

The Hong Kong Orthopaedic Association
香港骨科醫學會
The 40th Annual Congress
第四十屆週年會議



Orthopaedics & Traumatology Current, Future and Beyond

31st October - 1st November 2020
二零二零年十月三十一日至十一月一日

Hong Kong Convention
& Exhibition Centre
香港會議展覽中心



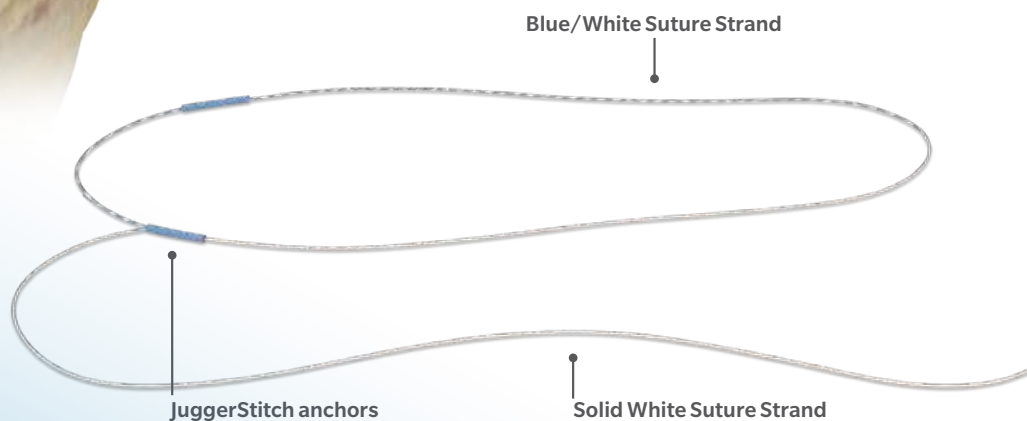
Programme & Abstracts

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Welcome Message from the President of The Hong Kong Orthopaedic Association



Dear Fellows, Members and Honourable Guests,

On behalf of the Hong Kong Orthopaedic Association, it is my great pleasure to greet you all with a very warm welcome to our 40th Annual Congress of the Hong Kong Orthopaedic Association.

While many international congresses have been cancelled or postponed in different parts of the world owing to the coronavirus disease 2019 (COVID-19) pandemic, our Organising Committee, led by our two co-chairmen, Dr Shui-wah Man and Dr Ming-yu Chiu, have worked hard to organise our Congress. With their dedication, determination and commitment, our Organising Committee overcame all kinds of challenges to make our Congress possible. We would like to express our sincere gratitude to all members of the Organising Committee.

The main theme of our Congress this year is 'Orthopaedics & Traumatology – Current, Future and Beyond'. The plenary sessions will focus on Robotic Surgery, Advanced Technology in Orthopaedics, Contemporary Orthopaedic Evaluation, New Insight on Old Problem, and Healing: Inspiration and Beyond. New orthopaedic developments result in significant changes to the management of a range of orthopaedic diseases. Renowned experts are invited to enlighten us with their inspiring lectures. I believe it will be a wonderful opportunity to share professional knowledge in our Congress.

Finally, I wish you all a fruitful and enjoyable Congress as well as good health.

Dr Kwai-ming SIU
President, The Hong Kong Orthopaedic Association

Welcome Message from the Co-Chairmen of the Organising Committee



Dear Honourable Guests and Colleagues,

Welcome to the 2020 Annual Congress of the Hong Kong Orthopaedic Association!

This is the 40th Anniversary of the Congress. The title of the congress this year is “Orthopaedics & Traumatology – Current, Future and Beyond”.

The practice of Orthopaedics and Traumatology has been evolving quickly in the past years. We have observed the huge impact of modern technology in taking care of clients of orthopaedic trauma and deformity reconstructions. There have been many advancements, including newer and minimally invasive surgical techniques; newly designed and innovative implants and joint replacement prostheses; the introduction of

robotic surgeries for precise bone cuts in joint replacements; new cartilage regeneration techniques; the introduction and evolution of 3D printing in the management of fractures and reconstruction; modern imaging techniques for diagnosis, pre-operative assessment, intra-operative assessment, and image-guided surgery; and the evolution of comprehensive management of geriatric osteoporotic fractures.

The year 2020 has been a challenge for Hong Kong. The orthopaedic community is inevitably involved. We took up the posts as co-chairmen in late 2019 and the organising committee was then assembled in early 2020. We faced mass social unrest in Hong Kong in late 2019 and early 2020, which made most of us feel frustrated. It appeared that we had seen the light in early 2020. Then, coronavirus disease 2019 (COVID-19) spread around Hong Kong and internationally. The early phases of preparation for the congress were gloomy. Thanks to the support of various parties, which included the council of the Hong Kong Orthopaedic Association (HKOA), the two universities, the Hong Kong College of Orthopaedic Surgeons and various other organisations and individuals, particularly, with the encouragement from our HKOA president Dr KM Siu, we held tight and proceeded with Organising Committee meetings regularly online. The preparation of the congress had been going on persistently. The condition of COVID-19 and the resulting restrictions on public gathering changed from time to time. We planned to have the congress meeting as usual. At the same time, we drafted a contingency plan to deliver the meeting online. To avoid the need to quarantine travellers to Hong Kong, all of our overseas speakers were asked to present their talks online. Anyway, with the close collaboration of our IT colleagues and the staff of the Hong Kong Convention and Exhibition Centre, our combined on-site and online meeting should come true though it was not finally confirmed even by the time when this welcome message was being sent for publishing.

With the persistent support from various parties, we believe this congress is going to be successful. This is part of the reason why we proposed the title of the congress of this year. Our orthopaedic community is evolving quickly and we are facing with the critical moment of the community of Hong Kong. With the effort of the orthopaedic fraternity, we believe that we can have a brighter future and enjoy the subsequent development which is going to be beyond what we have achieved today.

Our scientific subcommittee has been working hard alongside with different chapters and subspecialties. We have invited 16 regional or international speakers to deliver talks in various subspecialties including Adult Joint Reconstruction, Foot and Ankle Surgery, Hand Surgery, Paediatric Orthopaedics, Spine and Sports. We have also organised a pre-congress symposium with the primary care physicians for the first time, i.e. “Symposium on Advances in Orthopaedics – Primary Health Care Perspective”, so as to enhance our connection with the general practitioners. The symposium will be held online one week before this congress.

The organising of this congress was challenging and loaded with difficulties. We would like to say thanks for the tremendous support from HKOA, the persistent effort of all our Organising Committee members and those senior consultants who had joined us in screening the award-winning papers and posters, and, as adjudicators in the congress. We received more than 200 academic research papers for presentation this year, despite COVID-19. This reflects a blooming orthopaedic community with remarkable interest in scientific research despite the adverse global environment. Finally, we would like to send our gratitude to the commercial sponsors of the congress. Financial support from the industry in this critical moment is indispensable for the success of the congress and for future congresses.

We wish every success for the 40th Congress of HKOA!

Dr Shui-wah Man, Dr Brian Ming-yu Chiu
Co-Chairmen, Organising Committee

Organising Committee



Co-Chairmen

Dr Shui-wah MAN
 Dr Brian Ming-yu CHIU
 Dr Angela Wing-hang HO
 Dr Kenneth Wing-kin LAW

- Honorary Secretary**
- Honorary Treasurer**
- Scientific Subcommittee**
 - Convener**
 - Members**

Dr Brian Ming-yu CHIU
 Dr Dennis Chi-chiu CHAN
 Dr Lewis Ping-keung CHAN
 Dr Jeffrey Justin Siu-cheong KOO
 Dr George Ying-kan LAW
 Dr Charles Churk-hang LI
 Dr Samuel Ka-kin LING
 Dr Lin-wing LOK
 Dr Sammy Nin-tai MAK
 Dr Kenneth Cheuk-kee NG
 Dr Raymond Wai-kit NG
 Dr Diane Hei-yan TAI
 Dr Michael Siu-hei TSE
 Dr Eleanor WEN
 Dr Yip-kan YEUNG
 Dr Paul Sin-chuen YIP

- Publication Subcommittee**
 - Convener**
 - Member**

Dr Tsz-lung CHOI
 Dr Alex Ching-lik HUI

- Social Function Subcommittee**
 - Convener**
 - Member**

Information Technology Audio-visual and Venue Subcommittee

Dr Yip-kan YEUNG
 Dr Hoi-yeung IP
 Dr Charles Churk-hang LI
 Dr Michael Siu-hei TSE
 Dr Chi-wai CHAN
 Dr Sheung-tung HO
 Dr Tik-koon KWOK
 Dr Kin-bong LEE
 Dr Yuen-lun LEE
 Dr Henry Siu-fai YIP

Extended Abstract Adjudicators

Overseas and Local Faculty

OVERSEAS SPEAKERS — Plenary Sessions and Concurrent Sessions

Dr Jean Noel ARGENSON

Professor and Chair of the Orthopedic Department
Medical Director Institute for Locomotion
Aix-Marseille University
Marseille, France



Dr Chris HARRIS

Consultant Orthopaedic Surgeon
Royal Children's Hospital
Melbourne, Australia



Dr Beat HINTERMANN

Chairman
Center of Excellence for Foot & Ankle Surgery
Orthopaedic and Traumatology Clinic
Kantonsspital Baselland
Liestal, Switzerland



Professor James HUI

Professor and Head
Department of Orthopaedic Surgery
Yong Loo Lin School of Medicine
National University of Singapore
Singapore



Dr Yaser JABBAR

Consultant Orthopaedic Surgeon
Great Ormond Street Hospital
London, United Kingdom



Dr Woo-chun LEE

Director
Seoul Foot and Ankle Center
Dubalo Orthopaedic Clinic
South Korea



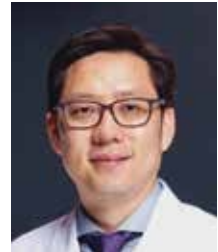
Professor Ronald A LEHMAN

Professor of Orthopaedic Surgery, Tenure (in Neurological Surgery)
The Spine Hospital
Columbia University Medical Center
New York, United States



Dr Bo LIU

Consultant
Beijing Ji Shui Tan Hospital
Beijing, China



Dr Brian LOH

Orthopaedic Surgeon
Royal Children's Hospital
Melbourne, Australia



Dr Chanakarn PHORNPHTUKUL

Associate Professor
Chiang Mai University
Thailand



Professor Shanmuganathan RAJASEKARAN

Chairman
Department of Orthopaedics, Trauma & Spine Surgery
Ganga Hospital
Coimbatore, India



Dr Martin ROCHE

Robotic Director
Holy Cross Orthopaedic Institute
Florida, United States



Dr Jordi VEGA

Associate Professor
University of Barcelona
Barcelona, Spain



Professor Wendong XU

Vice-President of Huashan Hospital
Deputy Director of Hand Surgery department
Huashan Hospital, Fudan University
Shanghai, China



Dr Xiangyang XU

Chief of Foot & Ankle Center of Shanghai Jiao Tong University School of Medicine
Chief of Division of Foot & Ankle Surgery, RuiJin Hospital Shanghai Jiao Tong University School of Medicine
Chief of Department of Orthopedics, RuiJin Hospital North, Shanghai Jiao Tong University School of Medicine, Shanghai, China



Dr Hui ZHANG

Associate Professor of Peking University
Sports Medicine Service, Beijing Jishuitan Hospital
Peking, China



LOCAL SPEAKERS — Plenary Sessions and Concurrent Sessions

Dr Christian FANG

Dr Henry Chun-him FU

Dr Pak-cheong HO

Dr Jeffrey Justin Siu-cheong KOO

Dr Evelyn KUONG

Dr Qunn-jid LEE

Dr Wilson LI

Dr Tun-hing LUI

Dr Michael Chu-kay MAK

Dr Wan-yiu SHEN

Dr Kwai-ming SIU

Dr Ning TANG

Dr Yat-wa WONG

Dr Wai-pan YAU

Dr Dennis King-hang YEE

Prof Patrick Shu-hang YUNG

OVERSEAS AND LOCAL SPEAKERS — Lunch Symposia

Professor Azhar Mahood MERICAN

Department of Orthopaedic Surgery
University of Malaya Medical Centre
Kuala Lumpur, Malaysia



