

Electronic Poster Presentations

P01

Prevalence of Sarcopenia in Hong Kong Chinese Geriatric Hip Fracture Patient and Its Correlation

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Introduction: Sarcopenia and osteoporosis are age-related declines in the quantity of muscle and bone, respectively. Both contribute in disability, fall, and hip fracture in elderly.

Methods: All geriatric primary hip fracture patients admitted to Kowloon West Cluster Orthopaedic Rehabilitation Centre. Hand grip strength and body composition measurement using dual-energy X-ray absorptiometry were performed.

Results: A total of 356 patients were included with a mean age of 81.7 years. By stratifying in males and females, their respective mean hand grip strength were 20.8 kg and 13.7 kg, the mean Relative Skeletal Muscle Mass Index (RASM) being 5.79 kg/m² and 4.90 kg/m², and the hip bone mineral density (BMD) being 0.699 g/cm² and 0.992 g/cm². The prevalence of sarcopenia based on RASM according to the Asian Working Group for Sarcopenia definition were 89.5% in male and 76% in female. The prevalence of femoral neck osteoporosis based on hip T-score of <-2.5 were 43.4% in males and 63.6% in females. The RASM was positively correlated with hand grip strength, body weight, femur T-score, hip BMD, body mass index, and total fat mass in both males and females. All were statistically significant.

Conclusion: The prevalence of sarcopenia was very high in geriatric hip fracture patients, and much higher than community-dwelling elderly. Apart from the need to prescribe osteoporosis medicine to these patients, sarcopenia screening and treatment should be addressed, which is essential to reduce subsequent fall, subsequent fracture, and the fracture-related complications and economic burden to Hong Kong.

P02

The Effect of High-intensity Circuit Training on Youth Soccer Players: An Implication on Injury Prevention and Performance Enhancement

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Introduction: Previous studies found that neuromuscular training programme was effective to reduce lower limb injuries in youth soccer players. However, there were limited studies about its effect on fitness performance. Using high-intensity circuit training (HICT) format to implement neuromuscular training on youth players may be the solution to coaches to achieve fitness enhancement and reduction of injury risk.

Materials and Methods: A total of 56 male soccer players were recruited from local secondary school football teams. Subjects were randomly assigned into 2 groups – HICT group (HG) and controls (CG). The HG underwent a 7-week intervention, with HICT programme twice a week on top of regular training. All subjects had done a total of 7 tests to examine the anthropometry condition, fitness performance, i.e. lower limb explosive power, sprint performance, agility performance, aerobic endurance, as well as injury risk factors, i.e. core strength and dynamic balance before and after intervention period.

Results: The HG significantly reduced their percentage body fat, agility test performance, and improved core strength compared with CG. No significant improvement was found in other test items.

Discussion and Conclusion: The HICT programme adopting neuromuscular training exercise can bring enhancement in soccer agility and reduce percentage body fat. It also helps to reduce injury risks by improving core muscle strength. It is implied that HICT training programme, characterised by utilising little space and time, is a potential injury prevention and performance enhancement programme. Further prospective cohort study on the protective effect of HICT training in youth soccer players is warranted.

P03

Effect of Short-term High-intensity Interval Training on Land Versus in the Pool in Elite Youth Swimmers**PSH Yung, QKC Yau, E Boit, KM Chan***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*

Introduction: Conventional swimming training involves heavy loading on shoulder which may prone to overuse injury. Several cross-training programmes have demonstrated a transference effect which is able to build up fitness with reduction of the overall work at particular joint. The present study was conducted to investigate whether high-intensity interval training (HIIT) on land and in the pool would improve swimming sprint performance in the 50-metre freestyle.

Materials and Methods: A randomised longitudinal study of 12 competitive swimmers were arranged into 3 groups and each performed different training programmes for 4 weeks, each session lasting 20 minutes long, 3 times a week. Swimmers' profile included mixed gender, 16-to-22-years-old with regular training, and at sub-elite level. The control group (C) performed steady-state swimming, the second group performed HIIT in the water (HW), and the third group performed HIIT on land (HL). Baseline tests included hand grip strength, 50-metre sprint performance, and overhead medicine ball throw. The HL and HW groups underwent an HIIT programme, while the C group had their training regimen extending for the same amount of time.

Results: Post-test showed that the hand grip strength test had a substantial increase in strength variables for the HL group ($p=0.002$) to the other groups, while the 50-metre swim ($p=0.273$) and the overhead medicine ball throw ($p=0.496$) did not yield any statistically significant data.

Conclusion: The short HIIT on land increased hand grip strength in swimmers compared with conventional training.

P04

Adolescent Idiopathic Scoliosis-specific Hand Bone Age Atlas — A Cross-sectional Study of Bone Maturity Level from 986 X-ray Films Using a New Simplified Thumb Staging System**WW Chau, LH Hung, B Shi, B Yip, TP Lam, JCY Cheng***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*

Introduction: Greulich & Pyle (GP) Atlas established in 1950 was an invaluable bone age tool for maturity assessment using hand and wrist radiographs in idiopathic scoliosis patients, leading to make clinical decisions. However, information are validated with normal British subjects which may not be applicable for Chinese adolescents. We aimed at establishing a new bone age maturity model for Chinese idiopathic scoliosis patients using a novel staging method.

Materials and Methods: A newly developed simplified thumb staging system, Thumb Ossification Composite Index (TOCI) classifying maturity into 8 stages, was introduced in this study. Inclusion criteria were as follows: female, diagnosis of idiopathic scoliosis, aged 10 to 16 years, and good past health. The TOCI staging was carried out from hand and wrist radiographs which were taken at their first visit. Results from TOCI staging were compared against age-groups and GP Atlas.

