF1, few PDGF, high amount of VEGF.

We found a lower concentration rate for all devices than usually reported. Some yield to poorer plasma. The more effective concentrate as well platelets and leucocytes whom usefulness is controversial. Focusing on standard deviation, some are not reproducible or even unpredictable. Standard centrifugation is pretty similar.

Some GF are poorly present in platelets. Presence of IGF1 in blood test is not related to PRP use (WADA clinically relevant).

## Incidence and prognosticators of lower extremity fractures in belgian football players

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Introduction: football is the world's most popular sport with approximately 265 million active players. With ever growing athletic and financial expectations, the nature of football is associated with a risk for injuries. These can be mild with reactivation after a few days but fractures of the lower extremities are severe injuries resulting in a long sport- and work disability.

This large retrospective nation-wide study evaluated the incidence and type of lower extremity fractures (LEF) in Belgian football players over two seasons.

Methods: the national Royal Belgian Football Association (Koninklijke Belgische Voetbalbond, KBVB) represents 416,000 football players. The KBVB database collects all injuries of the members and this database was searched for all injury reports. The detailed injury data from two seasons (1999-2000 and 2009-2010) were vigorously recorded and compared the incidence of different types, as well the influence of gender, age and level of performance on LEF's.

Results: 417,462 football players (401,976 men and 15,486 women, 162,558 adult and 254,904 youth players) and 415,934 players (394,250 men and 21,684 women, 161,963 adult and 253,971 youth) were member of the KBVB in season 1999-2000 and 2009-2010 respectively. In season 1999-2000 a total of 713 LEF's were reported, with an average of 0.031 injuries per 100 players compared to 752 LEF's per 100 players in season 2009-2010, with an average of 0.03 injuries\*.



The most occurred LEF's over two seasons, the ankle fractures (n=585, 39.9%) were similar in male and female players with an average of 0.08\* for both groups (p=0.95). 93.2% were unimalleolar fractures (n=545), 6.0% bimalleolar (n=35) and 0.9% trimalleolar (n=5). With an average of 0.1 vs. 0.06\*, adults were more affected than youth ( $\leq 18$ y) players (p < 0.0001). Amateur level players were at higher risk for an ankle fracture compared to top level players (0.09 vs. 0.04\*, p < 0.0001). 74% of all ankle fractures occurred during a game and 26% during training.

Also the foot fractures (n=531, 36.2%) with an average of 0.07 per 100 male players (n=517, 97.4%) and 0.04 per 100 female football players (n=14, 2.6%, p=0.02), were more common in adult players compared to the youth players (0.1 vs. 0.05\*, p < 0.0001) and on amateur level (0.08 vs 0.04\* on national level, p<0.0001). 67% of the foot fractures were sustained during a game and 33% during training.

Three hundred forty-nine tibial fractures (23.8%) were seen over the two seasons and again slightly more in male football players (0.05 vs 0.03\*, p=0.08) on amateur level (0.05 vs. 0.02\*, p<0.0001). Youth players were much less affected than adult players (0.04 vs. 0.06\*, p=0.0041). The majority of tibial fractures occurred during games (79% vs. 21%).

Discussion: this retrospective study over 2 seasons in the Belgian football league, shows that adult players are exposed to a higher risk for LEF's. A Lower bone quality could be an explanation. There is also a higher incidence of LEF's when performing on amateur level. The more aggressive way of playing on amateur level and the better trained and average younger aged players on top level, could be possible explanations here. The competitive spirit and high pressure to win a game might be the reason for the vast majority of fractures (73%) during competition games.

\* fractures per 100 football players.

## The Prevention of Injuries in American Flag Football

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Introduction: American Flag Football (AFF) is a non-tackle, contact sport. Many moderate-severe contact-type injuries have been reported. In the 2007-9 playing seasons, the authors conducted a two-season prospective injury surveillance study (historical cohort). This study revealed a high incidence of injuries to the fingers (caught in the opposing player's pockets), face, knee, shoulder and ankle. The objective of this study was to introduce a one-season, injury prevention program in an attempt to significantly reduce the incidence and the severity of sports-related injuries in AFF, as compared to a historical cohort.

Methods: a prospective injury prevention study was conducted in Kraft Stadium, Jerusalem, Israel. There were 724 amateur male (mean  $\pm$  SD age, 20.00  $\pm$  3.05 yrs) and 114 female (mean  $\pm$  SD age, 21.20  $\pm$  7.23 yrs) players. Four prevention measures were implemented: the no-pocket rule, self-fitting mouth guards, ankle braces (for those players with recurrent ankle sprains) and an injury treatment information brochure. An injury surveillance questionnaire was administered to record all time-loss injuries sustained in game sessions.

Results: the two-tailed t-test, as well as the Levene's test for equality of variances, showed a highly statistically significant reduction in the number of finger injuries, and ankle sprains (p<0.01). There was no statistically significant difference in the severity of injuries. The rate of compliance with the intervention methods ranged from between 40-60%.

Discussion: implementation of the prevention program significantly reduced the incidence rate of injuries. Further development of prevention strategies is needed. This should involve the strict enforcement of the no-pocket rule, appropriate head gear, self-fitting mouth guards, the use of ankle braces and changing the blocking rules of the game.

## The epidemiology of injuries in elite UK athletes

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Introduction: athletes representing the United Kingdom will increase the frequency and intensity of their training, as London prepares to host both the 2012 Olympics and 2017 World Athletics Championships. The effectiveness of appropriate training load, including strength and conditioning to prevent injuries is well recognised. There is an historical lack of comprehensive data on injuries sustained by track and field athletes representing the United Kingdom.

Materials and methods: this retrospective epidemiology study analyses all injuries sustained by elite athletes in the United

Kingdom on the electronic medical record keeping system Injury Zone, by UK Athletics and other medical and therapy professionals, since 2004.

Results: 756 discrete injuries were identified in 91 athletes over a period of 7 years divided as follows: tendon injuries 34.4%, muscular injuries 25.8%, joint injuries 14.3%, ligament injuries 5.8% and fractures 5.1%. Injuries arranged by athletic event and body part are demonstrated.

Conclusion: invariably, athletes tend to injure the body parts they use the most in their chosen track and field event. Lower limb injuries predominated all sporting disciplines, above all ankle and foot injuries. Prevention is the best cure for all maladies. Athletic injuries are no exception. This data provides information specific to UK athletes to help guide preventative training measures and pre-emptive rehabilitation awareness.

## Effect of pre-season screening for patella tendinopathy: the findings of a professional football club

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Introduction: patella tendinopathy is a common pathology amongst footballers associated with considerable time periods when players are unavailable for selection. The optimum treatment method remains controversial. Our aim was to determine the effects on frequency of this diagnosis following the introduction of a pre-season screening protocol.

Materials and methods: data was collected prospectively regarding every injury suffered by a player at an English Professional Football Club. This included diagnosis, time taken to return to play, mechanism of injury, activity during injury, treatment received, side of injury and ground conditions. This data was recorded prior to and following the introduction of a pre-season screening protocol for patella tendinopathy, which included the VISA-P questionnaire, previous injury survey and ultrasound scan recording of tendon vascularity and thickness. Players were offloaded or had loading modified if tendinopathy was detected during the screening process.

Results: 421 injuries were recorded, 15 (3.56%) of these were diagnosed as patella tendinopathy, 218 injuries were suffered prior to screening and 203 post-screening. 12 (5.5%) diagnoses of patella tendinopathy, were suffered prior to the screening protocol being introduced compared to 3 (1.48%) following its introduction ( $p < 0.05$ ). The mean return to play following a diagnosis of patella tendinopathy pre-screening was 73 days compared to 3 days post screening.

Conclusions: the introduction of a pre-season screening protocol for patella tendinopathy can result in a statistically significant decrease in the frequency of the diagnosis and a decrease in the mean time to return to play for a professional footballer. We recommend its use.

## Dislocation of peroneal tendons. Anatomical reconstruction of the superior peroneal retinaculum (SPR)

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Introduction: the superior peroneal retinaculum is the primary restraint to subluxation of the peroneal tendons in the fibular groove. Eckert and Davis described three grades of acute tears of the superior retinaculum; a fourth grade was later described by Ogden. In grade 1, the retinaculum is separated from the collagenous lip and lateral malleolus. In grade 2, the collagenous lip is elevated with the retinaculum. In grade 3, a thin sliver of bone, visible on radiographs, is avulsed with the collagenous lip and the retinaculum. In grade 4, the retinaculum is torn away from its posterior attachment on the calcaneus. The superior peroneal retinaculum itself generally remains intact. Dislocation of the peroneal tendons may be traumatic or habitual and voluntary. In the latter case, congenital deficiency of the superior peroneal retinaculum and a shallow fibular groove may play a role. In traumatic chronic subluxation, there is little to be gained with conservative management, and surgical management is generally advocated. Many procedures have been described, but some are non-physiological and have marked postoperative morbidity.

Material and methods: we operated on 14 patients (all men; mean age,  $25.3 \pm 6.3$  years; range, 18-37 years). All had sustained a traumatic unilateral peroneal tendon subluxation: 6 playing soccer, 3 playing basketball, 3 playing rugby,

and 2 having fallen off a motor bike. In 5 patients, the peroneal tendon subluxation had not been diagnosed at the time of injury.

Results: all patients were able to fully bear weight on the affected limb by the end of the 5th week after the operation. The AOFAS Ankle-Hindfoot Scale increased significantly from  $54.3 \pm 11.4$  to  $94.5 \pm 6.4$  ( $P = .03$ ), with 5 patients reporting a fully normal ankle. No patient experienced a further episode of peroneal tendon subluxation by the time of the latest review, and all had returned to their normal activities of daily living and their sports activities.

Conclusions: we report our experience in the surgical management of this condition by anatomical reattachment of the retinaculum using soft tissue anchors. This procedure is safe and effective in managing instability.

## Time to return to playing professional football following fifth metatarsal fracture - The influence of the media prediction upon general public expectations

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Introduction: the media frequently report that fifth metatarsal fractures result in a 6-week absence from play for a professional footballer. This study assesses frequency of media reporting of fifth metatarsal fractures, the time that is predicted by the media before the player will return to soccer, the actual time taken for the player to return to play and compares this to the expectation of the general public.

Methods: internet search engines identified 40 professional footballers that suffered 49 fifth metatarsal fractures between 2001 and 2011. Information was collected from various media and team websites, match reports, photography and video evidence to provide data regarding the estimated amount of time to be missed due to the injury and time taken to return to play. A survey of the general public provided information of their expectations regarding recovery from injury.

Results: 49 fractures were identified in the 40 players. The mean return to play time was 14.6 weeks (range 5 to 34 weeks). The mean estimated absence in the media was 7.8 weeks (range 2 to 16 weeks), median 6 weeks. The mean estimated absence amongst the general public was 9 weeks (range 4 to 26 weeks). 50% of people felt influenced in their prediction by the media.

Conclusions: fifth metatarsal fractures are being reported in professional footballers with an increasing trend. The commonly quoted period of 6 weeks before return to play is unrealistic but assumed by the general public rather than the reality of 3 months.

## Outcomes of modified Brunelli procedure in professional athletes with scapholunate instability

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Introduction: one of the major types of traumatic injury of the wrist is scapholunate instability, which usually occurs after a fall onto an outstretched hand causing excessive wrist extension and ulnar deviation. Late diagnosis can have long term consequences and can result in degenerative changes in the joint leading to scapholunate advance collapse (SLAC). Therefore, it is important to accurately diagnose, treat and in an athletic population, return back to competition. Currently, there are few reports in the literature detailing the outcomes of having a modified Brunelli procedure which is one of the treatment options for symptomatic scapholunate instability, and none with regards to specific populations such as athletes.

Method: we identified 16 professional athletes who had undergone reconstruction of their scapholunate ligaments using flexor carpi radialis tendon graft (modified Brunelli procedure) from our prospectively managed database. All procedures were performed by the senior author. From our prospectively managed database, 15 (94%) athletes completed a questionnaire. Patients were evaluated with the Quick Disabilities of the Arm Shoulder and Hand score and the Wrightington score. Pain scores, stability and return to competition level were also recorded. Between 2008 and 2011, 15 pro-

professional male athletes (11 rugby, 2 boxing, 1 golf, and 1 motor cycling) had the procedure with 1 bilateral reconstruction. The mean age of the patients was 30 years (range 18 - 42). the mean follow up period was 24 months (range 3 - 43 months).

Results: the mean Quick Disabilities of the Arm, Shoulder and Hand score was 7.7 (standard error of mean 2.11). The mean Wrightington activity of daily living assessment for wrist function was 9.3 (0.38). The pain level was measured on a visual analogue scale with 0 being pain free and 10 the worst pain possible. At rest the mean score was 4.2 (0.74) and improved to 0.4 (0.26) and on activity from 7.9 (0.39) to 2.6 (0.61). Out of the 16 wrists reconstructed, 13 (81%) were reported to have improved wrist stability and 3(19%) had worsen. Twelve of the 15 (80%) athletes returned to play within 4 months of surgery. By the final review, 10 of the 15 (67%) athletes had returned to play at their pre-injury level of competition.

### Summary Points

\*Modified Brunelli procedure relieves pain, improves stability and functions of the wrists in professional athletes with symptomatic scapholunate instability.

\*80% of athletes return to play within four months of reconstruction.

\*Approximately three quarters of athletes return to their pre-injury level of competition.

## Are thumb injuries becoming more frequent in men's lacrosse?

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Men's lacrosse is a rapidly growing sport. The authors were concerned by the number of thumb injuries sustained while working with an international team at the 2012 European Championships.

To compare data collected during immediate pre-tournament training camp and the European Championships with published reports.

Data was gathered prospectively on all 23 players on the England Men's lacrosse team. An injury was defined as one that occurred during a team practice or game, and resulting in the player missing one or more further sessions.

Over 15 days, 23 players participated in 17 athletic exposures each. This included 9 games and 8 practices. There were 3 thumb injuries (Rate = 0.007673). 1 occurred from contact with an opponent, 1 from direct contact with an opponent's stick and another from a direct blow from the ball. 2 fractures of the proximal phalanx and 1 MCPJ sprain. The data was compared with published by Bowers et al.

They reported 276 thumb injuries in 1,019,222 athletic exposures (Rate = 0.000271). A c2 test with Yates correction for continuity was performed. This yielded a Yates' c2 value of 53.559 which is statistically significant (p <0.001). Mechanism of injury corroborates with published reports.

Lacrosse has become more popular and there has been a trend to develop lighter flexible equipment. Data needs to be collected to determine if thumb injuries can be attributed to equipment design. We would advise manufacturers to explore alternative designs to help protect the thumb more successfully.

## Classification of the Acetabular-Labral-Pincer-Complex: an arthroscopic study of the acetabular labrum in relation to pincer lesions

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Introduction: the anatomy of the Acetabular-Labral-Pincer-Complex (ALPC) has not been fully understood. We observed the ALPC in at hip arthroscopy over 2 years. Characteristics of the ALPC were recorded. We propose a classification for the ALPC and discuss the significance of our findings.

Methods: between January 2010 and December 2011, hip arthroscopy was performed on 254 patients by a single experienced surgeon. Complete examination determined the pathology and the ALPC was examined and defined. Surgery including; partial labrectomy, labral "take down" and reattachment, excision of pincer and cam lesions and debridement of articular chondral defects were performed as necessary.

Cases where a pincer lesion was confirmed were classified into the following categories.

Type I – a pincer lesion formed immediately behind but distinct from the labrum.

Type II – a pincer lesion within the body of the acetabular labrum and therefore indistinct from the surrounding labral tissue.

Type III – a pincer inferior to the labral tissue and distinct from it.

A further group where no pathological pincer lesion is present was classified as Type 0.

Results: mean age of the 254 patients was 36 years (range 14 to 70 years). 154 female (61%) and 100 male (39%).

Classification of the ALPC using the definitions above revealed 23 Type 0 (9%), 22 Type I (9%), 200 Type II (79%) and 9 Type III (3%).

Operations performed were: partial labrectomy and cam excision 4 patients (2%), partial labrectomy 17 patients (7%), excision of cam 2 patients (1%), labral takedown, excision of pincer and labral re-attachment 28 patients (11%), labral takedown, excision of pincer and excision of cam 12 patients (5%) partial labrectomy, excision of pincer and cam 135 patients (53%) and partial labrectomy with excision of pincer 56 patients (22%).

The labrum was calcified in 16 cases, a torn labrum was found in 128 hips of which 32 were classified as complex tears (including bucket handle tears). The labrum was macerated in 104 cases. No labral pathology was noted in 4 hips and 2 had hypertrophied labrums.

A cam lesion was identified in 157 patients and a pincer in 234 patients (147 patients had both a cam and a pincer lesion present).

Conclusion: acetabular labral tears are a cause of hip pain. The anatomy of the adult acetabular labrum has been described (Seldes 2001). In their study a consistent tongue of bone extended from the edge of the acetabulum into the the labrum. This is analogous to the type 2 ALPC we have described in our study. We also described 2 other variants of ALPC present in a significant minority of our patients (type I and type III ALPC).

The type I ALPC can be managed without the need for partial labrectomy or labral takedown and repair. The pincer lesion can be excised without damaging the labrum and its blood supply. Type II ALPC requires a labral takedown, excision of pincer and reattachment of the labrum or partial labrectomy and excision of pincer depending on the condition of the labral tissue. Type III ALPC can be managed without potential damage to the intact labrum which is then reattached to the acetabular margin once the pincer has been excised.

The current study identifies three types of ALPC. We have confirmed arthroscopically the description of the acetabular labrum previously reported, with the majority of cases examined revealing a type II ALPC. We have also been able to demonstrate variation in the anatomy of the ALPC. Further anatomic, radiological and cadaveric studies are needed.

## Comparison of dgemric to arthroscopic evaluation of acetabular cartilage damage in the weight-bearing area of the hip: a pilot study

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**Introduction:** Delayed Gadolinium-Enhanced Magnetic Resonance Imaging of Cartilage (dGEMRIC) is a non-invasive method to quantify cartilage viability. In general, normal value for dGEMRIC is approximately 570 milliseconds, while dGEMRIC index is below 390 milliseconds is considered abnormal, and has been shown to be predictive of early failure after peri-acetabular osteotomy. Moreover, some surgeons have used dGEMRIC measurements as a basis for decision-making between hip arthroplasty and hip preservation surgery. The hypothesis of this study is that that the dGEMRIC index is predictive of cartilage damage as evaluated at the time of arthroscopy.

**Methods:** between April 2009 and April 2012, 72 patients underwent dGEMRIC scan of their hip prior to hip arthroscopy. The surgery was performed in the supine position by a single surgeon. Acetabular cartilage evaluation was performed as part of the diagnostic arthroscopy using the Outerbridge classification. An arthritic dGEMRIC score was considered as below the threshold value of 390. Patients were divided according to arthroscopic assessment of cartilage damage into low-grade (grade 2 or less) and high-grade (grade 3 or more) groups. Microfracture was performed at the discretion of the surgeon at the time of surgery. Statistical analysis was performed to assess the sensitivity and specificity of a dGEMRIC score <390 in predicting high-grade cartilage damage.

**Results:** overall, there were 57 females and 15 males in the cohort, and the average age was 39 years (range, 16 to 67). The average dGEMRIC index value was found to be 418 milliseconds (range, 195 to 675). Twenty-eight patients (39%) had values below 390 milliseconds. A total of 21 patients (30%) had high-grade acetabular cartilage damage, of which only 12 (57%) had dGEMRIC values below 390 milliseconds. Out of the patients with low-grade acetabular cartilage damage, sixteen (31%) had dGEMRIC values lower than 390. Acetabular microfracture was performed in 14 patients, of which nine (64%) had dGEMRIC values below 390.

**Conclusions:** in this study the dGEMRIC index had low sensitivity and specificity for acetabular cartilage damage (57%

and 69% respectively), and low sensitivity and specificity for the need of acetabular microfracture (64% and 56% respectively). It appears that non-focal uni-planar dGEMRIC was of limited value for the detection of early cartilage changes seen during hip arthroscopy.

## Two year outcomes of endoscopic Gluteus Medius repair

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**Introduction:** gluteus medius (GM) tears may be present in as many as 25% of late middle-aged women, 10% of middle-aged men, and are often misdiagnosed. Outcomes of endoscopic repair of gluteus medius tears have scarcely been reported. The purpose of this study was to report early outcomes of endoscopic repair of partial and full-thickness tears of the gluteus medius.

**Methods:** between February 2009 and November 2010, data was prospectively collected for all patients undergoing endoscopic gluteus medius repairs. Inclusion criteria for the study were patients undergoing endoscopic gluteus medius repair with a minimum follow-up of one year.

Only patients with endoscopic evidence of gluteus medius tear were treated surgically. In the case of articular side GM tears a trans-tendinous repair technique was used, whereas in the presence of full-thickness or outer-side tears the tendon was refixated to the bone directly.

**Results:** a total of 15 hips met the inclusion criteria. Our cohort included 14 females and 1 male, with an average age of 58 years old (range, 44 to 74 years). Endoscopically, 9 cases were found to be full-thickness or outer-side tears and 6 were articular-side tears. At an average follow-up of 25 months (range, 12 to 37), all patients showed post-operative improvement in all four hip-specific scores, with an average improvement of more than 30 points for all scores. The average satisfaction with the surgery was 9 out of 10. Two patients underwent total hip arthroplasty within the first year after the hip arthroscopy, both remained asymptomatic peritrochanterically following the arthroplasty.

**Conclusions:** this study shows that endoscopic surgical repair whether performed through a trans-tendinous or full-thickness technique can be an effective treatment of gluteus medius tears at an average follow-up of over two years. A longer term follow-up study would help to determine long-term efficacy.

## Successful clinical outcomes of proximal hamstring avulsion repair in athletes presenting within 6 weeks, 6 months and after 6 months

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Avulsion of the hamstring origin is well documented in water-skiing, rugby, sprinting and hurdling and is increasingly seen in football, dancing, judo and bull-riding.

The purpose of the study was to compare the outcomes of surgical intervention within 6 weeks of injury, 6 months post-injury and more than 6 months post-injury.

This was a prospective review of case series from a tertiary referral centre. 112 athletes presenting with complete proximal hamstring tendon tears were confirmed on MRI. 63 were high-level athletes. All patients were surgically explored and repair of the torn tendons undertaken with the aim of returning to pre-injury activities and sport.

All patients underwent an individualised rehabilitation protocol. All patients were followed up until return to sport.

108 patients returned to sport at an average of 16 weeks (range 12-32).

Return to full sport was on average 6 weeks faster for early versus late repairs and was 10 weeks faster than for late reconstructions. There were 2 partial re-ruptures in those with delayed presentations - both those athletes retired from competitive sport but were recreationally active. 2 others recovered well but did not want to go back to their previous activity level. 12 athletes were delayed by sciatic nerve symptoms (2 early, 5 late, 5 very late) that required injection therapy and in two cases further exploration and nerve release/mobilisation.

Surgical intervention is associated with good clinical outcomes and return to sport however delay in diagnosis can lead to prolonged morbidity and the increased likelihood of complications.

# Returning to sports after surgical repair of acute proximal hamstring ruptures

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**Introduction:** proximal hamstring rupture is a rare injury, which may be immediately diagnosed. Only 12% of hamstring muscle injuries are proximal ruptures and 9% are complete. In the literature, functional outcomes seem to be improved if surgical repair occurs within four weeks after injury. Although surgical repair of acute proximal hamstring ruptures is now the treatment of choice, this technique is relatively new and requires further evaluation. Our hypothesis was that patients have the same level of sports activity after surgical repair as before the injury.

**Material and methods:** a prospective single-center observational study was performed from January 2002 to July 2011. Inclusion criteria were a partial or complete hamstring proximal rupture, acute rupture less than 4 weeks post-trauma and treated surgically. The diagnosis of rupture was based on clinical signs and emergency MRI confirmed the rupture. Surgical, rehabilitation and follow-up protocols were standardized. Clinical post-operative assessment was obtained at 6 weeks, 3 months, 6 months, 1 year and then every 3 years. MRI monitoring and isokinetic Biodex® tests were performed at the 6-month follow-up at least. The primary outcome was the level of activity level according to the UCLA and Tegner scores before the trauma and at the 6-month follow-up at least. The secondary end points were time to return to sports, the healing of tendons on MRI, the hamstring/quadriceps ratio isokinetic testing at 240 degree per second and a satisfaction questionnaire. Sixty patients underwent in the department surgical repair of complete or partial proximal hamstring rupture during the study period, including 34 patients within 4 weeks after injury, 9 women and 25 men, mean age 39.3±11.4 years. Patients underwent surgery within an average of 13.6±6.4 days after injury. Tendon rupture was complete in 23 patients, partial for two tendons (biceps and semitendinosus) in 7 patients and a single tendon (semimembranosus) in 4 patients. The average shrinkage per-operatively was 5.8±1.9 cm. The mean follow-up was 27.2±22.9 months and no lost to follow-up.

**Results:** the mean level of activity on the UCLA score was 9.1±1.3 before injury and 8.7±1.7 at the last follow-up,  $p = 0.03$ . The mean Tegner activity level was 6.5±1.6 before injury and 6.2±1.6 at the final follow-up,  $p = 0.05$ . The two scores were correlated ( $r = 0.76$ ,  $p < 10^{-5}$ ). Patients resumed their sport within an average of 5.7±1.6 months, at the same level in 27 patients (79.4%) and at a lower level in 7 patients (20.6%). The hamstring tendon was found to be healed on MRI after a minimum 6-month follow-up in all patients. The average hamstring/quadriceps ratio at 240 degree/second was 54.7±8.6% positively correlated to the activity level according to the UCLA score ( $r = 0.49$ ,  $p = 0.09$ ). Level of satisfaction was related to their level of activity at the last follow-up ( $p = 0.03$ ).

**Conclusion:** although surgical repair of acute proximal hamstring ruptures has significantly improved the functional prognosis of patients it remains a serious condition that can compromise future sports activities.

## Long-Standing groin pain in the active population - A review of 713 cases

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**Background:** Long-Standing groin pain in the athletic population is a common presentation to the Sports Physician. Accurate diagnosis is often difficult. Small numbers and inconsistencies in diagnostic classification, often limit studies investigating the epidemiology of chronic athletic groin pain.

**Methods:** all cases of groin pathology presenting to a single Sports Medicine Centre with an accessible electronic record between 1/1/2006 and 31/12/2011 at the time of initial consultation were assessed for demographic data, investigations and diagnosis. By virtue of a 9-week waiting time to present to the clinic, all cases were deemed to be long-standing. **Results:** 894 cases of athletic hip and groin pain were identified, 655 (73.7%) male and 239 (26.73%) female. 93 cases were predominantly buttock pain, with 88 lateral hip pain yielding 713 cases of anterior groin pain. The most common sport was soccer (37.50%) followed by running (16.23%) and Gaelic sports (12.98%). 157 (22.02%) cases could recall a specific inciting injury with adductor pathology (25.74%) and acetabular labral pathology (20.30%) the most frequent causes. The most common causes overall, were acetabular labral tear (15.46%) in females and adductor dysfunction (20.44%) in males. In combination, femoro-acetabular impingement was the most common cause (17.75%). Hip joint pathology was implicated in 55.82% of cases. Of those having one of 5 main clinical entities, 43.38% had multiple co-existing pathologies.

**Conclusion:** this is one of the largest studies examining the complex relationships and diagnoses of long-standing athletic groin pain. The role of the hip joint and presence of multiple co-existing pathologies are highlighted by this research.

# Buttock pain in the active population - A review of 93 cases

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Background: buttock pain is infrequently encountered in the sporting or active population. It can be difficult to identify the anatomical source of pain. Studies examining the epidemiology of chronic buttock pain in the active population are infrequent and often limited due to lack of study numbers.

Methods: all cases of buttock pain presenting to a single Sports Medicine Centre, with an accessible electronic record between 1/1/2006 and 31/12/2011 at the time of initial consultation, were retrospectively assessed for demographic data, investigations and diagnosis.

Results: 93 cases were identified, comprising 55 male (59.14%) and 38 female (40.86%). The most common sports were soccer (18.56%) and running (17.56%) with 21 (22.57%) having no regular sport. 22.58% of cases recall an acute injury with 28.57% of these around the ischial tuberosity and 23.81% suffering radicular pain. The most common acute cause in the adolescent (£18 yrs) was ischial tuberosity avulsion (33.33%) and SIJ dysfunction (33.33%). The most common diagnosis in men; sacroiliac joint (SIJ) dysfunction (22.03%) with hamstring/hamstring origin (35.59%) the most common structure of origin. Women; radicular back pain (30.77%) most common diagnosis - hamstring origin and SIJ (25.64% respectively) most common structure of origin. Overall, the structure producing pain most often was hamstring/hamstring origin (31.63%) followed by SIJ (24.49%) and lumbar spine (23.47%).

Conclusion: this study is one of the few to highlight the epidemiology of buttock pain in the active population and serves to inform of the frequency of various pathologies that may present to the sport/musculoskeletal physician.

# The anterior approach for a non image guided intra-articular hip injection

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Background: the purpose of this study is to assess the accuracy and safety of a technique utilizing an anterior approach for non-image guided intra-articular injection of the hip using anatomical landmarks.

Methods: patients elected to have hip arthroscopy were positioned supine on a fracture-traction table with the hip and foot in neutral position. A point was marked by the respective crossing lines coming, distally from ASIS and horizontally from the tip of greater trochanter. A 19G spinal needle was inserted vertically down towards the femoral neck from this point. Once bony resistance was felt, the inner needle was removed and air was injected to produce an air arthrogram. The position of needle and presence of air inside the joint were confirmed with fluoroscopy and back-flow of arthroscopic fluid from the joint. Results were correlated with age, weight, height, BMI, body type, gender, femur and pelvis morphology and alignment.

Results: 55 subjects enrolled in the study. There were 51 correct placements and 4 misplacements, yielding 93% success rate. Reasons for misplacements of the needle were: high riding trochanter, increased femoral version, thick adipose tissue, and lateral variant of ASIS position.

Conclusions: anterior non-guided intra-articular hip injection is a safe, reproducible and easy to learn technique. The technique can be performed bedside or in the outpatient clinic negating the need for US, fluoroscopy or CT guidance, avoiding radiation exposure and reducing health care costs.

# Early to medium term outcome of trans-tibial double bundle pcl reconstruction

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Introduction: femoral double bundle PCL reconstruction aims to restore the knee kinematics similar to the native knee joint. We report the results of a single surgeon prospective series assessing the functional and objective outcomes after double bundle PCL reconstruction.



Methods: Lysholm, IKDC scores, Anteroposterior laxity measurement at 30° and 90° knee flexion using the Rolimeter (Aircast, USA®) and complications were collected prospectively on all the patients.

Results: 28 patients (25 males and 3 females) underwent the above procedure with an average follow-up of 32 months (range 12-60 months). Mean Lysholm and IKDC scores were significantly better (p value 0.03 and 0.01 respectively). Rolimeter findings at 30° and 90° knee flexion were significantly better (p value 0.00 for both) at the final follow-up visit. There were no reruptures or any neurovascular complications noted. 1 patient developed rapid onset osteoarthritis post PCL reconstruction requiring total knee arthroplasty.

Conclusion: trans-tibial double bundle PCL reconstruction achieves significantly better clinical and objective outcomes with no failure in short to medium term, and compares favorably with the senior authors' previous single bundle reconstruction technique.

## Long-term follow up with gait analysis after anterior cruciate reconstruction (ACL) in patients aged over 50 years

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Introduction: the aim of this study was to assess stability, functional outcome and gait parameters i.e. cadence, speed, stride length, single and double leg support (SLS/DLS) and energy expenditure (EE) to assess functional outcome in middle-aged group of patients with ACL reconstruction.

Materials and methods: we analyzed gait parameters in 40 patients aged over 50 years and older with the IDEEA accelerometer as part of our long term follow up assessment. Speed, cadence, stride length and SLS/DLS were compared with the non-operative leg of the same patient and EE was compared with 25 healthy volunteers (control group) who performed the same routine. Knee laxity was evaluated by KT 1000 arthrometer and compared between the operated and non-operated leg. Weight-bearing antero-posterior, lateral, Skyline view and Rosenberg radiographs were taken to compare with pre-operative views and elicit progressive degenerative changes. IKDC, Tegner-Lysholm and SF 12 scores were collected simultaneously for functional assessment.

Results: the mean age of the patients and the control groups were 54.7 years and 29.4 years respectively and the mean follow up period 3.8 years (2.4-6 years). We found no statistically significant difference between cadence, stride length, speed and SLS/DLS between the operated and non-operated leg; p. 0.36, p. 0.62, p. 0.81 and p. 0.06 respectively on unpaired t test. Similarly, no difference was found comparing the overall EE during the gait cycle between the patients and the control group (p. 0.55). The mean IKDC, Tegner-Lysholm and SF 12 functional score were 86.1 and 87.5 and 55.7/49.5 (PCS/MCS) respectively. 11 patients (27.5%) had grade I changes on post-operative radiographs in accordance with IKDC guidelines. KT 1000 test showed no statistically significant difference between the mean values comparing the operated knee to the non-operated one (p.0.85) on unpaired t test.

Conclusion: we found good functional outcome post ACL reconstruction in middle-aged patients. Our results also show that ACL reconstruction surgery is beneficial in patients with high activity level irrespective of their age.

## Double-Bundle anterior cruciate ligament revision surgery using fresh-frozen Achilles tendon allograft

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Introduction: an increasing number of ACL revision reconstructions are executed each year. Different techniques (single- or double-bundle) and different grafts (autografts vs allografts) can be used. Revision with allograft tissue has the advantages of reducing donor site morbidity and allows versatility in choosing different approaches according to anatomical situation. The purpose of this study was to evaluate a novel revision double-bundle ACL reconstruction technique using an Achilles-tendon allograft.

Material and methods: between 2002 and 2008, 30 patients underwent ACL revision surgery in our department by means of a fresh- frozen Achilles tendon non-anatomical double-bundle arthroscopic technique, with soft-tissue fixation by staples. The Achilles tendon was splitted to have a two bundle graft: one was passed Over-The-Top to reproduce the AM bundle and one inside the femoral tunnel to reproduce the PL bundle. Only one tibial tunnel was created. The mean patient age at surgery was 28.1±7.5 (range 18-46) years; the mean follow-up was 5.0±1.5 (range 3-10) years. Clinical

evaluation was performed with Tegner Activity scale, Euro Qol 5 dimensions (EQ-5D) Score, Knee Injury and Osteoarthritis Outcome Score (KOOS), International Knee Documentation Committee (IKDC) evaluation form. Objective laxity measures were determined using a KT-1000 arthrometer. Magnetic Resonance Imaging (MRI) evaluation was used to assess the signal intensity of the graft at follow up.