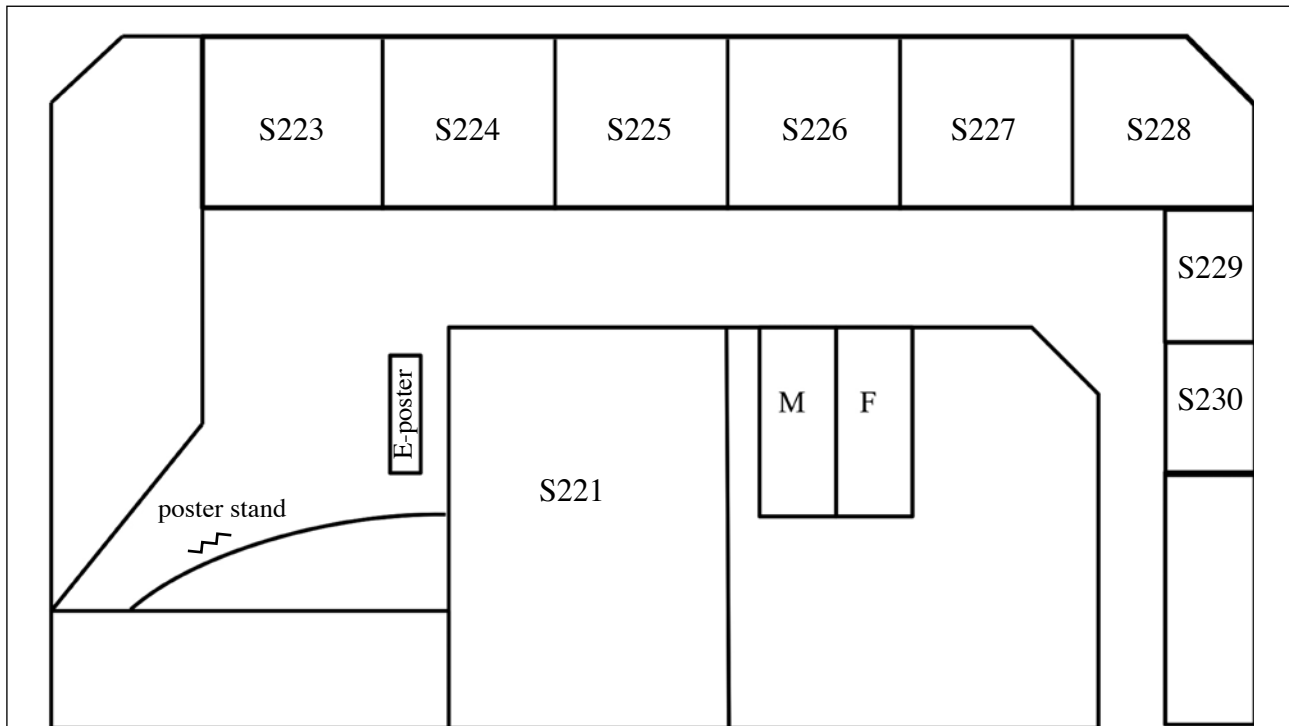
Dr Elaine CHEUNG

Clinical Associate Professor (Honorary)
The Chinese University of Hong Kong
Hong Kong



Floor Plan

The Hong Kong Convention and Exhibition Centre



Registration: S229

Slide Preview: S230

Plenary Sessions: S221

Concurrent Sessions: S225, S226, S227, S228

Free Paper Sessions: S221, S225, S226, S227, S228

Opening Ceremony: S221

Award Paper Session: S221

Award Poster Session: S221 Foyer

E-poster Station (please refer to floor plan)

Award Poster Station (please refer to floor plan)

Lunch Symposia: S423, S424, S426, S427 (4/F, Old Wing, HKCEC)

Programme at a Glance

Saturday, 31 October 2020

08:00 – 10:00	Free Paper Session I: Adult Joint Reconstruction I Free Paper Session II: Hand and Microvascular Free Paper Session III: Basic Science Free Paper Session IV: Foot and Ankle Free Paper Session V: Spine I	Room S221 Room S225 Room S226 Room S227 Room S228
10:00 – 10:30	Coffee Break	
10:30 – 12:00	Plenary Session I: Robotic Surgery	Room S221
12:00 – 12:30	Opening Ceremony	
12:30 – 13:45	Lunch Symposium/ Lunch	Room S423, S424, S426, S427
13:45 – 15:45	Award Paper Session	
15:45 – 16:15	Award Poster Session Room S221 Foyer	Coffee Break / Exhibition
16:15 – 17:45	Plenary Session II: Advanced Technology in Orthopaedics Room S221	Concurrent Session I: Adult Joint Reconstruction Room S225 Concurrent Session II: Hand Room S227 Concurrent Session III: Foot and Ankle Room S228
17:45 – 18:15	The Hong Kong Orthopaedic Association Annual General Meeting	
18:15 – 18:45	Inauguration of New Council (2021–2022)	
18:45 – 19:15	The Hong Kong Orthopaedic Association 40th Annual Congress Presentation Ceremony	

Sunday, 1 November 2020

08:30 – 10:30	Free Paper Session VI: Adult Joint Reconstruction II Free Paper Session VII: Spine II Free Paper Session VIII: Paediatric Orthopaedics, Musculoskeletal Oncology and Others Free Paper Session IX: Trauma and Rehabilitation Free Paper Session X: Sports Medicine	Room S221 Room S225 Room S226 Room S227 Room S228
10:30 – 11:00	Coffee Break	
11:00 – 12:30	Plenary Session III: Contemporary Orthopaedic Evaluation Room S221	Concurrent Session IV: Spine Room S225 Concurrent Session V: Paediatric Orthopaedics Room S227 Concurrent Session VI: Sports Medicine Room S228
12:30 – 13:30	Lunch Symposium/ Lunch	
13:30 – 15:00	Plenary Session IV: New Insight on Old Problem Room S221	Concurrent Session VII: Trauma Room S228
15:00 – 15:30	Coffee Break	
15:30 – 17:00	Plenary Session V: Healing: Inspiration and beyond	
17:00 – 17:05	Closing Remarks	

Programme in Detail

Saturday, 31 October 2020

Time	Room	Topic (Moderators)	Faculty / Presenter
08:00 – 10:00	S221	Free Paper Session I: Adult Joint Reconstruction I (CM Chan, Henry Fu)	
1.1		Long-term outcome of vascularised iliac bone grafting for osteonecrosis of femoral head: retrospective study with 17-year follow-up	Hui Woo Lau
1.2		Long-term survival analysis of patients suffering from avascular necrosis (AVN) of the head of femur underwent total hip replacement (THR) with or without previous vascularised iliac bone grafting (VBG)	Wai Wang Chau
1.3		Comparison of early outcomes of robotic-assisted fixed-bearing unicompartmental knee replacement and Oxford unicompartmental knee replacement	Tsz Lung Choi
1.4		Bone cement implantation syndrome in hip arthroplasty with cemented femoral component – a review of 459 patients	Ching Ngai Leung
1.5		How does sagittal spinal deformity affect spinopelvic relationship in patients undergoing total hip arthroplasty? A radiographic study	Thomas Ka Chun Leung
1.6		Lateral hinge fractures in medial open wedge high tibial osteotomy: incidence, predictive factors and diagnostic value of computed tomography from a local series	Samuel Yik Cheung Wan
1.7		Total knee arthroplasty in patients over the age of 80 years – long-term results	Rex Wang Fung Mak
1.8		Is high rate of early failure of ATTUNE total knee replacement system a myth or truth? Clinical evaluation and survival analysis of 522 patients with at least 3-year follow-up	PK Chan
1.9		A novel machine learning algorithm developed for knee arthroplasty loosening detection demonstrating superior accuracy and predictability, and augment clinical decision-making	Lawrence Chun Man Lau
1.10		Dynamic xi-scan assessment of knee before total knee arthroplasty and unicompartmental knee arthroplasty	Corby YC Cheung
1.11		Filmless prediction of implant sizes – review of >1000 total knee arthroplasties	Vincent Wai Kwan Chan
1.12		Internal rotation of femoral component in total knee replacement: is it safe?	Henry Fu
1.13		The effect of coronal femoral bowing on total knee arthroplasty	Hongtai Chen
1.14		Clinical and patient-reported outcomes on a guided-motion bicruciate-substituting total knee system in Chinese patients	Yi Pang Liu
1.15		Cruciate retaining design has equivalent outcome to posterior stabilizing design in mobile bearing TKA: a retrospective review	Man Hong Cheung
1.16		Rotational alignment of the femoral trochlea in Asian knees: A magnetic resonance imaging study of 213 patients and its implication on management in patellofemoral arthritis	Michelle Kar Lam Li
1.17		Fixed bearing versus rotating platform total knee replacements – which one is better?	Amy Cheung
1.18		Less is more: squatting, kneeling and other functional outcomes of bilateral unicompartmental knee replacement – a cohort comparison with bilateral total knee replacement in New Territories West Cluster Joint Replacement Center	Benedict Yan Yui Cheung
1.19		Metaphyseal cone in revision total knee arthroplasty – a retrospective review	Thomas Ka-Chun Leung

Time	Room	Topic (Moderators)	Faculty / Presenter
08:00 – 10:00	S225	Free Paper Session II: Hand and Microvascular (Edmund Yau, Emily Yip)	
2.1		Outcomes of extensor tenolysis after hand fractures: a retrospective case series of 11 patients	Ruby Yan Yu Wong
2.2		Clinical outcome of dorsal versus lateral plating in proximal phalangeal fracture: a retrospective cohort study	Cheuk Yin Tam
2.3		Functional outcome in interphalangeal joint fusion with headless compression screw	King Fung Tang
2.4		Combined botulinum toxin and surgical therapy gives better outcome than botulinum toxin alone therapy in upper limb cerebral palsy: an 8.8-year follow-up	Sum Lik Cheung
2.5		Arthroscopic management of STTJ arthritis: a decade's review of local case series	Henry Pang
2.6		Extra thumb Wassel type 6: a morphological and clinical study	Wing Lim Tse
2.7		Arthroscopic bone grafting in scaphoid non-union: what predict failure? An analysis of outcome on 128 wrists over 21 years	Jeffrey Justin Siu Cheong Koo
2.8		Assessment of web space morphology with 3D modelling: a new assessment tool for hand reconstruction	Alvin Zheng Chen
2.9		Cross-cultural adaptations and psychometric testing of Brief Michigan Hand Questionnaire for Hong Kong	Kin Ling Kwok
2.10		STTJ dorsoradial portal: a cadaveric study of its safety and clinical applications	Henry Pang
2.11		Review of clinical and radiological outcome of self-locking finger joints in proximal interphalangeal joints arthroplasty	Cham Kit Wong
2.12		Syndactyly release without using skin graft: a long-term follow-up and postoperative assessment with a 3D model	Esther Ching San Chow
08:00 – 10:00	S226	Free Paper Session III: Basic Science (Louis Cheung, Kevin Yeung)	
3.1		Simvastatin inhibits cell viability and enhances osteogenic differentiation of the neoplastic stromal cells in giant cell tumour of bone	Carol Po Ying Lau
3.2		Systematic investigation of metallosis associated with magnetically controlled growing rod implantation for early onset scoliosis	Jason Pui Yin Cheung
3.3		The active component of Ginkgo biloba extract increases the muscle mass and functionality in the postmenopausal animal model	Chien Wei Lee
3.4		Epistatic interactions between MBL2 and SOST modulate BMD in AIS and control females	Man Fung Tang
3.5		Surface biofunctionalisation with Notch ligands to activate repair Schwann cells in the management of peripheral nerve injury	Victor Hin Ting Yick
3.6		Epididymal adipose tissue macrophages secrete osteopontin to regulate bone homeostasis	Bingyang Dai
3.7		Macrophage polarisation landscape is associated with biomechanical properties during Achilles tendon healing	Sparrow Hongtao Xu
3.8		Assessment of graft remodelling following anterior cruciate ligament reconstruction (ACLR) in a rat model using spectral computed tomography (CT)	Shiyi Yao
3.9		Designed and translation of osteogenic Mg-based biodegradable implants for skeletal fixation and regeneration	Ling Qin
3.10		Biodegradable magnesium pins enhanced the healing of transverse patellar fracture in rabbits	Dick Ho Kiu Chow
3.11		AlignPro: a robust deep learning-based prediction of spinal alignments irrespective of image qualities acquired from smartphone photographs of radiographs displayed on PACS	Teng Zhang
3.12		Pulsed electromagnetic field augments the effect of hydrogel-based tissue engineering for cartilage repair	Yucong Li
3.13		A novel high slew rate pulsed electromagnetic field promotes distraction osteogenesis via enhancing osteogenesis and angiogenesis in a rat model	Yucong Li
3.14		Col2a mediated Wnt16 deficiency promote callus formation during femur bone fracture healing	Wenxue Tong
3.15		Identification of diagnostic biomarker candidates for AIS with proteomic analysis	Wayne Yuk Wai Lee
3.16		Deletion of SIRT3 inhibits osteoclastogenesis and alleviates bone loss in ageing and ovariectomised mice	Wayne Yuk Wai Lee
3.17		Oral magnesium supplementation attenuates age-related muscular changes in sarcopenia	Can Cui
3.18		The role of dentin matrix protein 1 (DMP1) in LMHFV accelerated osteoporotic fracture healing	Zhengyuan Bao
3.19		Ageing-related neuromuscular junction degeneration in sarcopenia is attenuated by cyclic mechanical loading	Zhengyuan Bao