Results: A total of 14,600 visits from 986 X-ray films from girls with adolescent idiopathic scoliosis (AIS) between 2007 and 2013 were reviewed, and grouped by age-groups of 6-month intervals from 10 to 16 years. Median TOCI stages by age-groups corresponding to GP Atlas (i.e. [TOCI] - [age-group] - [GP Atlas]) were as follows: [4]-[10-11]-[11], [5]-[11.1-12]-[12], [6]-[12.1-12.5]-[13], [7]-[12.6-13.5]-[14], [8 to 8.3]-[13.6-16]-[15 to 17].

Discussion and Conclusion: The TOCI staging effectively simplifies the bone maturation classification over the traditional method, and offers specific information on AIS-specific bone age (in 6-month intervals) which traditional method could not provide.

P05

80% Skeletal Maturity Information in Hand and Wrist Radiographs are Reflected in Thumb Region. Conclusions Drawn from an Analysis of 10,773 Epiphysis of Small Hand Bones

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Introduction: Skeletal maturity and bone age determination traditionally use either Greulich & Pyle Atlas or Tanner-Whitehouse III (TWIII) method, which focuses on morphological change of epiphysis (widening, covered, or capping status) over phalangeal, metacarpal, and wrist bones. Their sequences of ossification and fusion timing among each other have never been described precisely. This study aimed to investigate the relationship of ossification / fusion timing in thumb epiphysis and ulnar 4 digits epiphysis.

Methods: A total of 600 hand and wrist radiographs from 127 females with idiopathic scoliosis at their peripubertal period were reviewed and scored using TWIII method over all epiphyses except carpal bones. Probability of TWIII stages among thumb and remaining digits were computed.

Results: A total of 10,773 epiphyses were scored which showed that their ossification and fusion sequence followed a regular predictable pattern. The probability of the same TWIII stage (F, G, and I) in both proximal phalange epiphysis of thumb and epiphysis from remaining 4 ulnar digits were 80%, 81.5% and 96.5%, respectively. Thumb distal phalange (DP) epiphysis TWIII stage I correlated with 70% chance that all other DP digits' epiphyses were at stage I as well. Overall, there was 82% chance that TWIII stage in thumb epiphysis was the same as TWIII stage in all remaining ulnar 4 digits.

Conclusion: Morphological stage in thumb epiphysis represented 80% chance that same stage occurred in remaining 4 ulnar digits. It forms a good rationale that skeletal maturity in thumb is representative of the hand during pubertal period.

P06

The Enhancement of Blood Flow of the Foot Wound of Streptozotocin-induced Diabetic Rats by Mechanical Stimulation of Low Magnitude High Frequency Vibration

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Introduction: One of the multiple complications of diabetic mellitus (DM) is delayed wound healing due to factors like low blood perfusion and neuropathy, with 5% to 15% of DM patients undergoing lower-extremity amputation. Low magnitude high frequency vibration (LMHFV) is a non-invasive biophysical modality providing mechanical stimulation and we investigated its effectiveness on wound healing.

Methods: A total of 20 streptozotocin-induced DM Wistar rats had a 2 x 5 mm² wound opened at the dorsal foot and were divided into vibration (DM_V) or sham (DM_NV) group. The LMHFV (35 Hz, 0.3 g) was applied on DM_V group for 20 mins/day, 5 days/week. The healing rate and blood flow of the wound were measured at days 1 and 8 with SPOT and laser Doppler imaging.

Results: The mean (\pm standard deviation) flux in DM_V group (154.91 ± 65.67) was higher than DM_NV group (147.91 ± 84.54) on day 1 without significance. On day 8, the DM_V group (226.35 ± 185.45) had lower mean flux than DM_NV group (321.93 ± 230.98) [$p=0.027$]. Despite no significance observed on day 8, the wound area of DM_V group (2.736 ± 2.16 mm²) was smaller than that of DM_NV group (3.62 ± 3.38 mm²).

Conclusion: On day 8, DM rats with vibration treatments had significantly lower flux than those without, indicating that the wound was nearly / completely healed due to lower blood supply needed. The LMHFV is likely to accelerate the wound healing by enhancing blood circulation at earlier stage.

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P07

A Population-based Analysis of the Postfracture Care Gap in Hong Kong: The Situation is not Improving

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Introduction: Patients who sustain an osteoporotic fracture are at increased risk of sustaining further osteoporotic fracture. There are international guidelines to close this postfracture care gap but not in Hong Kong and the practice varies between different hospitals and departments. We report the current situation and practice of secondary drug prevention of fragility fracture after osteoporotic hip fracture.

Methods: We retrieved dispensation of osteoporosis drug record from patients with new osteoporotic hip fractures aged ≥ 65 years, from 2009 to 2012 using Hospital Authority Clinical Data Analysis and Reporting System. Those who took anti-osteoporotic drugs before the fracture and pathological fractures were excluded.

Results: A total of 15,866 osteoporotic hip fracture patients were included. Only 9% to 15% of fracture patients who were eligible for treatment of osteoporosis received medicines within 1 year after hip fracture. Orthopaedic surgeons initiated 63% of osteoporosis medicines, whereas physicians initiated 37%. The drugs of choice in descending order were alendronate (76%), ibandronate (12%), strontium (5%), zoledronate (4%), and others (3%).

Discussion and Conclusion: There is a huge postfracture care gap in secondary prevention for osteoporotic hip fracture patients in Hong Kong. Majority of the patients are neither diagnosed nor being tested for osteoporosis and remained untreated. The Government needs to allocate more resources to implement the best practice framework to those high-risk post-hip fracture patients before they go on to break another bone. By reducing the number of subsequent osteoporotic fractures, the Government can get significant cost savings that can be utilised in other valuable health care programme.