Results: the median Tegner score improved from 3 (range 3-4) to 6 (range 4-7) ( $P < 0.0001$ ). Moreover all other mean clinical scores improved significantly at follow-up: KOOS score (from  $65.8 \pm 9.3$  to  $82.5 \pm 10.9$ ,  $P < 0.0001$ ); EQ5D score (from  $0.34 \pm 0.16$  to  $0.77 \pm 0.23$ ,  $P < 0.0001$ ) and subjective IKDC (from  $49.2 \pm 8.0$  to  $75.8 \pm 16.8$ ,  $P < 0.0001$ ). The objective IKDC score improved from 2B, 10C, 18D to 6A, 18B, 4C, 2D. KT-1000 manual maximum test side-to-side mean difference at follow-up was  $3.0 \pm 2.2$  mm. The 80% of patients returned to the same Tegner level prior to ACL primary reconstruction at a mean of  $10.5 \pm 1.5$  months after revision surgery. MRI evaluation revealed a good graft signal quality in 25 patients at follow-up. The failure rate at 5-year mean follow-up was 10% (5% re-injury, 5% instability).

Conclusion: the presented technique combines the Achilles tendon allograft advantages to the possibility to perform an intrarticular double-bundle ACL reconstruction. Clinical results after revision ACL surgery are slightly inferior compared with those after primary ACL reconstruction. However at 5-year mean follow-up a good restoration of laxity and function was recorded in 80% of patients, with a low failure rate.

## Radiological and functional outcome of transtibial versus transportal approach for conventional single-bundle anterior cruciate ligament (ACL) reconstruction

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Purpose: anterior cruciate ligament tears are common in the population and commonly require surgical reconstruction and extensive rehabilitation. The purpose of this retrospective study was to find out if the functional and radiographic outcome from using a transportal approach of femoral tunnel placement in conventional ACL reconstruction differed significantly from a transtibial approach.

Methods: this is a retrospective study of 60 patients undergoing conventional ACL reconstruction by a single surgeon from 2005-2011. 37 patients had the femoral tunnel placed transportally (Group A) and 23 patients had it placed transtibially (Group B). Tunnel placement was measured radiographically using the method described by Bernard and Hertel. Functional outcomes were measured 1-2 year post-operative using various scores such as the Tegner Lysholm Scale. Results: there was a significant difference ( $p = 0.00185 < 0.01$ ) in radiographic outcome at a minimum of 1 year post operation for placement of the tunnel away from the notched roof. In Group A, the femoral tunnel was 35.4% away and 22.4% along from the roof as compared to Group B that was 26.5% and 26.7% respectively. In addition, it was noted that the variance in the transportal approach (0.0191 along roof, 0.0131 away from roof) was greater than that of the transtibial approach (0.00961 along roof, 0.00956 away from roof).

Differences in functional outcome scores were not found to be statistically significant.

Conclusions: there is a statistical difference in radiographic outcome but not functional outcome of tunnel placement. The transportal approach places the femoral tunnel more inferior and posterior. There was also a greater variation in tunnel placement for the transportal approach as compared to the transtibial approach. We postulate that this is due to less restriction in transportal placement of the femoral tunnel as compared to transtibial.

## Isolated AM or PL bundle augmentation improves sports function scores better than standard ACL reconstruction

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Introduction: up to 10% of patients presenting with ACL instability may have an isolated rupture of either anteromedial (AM) or posterolateral (PL) fibre bundles. Although clinical results are lacking in the literature, isolated AM or PL bundle augmentation has been advocated for these cases. It is suggested that augmenting the remnant fibre bundle may promote

increased graft revascularisation and improve proprioception. The procedure is, however, technically more challenging than standard ACL reconstruction, involving precise identification of bundle footprints and careful preservation of the intact fibre bundle.

Objective: to compare the functional outcome for patients undergoing isolated bundle augmentation with existing published outcome data for standard ACL reconstruction.

Materials and methods: we followed a cohort of 24 consecutive isolated bundle ACL augment reconstructions, performed at our unit. KOOS (Knee Injury and Osteoarthritis Outcome Score) and IKDC (International Knee Documentation Committee Form) scores at were obtained at a minimum of 1 year follow up (mean 1 year 9 months). The KOOS results for the ACL augmentation procedures were compared to previously published data from the Swedish ACL registry.

Results: there were 11 patients with isolated AM bundle rupture and 13 with isolated PL bundle rupture. Good outcomes for isolated bundle ACL augmentation were shown across all KOOS subcategories. There was no significant difference between isolated AM or PL augment reconstructions. Comparison with the Swedish ACL registry KOOS scores at 2 years, showed better sports and quality of life scores, closer to those in the comparison group of 118 soccer players with healthy knees: Sports and Recreation - ACL Augments 89/100, Healthy soccer players 94/100, Swedish ACL registry 64/100. Similar findings were shown for the KOOS quality of life scores - ACL Augments 84/100, Healthy soccer players 95/100, Swedish ACL registry 61/100.

Conclusion: this study suggests that, where possible, remnant bundles should be preserved at ACL reconstruction. Although technically more difficult than standard ACL reconstruction, isolated bundle augmentation appears to result in improved isolated sports function.

## The use of an accessory medial portal in anatomic single-bundle acl reconstruction. A prospective ct-study

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Introduction: the purpose of this study was to evaluate if any differences exist regarding the position and the length of the femoral tunnel between the anterior cruciate ligament reconstruction with the use of an accessory medial portal and the ACLR with no use of accessory medial portal using computed tomography (CT) imaging.

Materials and methods: twenty consecutive patients (all were recreational athletes) that underwent ACLR with the aid of an accessory medial portal (Group A) and 20 (ACL-R) patients (recreational athletes aslo) with no use of the accessory medial portal (Group B) formed the two study groups. CT imaging was used to measure the femoral tunnel position as the angle of the femoral tunnel (FTA) to the horizontal level as defined from a line tangential to the medial and lateral tibial plateau in both groups which is the first outcome variable. The femoral tunnel length (FTL) was the second outcome variable.

Results: mean group values (range, standard deviation) for FTA was 33.95° (30°-41°, 2.95°) and 48.15° (43°-59°, 4.4°) for groups A and B respectively ( $p < 0.005$ ). The mean FTL was 36.15 and 44.15 for groups A and B respectively ( $p < 0.005$ ). These differences were statistically significant.

Conclusions: with the use of an accessory medial portal the femoral tunnel is placed in a more oblique position in coronal plane as compared to the conventional AM portal technique. Additionally the femoral tunnel length with this new technique is not short and moreover has the appropriate length for the usage of the smaller button.

## Transphyseal anterior cruciate ligament reconstruction in skeletally immature patients

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This study was performed to evaluate the results of transphyseal anterior cruciate ligament (ACL) reconstruction in children with open physes.

Between 2001 and 2009, 31 knees in 29 patients with a mean age of 14.1 years (10-16) underwent transphyseal, arthroscopic ACL reconstruction using an autogenous four-strand hamstrings graft. The technique was identical to that used

in the adult population in our unit, except that care was taken to ensure fixation did not cross the physes. The patients were followed up to the point of physal closure at skeletal maturity. The mean length of follow up was 25 months. The primary outcome measure was graft survival. Functional outcome was measured using Lysholm scores, International Knee Documentation Committee (IKDC) scores and the Tegner activity scale.

There were two cases of re-rupture following a further sports injury, one 12 months post-operative and one at six years. Both patients later had successful revision ACL reconstructive surgery. The re-rupture rate in this case series was 6%. Two patients underwent repair of a concomitant lateral meniscal tear at the time of surgery. The mean post-operative Lysholm score was 88 and the mean IKDC score was 88.1. The mean Tegner activity scale was 7.95. There was no evidence of growth disturbance radiologically or leg length inequality clinically.

This study demonstrates that transphyseal arthroscopic ACL reconstruction using hamstrings graft and an 'adult' technique, in skeletally immature patients, provides good functional outcomes, has a low revision rate and is not associated with physal growth arrest or disturbance.

## Anatomic ACL reconstruction using a quadrupled semitendinosus graft: the translateral all-inside technique

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**Introduction:** laboratory studies have shown that anatomic positioning of an anterior cruciate ligament (ACL) reconstruction has biomechanical advantages over traditional techniques. We present one-year clinical data of patients who had anatomic positioning of their ACL reconstruction using an 'all-inside' technique and single quadrupled semitendinosus graft.

**Methods:** 70 patients presenting for ACL reconstruction between December 2010 and 2011 were managed with the TransLateral, all-inside technique. The semitendinosus alone is harvested, quadrupled and attached to two adjustable suspensory fixation devices. Anatomic placement on the femur is achieved using the validated direct measurement technique. Patients were evaluated preoperatively using the KOOS and Lysholm scoring indices. These were repeated at six months combined with clinical assessment and goniometric measurement of knee flexion.

**Results:** 70 patients (50 male, 20 female), mean age 29.3 years, underwent TransLateral, all-inside ACL reconstruction by a single surgeon. In nine patients, this was part of multi-ligament reconstructive surgery; and 42 had simultaneous chondral or meniscal procedures. A quadrupled semitendinosus graft was used in 66 cases, of which 5 were augmented with a single loop of FibreTape giving a mean diameter of 8.6 mm. Average preoperative scores were 63-KOOS, and 58-Lysholm. At six months, 76-KOOS, 79-Lysholm, showing an increase of 13 and 21 points respectively. Average knee flexion at six months was 133 degrees.

**Conclusions:** the TransLateral approach allows excellent visualisation of the lateral femoral condyle, and facilitates anatomic ACL graft placement. The single-bundle, quadrupled semitendinosus graft decreases the morbidity of hamstring harvest and allows greater flexibility in graft choice in cases requiring multi-ligament reconstruction. An average graft size of 8.6mm was achieved. We have had no failures using this technique and early results demonstrate good postoperative function.

## Proximal tibiofibular joint instability in the setting of a multiligamentous knee injury

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**Introduction:** proximal tibiofibular joint disruptions are uncommon injuries and usually occur as a result of an isolated injury following a direct blow or trauma. This joint is an important anatomic landmark and attachment for the lateral sided structures of the knee. This small case series describes the identification and acute operative stabilization of proximal tibiofibular joint disruptions in the setting of traumatic multiligamentous knee injuries.

Methods: over a 6 year period (2005-2010) 6 patients with proximal tibiofibular joint disruptions following a traumatic knee dislocation were treated operatively at a Level 1 teaching trauma center. Patients had preoperative x-rays, MRI scans of the knee, and exams under anesthesia. All injuries to the proximal tibiofibular joint were identified intraoperatively by either a dislocated or dislocatable fibular head from its articulation with the proximal tibia. All patients had stable contralateral proximal tibiofibular joints on preoperative examination.

Results: six proximal tibiofibular joint disruptions out of 72 (8%) consecutively treated multiligamentous knee injuries were identified. Patients (3M, 3F) had an average age of 35. Mechanisms of injury were all high energy; including three motor vehicle accidents and three motorcycle accidents. All (100%) were poly trauma. Schenck knee dislocation classification was KD (I, n=5 & III, n=1). Within 4 days of injury, patients underwent direct reduction and stabilization using a standard lateral approach and a single cortical screw.

All patients had concomitant posterolateral corner (PLC) injuries of the knee including the lateral collateral ligament (LCL). Five patients had concomitant cruciate ligament injuries (3 anterior and 2 posterior) all requiring reconstruction. Each patient had at least one meniscal injury (6 lateral & 2 medial). One patient had an open multiligamentous knee injury.

Conclusions: proximal tibiofibular joint instability in the setting of traumatic multiligamentous knee injuries has not been previously described in the literature to our knowledge. Accurate diagnosis and stabilization of the proximal tibiofibular joint is essential prior to attempted anatomic reconstruction of the posterolateral corner of the knee.

## Opening wedge bi-planar high tibial osteotomy as treatment for chronic multiple ligament injuries in the varus knee. A prospective clinical study

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Introduction: in patients with chronic multiple ligament – injured knee, failure to correct the varus alignment of the knee will often result in failure of the ligament reconstruction.

Purpose: to prospectively assess the functional outcomes of patients with combined grade 3 postero-lateral, ACL /PCL instability and varus alignment of the knee treated with opening wedge bi-planar HTO.

Material and methods: eleven patients with 12 knees with combined grade 3 posterolateral, ACL/PCL instability and varus alignment of the knee treated with opening wedge bi-planar HTO and observed prospectively. All twelve knees had grade 3 posterolateral instability. Six patients had ACL deficiency. Four patients had PCL deficiency. Two patients had combined ACL and PCL deficiency. Postero-medial opening wedge HTO was done for the ACL deficient knees to decrease the tibial slope. Antero-medial opening wedge HTO was done for the PCL deficient knees to increase the tibial slope. Second stage ligament reconstruction was performed in patients with continued instability after the osteotomies had healed and after at least six months of rehabilitation.

Results: eight of 12 knee (66.7%) had sufficient improvement in knee function that a subsequent ligament reconstruction was not necessary. There was a significant difference between the preoperative and postoperative coronal (femoro-tibial angle) alignment. There was a significant difference between the preoperative and postoperative posterior tibial slope in the ACL patient group and the PCL patient group. Two of 6 patients (33.3%) with ACL injuries required PLC reconstruction, one of them needed ACL reconstruction. One of 4 patients (25%) with PCL injury required PLC and PCL reconstruction. One of 2 patients (50%) with combined ACL and PCL injury required PLC and ACL reconstruction. Four of 6 patients (66.7%) with high velocity knee injuries needed further ligament reconstruction.

Conclusions: opening wedge bi-planar high tibial osteotomy can be an effective method of treatment for patients with combined chronic multiple ligament injuries and varus knee. Patients with an appropriate opening wedge and manipulation of the slope to enhance stability may not require the second soft tissue procedure. Patients with low-velocity knee injuries may not require a second stage ligament reconstruction after healing the osteotomy and rehabilitation.

### Abbreviations:

ACL: anterior cruciate ligament  
PCL: posterior cruciate ligament  
HTO: high tibial osteotomy  
PLC: postero lateral corner

# Anteromedial portal versus transtibial drilling techniques in ACL reconstruction: what is the clinical and radiographic relevance?

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**Background:** anatomical anterior cruciate ligament (ACL) reconstruction improves the kinematics of the knee and the control of tibial rotation.

**Methods:** eighty-eight non-consecutive patients (73 men; 15 women) with unilateral ACL insufficiency were evaluated before and after ACL reconstruction performed using either a transtibial (TT) or an antero-medial portal (AMP) technique. At a minimum follow-up of 5 years patients were evaluated using Lysholm and IKDC scores, return to sport activity, manual maximum displacement test with KT-1000 arthrometer and Lachman test, and rotational instability with pivot shift test. Degenerative changes were assessed on radiographs according to Fairbank classification. The position of the tunnel was assessed on CT scans.

**Results:** at a minimum follow-up of 5 years, the 2 groups were similar for Lysholm and IKDC scores, Tegner level. Compared with the SB TT ACL reconstruction group, AMP patients had lower grade pivot shift ( $p=0.42$ ) and Lachman ( $p=0.47$ ), with no statistically significant inter-group difference. Patients undergoing AMP reconstruction were more likely to return to pre-injury sport activity ( $p= .004$ ). Radiographic evaluation showed lower, not significantly different degenerative changes in the SB AMP ACL reconstruction group at final follow-up ( $p = 0.47$ ). On CT Scans, the native femoral footprint was better restored after AMP reconstruction than TT.

**Conclusion:** AMP ACL reconstruction better restores the native anatomical footprint, a results in a higher return to sport activity rate. The 2 procedures are not significantly different for development of radiographic degenerative changes at a minimum follow-up of 5 years.

# Computer assisted surgery is not more accurate or precise than conventional arthroscopic ACL reconstruction: a prospective randomized clinical trial

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**Introduction:** accurate and precise tunnel placement is critical to the success of anterior cruciate ligament (ACL) reconstruction. A new development has been computer assisted surgery (CAS), aiding in the ACL bone tunnel placement during surgery. Our hypothesis is that CAS will allow for more accurate and precise tunnel placement in ACL reconstruction as compared to conventional surgery.

**Material and methods:** this study is set up as a prospective double-blinded randomized clinical study. 100 patients eligible for ACL reconstruction, with a trans-tibial technique, were stratified per surgeon and randomized for either conventional or CAS. 3-dimensional CT measurement of the femoral and tibial tunnel placement was used as primary outcome to compare conventional ACL surgery to CAS.

**Results:** no difference in placement of the femoral tunnel for the conventional group was seen compared to the CAS group (respective mean 39.7% versus 39.0% on the proximal-distal intracondylar axis ( $P = 0.70$ )). The anterior-posterior placement of the tibial tunnel was not significantly different, 38.9% in the conventional group and 38.2% in the CAS group ( $P = 0.58$ ). There was no significant difference in precision of either the femoral or the tibial placement in the two groups.

**Conclusions:** there is no significant difference in accuracy or in precision of the tunnel placement between conventional and CAS ACL reconstruction.

# Results of a patient-tailored treatment algorithm for the treatment of posterolateral knee instability

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Posterolateral instability of the knee joint can lead to serious impairment in sports and ADL activity. Surgical reconstruction, if warranted, has no "one fits all" solution. 24 patients with posterolateral knee instability were included in a prospective cohort trial and have been treated according to an algorithm, based on: subjective instability, varus thrust, integrity of popliteus tendon, integrity of posterolateral arcuate ligament, integrity or lesion of posterior cruciate ligament, integrity or lesion of anterior cruciate ligament, and varus or valgus deviation on standing X-rays. stepwise reconstruction was performed for static varus deformity, reconstruction of PCL, reconstruction of lateral collateral ligament and popliteus tendon, and reconstruction of ACL.

Standard surgical technique with autologous BTB patellar tendon or quadriceps tendon was used for ACL and PCL reconstruction, and LCL and Popliteus tendon were reconstructed with hamstring grafts. All patients were analyzed at a minimal 5 year follow up.

After analysis according to the algorithm, 8 patients underwent posterolateral corner reconstruction (PLR) with high tibial osteotomy, 9 Patients PLR with PCL reconstruction, 4 PLR with ACL reconstruction, and 4PLR without any further reconstruction. All patients were follow up by stress x-rays and IKDC score.

The IKDC score subjective showed a significant amelioration in all patients, averagely 17 points higher than pre-surgery. 38% scored abnormal on the external rotation test pre-operatively, 94% scored normal 5 years postoperatively. The varus instability score changed from 84% abnormal to 63% normal post surgery. No complications, especially no vascular or neurogenic lesions, we noticed. We conclude that an individually tailored reconstruction for posterolateral instability of the knee results in significant amelioration of function, less disability and a higher quality of life, self sufficiency and active lifestyle.

## Combined HTO and extraarticular stabilization for arthritis on ACL deficient knee

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Natural onset of ACL rupture often yields to arthritis. It is logical to treat both when patients complain of both. This retrospective study reports the results of an original technique combining lateral closed wedge osteotomy with an extraarticular stabilization.

From 1996 to 2002, 29 patients (age 29-51) were concerned. Index ACL tear occurred 17,5 years (13-22) prior surgery. 26 were athletes before injury, 9 performed still sport. They all had previous surgery (52 procedures, more than one per knee): meniscectomy, debridement, ACL repair and/or HTO. Functional instability and medial pain were always present. The pivot shift was positive with a 8 mm (5-10) increased anterior drawer at instrumental testing. X-rays reported medial compartment arthritis (7 grades B, 18 C 4 D) with varus alignment from 5° to 15°.

The procedure combined closed wedge HTO and extraarticular autograft using a quarter of the patellar tendon; without any interference between osteotomy, fixations and tibial tunnel. Full weight bearing and active motion were allowed.

At 5 years FU (1,5 - 9), 26 patients had a very satisfied or satisfied IKDC subjective score. 22 resume to sport. One was unstable and two painful. Instrumental testing (KT 1000) was 2 mm (1-6). Pivot shift was 18 A, 10 B, 1 C. Radiological alignment was corrected, 3 arthritis worsened. Excluding radiological changes, IKDC scores were 2 A, 21 B, 6 C, 1 D.

This procedure gives satisfying results allowing return to sport. It is efficient on pivot shift and surprisingly on anterior drawer too.

# The correlation between quadriceps angle and tibial tuberosity-trochlear groove distance in patients with patellar instability

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**Aims:** the quadriceps angle (Q-angle) represents the angle between the vector of action of the quadriceps and the patellar tendon. An increased Q-angle has been associated with an increased risk of patellar instability, although there is disagreement on its reliability and validity as it is affected by the position of the limb and contraction of the quadriceps. Tibial tuberosity-trochlear groove distance (TT-TG) is ascertained by axial CT scanning, with an increased value associated with patellar instability. This study aimed to determine whether the Q-angle correlates with the TT-TG distance in patients with patellar instability.

**Methods:** Q-angles were measured in 34 knees that had previously undergone CT scanning for assessment of patellar instability. Measurements were made with the patient supine, the knee extended and the lower limbs in neutral rotation with the quadriceps relaxed and contracted. TT-TG distance was measured on CT scanning in an identical position.

**Results:** of the 34 knees measured, 24 had symptoms of patellar instability, and 10 were asymptomatic. A significant negative correlation between relaxed Q-angle and TT-TG in all knees was demonstrated ( $p = 0.028$ ). In symptomatic knees, contracted Q-angle also demonstrated a significant negative correlation with TT-TG ( $p = 0.037$ ).

**Conclusions:** If TT-TG distance is regarded as the gold standard measurement, Q-angle is not a reliable indicator of patellar instability. There is a clear need to develop methods to more fully characterise the knee and factors contributing to patellar instability.

# Knee joint rotation angle: a predictor of pathological tibial tuberosity-trochlea groove distance in patients with patellofemoral pain and instability

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**Introduction:** patella femoral pain and instability can be quantified using the tibial tuberosity to trochlea groove (TT-TG) distance with more than 20 mm considered pathological requiring surgical correction. However, in patients with trochlea dysplasia this measurement is difficult to obtain on cross sectional imaging.

**Hypothesis:** knee joint rotation angle does not predict for pathological TT-TG.

**Methods:** one hundred limbs were scanned using Computer Tomography (CT) cross sectional imaging in 50 patients presenting with patella femoral pain and instability at our institution. The TT-TG distance was measured along with the rotational measurements including femoral version, tibial torsion and knee joint rotation angle (KJRA). Knee joints with a TT-TG  $\geq 20$  mm were considered pathological and angles were compared with patients with no pathological TT-TG ( $\leq 19$ mm). Significant differences in the measured angles between the pathological and non-pathological groups were estimated using the t test. The inter- and intra observer variability of the measurement was performed. Logistic regression analysis was used to find the best combination of rotational angle predictors for a pathological TT-TG.

**Results:** a statistically significant difference ( $P=0.024$ ) was found between the KJRA between the pathological (mean=10.6, SD=7.79 degrees) and the non-pathological group (mean=6.99, SD=5.06 degrees). Logistic regression analysis showed that both femoral version ( $P=0.03$ , OR= 0.95) and KJRA ( $P=0.004$ , OR=1.15) were, in combination, significant predictors of an abnormal TT-TG.

**Conclusion:** the KJRA is a useful clinical measurement and is associated with a pathological TT-TG. It may be used as an alternative measurement when the TT-TG distance cannot be measured as in cases of severe trochlea dysplasia.



# Altered landing mechanics in professional rugby union players with patello femoral pain

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**Introduction:** this study investigated lower limb kinematics in sportsmen with and without PFP during a single leg drop from height.

**Methods:** one control (mean age: 23.2 ± 2.6 yr, mean mass: 102.8 ± 14.3 kg) and one PFP (mean age: 23.1 ± 2.7 yr, mean mass: 104 ± 13.1 kg) group each of 13 male professional rugby union players performed three repetitions of a single leg drop from height. Torso, hip, knee and ankle flexion angles in the sagittal plane were determined using optical trackers. Simultaneous measurement of the magnitude and location of peak foot pressure using a floor pressure mat on landing was undertaken. Mean Vastus Medialis (VM), Vastus Lateralis (VL) and Gluteus Medius (GMed) and Gluteus Maximus (GMax) electromyographic amplitude during the loading phase of landing were recorded.

**Results:** the PFP group demonstrated significantly less torso and knee flexion ( $P < 0.05$ ) on landing. There was no significant difference in hip or ankle flexion angle between groups ( $P > 0.05$ ). Peak foot pressure on landing was significantly greater in the PFP group ( $P < 0.05$ ), but no significant effect was found in the area or location of peak pressure on landing ( $P > 0.05$ ). The PFP group displayed significantly greater activity in VL and VM compared to controls ( $P < 0.05$ ), however there were no significant differences in GMed and GMax activity ( $P > 0.05$ ).

**Conclusion:** PFP participants demonstrated significantly reduced torso inclination and increased VL and VM activity and peak foot pressures on impact when performing a single leg land from a step compared to their pain free controls.

# The overlap between diagnosis of Patello-Femoral Joint pain and damage of lateral compartment of the knee, a prospective study

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**Introduction:** clinical diagnosis of Patello-Femoral Joint pain (PFJP) is often not backed by anatomical-pathological findings. Accuracy of the clinical diagnosis of Lateral Meniscal injury is not far over 50%. In this study we tried to verify the overlap in signs and physical diagnosis between these two pathologies, when confirmed by arthroscopic surgery.

**Methods:** 753 arthroscopic knee surgeries were recorded between 1998 and 2005. In each case a form was completed before the arthroscopy. The findings of clinical examination were recorded and the pre-surgical diagnosis was documented. The form was then completed after the surgical procedure, and the clinical examination, pre-surgical diagnosis and patients complaints were compared to the arthroscopic findings.

**Results:** a lateral meniscus was misdiagnosed as torn as in 46%. Of these 35.7% were found to have PFJ osteoarthritis of grade 2 or 3 which was clearly higher than in the population with correct diagnosis of LM tear - 23.6% (borderline significance.  $P = 0.094$ ).

**Conclusions:** there seems to be an overlap in clinical symptoms between PFJP, especially groove osteoarthritis, and damage to the lateral compartment of the knee, especially damage of the lateral meniscus. Though statistically showing a trend only, it should be kept in mind that misdiagnosis could occur because of the overlap of those two pathologies. This would mean that a diagnosis of lateral meniscal damage could eventually be proven to be PFJ diseases and diagnosis of PFJP could possibly turn out to be a lateral meniscus tear.

# Compartment pressures predict surgical success in the deep posterior chronic exertional compartment syndrome of the lower leg

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**Introduction:** a chronic exertional compartment syndrome (CECS) of the deep posterior compartment of the leg is frequently diagnosed in athletes. For yet unknown reasons, clinical outcome after surgery (fasciotomy) is disappointing. Gold standard for diagnosis is an intramuscular pressure measurement (ICP): a resting pressure >15 mmHg, >30 mmHg after 1 minute or >20 mmHg 5 minutes after exercise indicates surgery. To date, little research has been performed on the prognostic value of ICP.

**Purpose:** to analyze the prognostic value of ICP for success after surgery of deep posterior CECS.

**Method:** from 1996 to 2010, 117 patients underwent surgery for deep posterior CECS after confirmation by ICP. Measured pressures before, immediately after and 1 and 5 minutes after a standard exercise test formed a four-point pressure curve. The area under each curve was calculated. All 117 patients received a questionnaire on the 3 months post-operative clinical outcome (excellent/good = successful, fair/poor = unsuccessful).

**Results:** complete pressure registrations and questionnaire data were available for 52 patients (M/F 23:29, age 33±14 years). They rated their clinical outcome as excellent (14%), good (38%), fair (35%) or poor (13%). Outcome was related to the area under the preoperative four-point pressure curve (excellent, 127±28; good, 113±25; fair, 100±22 and poor, 88±15; P=.005, Odds ratio [OR] 1.04; 95% confidence interval [CI]: 1.01-1.08). Pressures immediately after exercise and a following pressure drop within 5 minutes were also prognostic for success (OR 1.06, 95%CI: 1.00-1.13, and OR 1.11, 95%CI: 1.01-1.21, respectively).

**Conclusion:** preoperative pressure measurements demonstrate prognostic properties for outcome after surgery.

# The effectiveness of functional neuromuscular warm-up strategies for preventing Lower Limb Injuries during sports participation: a systematic review

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**Aim:** to determine which practical functional neuromuscular warm-up strategies are effective in preventing lower limb injuries during sports participation, and in which sporting groups they are effective.

**Methods:** seven electronic databases were searched from inception to January 2012 for studies investigating neuromuscular warm-up strategies and injury prevention. The quality of each included study was evaluated using a modified version of the van Tulder scale. Data were extracted from each study and used to calculate the risk of injury following application of each evaluated neuromuscular warm-up strategy.

**Results:** nine studies were identified including six randomised controlled trials (RCT) and three controlled clinical trials (CCT). Heterogeneity in study design and warm-up strategies prevented pooling of results. Two studies investigated male and female participants, whilst the remaining seven investigated females only. Risk Ratio (RR) statistics indicated 'The 11+' prevention strategy significantly reduces overall (RR 0.67, CI 0.54-0.84) and overuse (RR 0.45, CI 0.28-0.71) lower limb injuries as well as knee (RR 0.48, CI 0.32-0.72) injuries among young amateur female footballers. The 'Knee Injury Prevention Program' (KIPP) significantly reduced the risk of noncontact lower limb (RR 0.5, CI 0.33-0.76) and overuse (RR 0.44, CI 0.22-0.86) injuries in young amateur female football and basketball players. The 'Prevent injury and Enhance Performance' (PEP) strategy reduces the incidence of anterior cruciate ligament (ACL) injuries (RR 0.18, CI 0.08-0.42). The 'HarmoKnee' programme reduces the risk of knee injuries (RR 0.22, CI 0.06-0.76) in teenage female footballers. The 'Anterior Knee Pain Prevention Training Programme' (AKP PTP) significantly reduces the incidence of anterior knee pain (RR 0.27, CI 0.14-0.54) in military recruits.

Conclusion: effective implementation of practical neuromuscular warm-up strategies can reduce lower extremity injury incidence in young, amateur, female athletes and male and female military recruits. This is typically a warm-up strategy that includes stretching, strengthening, balance exercises, sports-specific agility drills and landing techniques applied consistently for longer than three consecutive months. In order to optimise these strategies, the mechanisms for their effectiveness require further evaluation.

## Countermovement jump force as performance measure in 11-15 year old athletes?

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Introduction: jumping power as a commonly accepted measure for athletic performance is expected to improve in pubescent elite school athletes. The study investigates a cohort of 11-15 year old athletes of various sports to quantify changes in countermovement jump (CMJ) performance regarding age.

Material and methods: 197 young athletes of different sport-disciplines [m/f: n=137/60; age: 13.9±1.4y; height: 1.66±0.11m; weight: 56.0±12.9kg] were categorized by age [11y: n=21; 12y: n=50; 13y: n=21; 14y: n=42; 15y: n=63]. For all subjects CMJ was measured on a force plate [AMTI, 1000Hz, 3repetitions] quantified by absolute peak force (PFA [N]) and force normalized to body weight (PFBW [ $x \cdot BW$ ]). Applied descriptive statistics (means±SD), were followed by one-way-ANOVA and Post-Hoc-Test (Tukey-Kramer;  $\alpha=0.05$ ).

Results: overall mean values for PFA and PFBW were 1253±339N and 2.28±0.36 $\cdot BW$  respectively. PFA progressively increased over age [11y(975±252N); 12y(1015±188N); 13y(1260±319N); 14y(1399±365N); 15y(1436±270N)]. No statistically significant differences for PFA were observed, when comparing age 11 to 12, 13 to 14 and 14 to 15 ( $p>0.05$ ). Age 11 and 12 differed statistically significant from 13, 14, and 15 (PFA=390.96N,  $p<0.05$ ). No statistically significant difference could be found between age groups for PFBW [11y(2.23±0.42); 12y(2.27±0.36); 13y(2.32±0.35); 14y(2.38±0.46); 15y(2.24±0.26)], ( $p>0.05$ ).

Conclusions: differences of PFA and the stagnation of PFBW should be discussed in accordance with changes in anthropometric data over age. Observed low improvements in jump force give reason to analyse systematic training routines. PFA seems to serve as performance measure in adolescent athletes. Normalization of force to bodyweight eliminates any age effects in PFBW.

## Risk factors for neurovascular and soft-tissue injuries complicating anterior shoulder dislocation in sports

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Introduction: anterior shoulder dislocation is a common traumatic injury sustained across a wide range of sports. They may be complicated by neurological deficits, injuries to the rotator cuff, and fractures of the greater tuberosity. The early recognition of these associated injuries is important as they can compromise subsequent recovery of function. This is especially pertinent in the active sporting population to counsel patients of their anticipated delayed recovery and return to sport. We evaluated the prevalence of neurovascular deficits, greater tuberosity fractures and rotator cuff tears associated with anterior shoulder dislocation sustained during sport and exercise.

Materials and methods: a prospective trauma database recorded the details of 1030 consecutive patients (882 men and 148 women, mean age 25.7 years) presenting to the Royal Infirmary of Edinburgh with an anterior shoulder dislocation sustained during sport between 1995 and 2009. We evaluated the demographics and risk factors for ultrasound-proven rotator cuff tears, greater tuberosity fractures and neurological deficits associated with anterior shoulder dislocation.

Results: a dislocation without associated injury was found in 881 shoulders (85.5%). 74 patients (7.2%) sustained an associated neurological deficit, 47 patients (83.9%) had an associated fracture of the greater tuberosity, 9 patients (16.1%) had an associated rotator cuff tear, and 19 patients (0.87%) had a combined injury. Solitary axillary nerve palsy was the most common sustained neurological deficit. Being male ( $p=0.044$ ) and having a history of recurrent shoulder in-

jury ( $p < 0.000$ ) increased the likelihood of sustaining a neurological deficit. Being more than 25 years ( $p < 0.000$ ) and playing contact sport was associated with sustaining a greater tuberosity fracture or rotator cuff tear.