Time	Room	Topic (Moderators)	Faculty / Presenter
08:00 – 10:00	S227	Free Paper Session IV: Foot and Ankle (Dennis Chan, Fiona Lam)	
4.1		Arthroscopic repair of the anterior talofibular ligament for chronic lateral ankle instability	Diane Hei-Yan Tai
4.2		Early surgery in displaced intra-articular calcaneal fracture using sinus tarsi approach	Eugene Leung
4.3		Percutaneous repair of Achilles tendon—a review of our experience using the ‘8-hole technique’	Ryan Lok-Tin Moy
4.4		How to perform minimally invasive tibial cortex transverse transport surgery for diabetic foot ulcer management	Gang Li
4.5		Comparison of foot and ankle injuries between pre-professional ballet, contemporary, and Chinese dancers	Jojo Hoi-Ching Lai
4.6		Comparison of sinus tarsi approach versus extensile lateral approach and conservative treatment for displaced intra-articular calcaneal fractures	Alex Ching-Lik Hui
4.7		Can shoes really “boost” your performance and “zoom” your run?	Lok-Yi Tsui
4.8		Prognosis of elite basketball players after an Achilles tendon rupture	Ronald Wing-Hei Siu
4.9		Radiological and functional outcomes of Ludloff osteotomy for hallux valgus reconstruction	Leo Tsz-Ching Chau
4.10		The deformity of the tarsometatarsal joint and the first metatarsal in the coronal plane in hallux valgus	Rachel Xiaoyu Wei
4.11		Review on surgical outcomes on foot polysyndactyly	Michelle Syn-Yuk Lee
08:00 – 10:00	S228	Free Paper Session V: Spine I (Carmen Kung, Edwin Lam)	
5.1		What imaging profile exists for subjects with lumbar developmental spinal stenosis?	Marcus Kin Long Lai
5.2		Pedigree analysis of lumbar developmental spinal stenosis: determination of potential inheritance patterns	Marcus Kin Long Lai
5.3		Population-based prevalence of multilevel lumbar developmental spinal stenosis	Marcus Kin Long Lai
5.4		Clinical implications of lumbar developmental spinal stenosis on back pain, leg pain, and disability—results from a cohort of 2206 subjects	Jason Pui Yin Cheung
5.5		EOS-3D assessment of axial rotation of upper end vertebra, apical vertebra and lower end vertebra in thoracic adolescent idiopathic scoliosis with different curve severity	Qian Yun Chen
5.6		Implant failure in spinal metastasis surgery: incidence and risk factors	Tsun Kit Lau
5.7		Where does vertebral growth occur during distraction by magnetically controlled growing rods in patients with early onset scoliosis?	Andy Hon Fai Yee
5.8		Efficacy and safety of nucleo-annuloplasty using radiofrequency ablation for discogenic back pain in a local Hong Kong population	Joyce Oching Yam
5.9		Minimally invasive anterior vertebral body tethering for scoliosis in skeletally immature children in Hong Kong: a prospective case series	Kenny Kwan
5.10		Prediction of final body height for female patients with adolescent idiopathic scoliosis	Prudence Wing Hang Cheung
5.11		Long-term follow-up shows sustained improvement in patients following surgery for neuromuscular scoliosis	Carlton Tsoi
5.12		Does posture alter the shape of the lumbar spine? A comparison between the standing and supine position	Lauren Sun
5.13		Brace effectiveness is related to three-dimensional plane parameters in patients with adolescent idiopathic scoliosis	Kenny Yat Hong Kwan
5.14		Comparison of dynamic radiographs in determining fusion level in adolescent idiopathic scoliosis correction (FLEXIS)	Kenny Yat Hong Kwan
5.15		Prognosis of functional recovery in central cord syndrome using quantitative MRI assessment and scoring systems for acute traumatic cervical injury	Changmeng Zhang
10:00 – 10:30		Coffee Break	

Time	Room	Topic (Moderators)	Faculty / Presenter
10:30 – 12:00	S221	Plenary Session I: Robotic Surgery (WL Tse, Raymond Wong, CH Yan)	
10:30 – 11:00		Robotic surgery in scaphoid	Bo Liu
11:00 – 11:30		Soft tissue balancing in robotic assisted knee arthroplasty	Martin Roche
11:30 – 12:00		Why use a robot? How does it help and will it be the future?	Ronald Lehman
12:00 – 12:30	S221	Opening Ceremony (Vivien Lei, Henry Pang)	
		Welcome Address	Brian Chiu SW Man
		Presidential Address	KM Siu
		Guest of Honour	PC Leung
12:30 – 13:45		Lunch Symposium / Lunch	
12:30 – 13:30	S423 – S427	Lunch Symposium: sponsored by Stryker	
		The tapered fluted titanium stem: a revision workhorse	Azhar M Merican
13:45 – 15:45	S221	Award Paper Session (CW Chan, ST Ho)	
AP01		Prediction of final body height for female patients with adolescent idiopathic scoliosis	Prudence Wing Hang Cheung
AP02		Persistent quadriceps muscle atrophy after anterior cruciate ligament reconstruction was associated with defective exercise-induced changes in myokines	Michael Tim Yun Ong
AP03		The use of local tranexamic acid in Chinese elderly patients undergoing short femoral nailing for intertrochanteric fracture: A randomised controlled trial	Dennis KH Yee
AP04		Combating orthopaedic infection with machine learning for predicting antibiotic susceptibility and mortality in septic arthritis – a 17-year study with 447 subjects	Janus Siu Him Wong
AP05		Magnesium alloy wire facilitates bone tendon integration in bone tunnel after anterior cruciate ligament reconstruction in rabbits	Xuan He
AP06		AlignPro: a robust deep learning-based prediction of spinal alignments irrespective of image qualities acquired from smartphone photographs of radiographs displayed on PACS	Teng Zhang
AP07		Pulsed electromagnetic field augments the effect of hydrogel-based tissue engineering for cartilage repair	Yucong Li
AP08		Does sarcopenia affect osteoporotic fracture healing? Myostatin as a target to enhance repair	Ronald Man Yeung Wong
AP09		The burden of disease in patients awaiting joint replacement surgery – a study of 2091 patients	Amy Cheung
AP10		A handheld spine scanner for home monitoring of scoliosis patients can reduce clinic attendance by 47%: a prospective longitudinal study	Jack Zijian Wei
15:45 – 16:15		Coffee Break	
15:45 – 16:15	S221 Foyer	Award Poster Session (Kenneth Ng)	
BP01		Using the ulna physis in improving decision-making for brace weaning in adolescent idiopathic scoliosis	Prudence Wing Hang Cheung
BP02		A novel mechanical parameter to quantify the microarchitecture effect on apparent modulus of trabecular bone: a computational analysis of ineffective bone mass	Zhang Teng
BP03		Femoral component sagittal position is an independent predictor of clinical outcome in total knee arthroplasty regardless of implant design: retrospective review of 1000 TKAs with up to 5 years follow-up	Man Hong Cheung
BP04		Risk factors for symptomatic adjacent segment disease following lumbar fusion: a systematic review and meta-analysis	Kenney Ki Lee Lau
BP05		Patellar resurfacing does not improve clinical outcome in patella-friendly total knee arthroplasty design – a randomised controlled trial	Man Hong Cheung

Time	Room	Topic (Moderators)	Faculty / Presenter
16:15 – 17:45	S221	Plenary Session II: Advanced Technology in Orthopaedics (Raymond Ng, TM Wong)	
16:15 – 16:45		Advances in paediatric anterior cruciate ligament reconstruction	Brian Loh
16:45 – 17:15		Advances in trauma management – concepts and technologies	N Tang
17:15 – 17:45		Knee osteotomy for managing sports injuries	Zhang Hui
16:15 – 17:45	S225	Concurrent Session I: Adult Joint Reconstruction (Jason Fan, Michael Lam) Theme 1: Surgical alternatives to total knee replacement Theme 2: Crossfire – conventional vs robotic total hip replacement, which one is better?	
16:15 – 16:30		UKA: where are we coming from, where are we, where are we going?	Jean Noel Argenson
16:30 – 16:45		Should we choose UKA or HTO in patients with high activity level?	Jean Noel Argenson
16:45 – 17:00		How to prevent edge-loading in performing conventional fixed bearing UKA?	Jean Noel Argenson
17:00 – 17:10		Robotic total hip replacement	Henry Fu
17:10 – 17:20		Conventional total hip replacement	QJ Lee
17:20 – 17:30		Discussion	
17:30 – 17:45		Adult Joint Reconstruction Council Biennial General Meeting	
16:15 – 17:45	S227	Concurrent Session II: Hand (Esther Chow, SC Koo) Theme: Advance in scaphoid fracture management	
16:15 – 16:30		Acute scaphoid fracture: new evidence we need to know	SC Koo
16:30 – 16:50		3D printing assisted accurate arthroscopic treatment of scaphoid fracture and non-union	Wen-dong Xu
16:50 – 17:10		Role of navigation in scaphoid fracture	Michael Mak
17:10 – 17:30		Role of arthroscopy: from scaphoid non-union to SNAC	PC Ho
17:30 – 17:45		Case discussion	Panel Speakers
16:15 – 17:45	S228	Concurrent Session III: Foot and Ankle (Samuel Ling, Charles Li) Theme: Advances in Foot and Ankle	
16:15 – 16:30		Weight bearing CT in foot and ankle	Beat Hintermann
16:30 – 16:45		Ankle micro-instability	Jordi Vega
16:45 – 17:00		My approach for severe foot and ankle deformities	Xiang-yang Xu
17:00 – 17:15		Revision surgery for ankle fractures	KM Siu
17:15 – 17:30		Revision foot and ankle arthroscopy and endoscopy	TH Lui
17:30 – 17:45		Foot and Ankle Chapter Biannual General Meeting	
17:45 – 18:15	S221	Annual General Meeting of the Hong Kong Orthopaedic Association	
18:15 – 18:45	S221	Inauguration of New Council (2021–2022)	
18:45 – 19:15	S221	The Hong Kong Orthopaedic Association 40th Annual Congress Presentation Ceremony (Joyce Kwan, Adam Young)	