P08

Use of Taylor Spatial Frame as an Acute Reduction Tool in Paediatric Lower Limb Fracture: A Luxury Idea?

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Taylor spatial frame (TSF) is a multiplanar circular external fixation with 6 degree of freedom that allows accurate 3-dimensional deformity correction application. Use of TSF has gained its popularity recently in orthopaedic trauma, particularly paediatric tibial shaft fracture.

We report a 14-year-old boy presented with unstable tibial shaft fracture and fracture blister, who was treated successfully with TSF. The open proximal tibia physis status excluded rigid intramedullary nailing and poor soft tissue condition did not favour other internal fixation choices such as plating. Intra-operative immediate acute reduction using the computer program of TSF was adopted for this patient, which involved integration of intra-operative calibration technique and fluoroscopic mounting parameter measurement. A detailed workflow is also described.

Immediate full weight-bearing and hip / knee / ankle joint mobilisation was allowed postoperatively. Fracture union achieved at 10 weeks post-surgery and TSF was removed. Role of TSF as acute reduction tool was discussed and elaborated.

Taylor spatial frame is a reasonable alternative for management of selected unstable tibia fracture in skeletally immature patients with additional advantage of more aggressive rehabilitation process and satisfactory reduction alignment.

P09

Arthroscopic Retrograde Autologous Cancellous Plug Transplantation for the Treatment of Osteochondral Lesion with Large Subchondral Damage of the Talus

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Introduction: Since 2009 we have performed arthroscopic retrograde autologous cancellous bone plug transplantation (RACT) for large osteochondral lesions of the talus (OLT). We investigated the clinical results and the degree of cartilage reproduction after RACT by comparing with those after arthroscopic drilling (AD).

Patients and Methods: From 2005 to 2013 a total of 89 patients (89 ankles) were treated with OLT. Arthroscopic drilling had indicated for 53 patients who were treated by July 2009. Besides, RACT had performed for 36 patients since then. Clinical results were evaluated using Japanese Society for Surgery of the Foot (JSSF) score at 2 years after surgery. Second-look evaluation was performed for all cases after more than 6 months from the surgery and assessed by International Cartilage Repair Society (ICRS) score.

Results: The mean (\pm standard deviation) JSSF scores were improved significantly at final follow-up in both groups (AD group: from 68.0 ± 3.4 to 88.2 ± 8.1 ; $p < 0.05$, RACT group: from 65.4 ± 3.6 to 92.4 ± 4.6 ; $p < 0.05$). Besides, RACT group had significantly better score than AD group at 2 years after surgery ($p < 0.05$). There was significant difference in the mean ICRS score between 2 groups (5.4 ± 2.1 in AD group vs. 10.5 ± 0.8 in RACT group; $p < 0.01$).

Conclusion: Bone marrow stimulation technique is not always satisfying for the treatment in the cases of the OLT with bone cysts or large subchondral lesions. Being introduced as a novel technique, RACT may be one of effective procedures for OLT accompanied by bone cysts or large subchondral lesion.

P10**Integration of Computer-aided Design / Computer-assisted Manufacture Planning into Computer-assisted Deformity Correction Surgery in Fibula Hemimelia with Complex 3-Dimensional Foot Deformity — A Case Report****LH Hung,¹ YC Siu,² CS Chui,¹ CY Chen,¹ BKW Ng,¹ JCY Cheng¹**¹*Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong*²*Department of Orthopaedics and Traumatology, North District Hospital, Hong Kong*

Complex 3-dimensional foot deformity is common in fibula hemimelia, presenting with both cosmetic and functional problems of non-plantigrade foot, easy tripping symptoms. Bony osteotomy to correct these complex deformities precisely has been challenging as both the planning and execution of osteotomy is difficult. Integration of planning from computer-aided design / computer-assisted manufacture (CAD/CAM) software to computer surgical navigation system to achieve accurate execution has been extensively reported in tumour, trauma, and limb deformity corrective surgery. However, application of these new techniques to foot may not be feasible owing to the intrinsic problem of multi-mobile joints with limited working space and narrow safety corridor for intra-operative incorporation of navigation system.

We report a 17-year-old boy with Achterman-Kalamchi type IA fibula hemimelia, presented with left rigid equinovarus deformity. Foot 3-dimensional computed tomography (CT) reconstruction confirmed extensive tarsal coalition involving both hind-foot and mid-foot regions. We successfully realigned the foot with precise planning and execution multiplanar mid-foot osteotomy using the integrated computer-assisted surgical approach: preoperative planning of osteotomy using Mimics software, conversion of simulated virtual plan back to computer navigation system, intra-operative execution of the plan using navigation, and postoperative verification of planning with CT fusing image technique. A detailed workflow of the approach was described and discussed in this case report.

Accurate multiplanar midfoot osteotomy to realign equinovarus deformity in fibula hemimelia is feasible using the described computer-aided surgical approach.

P11**Managing Paediatric Chronic Fixed Patellar Dislocation: A Case Report and Short Review****YC Siu,¹ LH Hung,² XY Huang,² JHP Hui,³ BKW Ng²**¹*Department of Orthopaedics and Traumatology, North District Hospital, Hong Kong*²*Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong*³*Department of Orthopaedics and Traumatology, National University Hospital Singapore, Singapore*

Dealing with fixed and chronic patella dislocation is very difficult and challenging. This problem not only affects usual daily activity, but also significantly increases risk of early degeneration of patellofemoral joint.