Conclusions: anterior shoulder dislocations sustained during sport can have associated injuries to the neurovascular system or soft tissues which can occur in isolation or in combination. Being male and having recurrent shoulder instability increases your risk of sustaining an associated neurological injury. Being a patient older than 25 years playing a contact sport significantly increases the risk of sustaining an associated soft tissue injury. This should be taken into account when examining a patient with an anterior shoulder dislocation sustained during sport. A careful history and examination supplemented by investigations is advised to identify these lesions which may delay early functional recovery in the active individual.

## All-Arthroscopic Double-Bundle coracoclavicular ligament reconstruction using autogenous semitendinosus graft: a new technique

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Introduction: an acromioclavicular joint (AC-joint) separation typically occurs after falling on the shoulder. Treatment is often conservative. In type III-V dislocations the pronounced lifted position and anterior- posterior translation of the distal clavicle may cause problems among physically active patients and operative treatment may be considered.

Material and methods: we present our arthroscopic anatomical double bundle coracoclavicular (CC) reconstruction technique using a 4 mm semitendinosus tendon autograft. The unique aspect of our technique is the position of the dorsal limb of the graft around the dorsal edge of the clavicle reconstructing the conoid ligament. The anterior limb projects superiorly and replaces the trapezoid ligament. A significant advantage is that there is only one 6-mm drill hole in the clavicle and a 4.5-mm drill hole in the coracoid. An additional advantage is that the temporary fixation apparatus uses the same drill holes. These drill holes are the smallest possible if a distal button fixation and semitendinosus graft are used. The solution effectively stabilizes the AC-joint and prevents anterior posterior translation.

There are two alternatives for temporary fixation. A combination of a GraftWasher, a TightRope distal button and #5 FiberWire in acute cases and lighter built patients. The second is a GraftWasher, a Dog Bone button and FiberTape (Arthrex Inc, Naples, FL) in chronic cases or more heavily built patients.

Postoperatively, the patients use a gunslinger brace for 4 weeks. The patients are allowed to flex and extend the elbow. Light waistline movements are also allowed within the limits of pain. Rehabilitation is started 4-6 weeks after surgery with gentle passive exercises. At 8 weeks, free range of motion is allowed. Returning to contact sports, such as ice hockey, is permitted after 6 months. 23 patients have been operated so far. The longest follow up time is now 1 ½ years.

Results: in this series the first results of the operation were evaluated 6 months after the operation. The outcomes of the operation were divided into 4 categories: excellent, good, fair, and poor. The outcome was considered excellent if the patient was able to return to work or sports with no difficulty, had normal range of motion of the arm with no restrictions, and subjectively considered the outcome excellent. The result was regarded as good if the range of motion was full but there was still some stiffness, if the patient had occasional pain using the arm, or if a small bump (under 10 mm) remained in the AC joint. The outcome was considered fair if there was a bump (over 10 mm) remaining in the AC joint and the patient had frequent pain in the AC joint. If the stabilization of the clavicle failed, the outcome was considered poor. Preliminary patient outcomes were identified at 6 months postoperatively. In twelve patients, the outcome was excellent. In four patients, the outcome was determined to be good since there were slight pain in the AC-joint or a remaining bump under 10 mm. Seven patients are still in the early phase of recovery. The follow ups will continue.

Conclusion: the results have been very promising and the patients have been able to return to high demand sports or heavy labor. An all-arthroscopic double-bundle coracoclavicular joint reconstruction is an effective and reliable method in stabilizing the clavicle and neutralizing the anterior- posterior translation, and we find it to be technically practical for the surgeon.

# Platelet-Rich plasma vs cortisone injections for the non-surgical treatment of shoulder pain

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Introduction: to evaluate pain and functional improvement in shoulder pain with PRP injections versus cortisone.

Methods: this is a case-control study using 186 study patients who received a PRP injection and 299 control patients who received a cortisone injection for shoulder pain. Inclusion criteria were any patients having shoulder pain during the collection period already having tried NSAID's and physical therapy. Patients were evaluated clinically with pain scores and ASES scores for six months. Exclusion criteria were non-compliance with the physical therapy regimen or post-injection trauma. Results: overall pain and ASES scores improved for both study and control groups (Study: 6.0 to 2.6 & 47.7 to 72.5 and Control: 6.6 to 3.8 & 41.7 to 62.0,  $p=0.01$  &  $0.005$ ). Patients with tendonopathy and PASTA lesions all showed significant improvement with PRP over cortisone. Patients with DJD did improve with a tendency for recurrence after a few months in both groups ( $p=NS$ ). Adhesive capsulitis and full thickness rotator cuff tears improved equally with either cortisone or PRP injections ( $p=NS$ ).

Conclusions: this study shows that PRP injections are superior to cortisone injections to help decrease pain and improve functionality in shoulder pain. However, each individual diagnosis carries a different outcome with the different injections. Tendonopathy and PASTA lesions had significantly better outcomes with PRP than cortisone injections, but DJD, adhesive capsulitis, and full thickness rotator cuff tears all had similar outcomes with either injection. Further study is required to evaluate each diagnosis individually to better elucidate the best use of PRP.

# The role of the arthroscopic suprascapular nerve release in elite overhead athletes with shoulder pathology

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Introduction: suprascapular nerve (SSN) entrapment seems to be a common but often misdiagnosed condition especially in overhead athletes. This fact leads to failure of conservative and operative treatment in athletes with persistent shoulder pain and dysfunction.

Materials and methods: 21 elite overhead athletes were treated from Jan 2005 to May 2009 (16yrs to 34yrs, avg: 26yrs). We operated 3 Javelin throwers (silver Olympic Medalist, Olympic level thrower, National level thrower), 4 Weightlifters (International level), 2 Volleyball Players, 1 Kick Boxer, 1 Water Polo Player.

Results: all of them underwent an arthroscopic procedure for treating their main injury and during the procedure SSN release was performed. Postoperatively, all of the patients had complete pain relief, especially at the posterior shoulder and muscle atrophy improved. Additionally, all of them regained full ROM to their operated shoulder. Eight patients fully recovered at the preinjury level.

Discussion: in patients with advanced SSN entrapment significant muscle wasting is often irreversible. This underscores the importance of a quick and accurate diagnosis to facilitate appropriate intervention. The overhead athletes with an increased ROM of their shoulder predispose in SSN entrapment and shoulder injuries and vice-versa. Arthroscopic shoulder procedure for repairing the glenohumeral pathology with a simultaneous arthroscopic SSN release seems to be the appropriate treatment regarding to our early results.

# Painful unstable shoulder: new considerations (from a multicentric survey about anterior instability)

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Painful unstable shoulder is defined by bony lesions radiologically found without clinical displacement. But these lesions point out misdiagnosed dislocations. We removed such cases from a multicentric study about anterior instability to analyze epidemiology and treatment of «true» PUS.

25 patients represented 2,4% of the survey. Eighteen performed overhead/contact sport. Sex ratio was 21/4 (age 28,6 at first complain). Recurrences were only painful. Duplay score was 11,25. Nineteen patients had a positive apprehension test and 18 a relocation one. No patient had global hyperlaxity, 11 had a shoulder hypermobility. As inclusion criteria, X rays were normal. Systematic arthro-CTscan reported 16 bankart, 5 isolated labral tears and 4 RCT.

Delay to surgery was 4,6 years. One Bristow procedure, 24 arthroscopic bankart repair were performed. All patients had a capsule-labral tear: 21 in zone C extended up or downward, 3 in unusual isolated location. Complications included an ulnar nerve neurapraxy and 2 capsulitis.

At 2 years FU, global score was 75,8. Four patients were painful, the 3 unusual labral detachments were stiff and 3 unable to resume to sport. Subjective results were satisfying for 2/3 of them. 2 had re-surgery (Bristow failure and one recurrence). This underlines the bias of a multicentric study.

Capsulo-labral tears after forgiven event and/or overuse are found on arthro-CT. Arthroscopy finds a detachment too small to allow dislocation or an isolated labral tear and allows reconstruction. Antero inferior location appears a good prognostic factor. Pain at overhead activities yields to a reflex giving way.

## Early efficacy of pulsed electromagnetic fields in the management of rotator cuff tear a randomized controlled trial

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The antiinflammatory role of pulsed electromagnetic fields (PEMFs) on the articular tissue of both knee and ankle has been sufficiently described in clinical studies. The present prospective randomized double-blind study evaluates the effects of PEMFs application in arthroscopically repaired rotator cuff. for possible impact on reducing post-op pain and inflammation Fifty patients arthroscopically diagnosed of rotator cuff tear (medium to large) were enrolled and underwent arthroscopic repair They were randomly divided into two groups. The Control group were postoperatively managed using magnetic field at 0.05 mT and active group received magnetic field of 1.5 mT. PEMFs were applied for 45 days, 8 h per day. The groups were similar in regard to size of the tear (medium size tear), sex distribution, age, surgical technique, and post-operative rehabilitation programmes. After careful arthroscopic evaluation of the full-thickness rotator cuff tear, rotator cuff repair and biceps tenotomy were performed in all patients. Pre- and post-operatively, each patient was evaluated for range of motion, shoulder score (UCLA), and SF-36 self-administered questionnaire. Comparing pre- versus post-operative status at a minimum 24 months follow-up, forward elevation, internal and external rotation, modified UCLA rating system scores, and SF-36 scores improved significantly in both groups, with no significant difference between the groups. At the last follow-up, strength improved significantly in both groups, with non-significant intergroup difference. in the PEMFS group the motion recovery and pain pills consumptions were improved compared to the control group at 2, 4 and 6 weeks time. Mild capsulitis were 1 in the PEMFS group and 2 in the control group. All patients completed the treatment and were assessed at 2 weeks, 1 month, 6 weeks, months, 3 months, 6 months and minimum 12 months follow-up. The functional status was rated by t. To control pain, patients were allowed to use NSAIDs and instructed to schedule the administration. At 2 and 6 months follow-up, IKDC subjective scores and VAS measures were significantly improved in the active group ( $P < 0.05$ ) than in the placebo group. The percentage of patients who used NSAIDs was 12% in the active group and 32% in the placebo group ( $P < 0.05$ ). At 1 years follow-up, functional and pain status were comparable in both groups ( $P > 0.05$ ). In patients undergoing microfracture for grade III-IV cartilage lesions, I-ONE management improves short mid-term functional recovery, reduces pain and the use of NSAIDs.

## The effect of cycling on thoracic & lumbar spine posture: an introduction to the back posture index (BPI)

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Introduction: the popularity of cycling, both as a sport and as a means of transportation has seen a dramatic increase in the United Kingdom over the past decade. Cycling is known to have positive effects on general body fitness and car-

diovascular health, but the effects of cycling on the musculoskeletal system and joint structure & function are unknown. This study aimed to determine the effects of high intensity/long term, and low intensity/amateur cycling on upper trunk (thoracic spine) and lower back (lumbar spine) posture.

Methods and design: the 102 subjects (34 female and 68 male) that participated in the study were split into three groups; a high intensity cyclist (study) group, a non cycling (control) group and an amateur cyclists group. The same observer took all the measurements in the study, measurements which include general body size measurements (such as height, weight, e.t.c); and the relevant postural angle measurements. A questionnaire was also used to collect data on the cycling type, cycling intensity and the athleticism of the subjects.

Results: the mean lumbo-sacral angle measurements were smaller in the study group compared to the control and amateur cyclists groups, with significant differences of  $10.71 \pm 25.40$  ( $p < 0.05$ ) and  $14.12 \pm 28.30$  ( $p < 0.05$ ) respectively. There were no significant differences in the thoracic spine angular measurements.

Conclusions: in comparison to the control group, long term/high intensity cycling significantly decreases the angle at the lumbo-sacral junction (eventually resulting in a pathological lumbar lordosis), while short term/low intensity cycling may increase the lumbo-sacral junction angle (flattened lordosis). Cycling for any period of time/at any intensity has no effect on either the upper trunk (thoracic spine) posture or the back posture index, BPI.

## Stress fractures of the lumbar spine in professional cricketers

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Introduction: stress fractures of the pars interarticularis of the lumbar spine in professional fast bowlers have become commonplace in modern times with a recently reported prevalence of 16.1%. Immense strains are placed on the lumbar spine due to the repetitive combined movements of hyperextension, lateral flexion, thoracolumbar rotation and an impact force that occurs when the bowler lands in his delivery stride. This complex movement of bowling is repeated between 142-235 per week for an average professional bowler. Furthermore, modern professional cricketers play for 12 months in a year. It is therefore hardly surprising that many young fast bowlers develop stress fractures and that many are lost to the game with back pain.

Materials and methods: between 1982 and 2007, we diagnosed pars defects in 21 professional cricketers. 8 were managed conservatively by a combination of rest, supervised rehabilitation, bowling action analysis and re-training to a 'safe' action. Surgery was considered in those players who did not respond to these conservative measures and this group essentially compromised of the fast bowlers. Surgery was by Buck's direct repair of the pars lesion.

Results: this treatment regimen has given very good results enabling all of these players to return to professional sport with an average follow-up of over 5 years. Four of the surgical group have played for over ten years and 3 have played at international level.

Conclusion: we recommend treatment of this group of sportsmen in a unit consisting of a specialist physiotherapist, a bowling coach and a spinal surgeon. Should conservative measures fail, we recommend Buck's repair as the operation of choice.

## Trunk rotational strength in adolescent athletes with/without back pain

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Aim: the purpose was to examine trunk rotational strength in adolescent athletes with (BP) and without (H) back pain.

Methods: a pain assessment (VAS: visual analog scale) was used in 47 adolescent athletes to categorize subjects to BP (VAS>0.5) and H (VAS<0.5). According to back pain level n=12 athletes with back pain (BP: m/f: n = 3/9; 15±2yrs; 1.73±0.08m; 63±9kg; training: 17±6h/week) and n=34 healthy subjects (H: m/f: n=19/15; 15±2yrs; 1.69±0.11m; 61±15kg; training: 16±6h/week) could be identified. Peak torque of trunk rotation (left/right) was tested on an isokinetic dynamometer (Con-trex WS) in isometric (PTiso), concentric (30°/s; PTcon) and eccentric (30°/s; PTecc) mode. Peak torque [Nm] for right and left side and differences between sides (left-right) were calculated with mean±SD. Group differences were analysed by student's t-test ( $\alpha=0.05$ ).

Results: in BP absolute peak torques were PTiso 60.5±26.3Nm, PTcon 66.2±25.0Nm and PTecc 74.4±19.4Nm, in H

PTiso 55.5±17.1Nm, PTcon 65.7±18.9Nm and PTecc 69.5±18.5Nm. Mean side differences for BP were 9.4±7.2/15.8±11.7/8.1±7.4Nm (PTiso/PTcon/PTecc) and for H 8.7±7.6/8.9±9.1/7.2±6.5Nm (PTiso/PTcon/PTecc). No group differences were observed for trunk rotational strength measures. There were no group differences for side comparison ( $p>0.05$ ) except in PTcon ( $p=0.04$ ).

Discussion: in adolescent athletes trunk rotational strength does not differentiate between low back pain. This contradicts data showing reduced trunk strength in adult non athletes. Regardless of back pain the high amount of training in athletes could serve as an explanation model.

Conclusion: interpretation of maximum trunk strength capacity has to be seen critical in low back pain athletes.

## Low back pain in youngsters: lumbar MRI findings

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Introduction: very little is known about the distribution of lumbar MRI findings and how they are associated with low back pain in youngsters. The aim of the study is to describe any associations between “abnormal” lumbar MRI findings and low back pain in the early teenage years.

Materials and methods: disc abnormalities, nerve root compromise, endplate changes, spondylolysis and anterolisthesis were documented from MRI studies of 58 young teenagers (42 males, 16 females; age range, 13-15 years). Low back pain was identified from structured interviews. Correlation of low back pain with MRI findings was performed.

Results: low back pain was reported by 18 (31%) of the young teenagers. Disc abnormalities (disc degeneration or disc protrusion) were documented in 16 of the 58 young teenagers. Most positive MRI findings relating to the disc were noted at the L4–L5 vertebral levels. This was also the case for nerve root compromise. Endplate changes were most frequently noted in the 2 lowest levels of the thoracic spine and the 3 upper lumbar spine levels. There were no cases with Modic changes or retrolisthesis and there were identified 5 cases of anterolisthesis at L5 (4 cases were associated with grade I spondylolysis). Endplate changes, especially in relation to L3 disc, disc herniation with or without nerve root compromise and spondylolisthesis with or without spondylolysis were strongly associated with low back pain.

Conclusions: in young teenagers, disc abnormalities are not uncommon. Disc protrusions, endplate changes, and anterolisthesis in the lumbar spine were strongly associated with seeking for medical care.

## Knee osteoarthritic changes of sumo wrestlers had already appeared at high school -radiological changes of knee joint in high school and collegiate sumo wrestlers

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Introduction: sumo has long been a traditional sport in Japan, and recently is becoming a popular sport that is rapidly attracting enthusiasts abroad. With the aim of having the sport included in the Olympics, World Women's Sumo Championships as well as World Sumo

Championship have also been held since 1999. In October 2012, these Championships will be held in Hong Kong. We previously reported that even in freshman sumo wrestlers, forty-four percent of fall had some abnormal findings in their knee joints, and that these risk factors were heavy bodyweight and large body mass index. The purpose of this study was to examine the radiological changes in the knee joint in high school sumo wrestlers, and to compare their radiological changes of high school sumo wrestlers with ones of freshman collegiate sumo wrestlers.

Materials and methods: thirty-five high school sumo wrestlers and one hundred and six freshman sumo wrestlers who belonged to the Japanese Sumo Federation underwent routine radiographic examination of their knee joints and questionnaire of their knee symptoms as a medical check.



Results: their mean height was 173.5 cm, weight was 102.2 kg, body mass index was 33.7 kg/m<sup>2</sup>, and sumo career was 6.4 years in high school. High school sumo wrestlers were significantly smaller than collegiate ones in weight, BMI and sumo career, but they were significantly longer than collegiate ones in training time. Seventeen high school wrestlers (48.6%) and fifty-one collegiate ones (48.1%) had some knee symptoms. There were 4 knees of 3 high school wrestlers (8.6%) and 23 knees of 15 collegiate ones (14.2%) in joint space narrowing, and 4 knees of 4 high school-wrestlers (11.4%) and 24 knees of 19 collegiate ones (17.9%) in osteophyte formation (mainly in the medial compartment). The risk factors for these phenomena were heavybodyweight, large body mass index and short sumo career. There were one knee of one high school wrestler (2.9%) and 6 knees of 4 collegiate ones (3.8%) in bony sclerosis. The correlation between the osteophyte formation and bony sclerosis and their knee joint symptoms was significant. There were 9 knees of 7 high school wrestlers (20.0%) and 52 knees of 37 collegiate ones (34.9%) in sharpness of their intercondylar eminence. Eleven high school wrestlers (31.4%) and 46 collegiate ones (43.4%) showed some abnormal findings on their knee radiography. The occurrence rate of only their sharpness of intercondylar eminence in collegiate wrestlers was significantly larger than high school ones.

Discussion: probably because of their heavy weight and large body mass index, several sumo wrestlers had joint space narrowing and osteophyte formation in their knee joints at early stage of high school periods. The sharpness of intercondylar eminence in their knee joints increased chronologically.

Conclusion: one-third or two-fifth sumo wrestlers had some abnormal findings on their knee joint radiography. Knee osteoarthritic changes of sumo wrestlers had already appeared at high school.

## Anterior knee pain in competitive cyclists

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Introduction: competitive cycling is a popular sport in Ireland. Knee pain occurs in 33% of elite cyclists. Consequently, knee pain is a common diagnostic and management dilemma for physiotherapists, family physicians and orthopaedic surgeons. The aetiology of anterior knee pain remains unclear. Abnormal patellar tracking, vastus medialis obliquus (VMO) weakness, patellar chondromalacia and quadriceps/hamstring inflexibility are proposed mechanisms of injury. Aim: to correlate anterior knee pain with: lower limb pedal kinematics, patellar chondromalacia, VMO size, bike set up, quadriceps strength and hamstrings flexibility.

Material and methods: 18 cyclists with and without anterior knee pain were recruited. All held amateur cycling licences with Cycling Ireland and cycled at least 200 kilometres per week. Lower limb kinematics were recorded using a Motion Analysis CorporationTM6 Camera (Eagle) 240Hz Motion Analysis System with EVaRT software. Standard MRI protocol determined the presence of patellar chondromalacia and VMO size. A Con Trex dynamometer measured quadriceps strength. Straight leg raising and angle at the hip using an inclinometer determined hamstring flexibility.

Results: patellar chondromalacia was seen in 2 cyclists experiencing pain. Asymmetrical cycle patterns were also detected.

Conclusion: anterior knee pain is a common problem for cyclists. Asymmetrical cycle patterns and patellar chondromalacia were seen in our cyclists experiencing pain.

## The evaluation of the arthroscopic shoulder treatment for the weightlifters of the hellenic national weightlifting federation (2000-2010)

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The expansion and application of the arthroscopic treatment to serious and catastrophic injuries to the weightlifters of the Hellenic National Weight Lifting Team. The evaluation of the results of this specific arthroscopic treatment.

Material and methods: 49 athletes (39 male, 10 female) with shoulder injuries 2000-2010

15 yrs to 33 yrs, average: 26 yrs old.

One three times golden olympic winner, one bronze medalist, 2 silver olympic winners, 3 olympic winners, 5 world champions, 3 european champions, etc.

Treatment Surgery: all of them underwent an arthroscopic treatment (in only 3 of them underwent a mini-open rotator

cuff repair). In the 52 operated shoulders, all of them returned to the same sport level except for one with a multidirectional shoulder instability and neurological injury from his cervical spine.

The early rehabilitation time for starting basic weightlifting exercise was average 4,5 months average and starting exercise for competition was average 5,5 months. Full ROM was necessary for the operated shoulder before starting exercise for a competition. The time for returning to weightlifting was more elongated to the athletes with M.DI.

Discussion/conclusion: because of the biomechanical shoulder demands during the snatch and clean and jerk attempts of the weightlifters, a lot of various shoulder injuries are often presented. The arthroscopic shoulder surgery gives more thorough and broad knowledge of their shoulder injuries. The minimal detachment of soft tissue, the less postoperative joint stiffness and often decreased shoulder pain are encouraging factors for the arthroscopic shoulder treatment. Additionally, the returning time for training and competition combining with a proper rehabilitation seems to be less than the open surgery.

## Instrumented measurement of shoulder laxity in badminton players

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Introduction: badminton is an overhead sport and requires significant shoulder joint mobility, which may compromise shoulder stability. The aim of this study is to investigate the shoulder laxity in badminton players and if there is significant difference in laxity between the dominant and non-dominant shoulder. The prevalence of shoulder injuries in badminton players in Singapore will also be investigated.

Method: 46 competitive badminton players who have represented the combined schools or the country (Singapore) were selected for this study. A survey and 2 questionnaires, UCLA Shoulder Score (USS) and Oxford Instability Score (OIS), were administered. Assessment of shoulder laxity was performed using a shoulder mechanical device that was fitted on the participants' shoulders. The translation of the displaced humeral head on the glenoid cavity was measured anteriorly and posteriorly. This test was performed on both shoulders.

Results: there was increased laxity in the non-dominant shoulder. The anterior-posterior translation range from 3.0 to 15.2 mm for the dominant shoulder and from 3.6 to 22.5 mm for the non-dominant shoulder. Female badminton players had more shoulder laxity (3.6 to 22.5 mm) compared to male badminton players (3.0 to 14.5 mm). 65% of participants had maximum scores for USS and 36.9% for OIS. The prevalence of shoulder injuries in the studied group was 40%.

Conclusion: the decreased anterior-posterior translation of the humeral head in the dominant shoulder of badminton players demonstrates that it has greater stability despite the need for greater mobility. Female badminton players have greater humeral head translation compared to males.

## Thermal capsular shrinkage outcomes in patients with chronic lateral ankle instability

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Introduction: thermal capsular shrinkage is a well recognised procedure in the management of shoulder instability, but little data has been collected with regards to other joints. This surgical technique offers an alternative treatment to ligament reconstruction in chronic lateral ankle instability.

Objectives: this study looks at the outcomes of thermal capsular shrinkage in patients with chronic lateral ankle instability. It aims to audit the results of thermal capsular shrinkage against published literature, and to devise a recommended rehabilitation protocol.

Materials and methods: data was collected from 26 patients (12 males, 12 right ankles, mean age 32.88 years) from November 2004 to March 2011. 20 patients were available for follow up. Preoperative MRI scans and stress radiographs were taken. The patients were all assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot scale, Manchester-Oxford Foot Questionnaire, EuroQoL and the Visual Analogue Scale Foot and Ankle. Reviews were held at an average of 27.4 months postoperatively.

Results: postoperative AOFAS scores improved by a mean of 40 points ( $P<0.05$ ). 12 patients rated their satisfaction as excellent or very good, 7 as good and 1 as poor. No revision procedures were required. Physiotherapy regimes were analysed, and then collaborated to form what we believe to be the optimum postoperative management for these patients.

Conclusion: results show that this minimally invasive arthroscopic surgical technique is a successful treatment option with minimal morbidity for patients with chronic lateral ankle instability. No revision procedures were performed.

## Biomechanical analysis of tightrope versus screw fixation for a complex lisfranc ligament rupture

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Introduction: ligamentous lisfranc injuries are associated with significant morbidity. Tightrope fixation is a relatively new treatment for lisfranc injuries with potential advantages over screw fixation, but clinical and biomechanical data are sparse. The aim of the current study was to measure diastasis following tightrope or screw fixation for treatment of a complex lisfranc ligament rupture under initial loading and following load cycling in a cadaveric model.

Materials and methods: 12 pairs of fresh frozen cadaveric feet were assigned to either tightrope or screw fixation. The feet were loaded to 343N and displacement between the first and second metatarsal bases measured using a kinematic analysis system with the feet intact, after sectioning of the lisfranc ligament and the ligament between the medial and intermediate cuneiform, after fixation and after cycling the fixation for 10000 cycles. Differences in diastasis at the first and second metatarsal bases comparing fixation methods were statistically analysed, with significance set at  $p<0.05$ .

Results: the mean diastasis observed at the first-second metatarsal bases for the tightrope and screw fixations under initial loading, was 1.0mm and 0.0mm respectively ( $p=0.017$ ). Following cyclic loading, the diastasis decreased by a mean of 0.7mm in the tightrope group ( $p=0.035$ ) and was virtually unchanged in the screw fixation group.

Conclusions: after tightrope repair, a significant increase in diastasis occurred compared with screw fixation under initial loading, but no further increase in diastasis was observed after cyclic loading for either fixation. Tightrope fixation potentially has advantages over screw fixation including not requiring removal at a later stage. Two previous similar biomechanical studies assessing fixation of isolated lisfranc ligament ruptures have shown conflicting results. One study showed significantly greater diastasis following tightrope fixation compared with screw fixation and the second study showed no significant difference between fixations. The current study is novel in that it simulated a complex ligament rupture rather than an isolated lisfranc ligament injury and shows that tightrope repair allows a greater diastasis versus screw fixation. Cycling of the tightrope device has not previously been assessed; we found that diastasis did not significantly increase for either implant over the course of 10,000 cycles. At present, the optimal motion at the lisfranc joint is currently unknown and therefore further clinical research is required to determine the optimal treatment.

## Minimally invasive technique for closed reduction and fixation of the tarsometatarsal joint complex (Lisfranc) injuries

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Introduction: lisfranc injury which involves the tarsometatarsal joint complex (TMC) is a rare and easily missed serious trauma. Controversy still exists concerning the treatment of such injuries. Open reduction and internal fixation is currently the accepted treatment of displaced tarsometatarsal joint complex injuries. A new minimally invasive percutaneous reduction and fixation of this injury is described.

Material and methods: the technique is based on the use of a tensioned K-wire through the third metatarsal for traction and a twisted K-wire for antero-medial pull. The technique was used in eight adult patients.

Results: satisfactory reproducible outcome was obtained (mean AOFAS midfoot score of 80.5 points).

Conclusion: the new technique is simple, provides adequate anatomical reduction and percutaneous fixation, and gives satisfactory results with minimal complications.

# Operative vs non-operative treatment of acute achilles tendon rupture: the debate continues...

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**Introduction:** there is a lack of consensus on the best management of acute Achilles tendon ruptures (AATR). The primary aim of medical professionals should be to return these patients to full functional pain - free activity in the shortest time possible, without increasing their susceptibility to re-rupture. The objective of this study is to identify and summarize the up-to-date evidence-based practice concerning the optimal effectiveness of different interventions in the treatment of AATR.

**Methods:** a search was conducted using multiple databases, including the Cochrane Musculoskeletal Injuries Group's specialized register the Medline, PubMed, Embase and Cinahl search registers (to May 2012). All prospective, level 1 and 2, randomized and quasi-randomized were reviewed.

**Results:** twelve studies, involving 1074 patients were included. The most trials showed good to excellent long-term results in the non-operated group, with no significantly higher re-rupture rate compared to the operative cases. These all used early functional post-op rehabilitation. Patients fitted post-operatively with a functional brace rather than a cast tended to have shorter in-patient stay, fewer days off work, a quicker return to sporting activity, better range of ankle motion and strength.

**Conclusions:** contrary to previously reported studies, there is growing evidence that AATR may be successfully rehabilitated in a non-operative manner without increasing their susceptibility to re-rupture. This needs to be further studied with larger sample sizes and further high-quality research protocols. Functional rehabilitation in an active brace post-surgery is more advantageous than the current protocol of immobilization. This is irrespective of whether surgery has been performed or not.

## An osteochondral lesion in the distal fibula: a case report

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Osteochondral lesions of the talus are well recognised clinical entities, however this report illustrates a rare case of an osteochondral defect in the distal fibula. A 15 year old male was referred to the orthopaedic services with a 9 month history of persistent ankle pain following an initial inversion injury. Plain X-ray was unremarkable but MRI and CT imaging revealed an osteochondral lesion at the level of the fibular physeal scar. The patient underwent an ankle arthroscopy where an unstable chondral flap was debrided and the associated fissure decompressed. The patient made an uneventful recovery and returned to normal sporting activities, symptom free. This diagnosis should be considered in patients presenting with chronic ankle pain particularly with a history of an inversion injury. The purpose of this report is to raise awareness of this condition.

## Functional outcome of percutaneous Achilles repair: early reduction in limitation

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**Introduction:** the current literature shows little difference in outcome between non-operative and operative management following rupture of the Achilles tendon. Function scoring and assessment in these series is usually performed at a six monthly intervals. We report on the early outcome of a series of patients with a ruptured Achilles tendon managed by percutaneous repair followed by early functional rehabilitation.

**Materials and methods:** seventy-five patients elected to have percutaneous surgical repair of acute Achilles tendon ruptures from April 2009 to April 2012.

**Results:** mean ATRS scores at 3, 6, 9 & 12months were 46.1 (18-93), 74.3(26-100), 81.2(33-100) and 87.9(48-100) respectively. The number of patients who reported excellent or good scores (ATRS>84) at 3, 6, 9 & 12 months were 3%, 40%, 60% & 73%.

There was 1 case of re-rupture at 8 weeks following surgery and 2 cases of DVT. In addition there was a complication rate related to surgery of 9%: superficial infection 2.6%, iatrogenic sural nerve injury 6% and one patient requested excision of the suture knot 1.3%.

Conclusions: our patients report a marked improvement in function between 3 and 6 months following surgery. The majority of patients reported excellent or good scores beyond 6 months following repair. We recommend percutaneous repair followed by early functional rehabilitation to promote early recovery following rupture of the Achilles tendon.

Level of evidence: level 4 case series.

## The mehta lower limb elevator

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Background: foot and ankle surgery often requires the use of intra-operative radiography. To ascertain three-dimensional positions of screws and bony fragments, multiple views are needed, with at least two orthogonal views - usually antero-posterior (AP) and lateral. AP views are achievable through the radiolucent table. Lateral radiographs are harder to obtain as the opposite leg obstructs the X-ray beam. Orthopaedic surgeons often resort to elevating and twisting the leg, but this may introduce movement artefact, may be technically difficult, and risks losing the reduction.

Methods: a radiolucent, hollow elevator was devised to allow easy lateral radiographs without the contralateral leg obstructing the X-ray beam. The elevator allows the contralateral leg to sit inside the hollow device and the operated leg to sit on top. It is well padded, allowing elevation and stabilization of the operated leg without risk of pressure sores.

Results and discussion: obtaining lateral radiographs is commonly required in foot and ankle surgery. Using the Mehta elevator, AP and lateral radiographs can be taken with ease during surgery without moving the leg. The device can be used with the patient in both supine and lateral positions. The contralateral leg does not obstruct the medial surgical field, particularly while using long wires and drills. It also raises the surgical field to a suitable level to allow healthy posture of the surgical team, whilst maintaining the table height at a suitable level for the anaesthetist. The device has been used by the senior author for 4 years without complications.

## Compartment syndrome of the foot: review of the literature

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Introduction: compartment syndrome of the foot is a rare, severe complication of high-energy deceleration trauma. The diagnosis is challenging and requires a high index of suspicion. It is based on clinical examination and measurement of the intracompartmental pressure.

Once the diagnosis is made, acute compartment syndrome of the foot is treated as an orthopaedic surgical emergency. Operative decompressive fasciotomy is the only definitive treatment. Many different surgical approaches exist depending on the basis of the associated injuries. The devastating consequences of untreated compartment syndrome of the foot include: chronic pain, clawing of the lesser toes, stiffness, contracture of the forefoot, sensory disturbance and motor weakness. In severe cases, amputation may be required. There is however an increasing trend by foot and ankle surgeons to not treat compartment syndrome of the foot unless the foot itself is at risk.

Methods: we analysed published evidence relating to compartment syndrome of the foot as part of a systematic review with respect to causes, clinical features, associated osseous injury, diagnosis techniques, fasciotomy approach and complications, as well as the functional outcome. The PubMed and HighWire databases were used for the collection of published articles, which were then reviewed as above. In total, we reviewed 18 retrospective articles covering 44 patients with 49 counts of compartment syndrome.

Results: we found that crush injuries and falls/jumps from heights were the most common cause for compartment syndrome (59%). Osseous injuries were present in 38 of 49 instances, with calcaneus fractures being the most common (29%). In addition, pain and swelling was observed clinically in all conscious patients. In sixty three percent of cases, diagnosis was made using a combination of clinical assessment and the Stryker TM intracompartmental pressure monitor. Fasciotomy was most commonly performed via a medial approach (36%) followed by delayed primary wound clo-

sure in the majority of cases. There were very few complications following decompressive fasciotomy and at follow-up no outstanding problems were seen in seventy eight percent of occurrences.