Sunday, 1 November 2020

Time	Room	Topic (Moderators)	Faculty / Presenter
08:30 – 10:30	S221	Free Paper Session VI: Adult Joint Reconstruction II (Amy Cheung, YK Sit)	
6.1		The burden of disease in patients awaiting joint replacement surgery – a study of 2091 patients	Amy Cheung
6.2		Enhanced recovery after surgery (ERAS): How does it affect the postoperative length of stay after unilateral primary total hip and knee arthroplasty in a private hospital?	Marvin Man Ting Chung
6.3		Patterns of musculoskeletal injury among joint replacement surgeons in Hong Kong	Amy Cheung
6.4		Impact of COVID-19 on joint replacement services in Hong Kong	LS Lee
6.5		Incidence and risk factors of hypovitaminosis D in patients undergoing joint replacement surgery – a multiple regression analysis	PK Chan
6.6		Antibiotic prophylaxis in total joint arthroplasty – the usual practice and variability among joint replacement surgeons in Hong Kong	Chi Him Tong
6.7		Culture in automated blood culture system (BACTEC) is more sensitive when compared with conventional culture methods for detection of bacteria in synovial fluid in periprosthetic joint infection	PK Chan
6.8		The sky's the limit? Adaptation of Oxford criteria can improve utilisation of unicompartmental knee arthroplasty without compromising clinical outcome: experience of first 150 cases of Oxford mobile bearing UKA	Man Hong Cheung
6.9		Simple method to predict the feasibility to correct varus deformity with unicompartmental knee arthroplasty	Yik Cheung Wan
6.10		Would the change in joint line orientation after Oxford unicompartmental knee replacement affect early clinical outcome?	Cheryl Cheuk Wing Kong
6.11		Does component axial rotational alignment affect clinical outcomes in Oxford unicompartmental knee arthroplasty?	Jonathan Patrick Ng
6.12		Robotic arm-assisted total hip replacement: early experience in Hong Kong	Henry Fu
6.13		Robotic arm-assisted total hip replacement: the perfect solution for complex hip pathologies	Henry Fu
6.14		Early results of robotic unicompartmental knee arthroplasty – experience in a local hospital	Douglas See Lok Ho
6.15		Could patients recover faster after direct anterior approach total hip replacement compared with posterior approach?	Kelvin Chin Hei Lo
6.16		Comparison of radiological and early clinical outcomes between conventional and robotic medial unicompartmental knee replacement	Wai Lun Tang
6.17		Robotic arm-assisted cementless cruciate retaining total knee arthroplasty: the Hong Kong experience	Henry Fu
6.18		When robots fail – the local experience with robotic-assisted joint replacement surgery	Ching Ngai Leung
6.19		Navigated geometry scanning system for imageless navigation-guided robotic joint surgery	Chun Sing Chui

Time	Room	Topic (Moderators)	Faculty / Presenter
08:30 - 10:30	S225	Free Paper Session VII: Spine II (CK Wong/Wilson Hau)	
7.1		MRI-SegFlow: a deep learning-based unsupervised pipeline for vertebral segmentation of spinal MRI image	Xihe Kuang
7.2		The use of Floseal right before closing of the percutaneous stenoscopic lumbar decompression (PSLD) operation: a retrospective review	Ho Ming Li
7.3		Reconstruction after total en bloc spondylectomy: does bony fusion mean long-term stability?	Thomas Wai Kiu Liu
7.4		High-resolution peripheral quantitative computed tomography (HR-pQCT) is superior to dual-energy x-ray absorptiometry (DXA) and fracture risk assessment tool (FRAX) in predicting asymptomatic vertebral compression fractures in postmenopausal women	Ronald Man Yeung Wong
7.5		Development of spine proprioception testing using motion capture analysis	Sze Kan Ha
7.6		Effectiveness of a secondary osteoporotic vertebral fragility fracture prevention pathway after 3 years	Michelle Kar Lam Li
7.7		Measurement of classical and novel whole-body sagittal alignment in patients with osteoporotic vertebral fracture and its effect on quality of life	Leo Tsz Ching Chau
7.8		Prediction of standing radiographic lumbar lordosis by using supine MRI	Laura Yee Lei Tsoi
7.9		Identifying the optimal instrumented level: prospective case series of 102 patients treated by vertebral body tethering (VBT) with 2-year follow-up	Chris Yuk Kwan Tang
7.10		Enhanced recovery after surgery (ERAS) protocol for scoliosis leads to improved postoperative outcome and earlier discharge from hospital	Kelvin Sin Chi Cheung
7.11		Screening for scoliosis using computer vision and machine learning allows high throughput screening: a proof of concept study	Kenneth MC Cheung
7.12		Can infrared camera images be used for screening for adolescent idiopathic scoliosis?	Natalie Oi Ka Lam
7.13		Outcome of patients with acute spinal cord compression due to tumour metastasis	Yuen Ting Leung
7.14		A handheld spine scanner for home monitoring of scoliosis patients can reduce clinic attendance by 47%: a prospective longitudinal study	Jack Zijian Wei
7.15		Comparison of proprioceptive reweighting in middle-aged patients with chronic low back pain and healthy people: a cross-sectional study	Sabina Margaret Pinto
7.16		Patients' perspective regarding surgical management for lumbar spinal stenosis: a qualitative study	Arnold YL Wong

Time	Room	Topic (Moderators)	Faculty / Presenter
08:30 - 10:30	S226	Free Paper Session VIII: Paediatric Orthopaedics, Musculoskeletal Oncology and Others (Arthur Ma, Calvin Chiu, KL Mak)	
8.1		Minimal invasive versus open curettage in giant cell tumour of bone with perioperative bisphosphonate – retrospective comparison with follow-up of nine years	Hiu Woo Lau
8.2		Identification of tumour-associated antigen in osteosarcoma: a machine learning approach	Amanda Yu Fan Wang
8.3		Association of serum 25(OH)Vit-D Levels with risk of paediatric fractures: a systematic review and meta-analysis	Guang Pu Yang
8.4		Epidemiology and outcome of fractures in patients with spinal muscular atrophy in Hong Kong	Johnny Chun Yin Cheng
8.5		Changing epidemiology of paediatric supracondylar fracture in past decades: implications and challenges to surgeon's training	Henry Pang
8.6		E-Fit: a potential lifestyle and exercise intervention for improving physical and psychological health among girls with adolescent idiopathic scoliosis (AIS)	Rufina Wing Lum Lau
8.7		Mismatch of the Risser staging, the distal radius and ulna classification and Sanders staging for peak growth in patients with adolescent idiopathic scoliosis	Prudence Wing Hang Cheung
8.8		A six-year prospective cohort study on the changes in bone density and bone quality up to peak bone mass in adolescent idiopathic scoliosis (AIS) with and without 2 years of calcium and vit-D supplementation	Guangpu Yang
8.9		Predictors of poor outcome in idiopathic clubfoot patients in Hong Kong – a decade of experience	Noah Lok Wah So
8.10		The relationship between electromyographic amplitude of paravertebral muscles and curve progression in Chinese adolescents with idiopathic scoliosis: a preliminary study	Michael Kai Tsun To
8.11		Too straight, or too curved? A model to study the effect of radial bowing in radius malunion and a strategy for computer-assisted corrective osteotomy	Michael Chu Kay Mak
8.12		Short-term Result of Pilot Fracture Liaison Service (FLS) in a Local Hospital in Hong Kong for better management of osteoporotic hip fracture	Kwok Keung Chu
8.13		Epidemiology and antibiotic susceptibility of septic arthritis in Hong Kong	Man Chun Mau
8.14		Does microorganism predict mortality in septic arthritis? Survival analysis with a mean 7.5-year follow-up	Stefanie Pui Jing Chu
8.15		Combating orthopaedic infection with machine learning for predicting antibiotic susceptibility and mortality in septic arthritis – a 17-year study with 447 subjects	Janus Siu Him Wong
8.16		Postoperative improvement in health-related quality of life: comparative outcomes and cost-utility after surgical treatment of focal lumbar spinal stenosis compared with osteoarthritis of the knee and hallux valgus	Karen Hoi Ting So
8.17		Volumetric reduction and dissolution prediction of monosodium urate crystal during urate-lowering therapy – a study using dual-energy computed tomography	Charlotte Shek Kwan Chui
8.18		Screening of sarcopenia in community-dwelling older people in Hong Kong by portable bio-impedance analysis (BIA)	Can Cui
8.19		Harmfulness of category 2 sentinel events (retained instruments or other materials after surgery/interventional procedure): do we have bigger fish to fry? A 12-year experience in Hospital Authority Hong Kong	Jackie Yee Man Chau

Time	Room	Topic (Moderators)	Faculty / Presenter
08:30 - 10:30	S227	Free Paper Session IX: Trauma and Rehabilitation (KH Cheng, KH Ng, Raymond Ng, Ronald Wong)	
9.1		Effectiveness of intravenous tranexamic acid in reducing blood loss in hemiarthroplasty for geriatric hip fracture: a retrospective cohort study	Charis Yi Lok Chan
9.2		The use of local tranexamic acid in Chinese elderly patients undergoing short femoral nailing for intertrochanteric fracture: A randomised controlled trial	Dennis KH Yee
9.3		A retrospective cohort study of the effect of intravenous tranexamic acid infusion on geriatric hip fractures patients undergoing proximal femoral nail antirotation	Ka Mun Lam
9.4		Osteosynthesis-associated infection in osteoporotic fracture causes severe infection and further delayed healing than normal bone	Jie Li
9.5		Does sarcopenia affect osteoporotic fracture healing? Myostatin as a target to enhance repair	Ronald Man Yeung Wong
9.6		Longitudinal study of surgically treated fragility fracture patients: are we doing enough for osteoporosis investigations and treatment	Cheuk Ho Leung
9.7		Functional outcomes of reverse shoulder arthroplasty compared with hemiarthroplasty and open reduction and internal fixation	Sui Kit Chan
9.8		Biodegradable magnesium screws in elbow fracture fixation: clinical case series	Michael Wai Him Lam
9.9		Can perioperative prophylactic proton pump inhibitor prevent acute gastrointestinal haemorrhage in geriatric patients with acute hip fracture? A study in a Hong Kong local hospital	Tsang Yeung
9.10		Short external rotators repair in hemiarthroplasty via posterior approach for neck of femur fractures – randomised study on dislocation rate	CY To
9.11		Fracture incidence and related mortality are reduced with social distancing measures in the COVID-19 pandemic – an epidemiological study	Janus Siu Him Wong
9.12		A multidisciplinary approach in a novel orthopaedic out-patient model: a review of clinical services provided by the Jockey Club specialist out-patient clinic in the MacLehose Medical Rehabilitation Centre (MMRC)	WC Fung
9.13		Use of independent toileting to predict length of stay in patients with knee and hip joint arthroplasty	Joyce Yuk-ping Wong
9.14		Can a community-based multi-model rehabilitation programme improve balance and function of patients after total knee arthroplasty? A pilot randomised controlled trial	Cathy Lo
9.15		Application of additive manufacturing in prosthesis design and manufacturing for below-the-knee amputations patients	Chun Sing Chui
9.16		Back to community and being active again – exercise training programme for patients with knee osteoarthritis in MMRC	Shun Shing Yeung
9.17		Tele-rehabilitation for patients with knee osteoarthritis during COVID-19 in MacLehose Medical Rehabilitation Centre	Shun Shing Yeung
9.18		Machine learning for continuous quality improvement and predictive model for length of stay for geriatric hip fracture	Ivan Chun Hei Lai
9.19		Factors affecting the 1-year mortality rate after lower limb amputation in the Hong Kong Chinese population	Pui Man Chung