We report a rare case about a 19-year-old girl who suffered from fixed and chronic left patella lateral dislocation (more severe on flexion) since 9 years after a fall and knee injury. Investigations were performed and the pathoanatomy in this case was identified. Extensive surgical correction including lateral soft tissue release, medial patellofemoral ligament reconstruction, quadriceplasty and tibial tuberosity corrective osteotomy were performed. The patient had satisfactory outcome in early postoperative period. A short review on workup and management of these complicated cases were also performed.

Detailed workup and physical examination are the keystones to formulate a successful treatment plan. The pathoanatomy should be clearly identified and tackled in order to deal with this difficult and complicated situation.

P12

When Atypical Femoral Fracture Nonunion Meets Loosening of Adjacent Arthroplasty

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Bisphosphonates are widely prescribed in rheumatoid patients for prevention of fragility fractures arising from steroid therapy. Atypical femoral fractures arising from bisphosphonate therapy are known to have increased incidence of delayed or nonunion. Rheumatoid patients frequently have long-standing arthroplasties which may require revisions. When nonunion of atypical fracture happens in the vicinity of a loose arthroplasty, it becomes an extremely challenging problem.

A 64-year-old female patient suffering from rheumatoid arthritis developed loosening of total knee arthroplasty 14 years after the primary arthroplasty. Revision knee arthroplasty was planned, but she developed an atypical femoral fracture at the distal femoral shaft while waiting for the revision. Long gamma nail fixation followed by dynamisation failed to achieve fracture union 2 years after the nailing. Plating and bone grafting were performed in an attempt to achieve union, but it was complicated by plate fracture. As loosening of the knee arthroplasty progressed and union of fracture was not achieved with repeated attempts, the knee was successfully revised with use of custom-made tumour prosthesis together with excision of the distal femur and prophylactic hip screw fixation. She was pain-free and could walk with a cane for 20 minutes at 4 months after the revision surgery.

As there is increasing use of bisphosphonates and joint replacements, more of such complications are expected to arise. A joint approach with participation of trauma surgeon, arthroplasty surgeon, and tumour surgeon is needed to deal with this difficult complication combo.

P13

3-Dimensional Printing Application in Pelvic-acetabular Fractures

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A total of 10 selected pelvic-acetabular fractures cases from 2013 to 2015 were 3-dimensional (3D) printed using preoperative high-resolution computed tomography (CT) scan. The CT digital imaging and communications in medicine data were imported to Mimics software for segmentation and output to Fortus 400mc 3D printing machine with ISO-certified biocompatible material ABS-M30i. Standard plasma technique was used for model requiring contact to human tissue.

The 3D-printed model and jig were then applied for different uses including: (1) diagnostic assistance (fracture classification and pathoanatomy analysis); (2) patient-specific implant (preoperative templating); (3) preoperative detailed surgical planning (fracture reduction-fixation strategy, total hip arthroplasty sizing and alignment); (4) simulated surgery; (5) preoperative patient education and information; (6) intra-operative orientation guide and aiming jig for implantation; and (7) teaching and research.

A total of 10 cases of pelvic-acetabular acute fractures employed the 3D printing technology including 2 pelvic fractures, 5 acetabular fractures, and 3 pelvi-acetabular fractures. We also used this for management of complication including total hip replacement planning for 1 case of complicated avascular necrosis of femoral head after ipsilateral acetabular fracture and neck of femur fracture fixation simultaneously, as well as 1 case of pelvic fracture malunion requiring corrective osteotomy and revision fixation.

We found 3D printing useful in the management of acute fractures and complications of pelvic-acetabular fractures. Potential advantages include better reduction and fixation, less operating time, and complications such as blood loss and infection.

P14**Surgical Stimulation Using Rapid Prototyping Technique in Complex Hip Arthroplasty****KY Chung,¹ KH Chiu,¹ KW Cheung,² N Tang,¹ XY Huang,³ CS Chui,³ KS Leung,³ KW Ho³**¹*Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong*²*Private Practice*³*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*

Careful preoperative planning is essential to achieve a successful outcome in complex hip arthroplasty. Rapid prototyping technique, or 3-dimensional printing, is a technique to transform the source image data to 3-dimensional physical model. Here we describe 2 cases of surgical stimulation using rapid prototyping technique in complex total hip arthroplasty.

A 64-year-old male suffered from ipsilateral acetabulum and femoral neck fractures was treated with closed reduction and screw fixation. He developed Ficat stage IV avascular necrosis of the femoral head. Computed tomography revealed doubtful healing and bone stock of the acetabulum. Total hip arthroplasty was planned.

Another 53-year-old female suffered from ankylosing spondylitis with total hip arthroplasty performed. It was complicated with acetabulum cup loosening 18 years after the primary arthroplasty. Computed tomography revealed severe osteolysis and bone defect of the acetabulum. Revision acetabulum cup was planned.

Rapid prototyping of the hemipelvis was generated from computed tomographic images. Surgical stimulations were performed using reconstruction ring and cemented acetabulum cup. Adequate stability of the reconstruction ring was achieved during the stimulation. Operations were performed with the actual implant size matching the one used in surgical stimulation. The postoperative course and rehabilitation were uneventful.

These 2 cases illustrated the role of rapid prototyping in complex hip arthroplasty. Surgical stimulation is invaluable for future training and preoperative planning. Precise intra-operative execution was achieved.