Conclusion: compartment syndrome of the foot is a rare but serious condition which must be diagnosed and managed promptly. It should be suspected in all patients following a traumatic event. Regular physical examination and intracompartment pressure readings are key to making the diagnosis. Operative decompressive fasciotomy, usually using a medial approach, is the only definitive treatment.

## The “stable/unstable” chronic isolated anterior syndesmotic injury: a presentation of 5 cases and a new surgical technique for delayed reconstruction

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Introduction: isolated syndesmotic injuries are reported to comprise 1-11% of all ankle sprains<sup>1</sup>. This number may increase to more than 40% in those involved in high contact and collision sports<sup>2</sup>. These injuries are frequently under-diagnosed often being mistaken for the more common lateral ankle sprains and are inadequately treated as a result<sup>3</sup>, leading to chronic syndesmotic instability<sup>4</sup>. When instability can be objectively documented with clinical and radiographic measures it is defined as mechanical instability. When it is only based on clinical symptoms, it is defined as functional<sup>5</sup>. Symptoms vary from long standing pain, stiffness, recurrent swelling and an instability sensation without actual giving way or mechanical correlation. It may lead often to functional disability and substantial activity restriction.

Imaging of the instability may be performed by dynamic ultrasound. However if there is no instability proven in imaging, the surgical decision to explore the syndesmosis is problematic. Proven pathology in the syndesmosis in MRI or CT may serve as relative indication for operation. Surgical options for chronic anterior syndesmotic proven instability include combinations of debridement, ligamentoplasty with varying graft options, syndesmotic screw fixation, translation osteotomy of AITFL insertion and arthroscopic debridement with graft reconstruction and screw fixation – with most techniques reporting satisfying results<sup>6</sup>. There are no clear indications of surgical approach to stable syndesmotic injury.

Materials and methods: we present 3 cases of chronic anterior syndesmotic instability suffering from chronic pain and instability sensation, all of which were stable upon radiographic evaluation including Dynamic US examination. MRI disclosed pathology in the anterior syndesmosis – with mainly scar tissue present. All 3 cases were operated and proven unstable upon in-operative mechanical examination after debridement of the scar tissue. The anterior syndesmosis was reconstructed using figure of eight suturing of the Chaput process to the anterior Fibula. In 6-18 months followup the patients recovered from their symptoms and returned to full activity.

Conclusions: in cases of stable symptomatic syndesmosis injuries there is indication for exploration of the anterior syndesmosis and stabilization if proven unstable.

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# The influence of the measurement of ankle edema in improving the reliability of the Ottawa ankle rules protocol

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**Objectives:** to validate the accuracy of the Ottawa Ankle Rule (OAR) to rule out clinical significant ankle fractures and to evaluate the impact of measuring ankle edema, with the figure of eight method, in patients with ankle injuries examined in the emergency department of an average Greek hospital.

**Design:** prospective cohort study.

**Participants:** between January and February 2012 123 patients presented with a case of ankle injury. Of these, 119 patients both met recruitment criteria and provided data for this study. Resident orthopaedic surgeons examined the patients and filled the data form and all patients underwent blinded radiographic assessment.

**Main outcome measures:** sensitivity, specificity.

**Results:** of the 119 patients with ankle sprains 34 had an ankle fracture (28,6%). All cases with a fracture had difference in the edema measurement between the injured and the uninjured ankle >1cm (sensitivity 100%) and of 85 patients without a fracture, the edema was ≤1cm in 63 cases (specificity 74,11%). In the same group of patients the OAR missed to predict 2 fractures (sensitivity 94,12%) and showed relative low specificity (37,65%).

**Conclusions:** this validation study of the OAR in a Greek setting produced similar results than those published previously in various other settings. A new rule, ankle edema measurement, seemed to be more accurate and more specific than OAR in ruling out possible fractures. Further studies should be performed in order to establish this rule in clinical practice.

**Key words:** ankle injuries, Ottawa ankle rule, figure of eight, sensitivity, specificity, clinical decision rules.

# Cost analysis in the management of acute Achilles tendon rupture

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**Introduction:** the management of acute Achilles tendon rupture remains contentious. The aim of this study is to ascertain the cost implications in patients with acute Achilles tendon rupture treated conservatively or surgically.

**Material and methods:** between 2007 and 2011, 41 patients were identified in this retrospective study. 20 patients were treated conservatively (Group A) and the rest were treated surgically (Group B). In Group A, non-operative protocol using Air Cast Walker was used for 12 weeks. In Group B, open repair was used. Both groups were compared for age, gender, occupation and mechanism of injury.

The outcome was correlated to complications, patient satisfaction and time return to normal activities. Cost analysis was calculated based on number of physical therapy sessions, out-patient follow-up clinics, operative tariff, in-patient hospital stay and Air Cast Walker used.

**Results:** there was no difference in terms of age, gender, side of injury and mechanism of injury. One patient had pressure sore from AirCast Walker in Group A. One scar tenderness and one wound infection in Group B. Patient satisfaction was similar in both groups. The follow-up period was longer in Group B (mean: 21 vs. 18 weeks) due to prolonged rehabilitation. No difference in terms of time return to normal activities for both groups. However, the cost of operative management was twice (£1393) of conservative management (£717).

**Conclusion:** the surgical treatment of acute Achilles tendon rupture cost more than non-surgical treatment and yet confer no advantages in term of early return to activities, complication rates and patient satisfaction.

# Can primary open repair of the Achilles tendon be justified in today's economy? A cohort comparison study.

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Background: the management of rupture of the Achilles tendon is controversial. Recent studies have failed to show a difference in outcome based on functional scores between operative and non-operative management and yet meta-analyses show significant differences in re-rupture rate.

In the current economic climate, we believe it is reasonable to consider the financial cost of management of patients sustaining Achilles tendon rupture.

Methods: we audited our practice of surgical management of Achilles tendon ruptures between 2005-2011 based upon length of hospital stay and follow up. Forty nine patients who requested percutaneous repair were compared with those 38 patients whom had open repairs. Groups were of comparable age and gender.

Results: complication rates were similar in both groups but tended to be lower in percutaneous repair: (PC vs. Open) Infection; 2.0% vs. 5.3%, Transient sural nerve damage: 6.1% vs. 5.3%, Wound breakdown: 0% vs. 7.9%, Re-rupture: 0% vs. 2.6%. Tourniquet time: 20.8 vs. 45.1mins and length of stay: 0.49 vs. 1.9 days were significantly shorter in the percutaneous repair group.

Functional outcome was reported as ATRS 84 (33-100) at 1 year following repair in the PC group and ATRS 88 (54-100) at just over 4 years (50months (18-70) in the Open group.

In our trust, the average cost of a managing a percutaneous Achilles tendon repair was £4793.10 compared to £10750.29 for open repair.

Conclusion: patients who had a percutaneous repair had shorter hospital stay, theatre time, and consumable item costs with fewer complications and yet had comparable functional outcome.

# Frequency of foot and ankle injuries in professional footballers following the introduction of Prehab which incorporates elements of the FIFA 11+

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Introduction: foot and ankle injuries are common amongst footballers. The FIFA 11+ is one form of Prehab that is designed to decrease their incidence. Our aim was to determine the frequency of foot and ankle injuries following the introduction of Prehab.

Methods: data was collected prospectively regarding every injury suffered by a player at an English Professional Football Club. This included diagnosis, time to return to play, mechanism of injury, activity during injury, treatment received, side of injury and ground conditions.

This data was recorded prior to and following the introduction of a Prehab exercise regime that includes the ankle proprioception exercises from the FIFA 11+.

Results: overall 421 injuries were recorded, 301 of which were involving First Team Squad players. Of the 301, 63 (20.9%) were Foot and Ankle injuries. 35 of these were prior to the introduction of the Prehab and 28 after. Ankle sprains (ATFL injury) were the most common injury but their frequency decreased from 37.1% to 10.7% following the introduction of Prehab ( $p < 0.05$ ). The mean number of days absent from training after an ATFL injury also decreased following the introduction of Prehab from 16 days to 3 days. The frequency of injuries suffered in training also decreased from 53.1% to 36% after the introduction of Prehab.

Conclusion: the introduction of a Prehab protocol including the ankle exercise components of the FIFA 11+ results in a statistically significant decrease in the frequency and severity of ankle sprains within the setting of a professional football club.



# Reconstruction of a large osteochondral lesion of the distal tibia with an iliac crest graft and autologous matrix induced chondrogenesis (AMIC) - Case Report

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Purpose: joint preserving treatment of osteochondral lesions (OCL) in younger sportive patients remains a big challenge for the orthopaedic surgeon. Isolated OCL of the distal tibia are rare and no clear treatment guidelines have been established. With this case we report the successful use of Autologous Matrix Induced Chondrogenesis (AMIC) aided reconstruction for OCL of the distal tibia.

Methods: a 29 year old male patient complained about persisting pain (Visual Analogue Scale (VAS) 4) and recurrent swelling 12 months after an ankle sprain. Sport activities were no longer possible. The AOFAS Ankle-Hindfoot Scale was poor with 61 points. MRI revealed a large OCL at the lateral distal tibia.

The osteochondral defect was debrided followed by microfracturing of the underlying sclerotic bone. A cancellous bone plug from the iliac crest was impacted into the defect. A collagen membrane (Chondro-Gide, Geistlich, Wolhusen, Switzerland) was used to cover the defect.

Results: at 12 and 36 months the patient had a VAS of 0 points and returned to a full time job and full sports. AOFAS hindfoot score increased from 61 points preoperatively to 100 points after 12 and 36 months. Conventional radiographs at one year showed successful osseous integration of the plug and a nearly anatomic shape of the tibial joint line. MRI dGEMRIC scans at 36 months showed intact cartilage layer over the defect and glycosaminoglycan content indicating fibrous cartilage repair.

Conclusion: this case demonstrates AMIC aided reconstruction of large osteochondral lesions of distal tibia to be a promising treatment method.

## Arthroscopic treatment of anterolateral ankle impingement in football players

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Introduction: arthroscopic treatment of antero-lateral ankle impingement has presented in the 90's as alternative of choice with satisfactory results reported and limits related to articular and ligamentous pathologies, with different population investigated. The aim of this study is to evaluate a group of football players who underwent arthroscopic treatment of this pathology using radiofrequency device.

Methods: we studied a group of 20 football players ( 19 males, 1 female. age 17-32, 18 amateur and 2 semiprofessionals), affected by anterolateral impingement of the ankle. and treated in the period between June 2001 and December 2008, with the use of radiofrequency probe (arthrocare device, Naples, FI). Patients did not present severe osteoarthritis and ligamentous symptomatic instabilities. Inclusion criteria were patients with arthroscopically confirmed diagnosis of anterolateral impingement who failed conservative management and presenting persistent symptoms during sports (soccer) activities with no giving way history or osteochondral lesion detected at MRI or CT exams.. All the patients were operated by the same surgeon and underwent a similar post-op program. All the patients were evaluated at follow-up at minimum 2 years of 2 year by independent examiner according to AOFAS score and the data obtained were statistically analyzed. Statistical analysis was performed using the Statistical Package for Social Sciences Software (SPSS 10.0 for Windows, SPSS Inc., Chicago, IL, USA). Data are shown as mean, standard deviation. Non-parametric tests (Wilcoxon for paired data and Mann-Whitney U for non-paired data) were used to compare different values. Two tailed p-values<0.05 were considered statistically significant.

Results: all the patients present a post-op score significantly improved (P<005) compared to the preop value (36 points range 21-44 ) with a mean value of 89 points (range 72 to 98) with a minor score in the 2 patients presenting osteochondral lesion of the talus. No significant complication were recorded in this series. Timing for return to competitions was 4 months (3.2 to 4.3)

Conclusions: arthroscopic treatment of antero-lateral ankle impingement through radiofrequency in football players can lead to satisfactory results.

# Meniscal repair using the all-inside fas T-fix technique

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Introduction: repair rather than removal is the favoured technique in treating meniscal injury in younger patients. The latter associated with time dependent degenerative changes. The all-inside method using devices such as the FasT-Fix system is quick, strong and reliable.

Methods: we reviewed our experience with the FasT-Fix (Smith and Nephew). Our Orthopaedic database was searched for meniscal repair operations using FasT-Fix sutures in Northumbria Trust Hospitals from January 2007 to January 2011 to determine initial surgery and any further surgery defining failure. All patients were also contacted by questionnaire using the Tegner activity scale and the knee injury and osteoarthritis outcome score (KOOS) to ascertain on going symptoms whether return to function has been achieved following surgery.

Results: 31 patients (26 Male: 5 Female), with an average age of 24.4y (range 15-43). There were 17 medial repairs (3 failures) and 14 lateral repairs (1 failure). The success rate defined as 'no re-operation' for all procedures was 87.1%. 16 questionnaires were returned giving KOOS scores of Pain: 92.5 (range 72-100), Symptoms: 87.5 (68-100), ADL: 97.5 (88-100), Sport 79.1 (35-100), QOL: 61.7 (31-100) Tegner Activity Scale: Pre-injury: 7.5 (6-9) Post-repair: 5.9 (3-9).

Conclusions: a success rate of 87.1%. The KOOS and Tegner scores illustrate that patients have recovered from the meniscal injury in their day-to-day life, with a reduction of 1.5 points on the Tegner scale. Further questioning identified anxiety about re-injury to be the cause of reduced level of performance rather than physical limitations.

# Implementation of an automated text messaging system to educate patients after ACL reconstruction

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Background: Anterior Cruciate Ligament (ACL) Reconstruction is commonly performed on young athletes world-wide. Following restrictions and performing the correct therapy is critical to a successful outcome. While physicians cannot counsel patients through every step of the recovery process, there is potential for a technology solution to do so.

Methods: an automated text messaging system was implemented to communicate post-operative information to patients and their families. This information contained routine post-operative instructions, appointment reminders, therapy guidelines and warnings about what activities to avoid. The authors report their experience with implementation and patient feedback.

Results: staff experience was positive with no extra time required to use the system. Staff's greatest satisfaction point was decreased inbound patient inquiries. Patient experience was positive and patients reported their greatest satisfaction points as being: many questions answered before they arose via text message, feeling in touch with physician, ability to keep entire family informed of expected progress and restrictions.

Conclusions: Automated Text Messaging is a useful solution to keep patients and their families informed following ACL reconstruction.

# Traumatic and degenerative cartilage lesions: arthroscopic differentiation using Near-Infrared Spectroscopy (NIRS)

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Aim: the study aimed to determine the impact of NIRS (near-infrared spectroscopy) on the distinction between traumatic and degenerative cartilage lesions in the MFC (medial femoral condyle).

Methods: arthroscopic evaluation was performed in 6 patients who had undergone ACL (anterior cruciate ligament) re-

construction and in 6 patients who had undergone HTO (high tibial osteotomy). In both groups, a grade III cartilage lesion was present within the MFC.

NIRS evaluation was performed with a special probe (arthrospec-one, Arthrospec GmbH, Jena, Germany). NIRS measurements produced semi-quantitative values ranging from 0 (heavily degenerated cartilage) to 100 (completely intact cartilage).

Results: the mean near-infrared-light absorption within the traumatic lesions in the MFC of the ACL group was 71.5 (range 61-80). In the HTO patients, this value was significantly ( $P < 0.001$ ) lower at 31.7 (range 31-33).

The margin of the MFC outside the lesion in the ACL group had the same adsorption as the lesion ( $p = 0.549$ ).

Conclusion: after an injury, cartilage has a normal or nearly normal absorbance on near-infrared-light. Thus, it is possible to distinguish intraoperatively between traumatic and degenerative lesions. In addition, our results demonstrate that evaluating cartilage with NIRS is a dependable method for improving the diagnosis of significant chondral lesions.

## Are platelet rich plasma injections effectiveness after arthroscopic rotator cuff tear repair?

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Background: rotator cuff healing after an arthroscopic repair is discussible because of the high incidence of failures. Among biologic augmentations currently used, platelet-rich plasma (PRP) is one of the most applied, supposed to enhance and accelerate the healing process in different musculoskeletal disorders. However, the evidence supporting its successful administration is still lacking, especially in the field of the rotator cuff repair.

Purpose: our purpose is to clarify if the recovery is accelerated and the integrity of repaired construct is increased in patients undergoing PRP injections after arthroscopic repair of the rotator cuff.

Methods: thirty-eight patients with full-thickness rotator cuff tears have been enrolled after they had been informed about the use of PRP and the timing of its application postoperatively. Seventeen patients underwent arthroscopic rotator cuff repair and PRP injections (3 injections at 10 days each other), 21 underwent arthroscopic rotator cuff repair without PRP injections. Outcomes were assessed preoperatively, at 3, 6, 12, and minimum 16 months after surgery (average 17.7 +/- 1.7 months). Constant system, the University of California at Los Angeles (UCLA) system and a Visual Analogue Scale (VAS) scale were used; range of motion and strength in all planes were also assessed. The healing of the repair was assessed at magnetic resonance imaging at a minimum follow up of 6 months from surgery. All patients had the same rehabilitation protocol.

Results: platelet-rich plasma gel application after to arthroscopic rotator cuff tear repairs did not accelerate recovery with respect to pain, range of motion, strength, functional scores, or overall satisfaction as compared with conventional repair at any time point. There was no difference between the 2 groups after 3, 6, 12, months and at final follow up. The follow-up MRI showed no significant difference in the healing rate of the rotator cuff tear. In addition, magnetic resonance imaging, at a minimum of 6 months after surgery, demonstrated a retear rate of 23.5 % in the PRP group and 19% in the conventional group, there was no statistical significance between the groups ( $P = .658$ ).

Conclusion: although PRP application after arthroscopic repair of the rotator cuff has no effects on clinical recovery and structural integrity, it reduces the postoperative occurrence of shoulder stiffness. Further studies should support these findings.

## The use of radio frequency energy for arthroscopic chondroplasty of the knee

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Introduction: chondral damage within the knee commonly occurs during sport following direct trauma or following degeneration through overuse. Radio frequency energy chondroplasty (RFC) can be used as an alternative to mechanical chondroplasty in the arthroscopic treatment of chondral lesions. Current literature supports the theoretical advantage of RFC and purports to in vitro improvements in cartilage structure and function following RFC. We conducted a retrospective study of patients undergoing RFC for isolated chondral lesions in the knee and assessed the short term benefits to pain and function.

Methods: retrospective analysis was completed of operative notes and arthroscopic images of all patients who underwent arthroscopic chondroplasty at the royal Devon and Exeter Hospital between January 2009 and September 2011. Inclusion criteria included 1 to 2 defined chondral lesions, less than 2cm<sup>2</sup>, of Outerbridge grade II-IV, treated via arthroscopic RFC. Exclusion criteria included diffuse articular cartilage damage, additional pathologies affecting the knee or subsequent further injuries or invasive procedures to the knee. Data was collected via a subjective and objective questionnaire assessing patient outcome.

Results: 17 patients met the inclusion criteria. Male: female ratio 10: 7, mean age 41 (range 22-60). 76% (n=13) of patients experienced a significant reduction in pain (mean reduction of 44%, p=0.00007) lasting until the time of study (median of 21 months, range 9 to 31 months). There was no correlation between change in symptoms and site and grade of osteochondral lesion. Pre-operative instability symptoms did not improve following RFC. Satisfaction with treatment was in direct correlation with pain relief achieved.

Conclusions: our study appears to support current literature by suggesting short term benefits in the use of RFC on chondral lesions. Greater population size and longer follow-up are required to provide more significant conclusions.

## Arthroscopic treatment in adults Tillaux fractures

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The type Tillaux fractures are unusual fractures of the ankle adolescents, type III Salter-Harris. Are due to rotational forces, with avulsion of anterolateral epiphysis by the action of strong ligament tibioperoneal. This type of injury is rare in adults since normally the ligament tears first. In adults the fractures bi and trimalleolar are more common fractures in the ankle, usually involve the internal, lateral and posterior malleolus.

We describe a patient of 49 years without relevant antecedents, that by "ankle sprain" came to the emergency service. Physical examination showed edema, ecchymosis and radiologically we find a fracture/avulsion of the anterolateral portion of the articular surface, a pattern reminiscent of the fracture of the ankle Tillaux teenager. It was considered a type of fracture tillaux reduced under arthroscopic control and made by a cannulated screw osteosynthesis.

The need to restore the perfect articular anatomy was made by fixing it arthroscopic, which allowed for not only the direct visualization and control the reduction, as the cleaning of edges and free fragments inside the ankle, final joint congruence without capsular retraction associated with open surgery.

## Anterior Cruciate Ligament (ACL) vascularity as seen by arthroscopy and the occurrence of osteoarthritis, a prospective study

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Introduction: ACL injury is well known to lead to osteoarthritis. In the great majority of cases, though, the cause of osteoarthritis is unknown. It is assumed that loss of knee proprioception could lead to degenerative changes. It also been shown that lack of ACL vascularity may be related to loss of nerve endings, and thus to reduced proprioception of the knee.

Methods: 753 arthroscopic knee surgeries were recorded between 1998 and 2005. In each case a form was completed before the arthroscopy. The findings of clinical examination were recorded and the pre-surgical diagnosis was documented. The form was then completed after the surgical procedure, and the clinical examination, pre-surgical diagnosis and patients complaints were compared to the arthroscopic findings.

ACL vascularity was estimated by direct vision and the extent of arthritic changes was defined and recorded in all three compartments of the knee using the ICRS classification (2003). The existence of osteoarthritis was compared to ACL vascularity.

Results: when no disturbance of ACL vascularity was documented, 51.3% of the cases showed osteoarthritis of the knee of various grades. When ACL avascularity was defined, osteoarthritis was seen in 83.5% of cases (p<0.0005).

Conclusions: ACL vascularity as documented by the crude method of direct arthroscopic visualization, has been shown to correlate well with the occurrence of osteoarthritis.

This probably results from the loss of proprioception in the devascularized ligament.

# The use of operative note templates in documenting arthroscopic knee procedures in sports injuries

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**Background:** the accurate and detailed documentation of surgical procedures is essential, forming part of good clinical practice set out by the General Medical Council (GMC). In the case of knee arthroscopy, it is vital for planning further management when referring to a soft tissue knee specialist. This study assesses the quality of documentation of knee arthroscopy and evaluates the implementation of a novel operative template.

**Methods:** a retrospective study of 50 operative-notes of patients undergoing knee arthroscopy was completed. A 41-point assessment was made based on guidelines from the GMC, Royal College of Surgeons of England (RCSE), British Orthopaedic Association (BOA) and British Association for Surgery of the Knee (BASK).

An operative-note template was devised to address the criteria important for further interventions and then assessed for its efficacy in providing appropriately detailed findings.

**Results:** detailed documentation deemed essential by current guidelines were lacking the minimum standards expected. Criteria that were considered necessary for an arthroscopic procedure were as low as 4%. After instigating the new operative template, there was a statistically significant increase ( $p < 0.001$ ) in documentation accuracy throughout the necessary criteria set out by the GMC, RCSE, BOA and BASK.

**Conclusions:** we have devised an operative template for knee arthroscopy that improves the quality of documentation and allows for optimal further surgical planning. Clear documentation is important for patient safety, adequate referral to a specialist, research and coding purposes. This will ideally reduce the number of repeat knee arthroscopies performed and optimise patient care from the outset.

# Incidence and prognosticators for injuries in belgian soccer player: evolution over the past decade

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**Introduction:** football is the world's most popular sport with approximately 265 million active players. With ever growing athletic and financial expectations, the nature of the football game may have become more intense with an associated increased risk for injuries. This large retrospective nation-wide study evaluated whether the incidence, type, and severity of football injuries in Belgium have significantly changed over the past ten-year period and evaluated the influence of possible prognosticators for the risk of injury during a football season.

**Methods:** the national Royal Belgian Football Association (Koninklijke Belgische Voetbalband, KBVB) represents 416,000 football players. The KBVB database collects all injuries of the members and this database was searched for all injury reports. The detailed injury data from the season 1999-2000 and season 2009-2010 were vigorously recorded and compared the incidence of injuries, type of injury, affected body part, timing of injury and the respective influence of gender, age and level of performance as variable possibly influencing the abovementioned parameters.

**Results:** 417,462 soccer players (401,976 men and 15,486 women, 162,558 adult and 254,904 youth players) were members of the KBVB in season 1999-2000. A total of 31,493 injuries were reported, with an average of 0.075 injuries per player per season (0.076 and 0.061 for men and women respectively,  $p < 0.0001$ ). In season 2009-2010, 415,934 players (394,250 men and 21,684 women, 161,963 adult and 253,971 youth) were member, with a total of 24,280 injuries. The average number of injuries per player per season was significantly lower in 2009-2010, i.e. 0.058 ( $p < 0.0001$ ), 0.059 for men and 0.045 for the females, a reduction of 23% compared to the first season. Gender was an important risk factor with a significantly lower relative risk in female players. The top level players in the National competition had a significantly lower relative risk compared to amateur level players (0.043 and 0.071, respectively). The mean age of all players in the KBVB was 21.8 years (range 4-90), with a significantly lower risk for youth players compared to adult players (0.044 vs 0.102 for adult players). The vast majority (65%) of injuries occurred during competition, whereas 35% occurred during training activities. 10.5% and 13.1% of injuries were fractures sustained during both seasons, respectively. Nation-wide preventive measures taken in the second season significantly decreased the risk of injuries during the winter compared to the first season (0.018 vs 0.011, respectively).

**Discussion:** despite the proposed increase in sportive and financial pressure, contemporary football inflicts fewer injuries in Belgian football compared to one decade ago. Possible explanations for this positive trend are a good prevention program (the FIFA 11+ program), better medical care and renewed postponement policy by the KBVB.

# The epidemiology of injuries in contact flag football

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**Objective:** to characterize the epidemiology of injuries in post-high school male and female athletes in the rapidly growing international sport of contact flag football.

**Design:** prospective injury-observational study

**Setting:** Kraft Stadium, Jerusalem, Israel.

**Participants:** a total of 1492 players, consisting of 1252 males (mean  $\pm$  SD age, 20.49  $\pm$  5.11 yrs) and 240 females (mean  $\pm$  SD age, 21.32  $\pm$  8.95 yrs), participated in 1028 games over a 2-season period (2007-2009).

**Main outcome measures:** all time-loss injuries sustained in game sessions were recorded by the off-the-field medical personnel and followed up by a more detailed phone injury surveillance questionnaire.

**Results:** one hundred and sixty three injuries were reported, comprising 1,533,776 athlete-exposures. The incidence rate was 0.11 (95% CI: 0.09, 0.12) per 1000 athletic exposures and incidence proportion was 10.86% (95% CI: 9.23, 12.24). Over 80% of the injuries were caused by contact with the ground or with another player. Thirty percent of the injuries were to the fingers, thumb and wrist, 17% to the knee, 17% to the head/face, 13% to the ankle, 11% to the shoulder and the remaining 12% included the ribs, neck, lower back, lower arm, pelvis, hip, thigh, foot and groin area. Forty-one percent were moderate injuries (8-28 days off-play), while 17% were severe (>28 days).

**Conclusions:** contact flag football results in a significant amount of moderate to severe injuries. These data may be used in the development of a formal AFF injury database, as well as in the development and implementation of a high-quality, randomized, prospective injury prevention study. This study should include the enforcement of the no-pocket rule, appropriate head gear, self-fitting mouth guards, the use of ankle braces, and changing the blocking rules of the game.

## Do structural changes explain the response to exercise in tendinopathy? A systematic review

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**Background:** previous reviews have highlighted the benefit of loaded exercise in the treatment of tendinopathy. Changes in observable structural outcomes have been suggested as a possible explanation for this response. However, the mechanism for the efficacy of therapeutic tendon loading exercise remains unclear.

**Objective:** to systematically review the relationship between observable structural change and clinical outcomes following therapeutic tendon loading exercise (TTLE).

**Data sources:** an electronic search of AMED, CiNAHL, Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, PEDro and SPORTDiscus was undertaken from their inception to April 2011. Study eligibility criteria: Any study design that incorporated observable structural outcomes and clinical outcomes when assessing the effect of TTLE on participants with tendinopathy.

**Study appraisal and synthesis methods:** included studies were appraised for risk of bias using the tool developed by the Cochrane Back Review Group. Due to heterogeneity of studies, a qualitative synthesis was undertaken.

**Results:** eighteen articles of 571 patients were included. Overall, there is strong evidence to refute any observable structural change as an explanation for the response to TTLE when treated by eccentric exercise training; however, moderate evidence does exist to support the response of heavy slow resistance training (HSR).

**Conclusion and implications of key findings:** the available literature does not support observable structural change as an explanation for the response of TTLE except for some support from HSR. Future research should focus on identifying other explanations for the response to TTLE including neural and biochemical changes.

**Registration Number:** registered with PROSPERO, registration number CRD42011001638.

# The biomechanics of maximising javelin throw distance

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**Introduction:** the javelin throw is a track and field throwing event and success is measured by the distance or range, which is a function of release conditions. Individual kinetic and kinematic variables contribute to the release speed and angle, the two primary parameters determining range.

**Methods:** with reference to relevant literature, this review evaluates the biomechanical parameters which contribute to maximising javelin throw distance.

**Results:** maximising the distance a javelin is thrown primarily depends on release parameters such as release speed and angle. In addition to strength and power, technique is vital to successful performance most notably sequential body segment movement. The phases of the throw can be analysed and modified, although an optimal release model is required to compare performance to. However, there is no ideal movement pattern in javelin throwing and so training should not focus on replicating successful athlete performance. Consideration is also required for injury prevention especially as load on tissues are large.

**Conclusions:** this review has described the mechanics of the different phases of the throw and evaluation how a good technique can exploit biomechanical and physiological principles to maximise the distance a javelin is thrown. Further research is required using 3D analysis on this complex throwing event as certain phenomena remained unexplained.

## Biologic effect of ESWT on soft tissue

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**Introduction:** tissue homeostasis is influenced by mechanical forces which regulate the normal function of connective tissues. Mechanotransduction, the process that transforms mechanical stimuli in chemical signals, involves mechanosensory units integrated in cell membrane. The mechanosensory units are able to activate gene expression for growth factors or cytokines as well as to induce a biological event which results in cell proliferation and/or differentiation. In connective tissue the fibroblasts are the cells more represented and are considered as a model of mechanosensitive cells. They are ubiquitous but specific for each type of tissue. Their heterogeneity consists in different morphological features and activity; the common function is the mechano-sensitivity, the capacity to adhere to extracellular matrix (ECM) and to each other, the secretion of growth factors and ECM components.

**Results:** extracorporeal shock waves (ESW) have been recently used to treat damaged osteotendineous tissues. Studies in vitro and in vivo confirmed that ESW treatment enhances fibroblast proliferation and differentiation by activation of gene expression for transforming growth factor  $\beta 1$  (TGF-  $\beta 1$ ) and Collagen Types I and III. In addition, an increase of nitric oxide (NO) release is even reported in early stage of the treatment and the subsequent activation of endothelial nitric oxide synthase (eNOS) and of vascular endothelial growth factor (VEGF) are related to TGF-  $\beta 1$  rise.

**Conclusions:** the data have been related to the increase of angiogenesis observed in ESW treated tendons, an additional factor in accelerating the repairing process. A suitable treatment condition, characterized by a proper energy/shot number ratio, is the basis of treatment efficacy. Further ESWT applications are suggested in regenerative medicine, in all cases where fibroblast activity and the interaction with connective tissue can be positively influenced.

## Trauma in the sporting arena; are tomorrow's doctors prepared?

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Undergraduate medical training aims to provide doctors with a solid foundation, which will enable them to embark on a broad range of career pathways. Within this skill set, doctors should feel confident in basic first aid principles and man-

agement of core trauma injuries. With junior doctors participating in sport, as spectators or even as event medics, these skills may readily be required. We therefore undertook this study to explore any deficiencies in the current curriculum. 199 senior student doctors in a UK medical school completed a questionnaire to evaluate their clinical trauma skills. Only a small proportion (8%) had previous first aid experience within the St. Johns ambulance. Over three quarters of students (78%) felt unable to apply a broad arm sling, only a quarter (26%) felt competent to apply a collar and cuff and less than half (44%) stating they were able to neighbour strap fingers. 35% of students admitted to lacking confidence in log rolling a patient and only 36% of students stated they understood the principles of 'clearing a C Spine'. Similar inexperience in the hospital management of ankle injuries was exposed with most (75%) un-aware of the Ottawa ankle rules. This study demonstrates many students lack the knowledge and confidence in performing basic first aid procedures. It also highlights a possible deficiency in trauma training and supports the need to strengthen the practical application of medical undergraduate education in these areas.

## Men's Lacrosse: injuries sustained during the 2010 World Championships

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**Introduction:** there is limited data available on the type of injuries sustained while playing Men's lacrosse. As the sport gains popularity, particularly in North America and Europe, practitioners will be more likely to treat lacrosse players. The aim was to gather and analyse injury surveillance data from the 2010 Men's Lacrosse World Championships; identifying potential injury patterns and possible means for prevention.

**Material and methods:** this is a prospective cohort study of injuries reported during the 2010 Men's Lacrosse World Championships. An injury surveillance proforma was developed. These were completed by medical staff of the tournament and individual teams. Data was categorised into Body Part Injured, Diagnosis, Mechanism, and Time of Injury.

**Results:** over 9 days, 29 countries competed in 79 games, with 667 players taking part. A total of 150 injuries were sustained by 129 individuals ranging from 16 to 46 years old. Five times more injuries were reported to have occurred during games than during training or warm-up sessions ( $n=104(69.33\%)$  versus  $n=20(13.33\%)$ , rate ratio =5.20). The most frequent mechanism of injury was contact ( $n=80, 53.33\%$ ), including direct impact with another player ( $n=45, 30\%$ ), with a stick ( $n=25, 16.67\%$ ) or with a ball ( $n=8, 5.33\%$ ). Change of direction, twisting and sprinting were the most common non-contact mechanisms of injury ( $n=41, 27.33\%$ ). The most frequently reported injuries were contusions ( $n=48, 32.00\%$ ), closely followed by sprains ( $n=34, 22.67\%$ ) and strains ( $n=34, 22.67\%$ ). The lower limb was the most commonly injured body part, reported twice as often as upper limb injuries ( $n=76(50.67\%)$  versus  $35(23.33\%)$ , rate ratio =2.17). The ankle was the most commonly injured joint ( $n=21, 14.00\%$ ) which was closely followed by the shoulder ( $n=15, 10.00\%$ ).