Time	Room	Topic (Moderators)	Faculty / Presenter
08:30 – 10:30	S228	Free Paper Session X: Sports Medicine (Stephen Chung/Michael Ong)	
10.1		Influence of hamstring autograft diameter on graft failure rate in Chinese population after anterior cruciate ligament reconstruction	Stephen Pui Kit Tang
10.2		Classifying basketball free-throw skill level using a wearable sensor	Kin Wai Li
10.3		Injury epidemiology of Ultimate Frisbee in Hong Kong	Florence Ou Suet Pang
10.4		Persistent quadriceps muscle atrophy after anterior cruciate ligament reconstruction was associated with defective exercise-induced changes in myokines	Michael Tim Yun Ong
10.5		Case series: early outcomes of tibial tubercle chevron osteotomy	Kelvin Tze Kit Wan
10.6		The role of muscle strength, muscle elasticity and muscle coordination of quadriceps and hamstrings in knee stability during single leg hop landing in patients with anterior cruciate ligament reconstruction	Xin He
10.7		Retrospective study: outcomes of Latarjet operation using single malleolar screw	Wei Hei Dao
10.8		The effect of eccentric versus concentric isokinetic trainings on muscle strength after anterior cruciate ligament reconstruction (ACLR)—a randomised controlled trial	Jessica Sum Yu Chan
10.9		Measurement of muscle elasticity as an additional outcome for determining return to play after anterior cruciate ligament reconstruction	Cham Kit Wong
10.10		Prospective clinical and radiological evaluation of a bioinductive collagen scaffold to treat full-thickness rotator cuff tears	Chun Kwong Lo
10.11		Magnesium alloy wire facilitates bone tendon integration in bone tunnel after anterior cruciate ligament reconstruction in rabbits	Xuan He
10.12		Type 2 diabetes mellitus increased the risk of symptomatic rotator cuff tendinopathy in older adults: an ultrasound study	Hio Teng Leong
10.13		Sports injuries: population-based data on incidence, diagnosis, severity and high-risk group	Ashley Ying Wong
10.14		Magnesium/vitamin C irrigation saline reduced postoperative quadriceps atrophy following anterior cruciate ligament reconstruction (ACLR) in a rat model	Jonathan Ng
10.15		Clinical and radiological outcome of arthroscopic massive rotator cuff repair with subacromial biodegradable balloon spacer implantation	Ying Kan Law
10.16		Estimation of upper trapezius muscle stiffness in office workers with chronic neck pain using shear wave elastography—a cross-sectional study	Ka Chun Mak
10.17		Patellofemoral joint osteoarthritis after anterior cruciate ligament reconstruction: a novel assessment for early PFJ changes	Lawrence Chun Man Lau
10.18		Incidence, prevalence and clinical characteristics of infection after anterior cruciate ligament reconstruction referred and managed by tertiary teaching hospital over a 15-year period	Lawrence Chun Man Lau
10.19		Is a steep posterior tibial slope a risk factor for poorer outcome after lateral meniscus root tear repair in patients after ACL reconstruction?	Cham Kit Wong
10:30 – 11:00		Coffee Break	
11:00 – 12:30	S221	Plenary Session III: Contemporary Orthopaedic Evaluation (CK Chiu, Kenneth Law, Diane Tai)	
11:00 – 11:30		Preoperative evaluation for robotic arm assisted knee arthroplasty	Martin Roche
11:30 – 12:00		3D printing orthopaedics	Christian Fang
12:00 – 12:30		Osteotomies around ankle for deformities correction	Woo-chun Lee
11:00 – 12:30	S225	Concurrent Session IV: Spine (Michael Tse/Eleanor Wen) Theme: Deformity	
11:00 – 11:20		A surgeon oriented morphological classification of kyphosis	Shanmuganathan Rajasekaran
11:20 – 11:40		Correction of post-tuberculosis kyphosis	YW Wong
11:40 – 12:00		Halo traction for spinal deformities	Shanmuganathan Rajasekaran
12:00 – 12:20		Robotic deformity correction	Ronald Lehman
12:20 – 12:30		Spine Chapter Biennial General Meeting	

Time	Room	Topic (Moderators)	Faculty / Presenter
11:00 – 12:30	S227	Concurrent Session V: Paediatric Orthopaedics (Alec Hung, LW Lok) Theme: Limb Deformity Correction	
11:00 – 11:20		Aetiology & evaluation	Evelyn Kuong
11:20 – 11:35		Acute correction of limb deformity	Chris Harris
11:35 – 11:50		Gradual correction of limb deformity	Yaser Jabbar
11:50 – 12:10		Deformity correction in skeletal dysplasia	Chris Harris
12:10 – 12:30		Deformity correction in congenital deficiency	Yaser Jabbar
12:30 – 13:00		Paediatric Orthopaedics Chapter Biannual General Meeting	
11:00 – 12:30	S228	Concurrent Session VI: Sports Medicine (TM Wong, Sammy Mak)	
11:00 – 11:15		COVID 19 & sports medicine	Patrick Yung
11:15 – 11:30		Management of subscapularis tendon rupture	Chanakarn Phornphutkul
11:30 – 11:45		Role of surgical repair in anterior cruciate ligament injury	WP Yau
11:45 – 12:00		Medial side management in multiple ligament injuries	Chanakarn Phornphutkul
12:00 – 12:15		Autologous human mesenchymal stem cells for cartilage repair surgery: from laboratory bench to clinical bedside	Wilson Li
12:15 – 12:25		Discussion	
12:25 – 12:30		Sports Medicine Chapter Annual General Meeting	
12:30 – 13:45		Lunch Symposium / Lunch	
12:30 – 13:30	S423 – S427	Lunch Symposium: sponsored by Amgen	
		Risk stratification approach for osteoporosis management in patients with fracture	Elaine Cheung
13:30 – 15:00	S221	Plenary Session IV: New Insight on Old Problem (Evelyn Kuong, SW Man, Eleanor Wen)	
13:30 – 14:00		Role of sub-clinical infection as an aetiology of disc degeneration	Shanmuganathan Rajasekaran
14:00 – 14:30		Total ankle replacement: current & future	Beat Hintermann
14:30 – 15:00		Advances in cartilage regeneration	James Hui
13:30 – 15:00	S228	Concurrent Session VII: Trauma (CY Tso, Dennis Yee) Theme: Management of Intracapsular Femoral Neck Fractures: New Gadgets, New Approach, New Controversies	
13:30 – 14:45		Topic Debate - Hip screws vs DHS vs FNS - Cemented vs cementless hemiarthroplasty - Direct anterior vs posterior approach - Geriatric hip rehabilitation	WY Shen Frankie Leung TW Lau Christian Fang N Tang Dennis Yee
14:45 – 15:00		Discussion	
15:00 – 15:30		Coffee Break	
15:30 – 17:00	S221	Plenary Session V: Healing: Inspiration and beyond (Stephen Chung, Angela Ho, HK Wong)	
15:30 – 16:00		Enhancement of healing in anterior cruciate ligament reconstruction	Patrick Yung
16:00 – 16:15		Treatment of ankle instability	Jordi Vega
16:15 – 16:30		My approach for malunited ankle fracture: how to preserve the joint	Xiang-yang Xu
16:30 – 17:00		Innovation makes fun: my journey in wrist arthroscopy	PC Ho
17:00 – 17:05	S221	Closing Remarks	

Award Paper Session

AP01

Prediction of final body height for female patients with adolescent idiopathic scoliosis

Prudence Wing Hang Cheung, Abhishek Mannem, Jason Pui Yin Cheung

Department of Orthopaedics and Traumatology, The University of Hong Kong

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AP02

Persistent quadriceps muscle atrophy after anterior cruciate ligament reconstruction was associated with defective exercise-induced changes in myokines

Michael Tim Yun Ong, Sai Chuen Fu, Story Sze Wing Mok, Su Sean Yong, Xin He, Patrick Shu Hang Yung

Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong

Introduction: Quadriceps muscle atrophy is common after ACLR. Myokine Brain-derived neurotrophic factor (BDNF) has been identified for its potential role in muscle hypertrophy. The aim of this study was to examine the serum levels of myokines before and after exercise in ACL reconstructed patients. We hypothesised that exercise-induced myokines upregulation was disrupted, and patients with quadriceps muscle atrophy would have blunted myokines response to exercise compared with patients without atrophy.

Materials and Methods: Patients who underwent ACLR were recruited. Questionnaires (IKDC, Tegner and Lyshom) were obtained. Quadriceps muscle thickness and isokinetic muscle strength were assessed. Blood samples were taken before and after exercise, and serum BDNF levels were measured. Bivariate correlation analysis was used to examine the relationship between BDNF and other outcome measures, and Mann-Whitney *U* test was used to compare differences between groups with and without persistent muscle atrophy.

Results: Sixteen participants were recruited. Half of the patients had quadriceps muscle atrophy which can persist up to 40 months after surgery. It was observed that serum BDNF was decreased after exercise in patients with significant quadriceps atrophy, while serum BDNF was increased in the no atrophy group ($p=0.010$).

Discussion and Conclusion: BDNF was increased after exercise for patients without quadriceps atrophy, whereas for patients with atrophy, BDNF was decreased after exercise. This showed that persistent quadriceps atrophy is attributed by the potential deregulation of BDNF in response to exercise. This can potentially change our current approach for rehabilitation after ACLR as this deregulation of BDNF may render traditional rehabilitation exercises futile.

AP03

The use of local tranexamic acid in Chinese elderly patients undergoing short femoral nailing for intertrochanteric fracture: A randomised controlled trial

Dennis KH Yee,¹ Janus Wong,² Christian Fang,² Evan Fang,² TM Wong,³ Frankie Leung²

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AP04

Combating orthopaedic infection with machine learning for predicting antibiotic susceptibility and mortality in septic arthritis—a 17-year study with 447 subjects

Janus Siu Him Wong,¹ Ningbo Fei,¹ Man Chun Mau,² Stefanie Pui Jing Chu,² Alfred Lok Hang Lee,³ Xin Li,⁴ Yong Hu,¹ Chun Hoi Yan,¹ Frankie Ka Li Leung,¹ Tak Wing Lau⁵

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AP05

Magnesium alloy wire facilitates bone tendon integration in bone tunnel after anterior cruciate ligament reconstruction in rabbits

Xuan He,¹ Jiali Wang,¹ Jiankun Xu,¹ Le Huang,¹ Ye Li,¹ Lizhen Zheng,¹ Tim Yun Ong,¹ Guangyin Yuan,² Ling Qin,¹ Shu Hang Yung¹

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²National Engineering Research Center of Light Alloy Net Forming and State Key Laboratory of Metal Matrix Composite, Shanghai Jiao Tong University

Introduction: Unreasonable tendon to bone integration after ACL reconstruction may be required revision surgery. In addition, early-stage rehabilitation training is concerned because of risk of re-injury. Extensive efforts have been made to develop novel biomaterials like magnesium implants aiming to enhance graft integration. In this study, Magnesium-zinc-gadolinium (MZG) wire was developed and tested for tendon graft weaving. We hypothesise that MZG wire could facilitate graft integration as a potential treatment for clinical problems.

Materials and Methods: Seventy-two rabbits were undergone ACL reconstruction using our established experimental model. The MZG wire weaved surrounding tendon graft. Samples were harvested at week 3, 6 and 9 after surgery. All the samples were evaluated radiologically, histologically, and mechanically.

Results: The MZG group presented narrower tunnel diameter and more peri-tunnel bone formation at all the time points ($p < 0.05$). For histological analysis at week 3, the control group presented fibrosis fibres degeneration with slight degeneration while blood sinus coupled with chondrogenesis at interface were found in MZG group. At week 6, fibroblasts started to distribute along bone surface in the control group. In MZG group, fibrocartilage like tissues bridging tendon and bone were found. Mechanical test showed higher ultimate loading in MZG group ($p < 0.05$).

Discussion and Conclusion: Application MZG wire to suture tendon graft can promote peri-tunnel bone formation and fibrocartilage formation to enhance tendon to bone integration at early stage after ACL reconstruction. Thus, clinically it might contribute to reducing the revision rate and facilitating earlier rehabilitation of patients to start with muscle power training.

AP06

AlignPro: a robust deep learning-based prediction of spinal alignments irrespective of image qualities acquired from smartphone photographs of radiographs displayed on PACS**Teng Zhang,¹ Yifei Li,² Jason Pui Yin Cheung,¹ Kenneth Kwan Yee Wong²**¹*Department of Orthopaedics and Traumatology, The University of Hong Kong*²*Department of Computer Science, The University of Hong Kong*

Introduction: Original X-rays are not easily accessible for telemedicine and existing deep learning-based automated Cobb angle (CA) predictions are not accurate on suboptimal quality X-rays.

Objective: To develop an automated CA prediction system irrespective of image quality: AlignPro, with no restrictions on curve patterns to facilitate clinical practice and telemedicine.