P15**Minimally Invasive Plate Osteosynthesis: An Effective Method of Treatment for Lower Limb Metaphyseal Fractures****B Benjamin,¹ JF Leong,² S Sugathan,¹ D Olabumuyi²**¹*Department of Orthopaedics, Royal College of Medicine Perak, University Kuala Lumpur, Malaysia*²*Department of Orthopaedics, Raja Isteri Pengiran Anak Saleha Hospital, Bandar Seri Begawan, Brunei Darussalam*

Introduction: Metaphyseal fractures of long bones are difficult to treat. Minimally invasive plate osteosynthesis (MIPO) is a technique used to treat these fractures. This has been in use in Brunei since 2009. However, there are no data available on the results. This study aimed to review the results of treatment of lower limb metaphyseal fractures using MIPO techniques.

Materials and Methods: This was a retrospective study of 16 patients treated with MIPO fixation at Raja Isteri Pengiran Anak Saleha Hospital, Brunei Darussalam. Clinical and radiological measures were assessed to measure the outcome with follow-up until union.

Results: There were 5 distal femoral, 4 proximal tibial, and 7 distal tibial fractures with 3 open fractures. Mean duration of hospital stay was 20.9 days. In all, 14 patients achieved clinical and radiological union at 6 months postoperatively. Besides, 2 patients had delayed union at 7 and 8 months, respectively. All patients were able to fully weight bear at 25 weeks. Only 1 patient developed superficial wound infection. Time to union and complication rate were comparable to other international studies.

Conclusion: Minimally invasive plate osteosynthesis is an effective treatment for metaphyseal fractures of the lower limbs with good union rate and recovery for patients with minimal complications.

P16

Treatment for Osteochondral Lesions of the Talar Dome with Lateral Instability of the Ankle

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This study aimed to retrospectively assess our treatment of post-traumatic osteochondral lesions of the talar dome (OLT) with lateral instability of the ankle (LIA).

Our treatment was performed on 86 feet in 86 OLT patients with LIA. The mean patient age at the time of surgery was 29.2 years. Patients were examined preoperatively and followed up for a mean of 52.2 months by American Orthopaedic Foot and Ankle Score (AOFAS). Regarding treatment strategy, for LIA, repair was performed when ligament fibre was remained by arthroscopic evaluation, if not remained, reconstruction was performed. For OLT, retrograde drilling (RD) was performed for only subchondral lesions by radiological and arthroscopic assessments. Microfracture (MF) was performed less than the diameter of 15 mm and no cyst in magnetic resonance imaging (MRI), and retrograde autologous cancellous bone transplantation (RACT) was performed more than the diameter of 15 mm and bone cyst in MRI.

The AOFAS improved significantly from 67.9 preoperatively to 92.1 postoperatively ($p < 0.01$). The mean AOFAS at the most recent follow-up was 94.2 in the RD and repair group, 94 in the RD and reconstruction group, 93.2 in the MF and repair group, 88.1 in the RACT and repair group, and 93.5 in the RACT and reconstruction group.

Our treatment has overall good clinical results for the treatment of OLT with LIA. Further clinical and radiological results will show its usefulness.

P17

Systematic Review on the Comparison of Effectiveness between Denosumab and Bisphosphonates in Postmenopausal Osteoporosis

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Introduction: Osteoporotic fragility fractures can significantly affect health and quality of life. Bisphosphonates are considered a first-line therapy for the prevention and treatment of osteoporosis. Denosumab is an antiresorptive agent which is a RANK (receptor activator of nuclear factor kappa B) ligand inhibitor. There is a paucity of comparison between these 2 classes of drugs. This study aimed to simultaneously compare efficacy of bisphosphonates and denosumab in various parameters.

Materials and Methods: Literature search was done for randomised controlled trials (RCTs) comparing bisphosphonates with denosumab. The RCTs with a treatment period of at least 1 year with a baseline bone mineral density (BMD) and bone turnover markers (BTM) and follow-up values at 1 year were included in the study. All studies included were analysed for complications. The study has also been registered in PROSPERO, an international prospective register of systematic reviews.

Results: A total of 5 RCTs were identified providing data on 3751 participants. In all 5 studies, the changes in BMD at the spine and hip were statistically significant in favour of denosumab. Result was similar in 3 studies that studied BMD changes at the wrist. Denosumab also produced significant reduction in BTM as early as 1 month, but at 1 year there was no difference compared with bisphosphonates. There was no statistically significant differences in the complication rates.

Conclusion: Although both bisphosphonates and denosumab were effective with similar side-effects, the latter was statistically superior in increasing the BMD and reducing the BTM.

P18

Bilateral Severe Slipped Capital Femoral Epiphysis Treated with Open Reduction and Subcapital Correction Osteotomy: A Case Report

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Slipped capital femoral epiphysis (SCFE) is one of the common hip disorders affecting children and adolescents. The treatment of SCFE is rapidly evolving in recent years but remains controversial. In-situ pinning was the standard treatment for unstable SCFE, but with recent advancement, open reduction and subcapital correction osteotomy is considered an option in severe cases. Recent literature mainly focus on comparing the risk of osteonecrosis, in which open reduction using surgical dislocation was shown to be similar to in-situ pinning by most studies. However, there is no direct comparison between functional outcomes. We presented a case of 11-year-old girl with acute on chronic severe SCFE with bilateral open reduction with subcapital correction osteotomy performed.

An 11-year-old girl presented with bilateral knee pain for 5 months. She attended the accident and emergency department twice before admission with X-ray of the knee performed which showed no abnormalities. She complained of recent increase in pain. Physical examination showed obligatory external rotation of both hip joints during flexion and marked limitation in internal rotation range. X-ray of the pelvis showed bilateral SCFE. Open reduction and internal fixation was performed using the Ganz surgical dislocation with modified Dunn's subcapital correction osteotomy to both hips.