**Conclusion:** as participation in men's lacrosse expands, health professionals unfamiliar with the sport could be responsible for treating lacrosse players. The combination of physical play, athleticism and equipment used means players are susceptible to a range of injuries. Familiarity with the sport's common injury-patterns could help in treatment and prevention. Despite slight differences in rules during international competition, the findings of this study corroborates reports from North America.[1, 2, 3]

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# Maximum isokinetic trunk strength in young athletes of various sports

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**Introduction:** differences in trunk strength capacity due to sports are known in adults. However, it is unclear whether young athletes already reveal these differences in trunk strength capacity. The purpose of this study was to assess maximum isokinetic trunk strength for young athletes of various sports.

**Methods:** 113 healthy athletes of different sports (m/f: 77/36; 15.0±0.5yrs; 1.73±0.10m; 64±11kg; training since: 5.9±2.8yrs; training hours/week: 13.4±6.3hr) were included in the study. Athletes were assigned into 4 groups based on similarity of skills: track&field (TF; N=22), team sports (TS; N=34 e.g. soccer), canoing&rowing (CR; N=23) and combat sports (CS; N=34 e.g. boxing, wrestling). Maximum strength for trunk flexors (Flex) and extensors (Ext) was assessed for all subjects during isokinetic concentric (60°/sec; 5 repetitions; ROM: 55°; Con-trex, physiomed, Germany) measurement. Outcome variables were absolute peak torque (Flex<sub>abs</sub>, Ext<sub>abs</sub>; Nm), peak torque normalized body weight (Flex<sub>norm</sub>, Ext<sub>norm</sub>; Nm/kg BW) and ratio of Flex<sub>abs</sub>/Ext<sub>abs</sub> (R). Data analysis was made descriptively (mean±SD) followed by ANOVA (α=0.05; post-hoc-test (Tukey-Kramer)).

**Results:** overall peak torque was 199±59Nm/3.1±0.7Nm/kg BW (Ext<sub>abs</sub>/Ext<sub>norm</sub>) and 140±38Nm/2.2±0.4Nm/kg BW (Flex<sub>abs</sub>/Flex<sub>norm</sub>). CR showed highest absolute values (Ext<sub>abs</sub>/Flex<sub>abs</sub>; CR 223±79Nm/154±48Nm; TF 191±46Nm/135±39Nm; TS 191±52Nm/142±34Nm; CS 196±54Nm/132±32Nm). However, there were no significant differences between sport groups regarding absolute and normalized values (p>0.05). R (all: 0.73±0.19) did not show any differences concerning sport groups (p=0.37).

**Discussion:** despite different demands of various sports on trunk strength and specific training, young athletes did not reveal differences.

**Conclusion:** a sport specific consideration of trunk strength capacity in young athletes is not always relevant.

# Inter-rater variability of sonographic cross-sectional-area in Achilles tendons

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**Aim:** measurements of Achilles tendon (AT) cross-sectional area (CSA) are used to describe and measure AT properties and alterations. However, localizations and methods to assess CSA vary and are discussed controversially. Therefore, this study evaluates inter-rater reliability of AT-CSA at certain areas by different assessment tools.

**Methods:** both AT of 12 healthy subjects (29±6years, 177±10cm, 74±13kg) were investigated by transversal ultrasound scans (8MHz transducer, Xario, Toshiba) by two trained investigators. CSA localizations at the tendon insertion of the calcaneus (M0), at 2cm (M1) and at 4cm (M2) proximal the insertion were measured freehand (Image J 1.45s) and estimated by an area calculation based on tendon thickness and width. To evaluate inter-rater reliability test-retest-variability (TRV), ICC and 95% limits of agreement (LOA) were calculated.

**Results:** freehand inter-rater CSA-measurements at M0 varied from 67±14mm<sup>2</sup> to 74±22mm<sup>2</sup> (TRV:14.9%; ICC:0.68; LOA:21,-35mm<sup>2</sup>). At M1 CSA ranged from 57±14mm<sup>2</sup> to 61±16mm<sup>2</sup> (TRV:9.2%; ICC:0.90; LOA:9,-16mm<sup>2</sup>) and at M2 from 55±14mm<sup>2</sup> to 56±15mm<sup>2</sup> (TRV:12.2%; ICC:0.69; LOA:21,-23mm<sup>2</sup>). Inter-rater CSA estimation ranged at M0 from 59±13mm<sup>2</sup> to 60±16mm<sup>2</sup> (TRV:13.2%; ICC:0.70; LOA:20,-22mm<sup>2</sup>), at M1 from 54±13mm<sup>2</sup> to 50±11mm<sup>2</sup> (TRV:9.9%; ICC:0.90; LOA:14,-6mm<sup>2</sup>) and at M2 from 53±13mm<sup>2</sup> to 49±11mm<sup>2</sup> (TRV:11.1%; ICC:0.79; LOA:19,-11mm<sup>2</sup>).

**Conclusion:** both methods showed good reliability in measuring AT-CSA 2cm proximal the calcaneus insertion. Inter-rater reliability at tendon insertion as well as 4cm proximal insertion was moderate. Estimation by area calculation seems to underestimate CSA when compared to other studies. AT CSA-measurements are recommended at localization 2cm proximal the calcaneus insertion and should be analyzed freehand.

# What is the significance of Magnetic Resonance Image appearances of deep medial collateral ligament in undiagnosed medial knee joint pain?

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**Introduction:** anatomically, the MCL is composed of two distinct components, the superficial MCL (sMCL) and the deep MCL (dMCL). The aim of this study is to describe signs on MRI that best define injury to the dMCL.

**Methods:** MRI scans of patients referred for investigation of medial knee pain from a Tertiary level University Hospital in Central London were retrospectively reviewed by two musculoskeletal radiologists. Case notes and MRI request forms were reviewed to extract relevant clinical information. The knees were scanned using a dedicated knee coil on a GE 1.5 T scanner. The menisofemoral and meniscotibial components of the dMCL were identified and note was made of their contours, thickness, and attachments. If oedema was present, its distribution was recorded.

**Results:** total of 51 MRI images reviewed. 38 out of 51 patients reviewed had signs of injury to dMCL or sMCL. Out of these, the meniscotibial ligament was affected in 3 cases and the menisofemoral ligament in 24 cases. In ten of these it was clearly torn; it was thickened and/or wavy in the other fourteen. Oedema was present in all cases of MCL injury except one, with the pattern of oedema being deep to the dMCL in seven cases, surrounding the dMCL in twelve cases, superficial to or surrounding sMCL in three and present in all areas in the remaining fifteen.

**Conclusion:** our study results demonstrate that oedema surrounding the deep portion of the MCL and thickened, wavy or torn menisofemoral and meniscotibial ligaments may represent isolated injury to the deep MCL.

# Influence of different sports on postural control in young athletes - A pilot study

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**Introduction:** importance of postural control (PC) on performance in high level sports is established. However, if type of sport influences PC in young athletes (YA) is unknown. The study aimed to investigate the influence of various types of sports on PC in young athletes (YA) is unknown. The study aimed to investigate the influence of various types of sports on PC in YA beginning their sports career.

**Methods:** 65 YA aged 12.0±0.4yrs (42m/23f; height:1.57±0.08m; body weight: 45.4±8.3kg; training hours/week: 4.7±1.8hr) participated in the study. The athletes, from 18 different sport disciplines, were assigned into 3 groups based on similarity of skills: strength and endurance skill sports (SESS; N=34), technical skill sports (TESS; N=11) and tactical skill sports (TSS; N=20). PC was assessed using one-legged-stance test (3 repetitions for each leg for 10sec) on a force plate (AMTI, 1000Hz). The total displacement of Centre of Pressure (COP) was the outcome measure and was calculated as the mean of the best value (minimum displacement) of left and right leg for each individual. Statistical analysis was made descriptively followed by ANOVA (p<0.05).

**Results:** anthropometric data did not differ in the 3 groups (height: p=0.18; weight: p=0.45). COP for the whole group was 658.6±136.6mm. There was no statistical significant difference for PC between the three groups (p>0.05; SESS 677.8±142.3mm, TESS 623.1±104.1mm, TSS 645.2±144.5mm).

**Discussion:** none of the groups showed superior PC. This might be due to comparable training content and less specification of training at this stage of sports.

**Conclusion:** at the beginning of their sports career, the PC of YA has not been differently influenced by the type of sports engaged in.

# Surgical treatment of chronic lateral epicondylitis: to anchor or not to anchor?

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**Introduction:** the surgical treatment of chronic lateral epicondylitis refractory to traditional nonoperative management remains controversial. Limited data exists regarding the relative clinical efficacy of current surgical alternatives. This is a

longitudinal case control study (level of evidence II) comparing the clinical results of traditional elbow arthroscopy plus extensive carpi radialis brevis (ECRB) debridement (Nirschl procedure) with combined elbow arthroscopy, ECRB debridement and suture anchor repair.

Materials and methods: fifty patients with chronic lateral epicondylitis unresponsive to a minimum of 6 months of non-operative treatment (NSAIDs, PT, bracing, and cortisone injection) were randomized into two groups for surgical management. Group 1 underwent elbow arthroscopy and ECRB tendon debridement alone and Group 2 received elbow arthroscopy, ECRB debridement and suture anchor repair. All patients had preoperative MRI exams and were followed up for clinical assessment with VAS, Mayo Elbow Score and DASH testing at 1, 2, 3, 6, and 12 months after surgery. Results: Group 1 (without anchors) included 13 males and 12 females with an average age of 48.2 (range 30-61). The average duration of symptoms was 8.9 months (range 5-18 months). All patients had failed NSAIDs, bracing, and PT and had an average of 1.54 cortisone injections (range 1-3). 24/25 Group 1 MRI studies demonstrated partial ECRB tears and all had evidence of chronic ECRB tendinosis. Group 2 (with anchors) had 14 males and 11 females with an average age of 49.3 (range 30-62). The average duration of symptoms was 10.4 months (range 6-36 months). All patients had failed NSAIDs, bracing, and PT and had an average of 2.1 cortisone injections (range 1-3). Partial ECRB tendon tears and chronic tendinosis were seen in 25/25 Group 2 MRIs.

Pre-operative Mayo elbow scoring in Group 1 was 59.4 (range 50-70 SD 3.94) and Group 2 was 58.0 (range 50-70 SD 4.22) (Confidence Index CI 95 % P=0.62), at 1 month post op Group 1 was 72.6 (range 60-100 S 6.24) and Group 2 was 92.5 (range 85-100 SD 7.91) (CI 95% P=0.001), at 2 months post op Group 1 was 77.5 (range 60-100 SD 11.61) and Group 2 was 97.0 (CI 95% P=0.001 SD 6.32), at 3 months post Group 1 was 90.2 (range 70-100 SD 9.32) and Group 2 was 100 (all scores 100) (CI 95% P=0.001), at 6 months post op Group 1 was 90.6 (70-100 SD 10.61) and Group 2 was 100 (all scores 100) (CI 95% P=0.0382) and at 12 months post op Group 1 was 97.0 (70-100 SD 10.49) and Group 2 was 100 (all scores 100) (CI 95% P=0.0142).

Pre-operative DASH scoring in Group 1 was 54.25 (range 38.3-59.5 SD 4.12) and Group 2 was 56.23 (range 50.2-59.5 SD 3.83) (CI 95% P= 0.28), at 1 month post op Group 1 was 34.67 (range 13.7-50.8 SD 12.75) and Group 2 was 12.45 (range 1.7-18.3 SD 5.8) (CI 95% P=0.0001), at 2 months post op Group 1 was 27.87 (range SD ) and Group 2 was 5.18 (range 0-9.2 SD 4.23)(CI 95% P=0.001), at 3 months post Group 1 was 19.49 (range 6.7-33.3 SD 11.24) and Group 2 was 2.60 SD 3.14) (CI 95% P=0.001), at 6 months post op Group 1 was 11.87 (range 6.7-26.7 SD 7.22) and Group 2 was 0.34 (range 0-5.3 SD 0.72) (CI 95% P=0.5) and at 12 months post op Group 1 was 7.29 (range 0-18.3 SD 3.65) and Group 2 was 0.17 (SD 0.54) (CI 95% P=0.001).

Conclusions: although both surgical techniques were effective in the treatment of refractory cases of severe lateral epicondylitis, the use of suture anchors to provided significantly better short and long term clinical results.

## Traumatic hand amputation whilst wakeboarding

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Wakeboarding is a sport increasing in popularity in the UK and the world. It is known to be associated with a high incidence of relatively minor injuries to the participating sportsperson. We present the case of a traumatic hand amputation to an associated third party and highlight the potential for serious injuries to all those directly involved with the sport.

## A less invasive treatment for tennis elbow using radiofrequency coblation

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Introduction: tennis elbow or lateral epicondylitis is a common condition that is normally self-limiting, or responds to conservative measures. Where non-operative treatment fails surgery may be indicated and many open techniques have been described. We present the outcomes of a series of 24 patients who underwent a less invasive treatment using bipolar radiofrequency coblation.

Methods: the treatment involves an incision over the lateral epicondyle under local anaesthetic. The common extensor origin is exposed and treated with the coblation wand. We followed a series of 24 self-selecting patients who chose the new treatment over open release. The patients were scored at 12 months (range 3-30) using Mayo Elbow Performance (MEPS) and Oxford Elbow Scores (OES).

Results: all patients had failed conservative measures during a mean 24 month period of symptoms. All had received steroid injections (median 2), 21 had received physiotherapy and 16 had tried a clasp. Two patients underwent revision to open release for ongoing pain, but there were no other surgical complications. For all patients mean OES overall was 42.2 (17-48), mean pain score 81.25 (18.75-100), mean function score 93.12 (68.75-100), mean socio-psychological score 88.13 (18.75-100). Mean MEPS for all patients was 91 with two fair (the patients listed for revision), 10 good and 12 excellent results.

Conclusion: these outcome scores are comparable to those for Boyd-Mcleod procedures previously published by our institution where 91% percent had good/excellent results. With bipolar radiofrequency the procedure is done without the need for a general anaesthetic. This has obvious benefits for the patient but also the healthcare provider in terms of manpower and infrastructure savings. We estimate a saving of around £9000 for the patients treated in this series. Our early experience with this technique is very promising but a comparative study is required to better clarify which technique is superior.

## Nerve injuries in extreme sports - A case series

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There is little documented on the management of traumatic nerve injuries sustained in dangerous sports. We present a case series of 5 patients with injuries to nerves in the upper and lower limbs as a result of accidents in their sporting pursuits.

These types of injury are different from regular sports injuries in that they are major, devastating skeletal and nerve injuries, best treated by specialist trauma surgeons. Even if the victims are not sportspersons, they need multiple operations, prolonged rehabilitation, psychological support and chronic pain management. Also the issue of difficulty in medication for the control of chronic or neuropathic pain in these patients may raise problems with competition and drug testing. These injuries — and the problems they present — differ from, for example anterior cruciate ligament reconstruction surgery which comparatively presents a far less challenging management picture.

Our first 3 patients were injured in Motocross accidents, each sustaining complex trauma which presented unique challenges. Injuries included a complex open Monteggia fracture, knee dislocation and posterior shoulder dislocation, all requiring surgical intervention and intensive rehabilitation. Patient 4 sustained a wrist injury as a result of a paragliding accident and presented with a median nerve injury, while patient 5 sustained a radial head fracture following a fall from a horse. High level sportspersons have high functional needs that may be unrealistic for their injury pattern, potentially leading to frustration for patient and surgeon and potential litigation and conflict of interest. From our experience, these needs should be addressed from an early rather than later stage with a realistic rehabilitation-to-sport plan or acceptance of impossibility. If return to sport is not viable, then return as a trainer or other sporting but non-participating role might be possible.

## Arthroscopic treatment of the osteochondral lesion of the olecranon in a basketball player

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Introduction: the osteochondral lesions in the elbow are commonly seen in the capitellum and radial head. They were not presented previously in the olecranon. The successful arthroscopic treatment of a case with osteochondral lesion on the articular surface of the olecranon was presented.

Materials and methods: a 35 years old male amateur basketball player was admitted to our clinic with right elbow pain, limitation in range of motion and sensation of clacking, eight weeks after a fall on his elbow. In his physical examination; the range of motion of the affected elbow was limited and painful. The radiological evaluation revealed an osteochondral lesion of 5 mm diameter on the humeral surface of the olecranon on X-Ray and CT. Arthroscopic evaluation and treatment of the lesion was performed after the written informed consent of the patient. In lateral decubitus position, the mid-lateral and superomedial portals were used. The lesion on the mid-ulnohumeral surface of the olecranon was identified.

Results: the arthroscopic evaluation revealed that it was very loosely attached to the underlying bone and had sclerotic

margins demonstrating that it was a chronic lesion. The lesion was excised arthroscopically. Postoperatively no immobilization was applied. The complaints of the patient were decreased one week after the surgery. The patient was followed-up for one year as being symptom-free.

Conclusions: the arthroscopic treatment of osteochondral lesions in the elbow is mostly performed for the capitellum and the radial head. This case is the first description of the successful arthroscopic treatment of the osteochondral lesion of the olecranon.

Abbreviations: CT=Computed Tomography

## Rolando fracture - distal intermetacarpal fixation

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Introduction: the function of the thumb is about 50% of hand function as a whole. The trapezoidometacarpica is a particular joint allowing a wide range of motion while maintaining it self stable. The Rolando fracture is a comminuted intra-articular fracture of the base of the first metacarpic initially described in 1910. It is considered unstable and its treatment can be challenging and even today there are multiple ways to do this.

Material and methods: we describe a patient of 40 years, victim of motorcycle accident that among the many fractures showed a fracture of Rolando, comminuted, apparently disabling the osteosynthesis with plate and screws. Reduction through ligamentotaxis and fixation with 2 Kichner wires from the thumb metacarpal shaft to the index metacarpal shaft, using the index metacarpal as the external fixator. A radial graft was harvested for the metaphyseal defect. A palmar splint as maintained for 3 weeks.

Results: radiological and clinically we obtained a consolidation, with good joint function and pain sporadic. The patient resumed his daily activities.

Conclusions: if most of the Bennett fracture can be treated percutaneously, significantly large fracture fragments Bennett or Rolando should be treated with open reduction and rigid fixation, allowing a early mobilization. Rolando comminuted fractures of multiple fragments still pose a challenge. Many authors consider as the best option for a very comminuted fracture, a closed reduction, or mini opening, with external fixation.

## Short-term results of platelet-rich plasma use in hip arthroscopy

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Background: Platelet-Rich Plasma (PRP) has been suggested for a variety of orthopedic uses including peri-operative injection. Some studies have demonstrated short-term benefits including reduction of pain at early follow-up. However, evidence is still lacking, especially regarding its effects after hip arthroscopy. We hypothesize that the use of PRP at the end of hip arthroscopy improves functional outcome, pain, and overall satisfaction.

Methods: in the period between October 2010 and December 2011, an intra-articular injection of PRP was administrated at the end of hip arthroscopy in 76 patients. Data was collected prospectively and analyzed retrospectively. The study included all patients who were willing to participate in the study. Revision surgeries and cases with history of acetabular fractures were excluded from the study. A paired match control group was created, matching patients who had surgery in the same period of time according to: gender, age, acetabular chondral damage, body mass index and surgical procedures. Functional outcome was measured using four hip specific scores (modified Harris Hip Score, Non Arthritic Hip Score, and Hip Outcome Score Activities of Daily Living and Sport-Specific Subscales), pain was measured using the Visual Analog Scale, and satisfaction was measured on a scale of 0 to 10.

Results: following exclusion of three patients according to the study criteria, 73 cases were included in the treatment group and 73 in the matched control group, both consisting of 52 females and 21 males. The average age of the patients was 35.7 (range, 14 to 67 years). Acetabuloplasty was performed in 60% of the cases, femoral osteoplasty in 65%, and labral refixation in 50%. On three month follow-up examination, no significant difference was found in functional scores, pain level, or satisfaction.

Conclusion: the results of this matched case-control study suggest that PRP application during hip arthroscopy did not clearly demonstrate clinical difference three months after the surgery. Limitations of the study were the inclusion of multiple arthroscopic procedures, lack of long-term follow-up, and lack of randomization. Additional investigations, including the optimization of PRP preparation and a larger randomized study, are necessary to further determine the effect of peri-operative PRP.

# Clinical results of capsular repair in arthroscopy of the hip

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**Introduction:** during hip arthroscopy, capsulotomy is routinely performed by many surgeons to obtain access and maneuverability. However, capsulotomy could have unwanted consequences such as iatrogenic instability. For this reason have proposed closure of the capsulotomy at the conclusion of arthroscopic hip procedures when instability is a concern. The purpose of this study is to present the clinical results of arthroscopic capsular closure performed at the end of hip arthroscopic surgery.

**Methods:** between September 2008 and May 2011, data was prospectively collected for all patients undergoing capsular repair at the conclusion of hip arthroscopic surgery. Most procedures performed were for labral tear and/or femoro-acetabular impingement. The exclusion criteria were revision surgeries and previous hip conditions such as fractures, LCPD, SCFE or AVN. Range of motion was measured pre- and post-operatively by the senior author. Indication for capsular closure included generalized ligamentous laxity, or radiographic and arthroscopic findings suggestive of microinstability. The surgical closure of the capsule was performed by side to side stitches across the capsulotomy. Surgical outcome was measured according to the improvement in four hip specific scores (modified Harris Hip Score, Non-Arthritic Hip Score, and the two Hip Outcome Score subscales: the Sport Specific and the Activities of Daily Living), visual analog pain score (VAS) and satisfaction with surgery on a scale of 0 - 10.

**Results:** a total of 232 cases (209 patients) fit our inclusion/exclusion criteria. Most of the cases in the cohort (81.5%) were females; the mean cohort age was 29.6 years (range, 14 to 62 years) at the time of surgery. At an average of 6 month follow-up a marginally significant reduction in external rotation was noted between pre- and post-operative measurements (55° and 50.5°, respectively;  $p=0.06$ ). Average improvement post-operatively of more than 18 points was noted for all four hip specific scores, an average reduction of 2.7 points in the pain level was noted as well. Good and excellent satisfaction (7 to 10 out of 10) was reported by 82% of the patients on the last follow-up.

**Conclusion:** capsular closure at the conclusion of arthroscopic surgery may be useful in certain patient populations to avoid iatrogenic microinstability as a result of capsulotomy. The current series shows good to excellent satisfaction and clinical results when capsular repair was performed with minimal reduction of external hip rotation.

# Patients with back pain have inferior results following hip arthroscopy

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**Background:** the hip and spine are intimately related anatomically and functionally, and their disorders may present with overlapping symptomatology. A problem in one area could cause or aggravate problems in the other. The hypothesis of this study was that of patients who underwent hip arthroscopy, those with concomitant back pain will have inferior results compared to patients without back pain.

**Method:** the study included primary hip arthroscopy surgeries in patients who agreed to participate in the study. Any cases with a previous hip condition (e.g., acetabular fractures or Perthes disease), Tonnis arthritic grade 2 or 3, and gluteus medius tears were excluded from the study. A total of 250 cases met the inclusion/exclusion criteria, in 66 of them (26.4%) a history of back pain was noted before the surgery. Twelve cases were lost to follow up, leaving 54 cases in the study group. A paired matched control group was created, matching gender, age and acetabular chondral damage. Any history of back pain was recorded, and the type of pain and duration were noted. All patients were assessed pre- and post-operatively using four hip specific questionnaires (modified Harris Hip Score, Non-Arthritic Hip Score, the Hip Outcome Score Activity of Daily Living and Sport Subscales). Pain was measured using the visual analog scale, and post-operative satisfaction was measured on a scale of 0 to 10. Pre- and post-operative radiographic assessments were performed on all patients as well.

**Results:** the average age of the patients was 40.3 in both groups, and the mean follow-up time was 30 months. On last follow up the back pain group had significantly lower results for all four hip specific scores in comparison to the control group ( $p<0.05$  for all). However, comparing the scores improvement, only the modified Harris Hip Score improved significantly less in the back pain group. Patients with back pain were on average less satisfied with surgery and had on average more pain, however both were statistically insignificant ( $p=0.07$  and  $p=0.22$  respectively).

Conclusions: patients with a history of back pain improve after arthroscopic treatment; however, the absolute functional scores were found to be inferior when compared to patients without back pain. Therefore, we believe that the patient's and surgeon's expectations should be adjusted accordingly.

Level of Evidence: Level II, Prospective paired matched controlled study.

## Clinical presentation and imaging results of patients with symptomatic gluteus medius tears

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Introduction: greater trochanteric pain syndrome (GTPS) is a common complaint with an estimated incidence of 1.8 per 1,000 persons. Recently, it has become well recognized that tendinopathy and tears of the gluteus medius (GM) and gluteus minimus tendons are common causes of recalcitrant GTPS. Nevertheless, the clinical syndrome associated with GM tears is not fully characterized.

Purpose: the purpose of this study is to characterize the clinical history, physical examination, imaging findings and intraoperative findings associated with symptomatic GM tears.

Methods: we evaluated 45 patients (47 hips) who had confirmed GM tear at the time of surgical GM repair. Evaluation of the clinical history, physical exam, and previous treatments was performed. Preoperative pain was estimated on the visual analog scale (VAS) and four hip-specific scores were administered to evaluate patients functional status. The imaging modalities were reviewed and intraoperative findings were recorded.

Results: the average patient age was 54 years (17-76), 33 patients (73%) were over 50 years old and 93% were female. Symptom onset was commonly insidious (75%) and the average time to diagnosis was 28 months (2-240). The most common pain location was the lateral hip (75%), yet many patients had associated pain in the groin and posterior hip regions. A total of three patients (7%) had previous spinal surgery, three (7%) patients had prior hip arthroscopy, and one patient had prior open hip surgery. On examination, 39 hips (83%) had tenderness with palpation over the greater trochanter, 36 (76%) had a positive anterior impingement test, 33 (55%) had gait abnormalities, 32 (68%) had Trendelenburg sign, and 30 (64%) had abductor muscle weakness. The average preoperative VAS and modified Harris Hip Score (mHHS) were 6.65 (0-10) and 55.5 (12-90) respectively. All patients had pathological findings on MRI ranging from tendinosis to complete tears of the GM tendon. Six patients (13%) had open GM repair and 41 (87%) had arthroscopic repair. Five (83%) patients in the open procedure group had complete GM tears. In the arthroscopic group, 12 patients (29%) had complete GM tears, and 29 (71%) had partial thickness tears.

Conclusions: gluteus medius tears are increasingly recognized as a cause of hip pain and weakness. Characterization of the presentation of the patients is crucial. These data describe the clinical presentation and imaging results of patients with gluteus medius tears, and may facilitate identification of patients affected by such pathology.

## Osteoplasty for cam-type impingement is more accurate when performed open than arthroscopic

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Introduction: cam-type femoral acetabular impingement (FAI) is characterized by reduced offset of the femoral neck and an increased alpha angle. The purpose of the study was to compare a single surgeon results of femoral neck osteoplasty performed via the open surgical dislocation approach versus the arthroscopic one. The null hypothesis was that the radiographic measurement of the cam lesion post-operatively will be similar between the two approaches.

Methods: between January 2008 and January 2011, 797 hip preservation surgeries were done by the senior author, 17 open and 780 arthroscopically. The inclusion criteria for the study were patients who underwent femoral neck osteoplasty and were younger than 31 year old. Revisions surgeries, cases with previous hip condition such as LCPD or AVN and hips with Tonnis arthritic grades greater than 1 were excluded from the study. A total of 92 hips (83 patients) fit the inclusion/exclusion criteria, 8 cases were treated by open surgical dislocation and 84 arthroscopically.

A surgical reshaping (osteoplasty) of the femoral head-neck was done in the presence of alpha angles > 50 degrees. During open surgical dislocation the femoral osteoplasty was performed using a plastic spherical template and an osteotome, while arthroscopically it was done under fluoroscopy using a 5.5mm burr.

The cam lesions were radiographically quantified pre- and post-operatively according to the alpha angle and the head-neck offset ratio as measured on Dunn view.

Results: the mean age of the patients was 22 (range, 14 to 30 years). Pre-operative cam lesions were not found to be statistically different between the groups; with a mean alpha angle of 60.6 ( $\pm$ 14.9) and 72.3 ( $\pm$ 12.4) degrees and mean offset of 5.4 ( $\pm$ 3) and 3.5 ( $\pm$ 2.6) millimeters for the open and arthroscopic groups respectively. However, there was significant difference in the post-operative head-neck morphology as reflected by the alpha angle and the femoral neck offset. The mean post-operative alpha angle of the open group was 39.8 ( $\pm$  2.3) degrees versus 49.3 ( $\pm$ 11.9) degrees for the arthroscopic group ( $p$ <0.0001).

The post-operative head-neck offset ratio was found to be 9.3 ( $\pm$ 1.2) and 7.9 ( $\pm$ 2.6) millimeters for the open and arthroscopic groups respectively ( $p$ =0.016).

Conclusion: despite the rapidly growing popularity of hip arthroscopy, the results suggest that open surgical dislocation may still be the gold standard for surgical treatment of FAI as this approach led to a more osteoplasty.

## Successful return to high level sport after early surgical repair of complete sleeve avulsions of the adductor complex, rectus abdominus and pectineus: a rare injury

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Introduction: adductor muscle and tendon injuries are commonly seen in sport. A rare variant of this injury is the complete avulsion of the adductor complex as well as the pectineus and rectus abdominus amounting to a complete sleeve avulsion from the pubis. This is a severe injury that is increasingly recognised due to improved imaging and a lower diagnostic threshold. We describe the management of 12 athletes with this injury.

Methods: all the injuries were prospectively collected onto our institutional pelvic sports injury database. This series summarises the outcome in 12 consecutive cases where surgery was undertaken after presentation with an acute avulsion (6-34 days). The procedure comprised anatomical reattachment of the avulsed tissues with mesh reinforcement of the inguinal wall in 7. The patients were all reviewed by an independent physiotherapist.

Results: one patient sustained a superficial wound infection treated with antibiotics. Transient complaints of local numbness were common but all twelve sportsmen returned to high level sport (five elite) at an average of thirteen weeks (10-21 weeks).

Conclusion: awareness of the possibility of this complex injury is important and there should be a low threshold for investigation. In elite athletes operative intervention is associated with good clinical outcomes and successful return to sport.

## Athletic activity post-lower limb arthroplasty - What are the determining factors?

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Introduction: Joint Arthroplasty (JA) is a successful surgical procedure for end stage joint disease. The number of younger patients with high functional demands having this surgery is increasing and it is known that athletes are susceptible to joint disease and many will wish to continue participating in their sporting activity post-surgery. There is current debate on outcomes of lower limb arthroplasty with respect to returning to sport, factors affecting return to sport and also implant survival.

Methods: a PubMed® search was performed using the terms 'sports' and in turn each of 'total hip replacement', 'total knee replacement', 'hip resurfacing' and 'unicompartmental knee replacement'. From the results of this search, only those published in English were included, with any duplications excluded. The remaining abstracts were reviewed and any unrelated to the search terms were excluded; the remaining abstracts had their full papers reviewed.

Results: following filtering of the abstracts, over 50 papers were reviewed. Factors associated with reduced participation in sports following arthroplasty were increasing age, multiple medical co-morbidities and the lack of sporting participation prior to surgery. A slight tendency towards higher participation in sports was seen in hip arthroplasty over knee arthroplasty. Little difference was seen between total and unicompartmental knee replacements or between hip arthroplasty and resurfacing. Many athletes were able to participate in high-impact activities.

Discussion: following JA, participation in sporting activity is largely determined by patient-specific factors including the pre-operative activity levels of the patient, age and medical co-morbidities. The type of joint replaced and type of activ-



ity performed do not tend to affect sporting participation. Such information should be made available to young active patients with end-stage joint disease who wish to continue to participate in sports post-arthroplasty.

## Evaluation of a customised dynamic elastomeric fabric orthosis (DEFO) to aid the management of athletic lumbopelvic injury

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Introduction: lumbopelvic dysfunction (LPD) is a common problem in sport (Ficek et al. 2008). Groin injury in football, for example, accounts for 10-18% of all injuries (Holmich et al. 1999). LPD can be acute or insidious. Diagnosis is often confounded by the close proximity of anatomical structures; often there exists more than one site of pain. Pelvic belts have been used in LPD management, but have had limited success. They have been shown to decrease pain (Mens et al. 2006), but are uncomfortable and not practical for athletic purposes.

Aim: to evaluate effectiveness of a customised dynamic elastomeric fabric orthosis (DEFO) to aid management of lumbopelvic injury.

Methods: eight single-case studies (AB design: A = control phase; B = wearing the DEFO) with randomised onset of intervention were completed. Fifteen daily assessments were undertaken, with at least 6 during each phase. Self-reported pain (Numerical Rating Scale) was measured at rest, during resisted bilateral hip adduction, on active straight leg raise (ASLR) and broad jump. Resisted hip adduction was measured via load cell. Training diaries were kept.

Analyses: visual analysis of trend, level and slope was undertaken on all data. Mean (+/- 2 SD) was plotted, followed by celeration lines and calculation of the point of non-overlapping data (PND) statistic.

Results: in 3 cases force production increased (exceeding 2 consecutive mean +2SD) during Phase B, with PND statistics of 58 - 100%. In 1 case, during phase B, pain significantly reduced at rest, pre-jump and post-jump (exceeding 2 consecutive mean - 2SD), with PND statistics of 25-75%.

In 4 cases pain scores were below celeration lines on several measures showing a trend towards reduced pain with the DEFO. Another 3 cases showed significant pain reduction on the squeeze test (exceeding 2 consecutive mean - 2SD); with PND statistics of 89% and 100% in two cases.

Questionnaire data indicated enhanced sports participation with DEFO usage.

Conclusions: these data support the use of this novel DEFO in the management of athletic lumbopelvic injury by improving pain and/or function.

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## Return to Judo after joint replacement

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Introduction: numerous epidemiological studies have shown that a sport can be practiced after arthroplasty, in particular golf, skiing or tennis. On the other hand, there have been no studies on this subject to date for judo. Judo is a contact sport, in which opponents use balance and body weight, with minimal physical effort, to throw or pin each other down or hold each other in a lock. The main purpose of the study was to determine if judokas

begin practicing judo again after joint replacement and if they change their way of practicing this sport. The secondary objectives were to evaluate the rate of revision surgery in these patients and to see if the surgeons of patients who returned to judo had approved their practice of this sport.