Methods: In total, 367 consecutive patients attending a scoliosis clinic were recruited prospectively and their coronal X-rays were re-captured using mobile phones. Five-fold cross-validation was conducted (5 experiments, each with 294 images to train a deep neural network named HRNet for endplates landmarks and end-vertebrae detection, and the remaining 73 images were used to test). The predicted heatmaps of the vertebral landmarks were visualised to enhance interpretability. Per-landmark-absolute-errors and recall of the landmark detection results were calculated to assess the accuracy of the predicted landmarks. Further calculated CAs were quantitatively compared with the spine specialists measured ground truth (GT).

Results: The average per-landmark absolute distance error and the recall of the detected endplates landmarks were 2.8 pixels and 0.99, indicating a highly accurate detection. The predicted CAs were all significantly correlated with GT ($p < 0.01$). Compared with GT, the mean error was 3.73-4.15° and standard error of the measurement was 0.8-1.7° for the predicted CAs at different spinal regions.

Conclusion: This is the first study using HRNet on non-original X-rays to automatically and accurately predict vertebral landmarks of the scoliotic spine. HRNet's applicability is evidenced by our thorough cross-validation, which can be used with telemedicine to facilitate fast reliable auto-diagnosis and follow-up.

AP07

Pulsed electromagnetic field augments the effect of hydrogel-based tissue engineering for cartilage repair**Yucong Li,¹ Qi Pan,¹ Nianli Zhang,² Erik Waldorff,² Wayne Yuk Wai Lee,¹ Gang Li¹**¹*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*²*Research & Clinical Affairs, Orthofix Medical Inc.*

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AP08

Does sarcopenia affect osteoporotic fracture healing? Myostatin as a target to enhance repair**Ronald Man Yeung Wong,¹ Ning Zhang,¹ Jinyu Wang,¹ Raymond Wai Kit Ng,² Chi Yin Tso,² Ning Tang,² Simon Kwoon Ho Chow,¹ Wing Hoi Cheung¹**¹*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*²*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*

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AP09

The burden of disease in patients awaiting joint replacement surgery—a study of 2091 patients

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Background: In Hong Kong, due to limitations in resources in the public sector, patients indicated for joint replacement are placed on a waiting list and may need to wait for years for their procedure. The effect of this delay in joint replacement on a patient's overall morbidity and mortality is currently unknown and no study has examined this previously. The aims of this study were to 1) quantify the degree of and 2) identify factors related to patient morbidity and mortality associated with joint replacement waiting list.

Methods: All patients that were put on waiting list primary total hip, knee and unicompartmental knee replacements in our cluster from November 2009 till March 2020 were included for analysis. CDARS system was used for data retrieval. Incidence of all-cause hospital admissions, AED attendances and occurrence of major medical events was calculated.

Results and Discussion: In total, 3715 patients had been placed on waiting list for primary joint replacement from 11/2009 till 3/2020. After exclusion of 965 cancellations, 2972 replacements in 2109 patients were included for analysis. 3.2% died while awaiting joint replacement. Incidence of all-cause hospitalisation and peptic ulcers were higher during the waiting period than at baseline and after operation. NSAID use was significantly related to increased hospitalisation and cardiovascular events during the waiting period.

Conclusion: Patients waiting for joint replacement are at an increased risk of hospitalisation and peptic ulcer events. NSAID usage is a major factor leading to patient morbidity while awaiting joint replacement.

AP10

A handheld spine scanner for home monitoring of scoliosis patients can reduce clinic attendance by 47%: a prospective longitudinal study

Jack Zijian Wei,¹ Jennifer Sze Kan Ha,¹ Pei Yu,¹ Berry King Cheung Cheung,² Johnson Yiu Nam Lau,² Kenneth Man Chee Cheung¹

¹*Department of Orthopaedics and Traumatology, The University of Hong Kong*

²*Avalon SpineCare (HK) Ltd*

Introduction: Early diagnosis of scoliosis by school screening programmes generates a significant burden on the clinic follow-up. SpineScan3D has been proven to be reliable for home-based assessment of back topography. This study aims to demonstrate that SpineScan3D can be used for the home monitoring of non-progressive curves and avoid regular clinic visits for patients without back shape changes.

Materials and Methods: In total, 113 patients with adolescent idiopathic scoliosis (AIS), aged between 9 and 17 years, were recruited and followed prospectively. At each clinic visit, patients' backs were profiled using SpineScan3D with spine radiographs taken as routine protocol. Changes in back shape were measured as a "tilt" angle. A cut-off value was used to define a positive or negative tilt angle change.

Results: Cobb angle changes of 113 patients was measured as a mean of 2.8° (range, -12.0° to 19.8°). A mean of 0.4° (range, -6.9° to 11.0°) was found in overall tilt angle changes. Using a cut-off value of 0.7° in tilt angle changes, a true-negative rate of 47% and a false-negative rate of 11% were found.

Discussion and Conclusion: SpineScan3D is a handheld and portable electronic device with a low manufacturing cost and therefore a potential for widespread adoption within the community. In this prospective longitudinal study, we demonstrate its potential to help reduce clinic follow-up for non-progressive curves by 47%. Further work is needed to reduce false-negative rate by examining the value of repeat home scanning and the use of machine learning to refine accuracy.

Award Poster Session

BP01

Using the ulna physis in improving decision-making for brace weaning in adolescent idiopathic scoliosis

Prudence Wing Hang Cheung, Jason Pui Yin Cheung

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BP02

A novel mechanical parameter to quantify the microarchitecture effect on apparent modulus of trabecular bone: a computational analysis of ineffective bone mass

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Introduction: Previous studies showed microarchitecture can vary the apparent modulus of trabecular bone independent of bone volume fraction (BV/TV). However, the modulus is a mechanical quantity and there is no mechanical explanatory parameter. This study aims to reveal a novel mechanical parameter to quantify the microarchitecture effect on the apparent modulus of trabecular bone.

Methods: Fourteen human vertebrae were scanned with DXA followed by micro-CT. Four trabecular specimens were obtained per vertebrae and converted to micro-finite element models. The apparent modulus (E) was computed using linear micro-finite element analysis. Ineffective bone mass (InBM) was the bone mass with a negligible contribution to load-resistance, quantified as the low von Mises stress ratio (LSVMR), which is the ratio of the number of InBM elements to the total number of elements in the model. Correlation between E* and LSVMR was analysed, with the experimental optimal stress threshold. Multiple linear regression of E against both BV/TV and LSVMR was further analysed.

Results: BV/TV alone can explain 59% of the variation in E ($E=2254.64BV/TV+1.04$, $R^2=0.59$, $p<0.001$), and LSVMR can explain 48% of the variation in E ($E=1696.4 - 1647.1LSVMR$, $R^2=0.48$, $p<0.001$). Combining these two predictors, 95% of the variation in E can be explained in a multiple linear regression model ($E=1364.89 + 2184.37BV/TV - 1605.38LSVMR$, adjusted $R^2=0.95$, $p<0.001$).

Conclusion: LSVMR can be adopted as the mechanical parameter to quantify the microarchitecture effect on the apparent modulus of trabecular bone.

BP03

Femoral component sagittal position is an independent predictor of clinical outcome in total knee arthroplasty regardless of implant design: retrospective review of 1000 TKAs with up to 5 years follow-up

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BP04

Risk factors for symptomatic adjacent segment disease following lumbar fusion: a systematic review and meta-analysis

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Introduction: Given the growing number of lumbar fusion and associated adjacent segment disease (ASD), numerous studies have investigated the risk factors for ASD. However, no systematic reviews and/or meta-analyses have summarised these factors, which can inform clinical decision-making. Accordingly, this meta-analysis aimed to summarise risk factors for ASD after lumbar fusion.

Materials and Methods: Academic Search Premier, CINAHL, Cochrane Library, EMBASE, MEDLINE, and Web of Science were searched from inception to December 2019. Primary studies were included if they were English articles related to risk factors for ASD after lumbar fusion in human. The methodological quality of the included cohort and case-control studies was evaluated by the Newcastle-Ottawa Scale.

Results: Of 665 identified citations, 43 studies involving 12215 patients were included. Ten, 29, and four studies were classified as high, moderate, and low methodological quality, respectively. The mean occurrence rate of ASD was $16.4 \pm 10.0\%$, while the mean ASD-related re-operation rate was $11.9 \pm 8.6\%$. Meta-analyses revealed significant demographic (older age, high body mass index, adjacent segment decompression), surgical (≥ 2 fused segments), and radiographic (preoperative lumbopelvic mismatch, preoperative adjacent disc degeneration, preoperative facet sagittalisation, preoperative anterior shift of lumbosacral sagittal plumb line, decreased postoperative lumbar lordosis or sacral slope, and increased postoperative pelvic tilt) risk factors for ASD.

Discussion and Conclusion: This is the first meta-analysis to summarise evidence regarding various risk factors for ASD following lumbar fusion. Although it is impossible to alter non-modifiable risk factors for ASD, it is possible to mitigate modifiable risk factors by conservative and/or surgical means.

BP05

Patellar resurfacing does not improve clinical outcome in patella-friendly total knee arthroplasty design—a randomised controlled trial

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Free Paper Session I: Adult Joint Reconstruction I

FP1.1

Long-term outcome of vascularised iliac bone grafting for osteonecrosis of femoral head: retrospective study with 17-year follow-up

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Introduction: We investigated the long-term results of osteonecrosis of femoral head (ONFH) undergoing decompression and vascularised iliac bone grafting (VIBG). The primary outcome is the long-term survivorship of VIBG, using conversion to total hip arthroplasty as an end-point. The average time of VIBG survival, and factors influencing the bone graft survival were also analysed.

Materials and Methods: In total, 42 patients (50 hips) underwent VIBG for ONFH in our institute between 1995 and 2013. Only patients with follow-up of at least 5 years were included. Patient demographics, Ficat staging of radiograph, surgical complications and VIBG survivorship were recorded. VIBG was performed only on patients with ONFH of Ficat stage II and stage III.

Results: 28 hips (56%) had surviving VIBG for the duration of follow-up. The overall mean graft survival was 12.2 ± 7.8 years (0.4-24.0). VIBG of 14 hips (28%) survived after 0-5 years, 10 hips (20%) survived after 5-10 years and 26 hips (52%) survived for ≥ 10 years. Steroid (HR 2.33) and alcohol-induced (HR 2.07) osteonecrosis were more predominant in the graft failure group ($p=0.047$).

Conclusion: At a long-term follow-up of 17 years, our results showed that VIBG is effective in treating patients with pre-collapse (Ficat Stage II) and early post-collapse (Ficat stage III) in ONFH. Alcoholics and patients with steroid are at a higher risk of graft failure, so VIBG should be performed cautiously in these patients. VIBG is an intermediate operation until osteoarthritis sets in, either by progression of ONFH or natural degenerative change.

FP1.2

Long-term survival analysis of patients suffering from avascular necrosis (AVN) of the head of femur underwent total hip replacement (THR) with or without previous vascularised iliac bone grafting (VBG)

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Introduction: Avascular necrosis (AVN) of the femoral head is a debilitating medical condition. Vascularised iliac bone graft (VBG) improves blood supply to avascular portion of femoral head which may delay secondary osteoarthritis and total hip arthroplasty (THR). However, long-term efficiency in terms of survivorship is still uncertain.

Materials and Methods: In total, 37 cases of AVN of the femoral head were firstly VBG transplanted following by THR due to secondary osteoarthritis (Group 1), 302 cases of advanced AVN were primary THR treated (Group 2). Baseline characteristics were collected. Overall survival was determined using the Kaplan-Meier method and variables were compared using the log-rank test.

Results: In Group 1, the mean age at VBG and THR was 38.7 years and 47.5 years, respectively; in Group 2, mean age at THR was 58.1 years. In Group 1, mean time between VBG and THR was 9.4 years, and that between THR and last visit was 11.8 years; in Group 2, mean time between THR to last visit was 12.5 years. Death or loss to follow-up rates was 13.5% in Group 1 and 43.2% in Group 2 ($p < 0.01$). Group 1 had better overall survival at 5, 10, 20, and 30 years (Group 1: 93.9%, 89.7%, 82.2%, and 41.1%, respectively; Group 2: 90.0%, 77.2%, 51.7%, and 15.6%, respectively; $p = 0.01$). Mean Harris hip score in Group 1 was significantly higher than that in Group 2 (92.63 vs 81.83; $p = 0.05$).