Surgical dislocation and subcapital correction osteotomy is an option in treatment of severe type of SCFE. We believe that realigning the femoral head will achieve a better function range of the hip joint and patient satisfaction.

P19

Patient-specific Instrument for Lower Limb Diaphyseal Osteotomy — A Technical Report

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Introduction: Patient-specific instrument (PSI) is essential for corrective osteotomy for multiplanar correction. Designing PSI for osteotomy around the diaphyseal region is one of the most challenging tasks due to the lacking of unique landmark for surface matching. This study describes an all-in-one method incorporating 2 surface matchings for PSI design with the guidance for cutting, fixation, and realignment.

Materials and Methods: A 28-year-old male patient suffered from bilateral valgus knees was planned for tibial osteotomy. The osteotomy cuts were planned at the diaphyseal region (the CORA site) so that the joint angles would be minimally affected. An all-in-one PSI was designed for guiding the osteotomy cuts and realignment. In order to improve the accuracy and stability of the diaphyseal region surface matching, the PSI was designed with a bridging structure linking the lateral tibial trochlea and osteotomy site. A hollow structure was incorporated in the bridge for inserting a metal rod to increase the rigidity.

Results: Laboratory trial showed that the PSI was placed accurately and rigidly according to the plan. Postoperative fluoroscopic images and standing X-ray also showed that the implant was placed according to the plan.

Conclusion: This case report shows the feasibility of implementing PSI for osteotomy around the diaphyseal region. Further work should be done to improve the rigidity and reduce the size of the PSI so that the surgery can be performed more accurately with a smaller wound.

P20

Patient Selection for Oblique Lateral Interbody Fusion Versus Anterior Lumbar Interbody Fusion

R Yip

Private Practice

Introduction: Most of the lumbar lordosis in the lumbar spine originate from the L5-S1 disc space. Anterior approach to the L5-S1 disc space is often preferred due to the ability to restore lordosis and sagittal balance, superior fusion rates, and reduced cage subsidence. Comparison between the oblique lateral interbody fusion (OLIF51) and traditional anterior lumbar interbody fusion (ALIF) approach to L5-S1 disc space and / or segments below was discussed with the perceived benefits of each approach versus the other.

Materials and Methods: Patients that have undergone anterior spinal fusion either via traditional ALIF or modified lateral decubitus approach were reviewed with discussion as to the reason for choosing that particular approach.

Results: Patient selection examples illustrated the decision-making process. Various factors influencing the decision to choose either approach included: (1) the need to perform interbody fusions above L5-S1 in a lateral or supine position; (2) obesity and a large abdomen; (3) ease of access (appendectomy wound vs. Pfannenstiel); (4) surgical access and exposure to the disc space; (5) position of iliac vessels; (6) sacral inclination angle; (7) type of implant used and / or the need to place an anterior plate; (8) cosmetic concerns; and (9) possible risk of superior hypogastric plexus injury.

Discussion and Conclusion: Further assessment and development of techniques and instrumentation are required to optimise approach to L5-S1 disc space and below. Understanding the advantages and disadvantages of the OLIF51 procedure versus traditional ALIF is important.

P21

Treatment of Bertolotti's Syndrome — The Association between Lumbosacral Transitional Vertebrae and Low Back Pain

R Yip

Private Practice

Introduction: Bertolotti's syndrome refers to the association between an lumbosacral transitional vertebrae (LSTV) and low back pain. It is considered controversial and has been both supported and disputed since Bertolotti first described it in 1917. The Castellvi classification is used for LSTV.

Materials and Methods: Two patients with LSTV were identified with low back and radicular pain. Both patients could not work due to their symptoms. Both patients had Castellvi type IV with incomplete sacralisation / lumbarisation on one side and complete fusion to sacrum on the other side.

Results: Both patients were treated successfully by fusion and indirect decompression of the mildly degenerated spinal segment associated with the lumbosacral transitional vertebra with complete elimination of their back and radicular pain symptoms.

Discussion and Conclusion: Treatment for symptomatic Bertolotti's syndrome is controversial with few reported excellent outcomes. Surgical treatment is divided into decompression / fusion alone, or decompression and fusion. Literature search for treatment for Bertolotti's syndrome or LSTV and low back pain yields very few promising results with some patient series reporting 13 out of 16 patients still being symptomatic. In carefully selected patients with recent-onset symptomatic Bertolotti's syndrome, anterior interbody fusion appears to be a very effective means to treat this controversial condition.

P22**Sagittal Plane Imbalance Correction****R Yip***Private Practice*

Introduction: Sagittal plane imbalance has been found to be very closely correlated with adverse health-related quality of life measures. The most common scenario is progressive positive sagittal imbalance from loss of lumbar lordosis. Various methods exist to correct sagittal plane deformities, Smith-Petersen osteotomies, pedicle subtraction osteotomies (PSO), vertebral column resection (VCR), and more recently anterior column realignment using hyperlordotic cages.

Materials and Methods: Two patients with sagittal plane imbalance undergoing sagittal plane correction via PSO and VCR were discussed. The first patient had a history of a fall with pelvic fracture and proximal junctional pullout of a long spinal fusion for multi-level infective spondylodiscitis. The second patient presented with ankylosing spondylitis with kyphotic back deformity and sagittal imbalance who subsequently sustained a pathological fracture of L2 after a fall. The patient had American Spinal Injury Association (ASIA) grade A injury at the time of surgery.

Results: Both patients achieved desired correction of sagittal plane deformity. The patient with cauda equina injury made a full recovery to from ASIA grade A to grade E.