Material and methods: two hundred and twelve questionnaires were sent to Judokas licensed at the French Judo Federation, over the age of 60, with at least a black belt 6th Dan. Out of 83 responses, 38 individuals, mean age 72.8±7.9 years old had at least one implant. The survey identified 36 Total Hip Arthroplasties (THA) in 27 patients, 10 Total Knee Arthroplasties (TKA) in 8 patients and 3 Total Shoulder Arthroplasties (TSA) in 3 patients. The main evaluation criterion was the return to judo after joint replacement. Secondary criteria were the level of judo after surgery, rate of surgical revision at the final follow up, the level of patient satisfaction (very satisfied, satisfied, moderately or not satisfied) and the surgeons' recommendations at the time of joint replacement.

Results: twenty nine out of 38 patients who underwent joint replacement returned to judo practice (76.3%) a mean 4.1±2.9 months after surgery. On the other hand, all patients stopped competitive judo. The surgeon recommended 65.8% of these patients to stop practicing judo. There were 2 surgical revisions in the THA group (5.5%) for loosening at 6 years and 9 years of follow-up. No dislocations or fractures were reported at the final follow up. Thirty-two patients (84.2%) were satisfied with their implant.

Conclusion: the practice of judo does not seem to be limited by joint replacement. A clinical and radiological study should be performed to confirm these results.

## Long-Standing adolescent sports hip and groin pain - A review of 113 cases

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Background: injuries to the hip and groin (H&G) region are common in the active population. H&G pathology in the adolescent athlete is less common but represents a major cause of morbidity in the developing athlete. The epidemiology of these injuries is not well established.

Methods: all cases of H&G pathology presenting to a single Sports Medicine Centre with an accessible electronic record between 1/1/2006 and 31/12/2011 18 yrs old or younger at the time of initial consultation were assessed for demographic data, investigations and diagnosis.

Results: 113 cases of H&G pathology were identified with 20 cases of lateral hip pain, 11 cases of buttock pain and 82 cases of anterior groin pain. 83 (73.45%) were male. 26 cases (23.01%) were as a result of an acute injury with ASIS avulsion, iliac crest Apophysitis and hamstring origin avulsion the most common causes for anterior, lateral and buttock pain respectively. Pathology to the hip joint (27.48%) was the most common anatomical area with growth-related adolescent neuromuscular tightness (GRANT) the most common individual cause in both males (19.01%) and females (28.57%). This condition occurred after a period of rapid growth, is associated with negative imaging and normally resolves with physiotherapy.

Conclusions: this is one of the largest studies to exclusively examine H&G pathology in the adolescent athlete. Important findings include the identification of avulsion fractures in acute injuries, the role of the hip joint in long-standing pathology and the identification of GRANT as a cause of groin pain that has not been previously reported.

## Outcome of psoas tenotomy in the management of psoas tendonopathy

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Introduction: iliopsoas tendonitis occurs due to friction of the iliopsoas tendon on the iliopectineal bar. This causes pain and snapping of the hip. If initial conservative management fails, patients may require diagnostic image-guided steroid injections which may provide sufficient relief to avoid surgery. If the injection provides only temporary relief then patients can undergo a psoas tenotomy.

This is a 14 year study describing the outcome of psoas tenotomy.

Methods: patients who had been referred for management of psoas tendonopathy were followed up by postal questionnaire which included a Non Arthritic Hip Score and a custom patient satisfaction questionnaire.

Results: twenty-three patients were reviewed with an average follow up time of 40 months. Two patients were excluded, eight patients had a lasting response to injection and required no further intervention and fifteen patients proceeded to psoas tenotomy utilising a medial Ludloff approach. The average NAHS scores following surgery and injection were 66.15 and 76.08 respectively. Ten patients reported pain relief after their tenotomy, five patients reported no change in pain. No patients experienced worsened pain.

All eight patients who only underwent injection reported lasting pain relief. Three patients led more active lives following the operation, four patients had no change in activity and one patient reported decreased activity. Patients were more satisfied following injection than after surgery.

Conclusion: local steroid injection can prove curative for patients presenting with psoas tendonopathy. For those patients with only temporary relief from injection, psoas tenotomy can provide good long term relief of symptoms.

## Abductor tenotomy as a treatment for groin pain in professional soccer players

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Background: chronic exercise-related groin pain is a debilitating condition for athletes. Non-operative treatment has limited efficacy. We report the outcome of adductor tenotomy and hernioplasty for professional soccer players with groin pain. Methods: two groups of soccer players with persistent groin pain, with or without additional lower abdominal pain and resistance to conservative treatment were included in this retrospective analysis. Both were treated with adductor tenotomy, while in the second group, hernioplasty was added. RTP time, subjective and objective outcome measures were compared.

Results: 155 professional and recreational soccer players with recalcitrant groin pain were treated. 96 patients (group 1) were treated with adductor tenotomy and additional 59 (group 2) were treated with a combination of adductor tenotomy and hernioplasty. No difference in pre- or post-operative parameters was detected between groups, apart from abdominal wall muscle defects demonstrated by ultrasound in group 2. Mean duration of pre-op symptoms was 5 months. All patients were males. Mean age was 23 years (16-36) and mean pre-op Tegner score was 8.2. Mean RTP was 11 weeks (Range 4-36). Post-op Tegner score remained 8.2. Subjective outcome was rated as 4.3 out of 5. The combined score indicated 80% of good or excellent results for both groups.

Conclusions: surgical intervention has been shown to allow RTP at the same standard in professional soccer players following the failure of non-operative treatments. Athletes with an adductor syndrome and accompanying sportsman hernia might benefit from adductor tenotomy only.

## Simultaneous bilateral hip arthroscopy for subjects with symptomatic bilateral femoroacetabular impingement

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Background: would patients with bilateral Femoroacetabular impingement would benefit from one surgery, addressing both hips simultaneously, compared to a staged later procedure.

Methods: Group1: both hips were treated simultaneously, Group2: hips were treated few month apart, Group3: single hip control group. Outcome measures: general anesthesia, surgical times, VAS pain at post operative days 1-30, Pain killers used, time patient started: biking, driving, office work, gym, running, return to play. Long term evaluation Scores, at 6, 12, 24m.

Results (interim analysis): 76 subjects (119 hips). G1 - 28 subjects (56 limbs), G2 -15 subjects (30 limbs) and, G3 - 33 subjects. No differences between groups were seen with regard to patient demographics and pre operative outcome measures.

Mean general Anastasia and surgery times was 211/164 minutes for G1, 115/87 for each procedure in G2 and 107/78 for G3. Post operative VAS scores were the same for the 3 groups. The only parameters shown to influence the post op VAS pain were the subject's pre-op NAH and Womac scores (direct correlation). No difference was seen in the amount, type or days, of pain killers used. At six months, improvement in Womac and NAH scores (was filled separately for each side and averaged for the bilateral subjects) was similar for all 3 groups.

Conclusions: simultaneous surgery does not lead to higher rate of complications, post-op pain, analgesic usage or side effects. Return to daily activities is similar to a single hip procedure with the advantage of a single rehabilitation.

# Withdrawal of adult stem cells from adipose tissue of the abdomen: new technique

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**Introduction:** in human adults adipose tissue is abundant and can be easily extracted by liposuction. Initially used in metabolic disorders, now it is considered an important and rich source of multipotent stem cells, as demonstrated by Zuk et al. in 2002. These cells have the ability to self-renew and undergo multi-lineage differentiation, including the chondrogenic and osteogenic cellular populations. Subcutaneous adipose depots are ubiquitous and easily accessible in large quantities with a minimal invasive and low donor site morbidity procedure. In this paper, we present our experience of knee chondral defect repair by stem cells withdrawn with a system recently developed in Italy, able to separate the "stromal vascular fraction" (SVF) of the adipose tissue without the need to perform collagenase lysis, whose incubation and washout times are not adequate to the 20-30 minutes timing of the one step surgical chondral defect repair procedure. **Materials and methods:** once the chondral defect has been arthroscopically identified and debrided, in local anesthesia, we extract, by a simple, minimally invasive method of liposuction aspirate, with a specifically created adipose tissue biopsy needle, the marrow tissue from adult adipose tissue of the abdomen. The vacuum syringe with the few ml of liposuction tissue is, bedside in the OR room, connected to the collection bag of pre-treatment, where the infuse content is mechanically filtered. Then the stromal-vascular fraction of cells is separated from the mature lipid-laden adipocytes and the water cell-free component by centrifugation according to a specific centrifugation protocol for 10 minutes. This fraction, which represents a heterogeneous population of cells, contains the ADSCs in a large number, with yields of approximately 250,000 cells per gram of tissue. We have then applied the cells concentrate obtained directly onto the defect or onto a collagen membrane used as a scaffold.

**Conclusions:** this procedure has met our expectations in terms of easyness of lyposuction technique, security of the cell culture made patient bedside in the OR in maximum sterility and rapidity, requiring about 20-30 minutes, timings perfectly adapting to those required to repair, in one single step, the chondral defect. As already described by many authors, one step patient-side surgery is certainly becoming the technique of choice for chondral and osteochondral defects repair. This single-step ADSCc implantation procedure reduces time, costs and is less invasive to the patient, but although promising, needs more patients and longer follow-ups.

# Neglected patellar tendon rupture with anterior cruciate ligament and medial collateral ligament rupture

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**Introduction:** anterior cruciate ligament (ACL) injuries are common, mostly during sport traumas. Conversely, patellar tendon ruptures are uncommon injuries and occurred secondary to a forceful contraction of extensor mechanism. Rupture of both ACL and patellar tendon on the ipsilateral side is a relatively rare occurrence. Our purpose in this report is to remind possibility of combined injuries around the knee. We present a case of 30 years old boy, who was hurted his knee during a football match, where his patellar tendon and ACL ruptures were reconstructed at the same operative setting.

**Case:** the patient is at 30 years old man. He defined his trauma as deceleration with the foot fixed and knee flexed. He administrated to our hospital after 16 weeks from the injury. He had an immobilizer. He could not extend his knee, he had grade 2 hemarthrosis. We identified superior displacement of the patella. Lachman and pivot-shift was positif. Subsequently, radiographs showed superior displacement of the patella, Magnetic resonance imaging(MRI) confirmed patellar tendon rupture, anterior cruciate ligament rupture, and medial kollateral ligament parsial rupture. The anterior cruciate ligament was reconstructed with hamstring tendons(gracilis and semitendinosus) that was harvested from the uninjured knee of the patient, then patellar tendon rupture could not be repaired primarily, was reconstructed by ipsilateral hamstring tendons (gracilis and semitendinosus). Finally, the stability of reconstruction was enhanced by a cable that was applied between patella and tuberositas tibia at 60 degrees knee flexion. Early rehabilitation was started the day after the operation. At 9 months he had 110 degree flexion, no extansion gap, pivot-shift and lachman was negatif. His IKDC(International Knee Documentation Committee) score was 88/100. His MRI scans showed anatomic ACL reconstruction, and patellar tendon reconstruction, with a healed MCL sprain. No instability on varus-valgus stress.

**Discussion:** when we reviewed the medical literature on pubmed, we have identified very few presentations of cases similar to this case. But most of them are recognized initially and operated immediately. The primer reason of this is misdiagnosis. The most common mechanism of the injury is forceful quadriceps contraction against a fixed load of the full

body weight, placing the knee in a flexed position. In our case the mechanism was same as like the others reported in the literature. All the patients in the previous reports were relatively young, and so is our patient. The full diagnosis is easily missed without having a high incidence of suspicion. So radiological investigation is very important in confirming the pathology. A true lateral radiographs of the knee can give a clue of patellar tendon rupture. When there is a suspicion, MRI should be taken. The aim of the treatment is restoration of the extensor mechanism and knee stability. Conclusion: patellar tendon and ACL rupture is a rare condition that may be easily misdiagnosed. Some other structure around the knee can accompanied to this condition. Prompt diagnosis is the key of management of this condition. Immediate treatment with controlled rehabilitation is the key of success.

## **A service review of current practices in anterior cruciate reconstruction, between september 2008 and february 2010, at the norfolk and norwich university hospital**

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**Introduction:** this study aims to identify patients undergoing day case ACL reconstruction and compare them with inpatient equivalents on a range of procedural and demographic outcome measures. ACL rupture is a common injury associated with non contact sporting trauma. Surgical intervention is the most effective intervention to recover normal function. ACL reconstruction surgery can be performed as a day case procedure; reducing costs to the trust and increasing patient satisfaction. **Method:** information on ACL repair operations (September 2008 -February 2010) was collected from the Operating Room Scheduling Office System (patient age, gender, surgeon, admission time, knife-to-skin time, knife-to-skin time, time-out-of-theatre time). Patients with significant second procedure during the ACL repair were excluded. Orthopaedic consultants completed a questionnaire describing their opinions and practice around ACL reconstruction.

**Results:** of 124 ACL repairs, day cases represent 19% (n=24). The majority of patients were male (81%, n = 101), and they underwent more day case surgery (75%, n = 18). The average knife-to-skin time for day cases was 3 hrs before other cases (10.07 vs 13.10). 100% (n = 5) of the surgeons considered ACL reconstruction a day case procedure. 60% (n = 3) stated that their average patients stay in the hospital for at least one night. These patients are often prepared as day cases (i.e. arrive at 7 a.m).

**Conclusion:** day cases for ACL repair are admitted earlier in the morning on the day of surgery, wait shorter times on the ward and are operated on earlier in the day. 100% percent of surgeons agreed that ACL repair should be day case surgery, and time of surgery is a key factor in enabling this. Patients on afternoon lists become inpatients but appear to be prepared as day cases (i.e. admission at 7.a.m). There is no apparent demographic difference between day case patients and inpatients. Further multi-centre studies are needed to improve the generalisability.

**Abbreviations:** Anterior Cruciate Ligament (ACL), Norfolk and Norwich University Hospital (NNUH), Operating Room Scheduling Office System (ORSOS)

## **Isokinetic knee strength and life quality after anterior cruciate ligament reconstruction: Nintendo Wii vs conventional rRehabilitation**

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**Introduction:** rehabilitation of Anterior Cruciate Ligament (ACL) reconstruction is fundamental component after surgery, but this period is long and sometimes boring. To investigate the feasibility of the Nintendo Wii Fit instead of conventional rehabilitation after Anterior Cruciate Ligament Reconstruction.

**Material and methods:** 43 healthy sedentary men (age: 29.5±7.9yrs, height: 176.3±5.3cm, body weight: 79.6±9.3kg, BMI: 25.6±3.0 kg/cm<sup>2</sup>) were included into this study. They were randomly separated into two groups: 21 subjects were included in Wii therapy group (group1), while 22 of them were taken in the conventional rehabilitation group (group2). The subjects went through the rehabilitation protocol during 12 weeks. Flexion and extension strengths of knee were assessed by Isomed 2000 isokinetic dynamometer at 60°/s and 180°/s angular velocities, and ACL outcome questionnaire was employed to assess the patients' life quality during the rehabilitation. Student t-test was used for all statistical analysis. This study has 80% power with 5% type 1 error level as statistically significant.

Results: hypothesis 0: there are efficiency of wii therapy as well as standard rehabilitation protocol on muscle strength and quality of life after ACL reconstruction with single-bundle hamstring tendon graft. There were significant differences between both groups in life quality outcome questionnaire at 4th ( $p=0.03$ ) and 8th weeks ( $p=0.04$ ) of the rehabilitation. However, there was no significant difference between the groups in terms of peak torque in flexion and extension at  $60^\circ/s$  ( $p=0.363$ ,  $p=0.852$ ) and at  $180^\circ/s$  ( $p=0.914$ ,  $p=0.694$ ) angular velocities in the 12th week of the rehabilitation. Similarly, there was no significant difference between the groups regarding total work in flexion and extension at  $60^\circ/s$  ( $p=0.706$ ,  $p=0.891$ ) and at  $180^\circ/s$  ( $p=0.807$ ,  $p=0.539$ ) angular velocities in the 12th week.

Conclusions: what this study illustrated was that Wii therapy might be used instead of /with combination of conventional rehabilitation as it gives the feeling of competition and makes the rehabilitation more fun after ACL reconstruction.

## A review of criteria prior to return to sports following ACL reconstruction

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Introduction: the purpose of this article is to present recommendations for new muscle strength and hop performance criteria prior to a return to sports after anterior cruciate ligament (ACL) reconstruction.

Materials and methods: a search was made of relevant literature relating to muscle function, self-reported questionnaires on symptoms, function and knee-related quality of life, as well as the rate of re-injury, the rate of return to sports and the development of osteoarthritis after ACL reconstruction. The literature was reviewed and discussed by the European Board of Sports Rehabilitation in order to reach consensus on criteria for muscle strength and hop performance prior to a return to sports.

Results: the majority of athletes that sustain an (ACL) injury do not successfully return to their pre-injury sport, even though most athletes achieve what is considered to be acceptable muscle function. On self-reported questionnaires, the athletes report high ratings for fear of re-injury, low ratings for their knee function during sports and low ratings for their knee-related quality of life.

Conclusions: the conclusion is that the muscle function tests that are commonly used are not demanding enough or not sensitive enough to identify differences between injured and non-injured sides. Recommendations for new criteria are given for the sports medicine community to consider, before allowing an athlete to return to sports after an ACL reconstruction.

## Identifying individuals with an anterior cruciate ligament deficient knee as copers and non-copers: a narrative literature review

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Study design: narrative literature review.

Objectives: first, to explore the differences and outcomes between individuals who have had anterior cruciate ligament (ACL) reconstruction and those who did not undergo surgical intervention following a tear of the ACL. Second, to review the evidence related to the ability to identify individuals who may or may not need surgery after an ACL rupture. Finally, to describe the differences between copers and non-copers.

Background: ACL rupture may result in increased tibiofemoral laxity and impaired neuromuscular function, which ultimately may lead to knee instability and dysfunction. Individuals who opt to choose surgery, due to these changes, may be defined as "non-copers". Conversely, "copers" may be defined as individuals with an ACL deficient knee who do not have functional impairment and instability and who successfully resume pre-injury activity levels without surgical intervention.

Methods: an electronic search was conducted up to April 2011, using medical subject headings and free-text words. Subject-specific search was based on the terms “anterior cruciate ligament reconstruction versus conservative treatment”, “copers”, “non-copers”.

Results: a similar percentage of copers and non-copers return to sporting activity. Three papers used an algorithm and screening examination involving individuals with ACL injuries. Evidence exists that, as opposed to copers, non-copers have: deficits in quadriceps strength, vastus lateralis atrophy, quadriceps activation deficits, altered knee movement patterns, reduced knee flexion moment, and greater quadriceps/hamstring co-contraction.

Conclusions: ACL screening examination shows preliminary evidence for detecting potential copers. Objective differences exist between copers and non-copers. Individuals with ACL injury should be informed of the possibility of good knee function following a non-operative rehabilitation program.

## Open vs closed kinetic chain exercises following anterior cruciate reconstruction; the debate continues...

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Background: until recently, it was widely believed that open-kinetic chain (OKC) knee extensor resistance training was harmful to the graft following Anterior cruciate ligament reconstruction (ACLR) and was less effective than closed-kinetic chain exercises (CKCE) in improving functional return to sporting activity. This however was based on few high quality controlled trials, and in most cases represented a more speculative approach to the subject.

Aims: to conduct a comprehensive systematic literature review on the subject matter and to summarize the relevant findings of the high quality randomized control trials (RCT) that investigated whether in fact OKC exercises were indeed more harmful.

Methods: a literature search of MEDLINE, PEDro, EMBASE, CINAHL and the Cochrane data base was conducted using the following search terms: “Open-kinetic chain exercises”, “Closed kinetic chain exercises”, “ACL rehabilitation”.

Results: seventeen papers were found relevant to the subject matter and were reviewed. Of these, seven were RCTs. Quadriceps strength is significantly enhanced with the addition of OKC exercises as opposed to CKC exercises alone. There were no significant differences regarding knee laxity or leg function between patients who trained using OKC versus CKC exercises. Maximum ACL strain values obtained during squatting (CKC) did not differ from those obtained during active flexion-extension (OKC). No difference in knee pain was found between OKC and CKC resistance exercises at two and six weeks respectively. Biomechanical studies have shown that peak strains on the graft were similar between OKC and CKC exercises. There is evidence of a significant increase in tensile strength for tendons exposed to cyclic stress compared to stress-deprived tendon.

Conclusions: the data suggests that there are no clinically significant differences in the functional improvement resulting from the choice of OKC or CKC exercises in the early period after surgery. It therefore seems that the great concern about the safety of OKC knee extensor training in the early period after ACLR surgery may not be well founded.

## Implementation of anterior cruciate ligament reconstruction as a day case procedure in torbay hospital

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Introduction: we examined the efficacy of converting anterior cruciate ligament (ACL) reconstructions at Torbay Hospital from inpatient to day case procedures, implemented a change to service and assessed the subsequent outcome.

Material and methods: a feasibility study was conducted to determine the modifications to practice necessary to perform ACL reconstructions as day case procedures. A clear management pro-forma was subsequently developed for all patients undergoing an ACL reconstruction. This included the use of single dose prophylactic antibiotics, pre-operative physiotherapy, appropriate analgesia organised pre-operatively and the management of patient and staff expectations. Femoral or saphenous nerve blocks were used to help manage acute post-operative pain.

Results: 88 procedures were performed between May 2007 and April 2010. 79 patients were correctly managed according to the implemented pro-forma. Eighty nine percent (n=70) of patients were successfully treated as day cases. Fifty

eight percent (n=51) of patients were successfully contacted twice within a week of operation. Ninety four percent (n=48) achieved good postoperative pain control, experiencing no or mild pain only. One hundred percent of patients were satisfied with their treatment. One hundred percent of patients were happy their procedure was completed as a day case. Conclusions: the significant majority of ACL reconstructions can successfully be completed as a day case procedures, reducing the need for hospital admissions. This has been implemented as standard practice in the Torbay Orthopaedic Department.

## Successful return to play in athletes following non-operative management of acute isolated posterior cruciate ligament injuries

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Our institutional protocol for twelve years has been to manage acute, isolated posterior cruciate ligament (PCL) ruptures non-operatively. The purpose of this study was to prospectively review the outcome of a consecutive series of active athletes managed conservatively for their acute PCL rupture. Care and review was supervised at a tertiary referral centre. 46 athletes presented with MRI confirmed acute PCL injuries within four weeks of their first consultation. Posteromedial, posterolateral and anterior cruciate ligament injuries or meniscal or chondral injuries mandating early intervention were excluded. Patients were managed by bracing and subsequently with a symptom and sign driven rehabilitation protocol. Individualisation took into account quadriceps inhibition, effusion, range of motion and patient comfort. The athletes were followed up until their return to sport and reviewed at a minimum of three years follow-up (range 3-9 years, mean 5.2 years). 30 were reviewed with imaging in clinic, 12 by phone/activity/score review and 4 via club physiotherapist/playing record. Mean return to play was 10.9 weeks at their previous level of sports performance. The athletes' biggest hurdle was sprinting, with many unable to reach maximum speed, despite excellent rehabilitation until a further six weeks of rehabilitation was completed. Over the follow-up period three athletes required arthroscopies for chondral and meniscal problems. On review, these may have been related to consequences of the initial injury / instability rather than new injuries. One athlete had posterolateral instability that was either present and initially missed or subsequently became clearer, requiring a PCL posterolateral corner reconstruction three years later. Medium term review suggests that non-operative management of acute isolated PCL injuries is associated with very good clinical outcomes and return to sport.

## Relationship between functional outcome, complications and isokinetic muscular knee testing in 633 patients after ACL reconstruction

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**Aim:** investigate, in patients who underwent an anterior cruciate ligament (ACL) reconstruction, the relationship between their profile, the functional outcome and complications at 2 months, and the results of isokinetic knee exploration at 4 months.

**Methods:** this is a single-center prospective study of 633 patients with ACL rupture, operated on by the same orthopaedic surgeon, between March 2004 and December 2012, using the modified Kenneth-Jones technique. They have been reviewed clinically at 2 months. 529 of them underwent a concentric isokinetic quadriceps and hamstrings testing.

**Results:** the mean age was 28,4 years (14 to 58 years). The older patients were the poorer functional outcome was. Women were significantly less satisfied than men. There was a significant positive correlation between the functional outcome, clinical signs (atrophy, effusion, local heat, adherent scar, loss of motion), quadriceps and hamstrings deficit. The patients injured during sports had better postoperative functional outcome than patients injured in domestic, road or work accident. Subjects who have had a skiing accident had significantly a poorer functional score than patients injured in other sports. The functional outcome wasn't depend on the place of postoperative rehabilitation (liberal or center). The presence of chondral lesions was significantly associated with poor functional score.



Conclusion: in our study, a close relationship exists between functional outcome, clinical signs two months after ACL reconstruction and the muscle strength recovery assessed at four months. The postoperative functional outcome is dependent on age, sex, circumstances of ACL rupture and concomitant chondral lesions.

## Outcome of primary hamstring anterior cruciate ligament reconstruction in patients with different body mass index classes

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Introduction: most studies conducted comparing the outcomes of orthopaedic surgery in obese patients were studied on patients following hip and knee replacement surgery, and fracture fixation procedures. To our knowledge, there is no published data in the English literature assessing functional outcomes and complications following primary hamstring graft Anterior Cruciate Ligament (ACL) reconstruction in patients with differing preoperative Body Mass Index (BMI) classes. The aim of our study is to assess the functional outcomes as well as complications in patients with different BMI classes following primary hamstring ACL reconstruction.

Patients and methods: we compared the functional outcomes using the Lysholm, IKDC 2000 and KOOS scores, following primary hamstring ACL reconstruction procedures carried out by a single surgeon in two groups of patients with different body mass index classes; normal BMI group (BMI 18.5-24.9) and high BMI group (BMI  $\geq 25$ ) between 2001 and 2009 with a minimum of 2 years follow up. Rollimeter readings for ligament laxity as well as complications between the two groups were also analysed.

Results: a total of 92 patients were reviewed with the normal BMI group consisting of 49 patients while there were 43 patients in the high BMI group. There were no differences between the groups in any of their preoperative and post-operative scores. Both groups showed comparable significant improvement in their post-operatives scores from their preoperative scores. However, patients in the high BMI group had an increased post-operative complication rate when compared to the normal BMI patient group although not major complications.

Conclusion: primary hamstring ACL reconstruction is an effective treatment option in patients irrespective of preoperative BMI. High BMI does not adversely affect functional outcomes and these patients benefit comparably well to patients of normal BMI.

## The occurrence ratio and treatment of the osteochondral injury during the patella dislocation

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Introduction: the objective of this study is to examine the occurrence ratio and treatment outcome of the cartilage injuries during patellar dislocation.

Materials and methods: we used 15 cases 17 knees who had the operation of their patellar dislocation from 2002 to 2011 in order to examine the occurrence ratio. There were 6 men 9 women, and 7 right knees 10 left ones. Their mean operative age was 27.2 years-old. To assess the cartilage injury, we used the ICRS classification. In order to examine the treatment outcome, we used 5 cases 6 knees who had the operation of their patellar dislocation and mosaicplasty from 1997 to 2010. There were 1 man 4 women, and 2 right knees 4 left ones. Their mean operative age was 24.8 years-old. Their mean follow-up period was 76 months (range 14 to 114 months). Their recipient sites were 4 cases in patella and 2 cases in patellar groove. We assessed the recipient area, the number of grafted plug, IKDC objective score and IKDC cartilage repair assessment.

Results: only 6 cases 6 knees (35.3%) had no cartilage injury in their patella femoral joint. The mean operative age (16.7 years) without cartilage injury was significantly younger than the one (32.9 years) with it. The cartilage injury sites were 5 knees in patella, 2 knees in patellar groove and 4 knees in both sides. There were 5 knees (29.4%) who had more than grade 3 of ICRS classification. According to the treatment outcome, their mean recipient area was 141mm<sup>2</sup>(49~400mm<sup>2</sup>), and their mean number of grafted plug was 2 (range 1 to 3). In preoperative IKDC objective score, there were 3 cases 4 knees in abnormal and 2 cases 2 knees in severely abnormal. In follow-up one, there were 3 cases 4 knees in normal and 2 cases 2 knees in nearly normal. Their mean IKDC cartilage repair assessment was 11.3 points (range 10 to 12 points).

Conclusion: twenty-nine percent cases of their patellar dislocation had cartilage injury with more than grade 3 in ICRS classification. The operation of their patellar dislocation and mosaicplasty obtained good clinical outcome.

## The anterior cruciate ligament injury during the menstrual cycle in recreational women skiers

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Introduction: according to literature, rates of Anterior Cruciate Ligament (ACL) injury are four to six times higher in women than in men. In women, most of these lesions occur after a non-contact accident. Various theories attempt to explain this gender difference particularly the menstrual cycle and hormonal fluctuations. Our purpose was to quantify the risk of ACL injury according to the phases of the menstrual cycle in a large series of women skiers.

Methods: a survey was conducted during the 2010-2011 winter season with women suffering of severe knee sprain after ski injury. A simple questionnaire was completed by the patient during consultation with the sports doctor at diagnosis of severe knee sprain, namely an ACL injury. Among the questions (year of skiing, ski level, causal accident, types of ski slopes, ski binding), patients were asked to indicate their Last Menstrual Period (LMP).

Results: among the 229 completed questionnaires, 41 were excluded because patients had no more menstruations (mean age 47±9 years, 15 menopausal, 12 coils with no periods, 6 contraceptive pill with no periods, 2 hysterectomies and 6 not specified) and 16 because LMP occurred more than 30 days ago. In total 172 cases were analyzed. The average age of the series was 34±9 years. All patients had a non-contact injury, more often a knee twisting or a fall forward. 121 of 172 women (70%) had a skiing accident in the first phase of the menstrual cycle (70%) and 51 of 172 women in the second phase (30%),  $p < 0.05$ . Besides, 53 among 172 patients were using oral contraceptives.

Conclusion: this study confirms that the risk of knee sprain at ski for women varies during the menstrual cycle. The risk was almost 2.5 times higher during the pre-ovulatory phase than during the postovulatory phase.

Keywords: anterior cruciate ligament injury, women skiers, menstrual cycle.

## Validity assessment of GNRB® arthrometer in anterior cruciate ligament tear. A prospective study of 139 patients

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Introduction: in case of an anterior cruciate ligament (ACL) tear, the laxity measurement allowed physician to assess the patient outcomes. Furthermore, if the tear is partial the laxity measurement is one of diagnosis criteria. Usually this measurement is performed with Telos stress radiography or KT-1000 arthrometer. The GNRB® is a new arthrometer which incorporates pressure and movement sensors in order to facilitate accurate measurements. The aim of this study was to assess the validity of the GNRB® with Telos for measuring anterior knee laxity and to determine a threshold value for complete ACL tear.

Methods: a prospective study was conducted from January to December 2011 and included all patients diagnosed with an ACL tear in our department. The diagnosis of complete tear was clinical based on the Lachman and the pivot-shift tests. A partial tear was diagnosed by an asymmetric Lachman-test result, a negative pivot-shift test and a low-grade Telos measurement ( $< 5\text{mm}$ ). The knee laxity was measured preoperatively in all patients using both Telos 25 kg and GNRB® 250 Newtons. The study included 139 patients, 54 women and 85 men with a mean age of 30.7±9.3 years. One hundred and nine underwent ACL surgical reconstruction, 97 for a complete tear, 9 for an anteromedial bundle tear and 3 for a posterolateral bundle tear. Thirty patients were diagnosed as partial tear and were managed non-operatively. The Pearson correlation coefficient between the two tests was calculated and tested for statistical significance ( $p < 0.05$ ). Optimal threshold of GNRB® for complete ACL tear was determined on ROC (Receiver Operating Characteristic) curves so as to maximize sensibility (Se), specificity (Sp) and the positive likelihood ratio (LR+). The accuracy of total tear diagnostic was assessed by the AUC (Area Under the ROC Curve) for each test.

Results: the mean laxity value was  $1.7 \pm 1.2$  mm for partial tears and  $4.5 \pm 2.2$  for complete tears ( $p=0.00001$ ) with GNRB® and  $3 \pm 1.8$  vs  $6.8 \pm 3.6$  mm ( $p=0.00001$ ) with Telos. The correlation between the two tests was moderate  $r=0.43$ ,  $p=0.00001$ . The AUC was 0.89 [0.83-0.94] for GNRB® and 0.81 [0.74-0.88] for Telos, ns. The most discriminatory laxity threshold for complete ACL tear was 3 mm (Se=73.7%, Sp=88.1%, LR+=6.2).

Conclusion: the GNRB® arthrometer had a good accuracy for measuring the anterior knee laxity. GNRB® and Telos measurements were correlated. Three mm was the threshold below which the ACL tear was partial.

## Intra-Articular injections for degenerative cartilage lesions of the knee: platelet rich plasma vs hyaluronic acid

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Background: in recent years the conservative management of degenerative cartilage lesions has received particular attention. Hyaluronic Acid is a widely used product, but newer solutions have been introduced in this field. Platelet Rich Plasma represents a promising method to manage degenerative cartilage lesion, despite its mechanism of action is still troublesome, its positive effects is encouraging. To better understand the PRP effectiveness we decided to compare this latter to hyaluronic acid.

Purpose: to compare clinical outcomes in patients undergoing injections of Hyaluronic Acid and Platelet Rich Plasma to the knee for treatment of degenerative chondral lesion.

Methods: one hundred and fifty (73 men and 77 women, mean age 55.6) patients with clinical and radiographic evidence of degenerative changes to the knee were enrolled. The lesions were classified according to the Kellgren-Lawrence radiographic system. Patients were randomized into 3 groups: 50 patients (Group A) received 3 intra-articular injections of 5.5 mL PRP "Regen", 50 patients (Group B) received 3 injections of 5.5 mL "Home made" PRP, and 50 patients (Group C) underwent 4 injections of Hyaluronic Acid. IKDC, KOOS and VAS score were administered to all patients before starting the treatment, at 1, 6 and 12 months from the end of the management.

Results: at 1 month and 6 months, PRP Regen Lab provided the best outcomes. Patients underwent home made PRP administration reported significant higher score than those undergoing hyaluronan injections ( $<0.005$ ), but lesser than PRP Regen Lab since the 6th post-injection month.

Conclusions: the overall cohort improved significantly from the pre- to the post-treatment time, but PRP is markedly more effective than hyaluronic acid. In particular, Regen Lab PRP injections provided significantly better outcomes than home made PRP.