Discussion and Conclusion: Patients with AVN treated with VBG then THR were younger and survived longer. Patients treated by VBG then THR showed much better functional results.

FP1.3

Comparison of early outcomes of robotic-assisted fixed-bearing unicompartmental knee replacement and Oxford unicompartmental knee replacement

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Introduction: Medial unicompartmental knee replacement (UKR) is an effective treatment for end-stage, symptomatic medial unicompartmental osteoarthritis of the knee. The primary aim of the study was to compare the knee-specific functional outcome of robotic-assisted fixed-bearing unicompartmental knee arthroplasty (rUKA) with manual Oxford unicompartmental knee arthroplasty (OUKA) for the management of isolated medial compartment osteoarthritis. Secondary aims were to compare length of hospital stay, operative time, haemoglobin level drop between rUKA and OUKA.

Methods: A retrospective cohort study was performed. In total, 20 patients undergoing rUKA and 26 patients undergoing OUKA were recruited in the study. The Knee Society function score, Knee Society knee score and Oxford knee score were collected before and 6 months after surgery. Length of stay, postoperative haemoglobin drop, and transfusion were also recorded.

Results: There were no significant differences in the preoperative demographics or function scores between the groups. rUKA had significantly longer operative time than OUKA group ($p < 0.05$). There was no significant difference in hospital length of stay, haemoglobin drop and transfusion need between two groups. There was also no significant difference in Knee Society function score, Knee Society knee score and Oxford knee scores between two groups at 6 months after surgery.

Conclusion: Except longer operative time, rUKA had similar early postoperative outcomes when compared with OUKA.

FP1.4**Bone cement implantation syndrome in hip arthroplasty with cemented femoral component—a review of 459 patients****Ching Ngai Leung,¹ Ping Keung Chan,² Tak Wing Lau,¹ Chi Fat Chan,¹ Kwong Yuen Chiu²**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: Bone cement implantation syndrome (BCIS) is a serious yet underreported complication in cemented hip arthroplasty. This study aims to determine the incidence of severe BCIS in cases with cemented femoral stems in hip arthroplasty (cemented stems) from a local tertiary centre.

Methods: This is a retrospective study of patients done in the years 2014-2019. Records were identified from clinical data and recording system (CDARS). Patients with primary hip replacement were included. Patients undergoing revision surgery or patients with pathological fractures were excluded. Cementation was performed with modern technique. Patient clinical records and anaesthetic records were reviewed for any evidence of BCIS. BCIS was defined as hypoxia, hypotension or cardiovascular collapse during procedure. The severity was graded according to classification proposed by Donaldson et al in 2009 from grade 1 to grade 3.

Results: A total of 524 patients were identified. 459 patients were included, in which 381 cases were cemented hemiarthroplasties for patients with fractured hip, and the remaining 78 cases cemented primary total hip replacements. The 30-day mortality rate was 1.52%. One patient had grade 2 and two patients had grade 3 BCIS. The incidence of severe BCIS was 0.65% (95% CI 0.21-2.01). All three patients were of American Society of Anaesthesiology (ASA) grade 3, two had pre-existing cardiovascular disease. There was no intraoperative mortality.

Discussion: Elderly patients of ASA grade 3, or pre-existing cardiovascular disease may be at higher risk of BCIS. Adequate communication with anaesthetist before and during surgery is important for prevention and amelioration of BCIS.

FP1.5

How does sagittal spinal deformity affect spinopelvic relationship in patients undergoing total hip arthroplasty? A radiographic study

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Introduction: Sagittal spinal deformity is associated with significantly higher risk of instability after total hip arthroplasty (THA). We aim to investigate relationship between sagittal spinal balance and spinopelvic motion in patients undergoing THA.

Materials and Methods: We recruited 139 patients undergoing primary THA, with standardised preoperative lateral spinopelvic radiographs and whole spine stereoradiographs (EOS imaging) taken at standing, sitting and leaning-forward positions. Spinopelvic parameters including pelvic incidence (PI), pelvic tilt (PT), sacral slope (SS), lumbar lordosis (LL), anterior pelvic plane tilt (APPT), and sagittal vertical axis (SVA) were measured. Patients were classified into three groups according to PI-LL mismatch, flatback deformity (PI-LL>10), hyperlordosis (PI-LL<-10), normal (-10<PI-LL<10). One-way analysis of variance and post hoc Tukey test were used to investigate static and postural differences in PT/APPT/SS/LL among the three groups. Pearson correlation was tested when reporting correlations between PI-LL/SVA and PT postural change.

Results: Static standing PT, APPT, SS, LL differed among the three groups (all p<0.01). Flatback patients had significantly less lumbar lordosis change in all postural changes, compared to normal and hyperlordotic patients (all p<0.01). When changing from leaning to standing, greater pelvic tilt change was associated with greater PI-LL mismatch (r=0.078, p=0.001), and greater SVA (r=0.031, p=0.038).

Discussion and Conclusion: Sagittal spinal deformity is prevalent in THA patients. It is associated with significantly altered spinopelvic motion. Flatback patients tend to have less lumbar lordosis and more pelvic tilt recruitment when changing posture. Preoperative analysis of sagittal spinal alignment and postural spinopelvic parameters are critical to prevent THA instability.

FP1.6

Lateral hinge fractures in medial open wedge high tibial osteotomy: incidence, predictive factors and diagnostic value of computed tomography from a local series

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Introduction: Lateral Hinge fracture (LHF) is not an uncommon complication associated with medial opening wedge high tibial osteotomy OWHTO, which can affect construct stability and result in delay or non-union. Moreover, the diagnosis of LHF may not always be reliable with radiography alone. The purpose of this study was to investigate the incidence and predictive factors of LHF and evaluate the diagnostic accuracy of plain radiograph and computed tomography (CT).

Materials and Methods: A retrospective review was conducted in 86 OWHTOs performed in 66 patients with a minimal follow-up of 6 months. The incidence of LHF detected on plain radiographs or CT according to the Takeuchi classification was analysed and predictive factors of LHF were investigated.

Results: There were 34 knees (39.5%) diagnosed by either radiography and/or CT. Among the LHF group, radiographs yielded a detection rate of 63.3%. On the other hand, CT was able to confirm an additional 11 LHF in patients whose radiographs were found to be normal. The size of gap opening was larger (15.46 ± 3.58 mm vs 12.19 ± 3.02 mm; $p < 0.001$) and was the only predictive factor of LHF with statistical significance (OR 1.26, CI 1.03-1.61 $p = 0.034$).

Discussion and Conclusion: CT is more sensitive than plain radiographs in detection of LHF and its routine use may reduce complications associated with LHF. The average gap opening size was found to be the only predictor of LHF, suggesting a need for caution when operating on a patient with an anticipated larger gap opening.

FP1.7

Total knee arthroplasty in patients over the age of 80 years—long-term results

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Introduction: More and more elderly patients present with symptomatic knee pain indicated for total knee arthroplasty (TKA). Most joint centres routinely screen outpatients aged >80 years because of concerns of higher surgical risk. Here we study the long-term results of TKA performed in patients aged >80 years in our locality.

Methods: A total of 67 patients aged >80 years had TKA performed at Prince of Wales Hospital from 2005-2013. 70 patients, aged 70 to 80 years, were selected at random as a control group. Pre- and perioperative factors were recorded. On follow-up, range of motion, pain, ambulatory status and functional score were recorded. Mortality and postoperative complications were also recorded.

Results: Mean follow-up was 10.7 years. Mean age was 82.9 vs 74.1 years. Baseline factors such as sex distribution, body weight, preoperative knee deformity, range of motion and ASA grading were similar ($p > 0.05$). Tourniquet time, length of stay and ambulatory status on discharge were similar ($p > 0.05$). There was no statistical difference between the two groups in terms of preoperative and postoperative functional scores. Both groups showed statistically significant improvement after surgery. Rate of revision, infection or aseptic loosening were similar. Patients aged >80 years had a 5-year survival of 0.86 (vs 0.94) and 10-year survival of 0.45 (vs 0.72) which was statistically significant ($p < 0.01$).

Conclusion: TKA can be performed in patients aged >80 years with comparable postoperative knee range, functional score, and complication rate. Advanced age should not be a limiting factor for TKA.

FP1.8

Is high rate of early failure of ATTUNE total knee replacement system a myth or truth? Clinical evaluation and survival analysis of 522 patients with at least 3-year follow-up

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FP1.9

A novel machine learning algorithm developed for knee arthroplasty loosening detection demonstrating superior accuracy and predictability, and augment clinical decision-making

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FP1.10

Dynamic xi-scan assessment of knee before total knee arthroplasty and unicompartmental knee arthroplasty

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FP1.11

Filmless prediction of implant sizes—review of >1000 total knee arthroplasties

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FP1.12**Internal rotation of femoral component in total knee replacement: is it safe?****Henry Fu,¹ Man Hong Cheung,² Amy Cheung,¹ Ping Keung Chan,¹ Chun Hoi Yan,² Kwong Yuen Chiu²**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: The target for femoral component rotation in total knee arthroplasty has often been parallel to transepicondylar axis (TEA), yet outliers can still occur. The objective of this study was to investigate the mid-term results of patients with internally rotated femoral components.

Materials and Methods: In total, 79 TKAs performed between September 2016- March 2017 were prospectively followed up. Femoral component rotation determination was randomised to either measured resection (MR) or gap balancing (GB) technique. CT scans performed showed internal rotation of the femoral component was more common using either method. The effect of internal rotation of femoral components on clinical outcomes was analysed.

Results: In total, 79 patients completed the study with mean follow-up of 43 months. Of them, 61 knees (77%) had internally rotated femoral components with 17 (21.5%) exceeding 3°. The mean rotation of the MR and GB groups were 1.51° (SD 1.72) and 1.47° (SD 2.21), respectively and not significantly different. All implants survived without patella dislocation. Using >3° internal rotation from TEA as cut-off for acceptable internal rotation, Knee Society functional assessment at 3 months was marginally inferior in the internally rotated group (KSFA 3 months: 52 vs 58, p=0.06) but the effect washed out beyond 6 months. No differences were observed in Knee Society knee score.

Discussion and Conclusion: Mild internal rotation of femoral components did not jeopardise clinical or functional outcomes. Femoral component rotation can be safely adjusted to achieve soft tissue balancing such as in the setting of robotic TKA.

FP1.13**The effect of coronal femoral bowing on total knee arthroplasty****Hongtai Chen, Kwong Yuen Chiu, Chun Hoi Yan***Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: Most total knee arthroplasty (TKA) instrumentation systems were designed based on Caucasian anatomy instead of Asian. Coronal femoral bowing is a common extra-articular deformity in Asians. However, whether it is necessary to correct femoral bowing before TKA is controversial.

Materials and Methods: Important parameters related to TKA (femoral bowing angle, mechanical lateral distal femoral angle, mechanical medial proximal tibial angle, joint line obliquity, mechanical tibiofemoral angle and valgus correction angle) were measured on the radiographs of 422 lower limbs in 358 patients. We analysed their distributions and correlations, then comparing the accuracy of restoration of the mechanical alignment with different choices of distal femoral resection angle (fixed or patient-specific).

Results: Up to 19.9% of Asian patients undergone TKA had severe coronal femoral bowing. There was no statistically significant correlation between FBA and other radiographic parameters, except for VCA (r=0.711, p<0.001). Using patient-specific resection angle during TKA provides significantly higher accuracy in terms of restoring neutral lower limb alignment than fixed resection angle (p<0.001).

Discussion and Conclusion: Even if conventional TKA is quite enough to obtain accuracy restoration of mechanical alignment, even without femoral bowing correction, surgeons should pay attention to coronal femoral bowing in patients undergoing TKA. Accurate preoperative measurement and a patient-specific resection angle should be used, which is especially important in patients with severe femoral bowing.