Discussion and Conclusion: It is of the utmost importance to understand the implications of sagittal imbalance and wherever possible to identify patients at risk and at least not compound the problem. Ideally the aim is to treat the problem at the time of surgery by restoring sagittal alignment and lordosis to the lumbar spine.

P23**Perioperative Measures for Minimising Prolonged Hospitalisation of Total Joint Replacement Patients****EWY Chang, WP Mak, EWT Chung, QJ Lee, YC Wong, WL Wai***Department of Orthopaedics and Traumatology, Yan Chai Hospital, Hong Kong*

Introduction: The length of hospitalisation stay of total joint replacement was reduced since an accelerated discharge protocol had been introduced. Our protocol aimed to: (1) ensure quality and safety; (2) shorten the time of recovery; (3) cope with the rising service demand; (4) minimise the hospital-acquired complications; (5) increase patients and staff satisfaction; (6) improve clinical outcome; and (7) reduce the hospitalisation cost.

Materials and Methods: The predictive factors of prolonged hospitalisation were identified before service commencement of our Total Joint Replacement Centre. Problems were identified and tackled early by multidisciplinary pre-admission team. Anaesthetist and orthopaedic nurse provided preoperative assessment and education at Specialist Out-Patient Department same-day admission surgery. The procedures included preoperative skin preparation with 2% chlorhexidine gluconate antiseptic cloths; implementation of total joint replacement protocols and perioperative blood management protocol; fall prevention programme; selective chemical and routine mechanical prophylaxis with early ambulation for prevention of deep vein thrombosis (DVT); routine postoperative Doppler ultrasonography screening for early detection of DVT; and nurse clinic follow-up 2 weeks after operation.

Results: Between 1 October 2011 and 31 December 2014, 1553 patients had undergone total joint replacement surgery and their mean length of stay was shortened to 7.8 days. Over 90% of the patients were satisfied with our care and there was no increase in adverse outcomes.

Discussion and Conclusion: Prolonged hospitalisation is associated with perioperative factors. Identifying and tackling the risk factors early can provide improved quality of care and facilitate early discharge of the patients.

P24

Quantifying Functional Capacity in Anterior Cruciate Ligament Postoperative Rehabilitation, and Predict the Time to Return to Activity

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Introduction: In rehabilitation, clinicians have not had full understanding on when to allow patients to return to activity (RTA). We do not have an objective reference on their progress base on functional capacity during the rehabilitation period. This study aimed to quantify the functional capacity of patients with anterior cruciate ligament reconstruction (ACLR) during months 1 to 4 postoperatively using clinical relevant, sports-related functional tests, hoping to create a reference for clinician about the patient rehabilitation progress with reference to functional achievement.

Materials and Methods: A longitudinal study (postoperative days 7-125) was used to measure patients' recovery. Gait speed, gait symmetry, active function (squat, single-leg decent, single leg squat), and sports-related movement (hop, shuttle run, agility and balance) were tested throughout the 4 months respectively. A convenience sample of 60 subjects undergoing ACLR was enrolled in the study and 46 of them finished the 4-month measuring period.

Results: Overall patients could reach the reference point (mean \pm standard deviation): gait speed and symmetry required 11.6 ± 3.1 weeks, squatting required 11.9 ± 0.5 weeks, sports-related hopping required 29.7 ± 5.4 weeks, and sports-related agility required >30 weeks to reach the reference mean.

Discussion and Conclusion: The functional outcomes of rehabilitation process were comparable to those physically active subjects who were defined as successfully RTA found in literature. Functional task performance progress may act as a reference for clinicians to review the progress. It shall play a significant role to RTA in clinical set.

P25

Hamstring Strength In Soccer Players with and without Previous Hamstring Strain Injuries: A Retrospective Case-control Study

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Introduction: Hamstring strain injuries (HSI) are the most prevalent injuries in professional football players. This retrospective case-control study aimed to examine whether reduced hamstring strength and fatigue resistance assessed with the Chinese University of Hong Kong (CUHK) hamstring strength test is a risk factor for HSI.

Materials and Methods: A total of 36 male soccer players were recruited from local football teams. The CUHK test was based on Nordic hamstring exercise. Subjects were instructed to lower the upper body from a kneeling position until they reached a maximum point where the hamstring could no longer sustain the posture. The tilting angles were recorded by a smartphone that attached at lower back. Hamstring strength and fatigue resistance of participants were tested by the CUHK hamstring strength test during 2014-2015 season.

Results: Players with previous hamstring injury showed strength deficit in baseline CUHK hamstring strength test (hamstring injured: $153.65 \text{ Nm} \pm 67.42 \text{ Nm}$ vs. uninjured: $198.07 \text{ Nm} \pm 47.92 \text{ Nm}$, $R^2=0.34$, $p<0.05$). Regardless of previous HSI, larger strength drop was seen in players with weaker baseline hamstring strength after completing the hamstring fatigue protocol.

Discussion and Conclusion: The CUHK hamstring strength test demonstrated ability to detect hamstring strength difference between players with and without history of HSI within 12 months. With the test larger drop of eccentric hamstring strength after completing hamstring fatigue protocol can be identified.

P26

A Survey on Team Sports-related Injury and Management in Young Hong Kong Athletes

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Introduction: Young athletes playing team sports frequently incur sport-related injuries that can have lifelong consequences. Little is known about the prevalence, type, nature, severity, and management of such injuries among the Hong Kong secondary school athletes.

Materials and Methods: Young athletes aged 12 to 18 years, from 20 randomly selected secondary schools, who represented their school for basketball, soccer, volleyball, and handball completed a survey about their time-loss injury during sports training and competition and its injury management over the last 12 months.