## Which determinants predict osteoarthritis after an anterior cruciate ligament injury? A systematic review

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Introduction: previous studies have shown that an anterior cruciate ligament (ACL) injury is an important risk factor for the development of osteoarthritis (OA). Not all ACL patients will ultimately develop OA. To identify those patients at increased risk for OA, determinants of OA in ACL patients must be known. We therefore conducted a systematic review aimed to summarize the evidence of determinants influencing the risk of OA in ACL patients.

Material and methods: the Medline, Embase, Web of Science and Cinahl databases were searched up to March 2012. Two reviewers independently selected the studies and extracted the data. Four reviewers independently conducted the quality assessment. A best evidence synthesis was performed to determine the strength of evidence for the determinants.

Results: fifty-eight publications were included. The number of patients available for follow-up measurement in the studies ranged from 23 to 780. In 56 studies the OA outcome was determined with radiographs and two studies by MRI assessment. The mean follow-up time ranged from 4 to 20 years. We found moderate evidence for a significant relation with cartilage injury and development of OA. Limited evidence was present for meniscal injury in general and medial

meniscectomy. The studies, which evaluated lateral meniscectomy, graft type, reconstruction versus non-operative treatment and timing of reconstruction showed conflicting evidence. Conclusions: the risk of OA in patients with an ACL injury is increased in case of a combined meniscal or chondral injury. There is conflicting evidence that the choice of treatment influences the development of OA.

## The oblique lateral ligament of the knee-demonstration of a 'new' knee ligament

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Recent techniques to restore knee stability following anterior cruciate ligament injury include changing femoral tunnel position, and 'double bundle' reconstruction. However, they can still not fully prevent the 'pivot shift' post operatively. This may be due to damage of other, extra-articular anterolateral structures, leading to rotatory instability, as evidenced by the Segond fracture. The anatomy and biomechanics of the anterolateral knee structures are still poorly understood. Aims: to accurately determine the anatomy of the anterolateral structures of the knee.

Methods: systematic literature review and dissection of 6 fresh frozen cadaveric knees.

Results: the published literature was confusing, with a wide variety of names used for various anterolateral knee structures. Dissection revealed a consistent structure running anterodistally from near the lateral epicondyle of the femur to an attachment on the rim of the tibial plateau half way between Gerdy's tubercle and the fibular head. This structure has been named the oblique lateral ligament. The oblique lateral ligament ran over the lateral collateral ligament (LCL) and was distinct from the capsule. Distally, some fibres from the LCL and short head of biceps femoris also inserted in the same area. It moved isometrically. The mean length was 59mm; the mean length of the LCL was 64mm.

Discussion: manipulation of the specimens suggested that the oblique lateral ligament may have an important role in resisting anterolateral rotatory instability. The nomenclature of the tissues in this area is confused, and the identification of the oblique lateral ligament will allow further work into its role.

## Hamstring tendon regeneration after harvesting for ACL reconstruction. a systematic review

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Introduction: ACL reconstruction is frequently performed using a semitendinosus/gracilis tendon autograft because of the low donor site morbidity and good clinical outcome. The aims of this review were to investigate whether the resected hamstring tendons have the capacity to regenerate, to examine the time course of the expected regeneration and to identify predictive factors for regeneration.

Methods: databases PubMed, EMBASE and Web of Science were searched from inception to March 2012. Studies were included if hamstring tendons were harvested and regeneration was evaluated at harvest site. Data extraction and quality assessment were performed by the authors independently. Data concerning regeneration rates using different imaging techniques and regeneration rates in men and women were pooled. If statistical pooling wasn't possible, best evidence synthesis was used.

Results: 18 studies met the inclusion criteria. Regeneration was measured using MRI, 3D-CT, ultrasonography and/or biopsy. MRI was used most often and showed to be a reliable measuring method for regeneration. The regeneration rates for the semitendinosus varied from 62,5-100% and for the gracilis from 46,4-100%. Pooled results of eight studies showed that regeneration rates were 82,1% in men and 85,0% in women. Immobilization duration as a predictive factor had no significant effect on regeneration (100% in the intervention group versus 95,8% in the control group). There were contradictory results concerning the relationship between regeneration and hamstring function. The time since surgery and measuring regeneration varied from 2 weeks to 67 months. No studies reported a time path of regeneration, although hamstring regeneration was visible at 6 weeks post-operatively.

Conclusion: hamstring tendons do regenerate after harvesting for ACL reconstruction. The overall regeneration rates were 87,1% for the semitendinosus tendon and 86,8% for the gracilis tendon. No significant predictive factors were found. The included studies do not show a time path of regeneration.

# A rare case of bilateral Schatzker type IV injuries in a horse rider: a tale of two sides

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**Introduction:** the tibial plateau is one of the most critical load-bearing areas in the human body. Fractures affect stability, knee alignment and motion.

Bilateral type IV Schatzker fractures are extremely rare injuries. They are commonly associated with high energy impact events and usually occur as a sequelae of polytrauma. These complex injuries can have a debilitating outcome if not treated in a timely and precise manner. This can have a devastating impact on social and professional life, with the incidence of secondary osteoarthritis increasing amongst females in later years.

**Case report:** we describe a rare case of isolated bilateral medial tibial plateau and undisplaced fibular head fractures in a 43-year-old female. The injury resulted from a fall from the saddle as the horse jumped at low speed. The mechanism of injury was defined as an atypical axial loading-type. The patient sustained no other injuries and was admitted via a local emergency department for specialist management.

Clinical examination revealed intact bilateral common peroneal nerves with moderate soft tissue swelling. Plain radiographs of both knees (antero-posterior and lateral) were taken in our department.

Initial management involved analgesia and immobilisation using cricket pad splints. Computed tomography (CT) scan revealed a split depression of the medial condyle on the left side and a medial condyle split with minimal depression on the right side.

Examination under anaesthesia (EUA) of both knees and assessment of the postero-lateral corner was performed within 24 hours of initial injury. The examination demonstrated satisfactory soft tissues at assessment and revealed no ligamentous instability. The patient proceeded to bilateral standard AO buttress-plate fixation during the same surgical episode.

Post-operative management involved wheel-chair mobilisation immediately post-operative with early range of motion exercises. She was allowed to mobilise with cricket-pad support of both knees at two weeks with the aid of crutches. At 1 year outpatient clinic follow-up the patient had achieved good functional mobility with a 98 score on the SF-36 indices.

**Discussion:** restoration of articular congruity and early range of motion is the primary goal for treatment of complex tibial plateau fractures. Due to the rarity of this injury, there is lack of literature supporting definitive surgical management of bilateral Schatzker type IV injuries. The mechanism of injury in our case remained difficult to ascertain. Schatzker type IV injuries are commonly caused by varus compressive forces. We believe the injury mechanism to be an axial loading varus strain in a low energy incident. Similar injuries have been documented<sup>1</sup> in skiers resulting from relatively low energy injuries in a twisting-type non-contact fall. Non-operative management of type IV fractures has been associated with a high incidence of varus mal-union and is currently only indicated for non-displaced stable injuries. After careful assessment, the decision to proceed to surgery was undertaken.

**Conclusion:** we emphasise the importance of early recognition of these rare complex injuries even with low velocity injuries. The use of relevant imaging (CT, MR and cross-sectional imaging) to classify the injuries is a paramount with meticulous attention paid to assessing the associated soft tissue injuries, before proceeding to surgical treatment. We advocate the early fixation of these complex injuries for an excellent functional outcome and demonstrate excellent outcome following bilateral fixation at one surgical sitting.

## The polymorphisms and haplotypes in the collagen type I alpha-1 gene in Polish football players with anterior cruciate ligament injury

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**Introduction:** musculoskeletal injuries, including anterior cruciate ligament (ACL) rupture, are complex, multifactorial disorders determined by the interaction of extrinsic and intrinsic risk factors. Previous studies have shown an association

of the functional COL1A1 Sp1 binding site polymorphism with the risk of ACL rupture. Two other polymorphisms in the promoter of COL1A1 at position -1997 and -1663 that are in linkage disequilibrium with the Sp1 polymorphism have been reported to interact with the Sp1 polymorphism. The aim of this study was to examine the association of -1997G/T and +1245G/T polymorphisms in the COL1A1 gene, individually and as haplotypes, in conjunction with ACL ruptures in Polish male football players.

**Material and methods:** a total of 91 male football players with surgically diagnosed primary ACL ruptures were recruited, along with 143 apparently healthy, male football players of the same ethnicity, within a similar age category, who were without any self-reported history of ligament or tendon injury. DNA samples extracted from the oral epithelial cells were genotyped for the -1997 G/T and +1245G/T polymorphisms using PCR-RFLP method.

**Results:** the under-representation of the TT genotype of +1245G/T in the ACL rupture group (0% vs 4.2% in controls) was marginally significant ( $p=0.084$  Fisher's exact test). The G-T haplotype was significantly associated with the risk of ACL rupture.

**Conclusions:** the G-T haplotype comprising alleles of the -1997G/T and +1245G/T polymorphisms in COL1A1 gene was associated with reduced risk of ACL injury in a group of Polish male football players. The carriers of two copies of this haplotype might be protected from ACL injury.

## Efficiency of eccentric therapy in an elite bobsleigh athlete with chronic patella tendinopathy

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**Introduction:** the purpose of this therapy evaluation was to analyze the efficiency (reduction of pain and improved strength level) of six weeks eccentric therapy without limitation of sport-specific training in an elite bobsleigh athlete with unilateral patella tendinopathy.

**Material and methods:** a male athlete (27years, 184cm, and 114kg) with patella tendinopathy was analyzed before (M1) and after (M2) six weeks of eccentric training (performed twice weekly). Pain was monitored by numeric pain intensity scale (NPIS, 0-10) within a clinical examination prior to M1 and M2. Peak torque was measured eccentrically on isokinetic dynamometers (Con-trex Multi Joint (MJ) 60°s<sup>-1</sup>, Leg Press (LP) 0.3ms<sup>-1</sup>).

**Results:** clinical examination showed a decreased pain during sport-specific training from 7/10 (M1) to 3/10 (M2). After therapy there was a slight increase of eccentric strength capacity for the uninjured leg. The injured side showed decreased strength in all measurement modes, especially in eccentric evaluation on the isokinetic legpress. Regarding side differences there was an obvious decrease in M2 for the injured leg (MJ M1= 195Nm, M2= 149Nm; LP: M1= 2228 Nm, M2= 1726Nm) and an increase for the uninjured leg (MJ: M1=186 Nm, M2=191Nm; LP: M1=1899 Nm, M2=1961 Nm) in eccentric measurements.

**Conclusion:** in accordance with literature there was an obvious improvement in pain level after 6 weeks. In contrast, therapeutic eccentric exercises do not alter eccentric strength capacity of the injured leg. In high performance athletes mainly intensity and amount of eccentric training should be considered when strength is addressed in the treatment of patella tendinopathy.

## Transpatellar suture fixation of osteochondral patellar fracture after acute dislocation of patella - A report of 3 Cases

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**Introduction:** the osteochondral fractures of patella which are generally seen together with acute patellar dislocations are diagnosed hardly with plain radiographies and are frequently missed in clinics. Their treatment can be difficult, if they are small and chondral fractures. The aim of this study is to present the favorable clinical results of transpatellar suture technique in the treatment of patellar osteochondral fractures.

**Materials and methods:** between March 2007 and May 2009, three patients consulted to our clinics with the complaint of acute patellar dislocation were included in this study. After their initial evaluation and prompt reduction, they were di-

agnosed as osteochondral fracture of patella with direct XR and computed tomography. They were treated surgically with transpatellar suture technique.

Results: the fractured pieces were too small and thin for screw fixation in all three patients. After standard medial parapatellar incision, fragments were fixed with transpatellar suture technique. Medial retinacular augmentation and capsule repair were also done. Postoperatively early aggressive rehabilitation program was started: the patients were allowed for full-weight bearing with knee brace. 90 degrees and full flexion were obtained after 6 and 12 weeks postoperatively, respectively. After 2 years of follow-up, the physical examination, radiography and computed tomography yielded that the lesions were healed well and the patients returned back to their pre-injury activity levels.

Conclusions: the osteochondral fractures of patella are rarely seen and can be missed in clinics. For the fractures with small and thin osteochondral fragments, this study revealed that transpatellar suture fixation is an efficient treatment method, allowing early rehabilitation without need of further secondary procedures.

## Augmentation acl reconstruction with a hamstring autograft. Clinical outcome and 3-d ct evaluation

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Introduction: the purpose of this study was to evaluate both clinically and with a 3-D CT-scan the outcome of augmentation ACL reconstruction with a Hamstring autograft.

Materials and methods: fifteen consecutive patients (all of them recreational athletes) with a partial ACL rupture and a mean age of 28.12 years old ( 17-35) underwent Augmentation ACL reconstruction with a Hamstring autograft. In 12 patients the PL bundle was reconstructed while in 3 patients the AM bundle was augmented. All of them were acute ACL ruptures that presented with a knee hemarthrosis after an athletic injury.

Results: all patients returned to their previous level of athletic activity. All the knees were stable both in clinical examination (Lachman-Noulis test, Anterior Drawer test) and in arthrometric evaluation (KT-1000 < 3mm). The 3-D CT scans revealed that both tunnels (and in femur and in tibia) were placed in the true anatomic position of the natural ACL.

Conclusions: ACL augmentation in partial ACL tears is a technically demanding procedure, but both the clinical outcomes and the 3-D CT Scans revealed the efficacy of this procedure. The preservation of the intact bundle is crucial in positioning both tunnels in the "true anatomical position" as revealed from the 3-D CT Scan.

## A novel approach to the automated quantification of the pivot shift using inertial measurement units

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Aim: this study aims to develop and validate a two sensor system which can be used non-invasively in both clinical and research settings to quantify the degree of pivot shift present. This is a novel approach to objectively measure the pivot shift. It is low cost, non-invasive and the first sensor system to include gyroscopes to measure the angular rate of both segments of the leg during a pivot shift test.

Method: nine participants from three distinct groups were tested: healthy volunteers, anaesthetised ACL deficient, and post ACL repair patients. Two inertial sensors containing tri-axial accelerometers and gyroscopes were attached to the participants' skin using surgical tape. One was attached to the anterior distal femur and the other to the proximal anterior medial tibia. An experienced orthopaedic surgeon performed a pivot shift exam on the participants. Data was post-processed by filtering, resampling, normalising and aligning using a specifically written program in MATLAB.

Results: ACL deficient knees showed distinct high frequency spikes in the gyroscope and accelerometer readings from both sensors. These were not present in readings from healthy volunteers.

Conclusion: this study demonstrates that inertial measurement units (IMUs) can diagnose the presence of an ACL tear. With increased data collection specific quantitative parameters can be implemented and a smaller sensor system will be developed, allowing quantitative comparisons between different repair techniques and more objective diagnoses of

knee injuries. These are both simpler and cheaper than using optical tracking devices and less invasive than using bone mounted sensors.

## Mechanism of meniscus injury in judo: a retrospective analysis

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**Introduction:** there has been little information about events preceding meniscus injuries in judo. This study was aimed to determine the common situations and mechanisms of meniscus injuries in judo.

**Methods:** a total of 164 knees in 82 male university judokas were evaluated with questionnaires and interviews to elucidate the characteristics and the mechanisms of meniscus injuries.

**Results:** there were 16 knees in 14 judokas with the history of meniscus injuries. Of 16 knees, 13 meniscus injuries occurred with different grip styles between the injured participant and the opponent in contrast to 3 injuries with the same grip style between them. When the participants were being attacked, being counterattacked, and attempting an attack, 6, 5, and 5 meniscus injuries occurred, respectively. The techniques that directly caused the meniscus injury were Harai-goshi, Seoi-nage, Osoto-gari, and Ouchi-gari for 4, 3, 2, and 2 knees, respectively, while Kosoto-gari, Kouchi-gari, and Ura-nage individually caused a case of meniscus injury. Three menisci were injured when the participant with a different grip style attempted the attack with Seoi-nage. Three meniscus injuries were reported in the participant with a different grip style being counterattacked by the opponent at the attack of Harai-goshi. Knee ligament injuries were concomitant with all the meniscus injuries at the counterattack of Harai-goshi.

**Conclusions:** different grip styles may be associated with meniscus injury in judo. Rotational force applied to a fulcrum leg with knee extension movement during Seoi-nage or with the knee extended during the counterattack of Harai-goshi could cause meniscus injury.

## Return to Play Following ACL Injury in Professional Footballers in the United Kingdom - A comparison of media prediction and actual findings

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**Introduction:** the purpose of this study was to assess frequency of media reporting of ACL injuries and to compare the time predicted by the media before the player will return to play and the actual time taken for the player to return to play.

**Methods:** an Internet search was performed to identify professional footballers suffering an ACL injury. We recorded the date of injury and the date the player was first selected for a competitive match, the time between these two dates determined to be the time to return to play. Multiple media sources were reviewed to identify the estimated media time to return to play.

**Results:** 25 players suffered an ACL tear and all received surgery. Mean return to play was 9 months (range 6-16), median was 9 months and mode 10 months. The overall mean media predicted time to return to play was 7.3 months. Mean return to play in the Premiership was 8 months (media prediction 6.5 months) compared to 9.5 months in the Championship (media prediction 8.4 months) and 10 months in the Scottish Premier League (media prediction 10 months). No injury was career ending but 36% of players suffered a recurrent knee injury. 36% of injuries were sustained in a tackle.

**Conclusion:** the media consistently under-estimate the time taken to return to play following ACL injury. ACL injury in the professional footballer results in a long absence from play but is not career ending. Return to play is quicker in higher levels of league.



# Subject-specific preoperative outcome evaluation of medial patellofemoral ligament reconstruction: a pilot study

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**Introduction:** to optimise the clinical outcome of medial patellofemoral ligament (MPFL) reconstruction, restoration of normal patellofemoral kinematics is important. This pilot study aimed to assess the potential of a computer modelling technique for subject-specific surgical planning in anatomically normal knees.

**Material and methods:** a finite element modelling technique to analyse contact and kinematics of subject-specific patellofemoral joints (PFJs) was developed. The technique was validated against *in vitro* experimental results. Eight normal knees with MPFL intact were analysed in three stages; when MPFL was intact, following MPFL transection and following MPFL reconstruction. Three femoral tunnel positions: anatomical, 5mm distal and 5mm proximal to the anatomical one were investigated. Five grafts: single and double bundle gracilis and semitendinosus grafts and a quadriceps graft were used.

**Results:** following MPFL transection, peak lateral contact pressures were elevated and medial patellofemoral joint contact pressures were reduced. The patella shifted and tilted laterally following MPFL transection. PFJ contact pressure and tracking were restored after MPFL reconstruction with an anatomical femoral tunnel position. Too proximal and distal femoral tunnel positions elevated medial joint contact pressures and increased medial patellar tilting. Using different tendons in the normal knees affected joint contact characteristics and patellar tracking.

**Conclusions:** the potential of using the computer modelling technique to evaluate contact mechanics and patellar stability of pre- and post- MPFL reconstruction in normal knees is evident. Future study will develop this work and enable analysis of MPFL reconstruction in patients with trochlear dysplasia without limitations inherent with *in vitro* and *in vivo* investigation.

# Coronal knee laxity can be accurately quantified by using technology to standardise the assessment technique

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The assessment of coronal knee laxity is an important clinical manoeuvre for evaluating injuries to the collateral ligaments, but is highly reliant on clinician judgement. This study aimed to overcome the subjective nature of routine assessment and develop a repeatable, objective method for incorporation into clinical practice.

Eighteen clinicians were instructed to measure the coronal laxity of the right knee of a healthy volunteer using a non-invasive adaptation of the Orthopilot image-free navigation system, which enabled real-time measurement of coronal and sagittal mechanical femorotibial angles. Knee flexion angle and hand positioning were kept constant during testing. A manual varus and valgus stress was applied up to a perceived end-point and the maximum angular deviation recorded. A hand-held force application device (FAD) was then used to standardise the applied load.

Clinicians produced a narrow range of laxity measurements with assessment of valgus laxity more consistent than varus (SD 0.6° versus 1.3°).

We have successfully standardised the manual technique of coronal knee laxity assessment by controlling the subjective variables. Incorporating an FAD into the assessment did not affect the clinicians' ability to produce reliable and repeatable measurements, despite removing the manual perception of laxity. The FAD also provided information about the actual moment applied, which may have a role in improving the management of collateral ligament injuries with regard to initial diagnosis and grading, as well as a guide to rehabilitation. Also, by quantifying the technique of senior clinicians, the perceptive skills of more junior trainees may be enhanced.

# ACL repair in acute and chronic phase

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Introduction: literature is controversial on the possibility of repairing an ACL lesion in an acute or chronic phase. We compared a group of subjects treated in the acute phase (within the first 3 weeks) and a group of subjects treated in the chronic phase (after 4 weeks).

Material and methods: 37 patients were evaluated, with reinsertion of the ACL for a proximal lesion. Only lesions with good quality tissue were repaired. They were divided into 2 groups: Group A operated within 3 weeks of the trauma, 25 patients, 10 males and 15 females; mean age 26 years (range, 12- 41). Group B: 17 patients, 11 males, 6 females; mean age 33 years (range, 12-70). A transosseus reinsertion of the ACL with cortical fixation was performed. A pre- and post-operative evaluation using the KOOS, IKDC, Lysholm and Tegner scores was carried out. Statistical analysis with t test. Mean follow-up 42 months.

Results: the mean preoperative KOOS score: Group A 50 (St Dev 17), Group B 59 (St Dev 19). Postoperative Group A 98 (St Dev 7), Group B 97 (St Dev 16). Mean IKDC score: postoperative Group A 95, Group B 95. Lysholm postoperative Group A 99, Group B 96. Tegner Group A: preoperative score 7, postoperative 7; Group B preoperative 7 and postoperative 7. Significant differences did not emerge between the two groups.

Conclusion: ACL repair is possible in a limited number of cases. The proximal site of the lesion and the quality of the ligamentous tissue have more importance than the time since the trauma.

# Is the age of 40 a real limit for ACL reconstruction in football players?

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Introduction: purpose to compare the outcomes of arthroscopic Anterior Cruciate Ligament (ACL) reconstruction procedure in 20 football players over 40 and 20 subjects younger than 30 years (control group) at a minimum post-operative follow-up of 24 months.

Methods: the two groups consisted of 20 patients all males age ranged from 16-29 (mean age 26.1) for the first group and 20 patients in the second group ranged from 40 to 54 (mean age 46.7). Pre- and post-operative anterior-posterior laxity was assessed by Lachman test, pivot shift test and KT1000 arthrometer at manual maximum stress. Clinical functional evaluation was assessed according to IKDC Committee subjective knee form, IKDC ligament standard evaluation and Lysholm score.

Results: at 2 years, all variables significantly improved in both groups compared to pre-operative values ( $P < 0.05$ ), with non-significant intergroup difference. IKDC AB values were 92% in the two groups Lysholm score mean values were 91 vs 90 in the under 40 and over 40 groups return to play mean time was 5.8 months vs 5.9 months.

Conclusions: in the present study, arthroscopic surgery for the management of ACL tear and secondary lesions provides comparable clinical outcomes in football players over 40 and in patients aged below 30 years. Age over 40 yrs is not a limit for ACL reconstruction in football players.

# Arthroscopic all inside reinsertion of anterior meniscal root with all-inside simplified technique: 4 case reports in soccer players

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Arthroscopic reinsertion of anterior and posterior meniscal roots have been already described in the recent literature in order to restore the biomechanical function of the meniscus and to prevent early OA changes. with recent biomechan-

ical studies showing the possible detrimental effects of slight changes of meniscal root reinsertion site Purpose of this study is to review 4 cases of soccer players among a larger case series of all-inside anterior horn meniscal root reinsertion carried out with this novel technique.

Material and method: 4 patients age 25, 28, 36 and 51 y.o amateur soccer players with an arthroscopically confirmed medial meniscal root lesion underwent reinsertion of anterior horn of medial meniscus through a simplified technique using a suture anchor. In all cases the function of the meniscus have been dynamically analyzed before and after the treatment. Exclusion criteria were untreated ligamentous instability, severe OA changes, overweight, poor condition of the meniscal tissue. All the patients were evaluated at minimum 1 year follow-up according to Lysholm and IKDC scores Results All the patients showed statistically improved scores compared to the pre-op values, however because of the different degrees of cartilage lesions detected and 1 ACL reconstruction carried out in the patients each case will be detailed separately. All 4 patients were able to resume sport activity including soccer No complications technique related have been reported in these patients.

Conclusion: the anterior horn of the meniscus can be safely repaired arthroscopically through anchor reinsertion an alternative method with possible return to sport. A larger series with a longer follow-up is required for final validation of this technique.

## Arthroscopic all inside reinsertion of anterior meniscal root with all-inside simplified technique

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Background: arthroscopic reinsertion of anterior and posterior meniscal roots have been already described in the recent literature in order to restore the biomechanics function of the meniscus and to prevent early OA changes. Purpose of this study is to review a case series of all-inside anterior horn meniscal root reinsertion Material and Method A preliminary series of 11 patients age 17-52 6 males 5 females underwent reinsertion of anterior horn of medial meniscus through a simplified technique using a suture anchor. In all cases the function of the meniscus have been dynamically analyzed before and after the treatment. 3 of those patients were amateur soccer players Exclusion criteria were untreated ligamentous instability, severe OA changes, overweight, poor condition of the meniscal tissue. All the patients were evaluated at follow-up according to Lysholm and IKDC scores.

Results all the patients showed statistically improved scores compared to the pre-op values, however because of the different degrees of cartilage lesions detected in this series each case will be detailed separately. No complications technique related have been reported in this series Conclusion The anterior horn of the meniscus can be safely repaired arthroscopically through anchor reinsertion an alternative method.

## Return to play in a soccer player after ACL two stage revision with bone grafting and HTO: a case report

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Failure of ACL reconstruction can be produced by several factors ranging from technical pitfalls to limb malalignment. The treatment of a patient presenting combined ACL reconstruction failure associated with arthritis and malalignment is controversial when is presenting abnormal tunnel widening. This paper is to report a two stage treatment of a 41 y.o. male presenting both instability and medial pain symptoms following failure of a previous ACL reconstruction. Clinical and MRI exam confirmed ACL failure with OA changes in the medial compartment, standing X-rays showed a consistent narrowing of medial joint line and subsequent 3D CT scan detected an abnormal tunnel widening up to 13 mm in the tibia and over 12 mm in the femur. A two stage procedure was carried out with a first steps of hardware removal and bone grafting with bone chips for both tibial and femoral tunnels (with a modified bone grafting technique for the femoral side). 4 months later with evidence of bone healing in the grafted tunnels by a combined open wedge osteotomy com-

bined with hamstring ACL reconstruction was carried out. At final follow-up the patient is stable and symptoms free and she returned to working and sport activity including amateur soccer. Revision ACL reconstruction with abnormal tunnel widening requires a two steps procedure with consistent improvement of quality of life of the patient with possible return to sport activity at final follow-up. There are not direct guidelines in the Literature concerning the treatment of similar cases.

## The role of CT 3D for complex ACL revision with abnormal tunnel widening: criteria and planning for one vs two stage revision and alternative technique for bone grafting

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**Introduction** ACL lesions and further ACL reconstruction are a common issue in soccer traumatology with an increasing number of ACL revision performed. Revision ACL reconstruction can be a challenge when a consistent and abnormal tunnel widening is associated with the presence of metallic fixation hardware. Purpose of this paper is to analyse the role of CT 3 D for a proper planning through case presentation of a 5 years experience.

**Material and methods:** a consecutive series of more 78 CT scan of patients undergoing ACL revision has been reanalyzed. Inclusion criteria were: consistent/abnormal tunnel widening (11 mm) and fixation metallic hardware, arthritic changes detected at X rays involving more than one compartment.

**Results:** CT 3D provided useful information concerning 1) exact size and variable shape of tunnel widening 2) exact position of metallic hardware related to the position of the revision ACL reconstruction tunnels planned 3) condition of the posterior femoral cortex 4) arthritic changes evaluation integrated with both Rosenberg X-rays and MRI exams. Harner's criteria have been used as a guideline. Alternative technique of bone grafting tailored for the specific bone defects are described (all-inside for cyst like proximal tibial tunnel, iliac crest bone block, tibial metaphysis and bone chips all inside for the femoral tunnel).

**Conclusions:** in our experience the use of CT3D reconstruction can provide useful data for complex ACL revision planning for 1) criteria for one vs two stage revision 2) exact tunnel widening and its variability through the length of the tunnels 3) planning for bone grafting 4) planning for tunnel drilling in ACL revision 5) metallic hardware position and real need of removal 5) arthritic changes into the joint.

## Can hyaluronic acid affect the functional outcome of microfracture of medial femoral condyle associated with medial meniscal tear: a prospective medium term study in athletes

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Microfractures has been shown to be a basic and reliable treatment method for osteochondral lesion of the knee with a trend to deteriorate the results at a longer follow-up especially in athletes. Purpose of this study is to evaluate a possible role of additional treatment with hyaluronic acid on functional results. **Material and methods.** We prospectively studied 40 patients with a mean age of 33 years presenting both osteochondral lesion of the medial femoral condyle and not reparable medial meniscal tear with associated ligamentous instability or consistent malalignment. All the patients underwent a slow rehab program with full weight bearing allowed at 6 weeks and return to sports no sooner than 3 months. In the group A 20 patients underwent a serial treatment of high PM hyaluronic acid starting after the 1st month and repeated every 6 months.

**Results:** for both group A and B the results were evaluated according to ICRS and modified Cincinnati score showing a

statistically significant improvement ( $P<0.05$ ) compared to the starting score, however the Group A presented a better outcome at final follow-up than the Group B score ( $P<0.05$ ) Conclusions: In this study the use of high PM hyaluronic Acid provided a better functional outcomes for athletes who underwent microfracture treatment for presenting a medial femoral lesion.

## A novel management option for infected non-union of long bone fractures

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**Introduction:** management of infected non-union following fracture of a long-bone is a challenge to the orthopaedic surgeon. Several methods of treating these cases have been described. Although reports of single stage or multiple stage procedures exist in the literature, general consensus appears to favour a two-stage approach with initial debridement followed by the use of local antibiotic-cement in the first stage. This antibiotic-impregnated cement has been reported in previous papers as placed around an intramedullary nail or via antibiotic cement beads. Cement beads offer no mechanical stability to the fracture site. Placing cement around an intramedullary device provides added concerns, such as cement nail debonding and the continued presence of metal which could cause persistence of infection.

**Materials and Methods:** a 59 year old lady presented with an open, comminuted, segmental fracture of the mid-shaft and neck of the right femur following a road traffic accident. This was initially treated with wound debridement and a long intramedullary nail. Unfortunately the procedure was complicated by Staphylococcus Aureus infection, and sinus formation. At 1 year there was still non-union despite exchange nailing with reaming and lavage of the canal.

The second nail was removed and the femoral canal thoroughly lavaged. The canal was then sequentially reamed until cortex was reached. A cement nail was fashioned intra-operatively around a length of nylon tape with no metalwork included. The tape was used to allow retrieval of the cement rod in the event of rod fracture. The nail was shaped to the approximate diameter of the reamed femoral canal. The cement nail was left longer than the femur to allow the proximal portion to lie outside the femur to facilitate removal. The fashioned nail was intentionally left straight, again to aid removal.

Post-operatively the patient was kept in a long leg resin/fibre cast for the first 2 weeks post-operatively and was kept non-weight bearing on the limb for 6 weeks.

**Results:** at 8 months following the insertion of the cement nail, a further procedure was performed to remove the cement rod and replace this with a standard locked nail. Removal of the cement nail was easy and facilitated by the nylon tape left protruding from the proximal end of the femur. Although the cement nail had fractured it was intact, bonded to the tape and no cement was left in situ.

**Conclusion:** management of infected non-union is a particular challenge to the orthopaedic surgeon, with potential risk to limb and even life. The use of a cement rod in isolation facilitates local antibiotic delivery and affords some stability to the fracture site without the use of further metalwork. It is minimally obtrusive, avoiding additional skin incisions and is readily removable with no risk of cement debonding from a spacer or nail.

## Open wedge high tibial osteotomy; a retrospective analysis

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**Background:** opening wedge high tibial osteotomy has been used to adjust lower limb alignment with satisfactory results. However, many studies have reported negative postoperative radiographic findings including changes in patellar height, tibial inclination and length.

**Materials and methods:** a retrospective analysis of 21 patients treated with valgus high tibial osteotomy (HTO) with an open wedge biplanar technique for medial compartment gonarthrosis and/or knee instability. Our primary outcome measure was the functional and pain assessment using the WOMAC and the LEFS knee scoring systems. Other secondary outcome measures we analyzed were the degree of mechanical axis correction achieved postoperatively, the change in patellar height using the Insall-Salvati (IS) and the Blackburn-Peel (BP) ratios, the degree of tibial inclination using the Moore-Harvey method and the change in tibial length.

Results: there was an improvement in the WOMAC score from a mean value preoperatively of 41.6 +/-21 SD to a mean postoperative value of 17.5 +/- 20.7 SD (p-value:0.001) and an improvement in the LEFS score from a mean preoperative value of 40.3 (+/- 14 SD) to a mean postoperative value of 62 +/- 16 SD (p-value:0.0001). Both results were statistically significant. Mechanical axis measurements revealed change from a preoperative mean varus angle of 5.66 degree (+/- 3.6 SD) to a postoperative mean valgus angle of 2.43 degree (+/- 1.4 SD), this result was statistically significant(p-value<0.05). There was minimal decrease in the patellar height with a mean difference of (0.051) on the IS ratio and (0.060) on the BP ratio, neither values were statistically significant (p-value > 0.05). There was a minimal increase in the degree of tibial inclination (mean increase of 0.11 degrees) as well as a decrease in the tibial length (mean difference of 2.9 mm +/- 3 SD); however, neither were statistically significant (p-value > 0.05).

Conclusion: we conclude that opening wedge high tibial osteotomy significantly improves the functional outcome and improves the quality of life in selected patients. Our radiographic analysis confirmed that opening wedge HTO does not significantly affect the patellar height, degree of tibial inclination and tibial length.

## MRI observations at return to sport of clinically recovered hamstring injuries: a descriptive case series

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Introduction: hamstring injuries are common in athletes and are characterized by a high re-injury rate after return to sport (RTS). Previous studies showed that radiologic assessment of Magnetic Resonance Imaging (MRI) is valuable for diagnosis, prognosis and monitoring recovery of hamstring injury. It is suggested that MRI may contribute to decisions regarding a safe RTS. However, MRI findings at RTS of clinically recovered hamstring injuries have not been studied before.

Purpose: to describe MRI observations of hamstring muscles at RTS after injury.

Methods: MR images were obtained of thirteen consecutive athletes with a clinically diagnosed hamstring injury within five days after injury and within five days after RTS. Standardised parameters were assessed: injured muscle, site of injury within the muscle, grading of injury, presence and extent of intramuscular signal abnormality. This study was part of a RCT on the effect of platelet-rich plasma in hamstring injuries (Dutch trial register number 2771).

Results: mean time to RTS was 38 ± 13 days. All injuries involved the biceps femoris muscle; five grade I and eight grade II injuries. At follow up after RTS nine cases (69%) showed intramuscular signal hyperintensity on short-tau inversion recovery images, indicating oedema. Seven cases (54%) showed low signal intensity on T1 images, indicating scar formation.

Conclusions: on MRI at RTS of clinically recovered hamstring injuries intramuscular signal abnormalities are frequently observed, indicating oedema and scar tissue formation. Further research is needed to estimate the prognostic value of these observations in RTS decisions after hamstring injury.

## Injury Prevention in Marathon Runners

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Introduction: more people run today than ever before with participation in marathons becoming increasingly popular. Injury rates in those training for a marathon can be as high as 90%. (Satterthwaite et al., 1996).

Methods: 89 individuals running for Arthritis Research UK were followed up before and after running the London Marathon. All were asked to complete two online questionnaires, one before the marathon asking for demographic information, previous history of running injury and training habits and one after regarding how the run went and recovery

time to normal functionality. The mean response rate across both surveys was 62% and greater slightly in males than females (62.5% and 57.5% respectively).

Results: there was a significant association between previous injury and reoccurrence whilst running the marathon ( $p = 0.005$ ). There is also a relationship found between time and injury whilst running the London Marathon ( $p = 0.009$ ). This is supported by the fewest percentage of runners who sustained an injury are those who ran the marathon in less than 4 hours (13%). No other associations were found.

Conclusion: this report indicates how difficult it is to determine who will sustain an injury whilst running a marathon. It highlights that there are many risk factors for incurring injury but few proven by scientific research. It does suggest a relationship between previous injury and reoccurrence whilst running a marathon.

There is a need for guidelines for all marathon runners to help reduce rates of injury.

## Does a spindle shape or enlarged achilles tendon represent a problem in young athletes?

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Introduction: a spindle shape (SS) Achilles tendon (AT) with an apparent tendinopathic development, has been generally characterized when the ratio from the thickest part (TP) to insertion (IN) exceeds  $>1.2$  (i.e. 20% increase in thickness). Furthermore, it has been inferred that an AT thickness over 6 mm reflects an enlarged and most definitely pathological tendon. This study will therefore assess if these definitions and suggested values can also be applied at a young athletic population.

Methods: the AT anteroposterior thickness from 193 asymptomatic young athletes ( $12 \pm 0.5$  years;  $156 \pm 8.4$  cm;  $45 \pm 9.7$  kg) was examined lengthwise. Both ATs were measured with an ultrasound (8-MHz transducer, Xario, Toshiba) at IN, mid-portion (MP) and TP. The ratio from MP/IN and TP/IN was calculated. The percentage of tendons over 6 mm and those presenting clinical or sonographical abnormalities was also evaluated.

Results: values at IN ( $4.5 \pm 0.6$  mm), MP ( $5.2 \pm 0.6$  mm), TP ( $5.5 \pm 0.7$  mm) and the ratios MP/IN ( $1.1 \pm 0.1$  mm) and TP/IN ( $1.2 \pm 0.2$  mm) were measured within a physiological range. When computing ratio's percentages, results showed that 23% and 42% of tendons were characterized as having a SS according to the suggested definition. 21% of ATs were over 6 mm. However, only 1.8% of all ATs presented abnormal clinical findings.

Conclusion: this investigation showed no direct relation between SS or enlarged ATs and a tendinopathy scenario. The increase in thickness seems part of an adaptation process resulting from exercise. Therefore, the previously raised definitions could not be applied at a young athletic population.

## The fifa 11+ program for the prevention of injuries in basketball: a cluster randomized controlled trial

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Introduction: structured training programs for sports injury prevention ("The 11" and "The 11+") have been validated in soccer. We investigated the effectiveness of the FIFA 11+ program in preventing injuries in male basketball players.

Methods: we randomized 7 teams to the intervention group (80 players;  $13.5 \pm 2.3$  years) and 4 teams to the control group (41 players;  $15.2 \pm 4.6$  years). The injury surveillance program was conducted during a 9-month season. The primary and secondary outcomes were any injury to the athletes and any injury to the lower extremity, respectively. Type of exposure (match or training), type of injury (acute or overuse), and injured anatomical site were recorded.

Results: in the intervention group, injury rates per 1000 athlete-exposures were significantly lower than those in the control group for overall ( $0.95$  vs  $2.16$ ;  $P=0.0004$ ), training ( $0.14$  vs  $0.76$ ;  $P=0.007$ ), lower extremity ( $0.68$  vs  $1.4$ ;  $P=0.022$ ), acute ( $0.61$  vs  $1.91$ ;  $P<0.0001$ ), and severe injuries ( $0$  vs  $0.51$ ;  $P=0.004$ ). The intervention group also had statistically significant lower injury rates for trunk ( $0.07$  vs  $0.51$ ;  $P=0.013$ ), leg ( $0$  vs  $0.38$ ;  $P=0.007$ ), and hip/groin injuries ( $0$  vs  $0.25$ ;  $P=0.023$ ). There was no statistically significant difference in match, knee, ankle, and overuse injuries between two groups. The most frequent acute injury diagnoses were ligament sprains ( $0.41$  and  $0.38$  in the intervention and control groups, respectively;  $P<0.006$ ) and contractures ( $0.76$  and  $0.07$  in the control and intervention groups, respectively;  $P<0.003$ ).

Conclusion: the FIFA 11+ warm-up program is effective in reducing the rates of injuries in elite male basketball players.

# Comparing the effects of acupuncture with neuromuscular stimulation on short-term lower limb blood flow: an observational study

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**Background:** enhancing training or injury recovery is a fundamental aspect of achieving optimal athletic performance. Neuromuscular stimulation and acupuncture are used by athletes for this purpose, with benefits possibly accredited to increased blood flow. It is unclear which approach is most effective.

**Objectives:** this study compared short-term lower limb blood flow changes during ipsilateral neuromuscular stimulation with the gekoTM device and acupuncture at Urinary Bladder 40 (UB-40), in healthy subjects. Additionally, temperature changes, safety and comfort were important to consider.

**Methods:** twelve healthy volunteers were given 30 minutes of UB-40 acupuncture and 30 minutes with the gekoTM device, separated by 30 minutes recovery. The following measurements were performed: Laser Doppler fluxmetry, Photoplethysmography, heart rate, blood pressure, tissue oxygen saturation, transcutaneous tissue oxygen and discomfort level (questionnaire).

**Results:** the gekoTM device increased Achilles peritendinous microcirculatory velocity (306%), whereas UB-40 acupuncture decreased toe microcirculatory volume (36%), ( $p \leq 0.05$ ). The gekoTM device increased the temperature of the ipsilateral knee, while temperature of the calves and contralateral ankle decreased ( $p \leq 0.05$ ). The temperature of the contralateral knee and ipsilateral Achilles remained constant, as did all sites during acupuncture ( $p \geq 0.05$ ). Both interventions were rated minimal sensation/mild discomfort and no changes were detected in safety measures ( $p \geq 0.05$ ).

**Conclusion:** the gekoTM device considerably increased peritendinous microcirculatory velocity, which could benefit injury healing and training recovery. UB-40 acupuncture decreased microcirculatory volume, evidence for its use is still lacking. Future studies should include patients with post-exercise muscle soreness or relevant injuries, to relate blood flow changes to clinical improvement.

# Compartment syndrome of supraspinatus: a case report and review of the literature

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**Introduction:** compartment syndrome of the lower leg or forearm is a well-recognised condition and relatively common following trauma. Surgeons are taught to recognise the clinical symptoms and signs early to enable immediate surgical fasciotomy. We present a rare case of compartment syndrome of the supraspinatus muscle after bench pressing.

**Conclusions:** we recommend that in cases of intractable non-specific shoulder pain a differential diagnosis of compartment syndrome of the supraspinatus muscle is considered and surgical decompression performed.

# Arthroscopic assisted reduction and internal fixation of glenoid rim fractures

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**Aims:** anterior glenoid rim fractures are rare. Arthroscopic assisted reduction and internal fixation offers a minimally invasive method of achieving osteosynthesis. The aim of the study was to assess the results of an easily reproducible arthroscopic technique of reduction and internal fixation of these fractures.

**Methods:** five patients underwent the procedure. Examination under anaesthesia (EUA) confirmed shoulder instability and arthroscopy was performed. A superior anterior portal allowed washout of the haemarthrosis and a third (anterior)



portal was created. The fragment was freed and the bony surfaces were freshened. A guide wire was inserted into the fracture fragment, which allowed “toggling” of the bony fragment and fracture reduction. A second guide wire was inserted and a single cannulated 6.5mm screw (Asnis, Stryker-Howmedica) was inserted, allowing interfragmentary compression. Direct arthroscopic visualisation confirmed glenohumeral congruity and stability. Patients were followed up clinically using the Oxford instability, Constant and SF-12 scores.

Results: all patients achieved fracture union, with clinically stable shoulders and radiographic joint congruency. There were no peri-operative or post-operative complications. The median post-operative Oxford score was 43 (inter-quartile range 43-44), the mean Constant score was 71.8 (range 54-87) and the mean SF-12 physical score was 55.4 (range 52-59).

Conclusions: the technique provides a safe and efficacious method of treating anterior glenoid rim fractures, using a reproducible arthroscopic technique.

## Subclavian vein thrombosis following acute internal fixation of a clavicle fracture: a case report and review of best treatment

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Introduction: the recent trend towards acute internal fixation of middle third clavicular fractures may result in an increase in upper limb deep vein thrombosis. We present a case of a 41 yr old man who presented to our department with a left sided middle third clavicular fracture. He underwent an acute open reduction and internal fixation which was complicated by a post operative subclavian vein thrombosis. This was treated with oral anticoagulation. The thrombus had completely resorbed by three months. Five months after surgery the patient had a full range of movement of the left arm after having completed a 4000 mile cycle run. A review of the available literature shows the commonest and safest treatment to be subcutaneous unfractionated heparin followed by oral warfarin therapy.

Materials and methods: retrospective case report based on patients' medical records and radiological investigations followed by a literature search of the treatment of upper limb thrombosis.

Conclusions: upper limb thrombosis The case highlights the need for increased awareness of health-care professionals of the risk of upper limb deep vein thrombosis given the recent trend towards the acute internal fixation of clavicular fractures. Once identified, the optimal treatment is initial unfractionated heparin therapy followed by oral warfarin therapy. Untreated upper limb thrombosis can have potentially fatal complications.

## A clinical evaluation of a new arthroscopic biceps tenodesis technique

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Purpose: to evaluate the clinical effectiveness of a new arthroscopic biceps tenodesis technique.

Methods: fourteen study patients had their biceps tenodesed with a new distal notch arthroscopic technique while nine control patients had a tenotomy.

In the study group, the biceps within the distal notch was identified using ultrasound guidance. Arthroscopic stitching of the proximal, intra-articular biceps tendon and release was performed. Arthroscopically, the biceps was identified at the distal notch and pulled out one of the portals. Resection of 20 mm of tendon was done after using a FiberLoop on the tendon to baseball stitch the tendon. A 6.5 x 30 mm tunnel was created in the distal notch. A 6.25 mm BioComposite SwiveLock was then used to tenodesis the tendon into the tunnel.

Non-compliant patients and those suffering post-op trauma were excluded. Patients were evaluated clinically with VAS pain scores and ASES scores monthly for six months. Days to discharge and return to work were noted.

Results: no patient failed tenodesis. Pain scores decreased in both groups from pre-op to six months (Study: 6.4 to 0.7/Control: 7.8 to 3.1, p=0.03). ASES scores increased in both groups (Study: 42.7 to 87.2/Control: 32.4 to 67.3, p=0.03). Days to discharge were 127.1/147.4 days and return to work was 105.8 / 147.5 days for Study/Control groups, respectively (p=NS).

Conclusions: the new arthroscopic distal-notch biceps tenodesis reduces pain and improves function, better than tenotomy. Further study to enhance the power of this study is required.

# Increased concentration of white blood cells in PRP weakens rotator cuff tendons when used for PASTA repairs

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**Introduction:** to evaluate the method of failures of repairs of articular-sided partial-thickness rotator cuff (PASTA lesions) repairs without platelet-rich plasma (PRP), with PRP with concentrated white blood cells (WBC's), and with PRP with reduced WBC's.

**Methods:** three groups had repair of a PASTA lesion using a trans-tendon technique with suture anchors. Fourteen patients were repaired without use of PRP (Group 1); seventy-two patients received PRP with concentrated WBC's (Group 2); and twenty-nine patients were repaired with PRP with reduced WBC's (Group 3), placed arthroscopically during repair of a PASTA lesion. Patients were evaluated with pain scores and ASES scores. Repeat MRA or surgery was performed when patients had complaints at four to six months post-operatively.

**Results:** all groups improved in VAS and ASES scores ( $p=NS$ ). Two (14.3%) Group 1 patients resulted in non-healing of the repair and required revision surgery. Ten (13.9%) Group 2 patients on repeat surgery showed healing of the repaired partial tear, but revealed the sutures cutting through the tendon in a longitudinal fashion. Two (2.8%) Group 2 patients showed non-healing of the repair. One (3.5%) Group 3 patient showed a different, new delamination tear on MRA but healing occurred in all other patients of the primary lesion.

**Conclusions:** this study shows that PRP with concentrated WBC's can result in weakness of the tendon, increasing the likelihood of tear through by the sutures. This study also suggests that PRP improves healing in PASTA repairs as we saw healing of the primary lesion with PRP use.

# Collagen stuffed sutures enhance healing of full-thickness rotator cuff tears

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**Purpose:** to evaluate the clinical effectiveness of a new collagen stuffed suture on full-thickness rotator cuff repairs.

**Methods:** fifty-nine patients had their full-thickness rotator cuff tears repaired with a collagen stuffed suture while forty-five patients were repaired using standard sutures. In the study group, patients were repaired using a collagen stuffed suture and a 4.5 mm Vented Swivel Lock (VSL) anchor. The control patients were repaired using fiberwire or fibertape and VSL anchors. Non-compliant patients and those suffering post-op trauma were excluded. Patients were evaluated with VAS pain scores and ASES scores monthly for six months. Days to discharge and return to work were noted. Repeat MRA was performed for patients having persistent complaints.

**Results:** six out of forty-five (13.3%) control patients failed to heal, requiring revision repair while two of fifty-nine (3.4%) study patients failed to heal. Pain scores decreased in both groups from pre-op to six months (Study: 6.6 to 1.6 / Control: 5.9 to 2.4,  $p=NS$ ). ASES scores increased in both groups (Study: 43.2 to 76.6 / Control: 47.1 to 71.3,  $p=NS$ ). Time to discharge was 159.0 days (Control) compared with 110.7 days (Study). Return to work was 175.8 (Control) days to 59.9 days (Study).

**Conclusions:** collagen stuffed suture appears to enhance healing of rotator cuff repairs as there were fewer failures in the study group. Patients were discharged and returned to work faster. However, there was no significant difference in pain or functional recovery. Further study to enhance the power of this study is required.

# PASTA bridge - A new technique in PASTA repairs: a biomechanical evaluation of construct strength vs suture anchors

**A.M. Hirahara**

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**Introduction:** to verify the biomechanical strength of our new technique for PASTA lesion repairs: the PASTA Bridge.

**Methods and materials:** a 50% articular-sided partial tear of the supraspinatus tendon was created on six matched pairs

of fresh frozen cadaver shoulders. From each matched pair, one humerus received a PASTA repair using one 4.5 mm titanium Corkscrew FT with a horizontal mattress suture while another received a PASTA Bridge.

For the PASTA Bridge, a percutaneous 2.4 mm BioComposite SutureTak was placed for the anterior and posterior anchors. A strand of suture from each anchor was tied. The opposing two limbs were tensioned and fixated laterally with a 4.75 mm BioComposite SwiveLock. The samples were loaded to failure. Load and position data were recorded, and the mode of failure was noted for each sample. Displacement and strain was calculated.

Results: there were no significant differences between the two repairs in ultimate load, strain at the repair site, or strain at the margin. The modes of failure were tendon tearing mid-substance, humeral head breaking, muscle body tearing from the tendon, or tendon tearing at the repair site. Visual inspection of the samples post-testing revealed no damage to the anchors or suture damage.

Conclusion: our PASTA Bridge creates a very strong construct with no significant difference between this and a standard single suture anchor for ultimate load or strain. This technique, in contrast, is a percutaneous, simple procedure requiring no arthroscopic knot tying and carries only a minimal risk of damage.

## PASTA bridge - a new technique in PASTA repairs: a clinical evaluation

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Purpose: to evaluate the clinical effectiveness of a new PASTA repair technique – PASTA Bridge.

Methods: thirty-five patients had their PASTA lesions repaired with the PASTA Bridge while twenty-six patients were repaired using a standard trans-tendon technique using a 3.7 mm BioSutureTak with a horizontal mattress repair. For the PASTA Bridge repair, a percutaneous 2.4 mm BioComposite SutureTak was done to place the anterior and posterior anchors. A strand of suture from each anchor was tied. The opposing two limbs were tensioned to pull the knot taut over the repair site, and fixated laterally with a 4.75 mm BioComposite SwiveLock.

Non-compliant patients and those suffering post-op trauma were excluded. Patients were evaluated with pain scores and ASES scores for six months. Days to discharge and return to work were evaluated. Repeat MRA was performed for people having persistent pain.

Results: four of twenty-six (15.4%) control patients failed to heal, while one of thirty-six (2.8%) study patients failed to heal. Pain scores decreased and ASES scores increased in both groups (Study: 7.2 to 3.4 & 40.3 to 68.1/Control: 6.9 to 3.4 & 42.7 to 68.6, p=NS). Days to discharge & return to work were 135.4 /107.7 and 219.8 /106.3 for Study/Control groups.

Conclusions: the PASTA Bridge technique is easier, less risky, and requires no arthroscopic knot tying. This study shows the PASTA Bridge technique was more effective than standard trans-tendon technique for healing but had similar decrease in pain and increase in function.

## Arthroscopic capsular plication in a canine shoulder model: feasibility and evaluation of “in vivo” healing

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Capsular laxity is reported to be treated with arthroscopic suture plication techniques. Although there have been reports demonstrating its clinical efficiency nor is there basic science research evaluating the healing potential of the capsule after such plication and there is no animal model. The purposes of this study were to evaluate the feasibility of arthroscopic capsular side to side plication in a canine shoulder model and to evaluate histologically the possible healing.

Twelve shoulders of 6 mature Golden Retrievers were randomly assigned into 3 groups: capsular plication (CP), capsular plication with synovial abrasion (CPA), capsulotomy suture (CS). Procedures were successfully performed by a single surgeon. Six weeks postoperatively, animals were sacrificed. Capsules were dissected, three hematoxylin and eosin sections were prepared for each. A qualitative score was used by an experimented pathologist blinded to the procedure to evaluate cellularity, fibrosis and vascularity in both the synovial and the capsule (none, slight, moderate, severe).

For the synovium, there were no significant differences in cellularity, fibrosis or vascularity appearances after CS, CP or CPA. For the capsule, CS group has significantly higher capsular fibrosis and vascularity scores compared to CP and CPA. There were no differences in the capsular fibrosis score between CP and CPA.

The canine model fits correctly to assess arthroscopic capsular plication when procedure made by a skillfull arthroscopist used to deal with canine shoulder. Our results prevent us from recommending capsular plicature (even combined with synovial abrasion) as a reliable therapeutic choice for capsular laxity.

## Functional rehabilitation of the shoulder after arthroscopic repair of rotator cuff tears

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**Aim:** arthroscopic repair of rotator cuff tears is the first choice of these defects. The functional rehabilitation of the shoulder after these repairs needs a significant amount of time. The aim of this study is to record the time needed for the functional rehabilitation and to identify the affecting factors.

**Materials and methods:** sixty nine patients underwent arthroscopic rotator cuff tear repair (38 female, 31 male). The mean age of the patients was 57,8 years and the follow up was at 3,6 and 12 months postoperatively. We used UCLA score and Constant score to measure the functional ability of these shoulders. We record the level of rehabilitation at the time of the follow up. Good result was considered >27 at UCLA score and >80 at constant score. We examined the potential factors which can affect our results such as age, gender, preoperative stiffness, preoperative range of motion of the shoulder, tissue quality and tear size.

**Results:** twenty two patients (31,88%) achieved good functional ability of the shoulder in 3 months postoperatively. Thirty three (47,82%) needed six months and the rest of them (14 patients 20,28%) more than six months. Younger patients with smaller size of tear and better preoperative range of motion of the shoulder needed less time to achieve good results.

**Conclusions:** six months was adequate for 79,7% of the patients to achieve good functional results of their shoulder after an arthroscopic repair of a rotator cuff tear. Preoperative range of motion, age and size of the tear are the factors which affect the results.

## Massive non traumatic rotator cuff tear in athletes under 30: 2 case report

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Rotator cuff tear is a comon pathology in the patients over sixty even without a trauma. In the patients under 30 y.o. this pathology is very uncommun ad often associated to high energy traumatic event with or without shoulder dislocation. This paper is to present two case report of female volleyball player with a negative trauma history who have been playing up few weeks before surgery. At arthhscopic examination they presented a massive rotator cuff tear without subscapularis tendon lesion.

In both case we carried out an arthroscopic single row anchor repair achieving a complete and stabile rotator cuff repair followed by a slow and strictly supervised rehab program. Both cases achieved a satisfoty result at final follow-up (UCLA preop vs postop:  $P < 0.005$ ) with a complete return to sport with a time to return to sport of up to 8 months following surgery.

## Microfracture at the footprint in arthroscopic rotator cuff repair: a prospective study, 2-year follow-up

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**Hypothesis:** microfracture at the footprint have been described as a potential addition source of growth factor in oder to enhance the tendon healing at the bone tendon junction in patients undergoing arthroscopic rotator cuff repair with

no studies available to investigate the possible benefit. Study design: Prospective, randomized, controlled, double blind study.

Materials and methods: fifty seven patients who underwent shoulder arthroscopy for the repair of a complete rotator cuff tear were randomly divided into 2 groups, using a block randomization procedure. A treatment group (N = 28) consisted of those who underwent microfracture at the footprint with a standardized method. A control group (N = 29) consisted of those who did not receive that treatment. Patients were evaluated with validated outcome scores. All patients had the same post-op rehabilitation protocol.

Results: the 2 groups were homogeneous. The pain score in the treatment group was lower than the control group at 2 weeks, and 4 weeks and 6 weeks days after surgery ( $P < .05$ ). On the Simple Shoulder Test (SST), University of California (UCLA), and Constant scores, were significantly higher in the treatment group than the control group at 3 months after surgery; UCLA:  $26.9 \pm 3$  vs  $24.2 \pm 4.9$ ; Constant:  $65 \pm 9$  vs  $57.8 \pm 11$ ;  $P < .05$ ). There was no difference between the 2 groups after 6, 12, and 24 months. No complication technique related were recorded in this series.

Conclusion: the results of our study showed microfracture at the footprint s can be safely used in addition to RC repair providing a possible reduction of post-op pain with no consistent differences at final two years follow-up.

## Prevention of cervical spine injury education package by the rugby football union and barts and the London NHS trust

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Introduction: a joint initiative with Barts and the London NHS Trust and Rugby Football Union (RFU) to produce an on-line educational package for rugby union coaches and referees.

The main 2 objectives were:

- To reduce acute and chronic neck injuries, by improving knowledge and awareness of neck anatomy and mechanisms of injury;
- To aid prevention of injury by building competence and confidence in early intervention by coaches and referees.

Materials and Methods: a range of resources were utilised to tailor make a package which would be both very informative but also very accessible to professionals from non-medical backgrounds.

A team was put together which included representatives from Trauma dept, Radiology dept, Academic Sciences, Sports and Exercise Medicine and the Rugby Football Union to discuss the optimal content for the package and modern computer software used to design a multimedia online educational course.

Results: this is a dynamic online educational package which was critiqued by a test panel with highly positive feedback. The package offers a great introduction into neck safety in a contact sport and has potential to be used in other sports. The package will be rolled out to the rugby union community and improvement of the package can be a dynamic process due to the package being maintained by an Administrator. In future, the content could be changed in light of any potential changes to the IRB Rugby Union Laws or interpretations of the rules.

Conclusion: neck injuries in rugby union are very topical and this educational package has tackled the issue by clarifying and explaining the need to know knowledge in an interesting and dynamic way as well as assessing and offering continuing professional development to rugby union coaches and referees.

## Comparative study on intramedullary titanium elastic nail v/s k-wire fixation in femur shaft fracture in children

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Background: to compare the results of fixation by titanium elastic nail and K-wires in paediatric femoral shaft fractures.

Methods: 40 patients with femoral shaft fracture aging 6-14 yrs were included in this study.

We performed fracture fixation in 40 patients by dividing them randomly in two equal groups, in one group we did intramedullary titanium elastic nail and in other group we did intramedullary K- wire fixation. Knee physiotherapy was started

2days after the surgery and partial weight bearing after 6th week of surgery and full weight bearing at clinico-radiologic union. Implant removal was done in both groups at 6 months.

Results: both the groups were comparable, average time of callus formation and radiologic union was 6 to 10 weeks in both groups. One patient in K-wire group developed skin ulceration from protruding end of K-wires which resolved removing K-wire. Slight limb length discrepancy was seen in both groups. Cost comparison showed TEN was about more than 10 times costlier than K-wires.

Conclusion: results of fixation were found to be near about same in both the groups except the cost effectiveness of K-wires. Hence trial can be given for K-wire fixation in pediatric femur shaft fractures in developing countries.

## Musculoskeletal maturity and neck strength development in Under 19 male rugby players

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Introduction: there is little research on maturity and development in Under 19's male rugby players. Preliminary data suggests dramatic differences in neck strength and range of movement between individuals. This study demonstrates the benefits of a 6 week neck conditioning programme in this age group.

Material & methods: 30 male Under 19 rugby players were divided in a blinded study. The control group continued their normal training schedule whilst the neck conditioning group completed a 6 week intensive additional training programme focused on neck development using specially developed neck harnesses. All individuals were tested using the Gatherer analysis system before and after the 6 week study to look at differences between the 2 groups.

Results: the results highlighted several interesting points in the benefits of utilising a neck conditioning programme in this cohort.

Conclusion: neck injuries in rugby players is a very topical issue currently and this study addresses the subject by delivering evidence on neck conditioning programmes to minimize or prevent neck injury through focused conditioning. More studies are required to validate the new Gatherer neck conditioning programme in the Under 19 male group.

## Beware the unusual: traumatic vertebral artery dissection

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Introduction: vertebral artery dissection (VAD) has an estimated annual incidence of 1-1.5 cases per 10000 and is usually subdivided into traumatic and spontaneous. Spinal manipulative therapy and chiropractic neck manoeuvres have been strongly associated with VAD and neck hyperextension has been considered to be the most common precipitant. VAD due to head and neck injuries in sports like rugby are very rare.

Presentation: a previously fit and healthy 25 year old rugby league player was diving for the line during a game sustaining hyper flexion of his cervical spine. He suffered a sudden onset of sharp pain over the left side of neck but rose immediately and concluded the game with residual neck ache. Formal clinical examination showed reduced active range of neck motion without any major abnormality. The cervical spine radiographs were normal and a neck sprain was diagnosed. He continued to have minor symptoms but felt fit to play in a match six days later, but suffered a collapse prior to warm up with symptoms of dizziness and blurred vision. He rapidly recovered enough to watch the whole game and travelled back home. In the early hours of next morning he woke up with a dense left hemi paresis, left hemi sensory loss and left upper quadrant anopia.

Findings: he was admitted to a local hospital and urgent CT scan revealed a patchy low density lesion in the right occipital region and posterior limb of internal capsule suggestive of ischaemia. A subsequent Magnetic resonance angiography showed dissection of intima of the left vertebral artery with embolic occlusion of right posterior cerebral artery. Six weeks after treatment with intravenous heparin and oral anticoagulants, he made a steady recovery but was left with a mild sensory disturbance of left lower limb and moderate visual field defect.

Discussion: central nervous system (CNS) injury due to severe head trauma can occur in many sports activities. CNS injury associated with rugby or football has been reported in the form of intracranial hemorrhage. Development of vertebral artery dissection is a very rare and uneventful finding. Although neurologists and vascular surgeons are familiar with this condition, general practitioners, medical staff in sports, and other athletes who may be the first to help such patients are far less acquainted with this condition.

Conclusion: despite its rarity, early diagnosis and treatment of vertebral artery dissection are of paramount importance in preventing career and life threatening complications.

## Dangers of the Scrum: cervical spine injury - a case report and review of management guidelines

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Introduction: cervical spine immobilization is an essential component of the Advanced Trauma Life Support (ATLS®) system—-. Inadequate training in the management of trauma calls and failure of early recognition and proper immobilization of the cervical spine can lead to disastrous consequences.

Cervical spine injury occurs in 2%- 4% of all cases of blunt trauma. All patients involved in significant blunt trauma must be assumed to have an unstable injury to their spine, with the incidence rising from 2% up to 34% in the unconscious patient. In the cervical spine, ligamentous disruption without a major bony injury can lead to instability.

Traumatic atlanto-axial dislocation is a rare, but serious injury. Secondary spinal cord damage can be caused during extrication, resuscitation, transport and evaluation of patients with suspected spinal instability.

Case report: a 32-year-old semi professional rugby player was involved in a scrum which collapsed. Several players fell onto him. As he hit the ground, he heard a “crack” in his neck. Paramedics were called to the scene. He was found lying face down in a prone position with a torticollis deformity. He had complained of neck pain on any attempted movement. Initial assessment elicited no sensory or motor deficit. The Glasgow Coma Scale (GCS) was 15/15 and there was no history of loss of consciousness. The cervical spine was stabilised in a hard collar with head blocks on a spinal board. He was kept in the prone and torticollis position in which he was found. He was taken to the local emergency department where he was triaged. After a two hour wait, he was assessed in the department. A “trauma call” had not been issued. Radiographs of his cervical spine demonstrated an atlanto-axial dislocation. After specialist referral, he was log rolled in to a supine position and a cervical collar was applied. The spinal board was removed after more than two hours. Neurological assessment using the American Spinal Injury Association (ASIA®) system confirmed no neurological deficit. There were no other associated injuries. The dislocation was reduced after computerized tomography (CT) scan confirmed the diagnosis. Cautious rotation under traction with the cervical spine in flexion was applied thus avoiding harm by potential posttraumatic disc lesions. Definitive stabilization was achieved using a Sub Occipito Mandibular Immobilization (SOMI) brace which was worn for six weeks with good outcome.

Discussion: cervical spine injuries can lead to substantial morbidity and mortality. In athletes, especially it can end or change the future of their career.

Several recent UK based audits have suggested poor implementation of spinal clearance policies. This must be addressed through re-education and training, especially amongst the forefront medical personnel. This case report highlights some problems that are still seen on a daily basis in emergency departments.

Conclusion: we recommend that all clinical staff involved in the initial stages of hospital care (including triage), should receive the necessary training, education and courses (ATLS®) to recognize and manage cervical spine injuries. Appropriate management via established guidelines in emergency departments exists and these must be adhered to. We also recommend that a senior radiologist must report spinal clearance images prior to withdrawal of spinal protection.

## Variations of lumbar spine stress fractures in fast bowlers

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Variations of lumbar spine stress fractures in fast bowlers

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Introduction: the action of fast bowling places immense strains on the lumbar spine due to the repetitive combined movements of hyperextension, lateral flexion, thoracolumbar rotation and an impact force that occurs when the bowler lands

in his delivery stride. This complex movement is repeated between 142-235 per week for an average English professional bowler, who may play for 12 months in a year. Stress fractures of the lumbar spine are relatively common in this group and we report upon the variations seen.

Materials and methods: between 1982 and 2007, 37 pars defects were diagnosed in 21 professional cricketers. Diagnosis was made by a combination of investigations including x-rays, bone scans, CT and MRI scans. Several variations of the 'classical' pars lesion were seen with potential implications for management.

Results: the 'classical' Newman type 2 unilateral pars defect involving the lower 2 lumbar levels was the commonest lesion seen. Bilateral defects with or without spondylolisthesis was the commonest variation of this lesion. Multiple level defects were seen in 3 bowlers. CT scans also revealed several complex lesions extending from the pars into the laminae, facet joints or transverse processes.

Conclusion: the immense load placed upon the lumbar spine caused by the action of fast bowling and its repetitive nature causes stress fractures of the pars interarticularis. The unique nature of this load results in many variations of the classical pars stress fracture.

## Rehabilitation of fast bowlers with stress fractures of the lumbar spine

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Introduction: stress fractures of the pars interarticularis of the lumbar spine in professional fast bowlers have become commonplace in modern times. The action of fast bowling places immense strains on the lumbar spine due to the repetitive combined movements of hyperextension, lateral flexion, thoracolumbar rotation and an impact force that occurs when the bowler lands in his delivery stride. Many fast bowlers are lost to the game but with the correct treatment the vast majority can return to professional sport.

Materials and methods: between 1982 and 2007, stress fractures of the lumbar spine were diagnosed in 21 professional cricketers. 8 were managed conservatively and 13 underwent surgery and all returned to professional sport. The rehabilitation process for both conservative and surgical treatment has been refined over time and now is an interdisciplinary approach requiring the input and direction from surgeon, physiotherapist, trainer, cricket administrator, coach and biomechanist.

Results: a staged programme for both conservative and post operative rehabilitation that allows the progression of fracture stabilisation to full intensity bowling has been developed. Bowling action analysis and retraining to 'safer' actions have become more advanced in recent times and are now key steps of the programme. The importance of rest has also become more apparent and bowling load must be carefully monitored.

Conclusion: rehabilitation of the fast bowler with a lumbar spine stress fracture involves a multidisciplinary approach. A staged programme has been developed that has enabled all of the cricketers in our series return to professional sport.