Results: A total of 779 completed surveys were collected from 16 schools. The survey response rate was 79%. Basketball players sustained most injuries followed by soccer, volleyball, and handball players. Sprains, strains, and contusions were the most common types of injuries sustained. Areas most injured were the ankle followed by the knee, thigh, and wrist / fingers. Logistic regression revealed that injury prevalence was significantly associated with an increase in age ($p=0.001$) and older athletes were 1.175 times more likely to sustain an injury compared with younger athletes. Approximately 45% of injured athletes managed their injuries with self-therapy and rest and less than 10% sought western medical treatment or physiotherapy.

Discussion and Conclusion: Sport injuries are common in youth sports and the reliable epidemiological data on injury type and location generated from this study have formed a basis for the investigation of injury risk factors. The high sport injury prevalence necessitates boosting public awareness and educating trainers, coaches, parents, and athletes on injury prevention and management.

P27

Comparison of Cellular Activities of Tendon Graft Healing Cells Cultured from Different Time Points after Anterior Cruciate Ligament Reconstruction

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Introduction: Anterior cruciate ligament (ACL) injury is a common sports injury. Numerous biological modulations to promote graft healing are proposed, but the temporal changes of the cellular responses in the graft have not been investigated. Recently, we showed that weekly GHK-tripeptide copper complex (GHK-Cu) administration from 2 to 5 weeks postoperation promoted graft remodelling. To determine whether earlier GHK-Cu supplementation is beneficial, healing cells from grafts harvested from 1 or 2 weeks after ACL reconstruction (ACLR) were cultured to study their responses to GHK-Cu.

Methods: Rats underwent ACLR and at week 1 and week 2 postoperation, they were sacrificed and healing cells in grafts were released and cultured. Healing cells were treated with 0, 0.03, 0.3, or 3.0 mg/mL GHK-Cu. Proliferative responses were assessed by BrdU assay and mRNA expressions of Col1, Col3, MMP1, TIMP1 were assessed by semi-quantitative real-time polymerase chain reaction.

Results: Week-1 healing cells exhibited higher proliferation capacity than week-2 healing cells but the mRNA expressions of Col1, MMP1, and TIMP1 were lower. GHK-Cu stimulated cell proliferation, as well as Col1 and TIMP1 mRNA expressions in week-1 healing cells. Although GHK-Cu also stimulated mild proliferative response in week-2 healing cells, it suppressed Col1 mRNA expression and increased Col3, MMP1, and TIMP1 at low dose.

Conclusion: Cells isolated from week 1 and week 2 exhibited different cellular activities and differential responses to GHK-Cu. It provides valuable information to devise sustained release system of GHK-Cu to promote graft healing.

P28

Virtual 3-Dimensional Planning and Patient-specific Diaphyseal Surgical Guide for Tibial Varus Osteotomy in a Patient with Rare Diagnosis of Aromatase Deficiency: A Case Report

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Osteotomies around the knee have been used to correct lower limb malalignment to prevent future joint degeneration. The procedure is technically demanding with risk of neurovascular injury and poor fixation. Majority of planning is still performed on 2-dimensional conventional standing scanogram, which is inaccurate especially in case of multiplanar deformities and the precise execution of operation remains challenging. The newly evolved patient-specific guides incorporated from 3-dimensional (3D) virtual planning had been reported with great success and accuracy in those knee deformities with apex around metaphyseal region. We report a patient that with tibial deformity's apex at diaphyseal region and was corrected successfully using similar technique but with a special guide tailor-made for diaphyseal correction.

A 28-year-old male with a diagnosis of aromatase deficiency presented with bilateral painful valgus knee with tibiofemoral angle of 20 degrees. Malalignment test of lower limb demonstrated zone III border valgus mechanical axis (mechanical axis deviation=lateral 55 mm). Mapping of tibial deformity showed medial proximal tibia angle of 93 degrees and lateral distal femur angle of 81 degrees. Mechanical axis planning showed centre of rotation angle at 20 cm from medial plateau of proximal tibia. Surgical treatment aimed to overcorrect tibial deformity in order to unloading the lateral compartment of knee. Detailed execution of workflow was discussed.

Virtual 3D planning and patient-specific diaphyseal surgical guide are also feasible in tibial diaphyseal deformity.

P29

Development and Validation of a Subject-specific Computational Foot and Ankle Model

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Introduction: The study aimed to develop and validate a subject-specific computational model of foot and ankle whereby joint behaviour was dictated by 3-dimensional (3D) articular contact and ligament constraints.

Materials and Methods: A male subject who had sprained his ankle in our previous study was invited to participate in this extended study. Computed tomographic (CT) scan was performed from mid-femur to the foot segments. The CT images were imported to Mimics and meshed as individual solid bodies. These bones were computationally separated and were then being assembled in SolidWorks according to the anatomical position. Ligamentous restraints and motion constraint were being applied to the model. The model was then being validated against a cadaveric study from literature to investigate the ligament strain. A continuous 20-degree dorsiflexion to 30-degree plantarflexion was applied to the foot. A rotational torque of 3 Nm was then applied to the talus at different angles within the above range of motion. Ligament strains in the anterior tibiofibular ligament and posterior tibiofibular ligament were calculated and compared with the cadaver data.

Results: The ligament behaviours of the model showed a similar trend compared with that in literature.

Discussion and Conclusion: The computational model was successfully developed and validated against a cadaver study with acceptable result. The model would be used to simulate subject-specific ankle inversion sprain injury profile in order to have a better understanding of injury mechanism, and thus to design preventive measures.