FP1.14

Clinical and patient-reported outcomes on a guided-motion bicruciate-substituting total knee system in Chinese patients

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Introduction: The Journey II bicruciate-substituting total knee arthroplasty (TKA) system is a second-generation guided-motion knee implant. We looked at the clinical, radiological and patient-reported outcomes in Chinese patients up to 1 year after surgery.

Materials and Methods: In total, 124 TKAs in 104 patients who received Journey II TKA in three hospitals under one university healthcare system were recruited. Patients were assessed before surgery, and at 6 months and 1 year after surgery. Patient-reported outcome measures (PROMs) including the new Knee Society score, knee injury and osteoarthritis outcome score and forgotten joint score were recorded prospectively. Radiological outcomes such as change in lower limb alignment and component positioning were also documented.

Results: The mean age of the patients was 69 ± 7 years. The mean body mass index was 27 ± 4 . All clinical and patient-reported outcomes showed significant improvement compared with the preoperative values. The PROMs continued to improve from 6 months to 1 year ($p < 0.05$). The radiological assessments showed satisfactory restoration of mechanical alignment and components positioning. There was no major complication or revision documented. No significant correlation between clinical outcomes and PROMs was found.

Conclusion: The second-generation guided-motion bicruciate-substituting total knee implant demonstrated satisfactory short-term outcomes in Chinese patients. The PROMs showed significant improvement up to 1 year after surgery.

FP1.15

Cruciate retaining design has equivalent outcome to posterior stabilizing design in mobile bearing TKA: a retrospective review

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FP1.16**Rotational alignment of the femoral trochlea in Asian knees: A magnetic resonance imaging study of 213 patients and its implication on management in patellofemoral arthritis****Michelle Kar Lam Li, Samuel Yik Cheung Wan, Tsz Lung Choi, Dennis King Hang Yee, George Ying Kan Law, Jason Chi Ho Fan***Department of Orthopaedics and Traumatology, Alice Ho Miu Ling Nethersole Hospital*

Introduction: Maltracking of the patella is a key contributor to early failure of patellofemoral arthroplasty (PFA). Native femoral trochlear morphology and rotation can influence PFA trochlear implant positioning and tracking of the patella. This is the first study in an Asian population designed to assess the rotational alignment of the femoral trochlear groove.

Materials and Methods: Trochlear inclination angle was measured from 213 magnetic resonance images (MRI) of Chinese knees retrieved from a single centre in Hong Kong. Knees were divided into normal and dysplastic groups according to the Dejour classification for trochlear dysplasia.

Results: The mean trochlear inclination angle was internally rotated in both normal knees (11.0°; range, 4°-17°) and dysplastic knees (11.5°; range, 4°-19°). There was no statistically significant difference among normal and dysplastic knees, or gender. Internal rotation was found to be less prominent when subchondral bone landmarks instead of cartilage landmarks were used for trochlear inclination measurement (9.9° vs 11.0°, $p < 0.05$).

Discussion and Conclusion: In view of the internal rotation of the native trochlear groove, inlay PFA implants placed flush with the native trochlear articular surface may result in malrotation and patella maltracking. Preoperative MRI may inform surgeons of appropriate implant choice and position for patellofemoral arthroplasty.

FP1.17**Fixed bearing versus rotating platform total knee replacements—which one is better?****Amy Cheung,¹ Ping Keung Chan,¹ Vincent Wai Kwan Chan,¹ Henry Fu,¹ Man Hong Cheung,² Chun Hoi Yan,² Kwong Yuen Chiu²**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*

Background: Patella tracking issues and anterior knee pain (AKP) remain a significant cause of dissatisfaction after total knee replacement (TKR). Rotating platform (RP) designs were developed with the aim to decrease polyethylene contact stresses and wear to decrease incidence of aseptic loosening. The aim of this study was to compare the clinical outcomes of patients who have undergone TKR using a fixed bearing (FB) compared to those using a RP design.

Methods: This is a prospective study involving 994 PS TKR using the same brand of prosthesis (ATTUNE, DePuy Synthes). 790 replacements of the FB and 204 were of the RP design. 2.7% underwent concurrent patella resurfacing. Mean duration of follow-up was 28.2 months.

Results and discussion: There were no revisions required for patella tracking issues and anterior knee pain. 6 patients required revision at an average of 12.3 months due to infection (3), aseptic tibial component loosening (1) and residual stiffness (2). No significant difference was found in the postoperative incidence of AKP, Knee Society knee and functional scores at all time points after operation between the two groups.

Conclusion: At short-midterm follow-up, no significant difference was found in the clinical performance of TKR using FB and RP designs. A longer period of follow-up may be necessary to ascertain whether differences truly exist.

FP1.18

Less is more: squatting, kneeling and other functional outcomes of bilateral unicompartmental knee replacement—a cohort comparison with bilateral total knee replacement in New Territories West Cluster Joint Replacement Center

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Background: There has been a renewed interest in using unicompartmental knee replacement (UKR) and subjective reports of functional improvement in our locality. While better knee kinematics after UKR in Western populations has been discussed, no study has looked at restoration of squatting or kneeling, important in the oriental lifestyle. This is the first retrospective cohort study to compare ability to squat and kneel in patients with UKR and total knee replacement (TKR) in Hong Kong.

Methods: Patients after bilateral UKR from 2016 to 2019 were analysed. A second group of patients matched by demographics, BMI, ASA grade and preoperative Knee Society function score (KSFS) after bilateral TKR was selected for comparison. Primary outcomes assessed include the ability to squat, kneel, climb up/downstairs and walk briskly. Secondary outcomes recorded include the knee range of movement, KSFS, and postoperative complications.

Results: In total, 23 patients with 46 UKR and 20 patients with 40 TKR from age 49 to 70 years were assessed. There was no statistical difference between the two groups in gender, BMI and ASA grading. Patients who had UKR were more likely able to squat ($p=0.014$), kneel ($p=0.001$) and walking briskly ($p<0.001$) than those with TKR. There was no significant association between patients with UKR or TKR and stairclimbing. The mean postoperative with respect to preoperative KSFS in UKR and TKR groups also revealed no statistical difference.

Conclusion: Compared to TKR, UKR results in better ability to squat, kneel and walk briskly crucial for daily living in our society.

FP1.19

Metaphyseal cone in revision total knee arthroplasty—a retrospective review

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Introduction: Metaphyseal cone has emerged recently to be an effective tool in managing metaphyseal bone defect in revision total knee arthroplasty (TKA). We aim to review clinical and radiological outcomes of metaphyseal cone in our hospital.

Materials and Methods: We retrospectively reviewed 17 patients (age 70.1 ± 9.2 years; 5 male and 12 female) who had undergone revision TKA using metaphyseal cone (Triathlon Tritanium Cone Augments, with the Triathlon Total Stabilizer Knee System, Stryker) during the period of August 2017 to January 2020. The mean follow-up period was 22 months. We investigated their demographics (age, gender, ASA class, comorbidities, indication), surgical factors (bone defect according to the Anderson Orthopaedic Research Institute (AORI) classification, tibial/femoral cone, implant size and shape), clinical outcomes (end-of-stem pain, Knee Society knee score, infection, revision surgery), as well as radiological outcomes (osteointegration, fracture, radiolucency, aseptic loosening).

Results: In total, 15 tibial and two femoral cones were used. Surgical indications were periprosthetic joint infection (10 of 17), aseptic loosening (4 of 17) and others (3 of 17). All of the bone defects were classified as class II A/B by the AORI classification. There were two cases of intraoperative femoral fracture during femoral cone press-fit. There was no infection or revision surgery. Radiologically, osteointegration was seen in all cases except one case of aseptic loosening.

Discussion and Conclusion: Metaphyseal cone is useful in managing bone defect in revision total knee arthroplasty, with promising short-term clinical and radiological outcomes. Precautions should be taken when using cone in patients with small body build.

Free Paper Session II: Hand and Microvascular

FP2.1

Outcomes of extensor tenolysis after hand fractures: a retrospective case series of 11 patients

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Introduction: Hand stiffness from tendon adhesion remains common after hand fractures. We retrospectively analysed the outcomes of extensor tenolysis after hand fractures.

Materials and Methods: We reviewed 11 fingers of 11 patients (mean age 47.7 years) with extensor tenolysis after hand fractures (5 closed, 6 open and 2 intra-articular fractures). Range of motion was evaluated and compared.

Results: Extensor tenolysis was done at a mean of 33 weeks after hand fracture. Among open fractures, 3 had tendon injury and another 2 had digital nerve injury. Besides removal of implant, 11 patients had extensor tenolysis and 6 also had dorsal capsulotomy. 3 patients had tenolysis delayed over 9 months. By 3 to 7 months after tenolysis, motion became static in 9 patients. Total active motion (TAM) improved from 143° preoperatively to 192° postoperatively ($p=0.002$). Significant improvement of motion was observed at metacarpophalangeal joint ($p=0.006$), but not at interphalangeal joints. Of the 3 patients had surgery under regional anaesthesia or wide-awake local anaesthesia no tourniquet, 76% of intraoperative TAM versus 84% of total passive motion on table was maintained at final follow-up. No significant difference in outcomes between open and closed fractures or the timing of tenolysis. No patient had worse motion after surgery.

Discussion and Conclusion: The gain of motion of 49° is comparable to other series. Release of all pathologic anatomy and aggressive mobilisation may improve the result further. Extensor tenolysis can provide an encouraging improvement of active motion for stiff finger after hand fractures.

FP2.2

Clinical outcome of dorsal versus lateral plating in proximal phalangeal fracture: a retrospective cohort study

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Introduction: Proximal phalangeal fracture is a regularly encountered hand trauma entity. Yet, there is still no consensus in the standard operative management for this fracture. Plating of proximal phalanx is the commonly adopted fixation method. However, whether placing the implant at dorsal or lateral aspect of phalanx can yield better clinical outcome is still under debate. Our study aims to compare the functional outcome of dorsal plating versus lateral plating in patients suffering from proximal phalangeal fracture.

Materials and Methods: A retrospective cohort study was performed comparing clinical outcome of dorsal and lateral plating in proximal phalangeal fracture. Total 14 patients with total 17 proximal phalangeal fractures (excluding thumb) were included in this study with demographic data and injury-specific information recorded for analysis. Fracture patterns are classified with the OTA classification by preoperative radiographs in each case. Total range of movement (TAM), range of movement of each finger joint together with grip strength are the main focuses of this study. Operative complications and the need for subsequent related operations including tenolysis and removal of implant are also analysed.

Results: There was no significant difference in demographic data between the two groups. Lateral plating provides better TAM, less extension lag and less percentage difference in grip strength compared with contralateral normal hand with statistical significance. There was no significant influence on complications or subsequent related operations.

Discussion: Base on this study, lateral plating group leads to better functional outcome in terms of range of movement and grip strength than dorsal plating group.

FP2.3

Functional outcome in interphalangeal joint fusion with headless compression screw

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FP2.4**Combined botulinum toxin and surgical therapy gives better outcome than botulinum toxin alone therapy in upper limb cerebral palsy: an 8.8-year follow-up****Sum Lik Cheung, Yee Ting Pang, King Fung Tang, Haseeb Hussain, Wing Yuk Ip***Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: Surgeries for upper limb cerebral palsy (ULCP) have been criticised for their poor outcome. Recently, botulinum toxin (BTX-A) injection has gained popularity due to its safety profile and immediate effects, but its long-term result varies. Despite ongoing studies on both modalities, most literature evaluates them separately. Very few studies discussed the outcome of patients receiving both BTX-A and surgery. This study compares the functional outcome of BTX-A injection alone therapy (BTX-A alone) with combined treatment of both surgery and preoperative BTX-A injections (combined therapy) in cerebral palsy hands.

Materials and Methods: A single-centre 8.8-year prospective study of 19 patients (M: F=7:12) with 20 hands divided into two groups (10 hands each): BTX-A alone and combined therapy.

Results: House score improved from 1.89 to 4.33 in the combined therapy group ($p < 0.001$), with a mean improvement of 2.44. BTX-A alone group did not show statistically significant improvement: House score from 3.09 to 4.36 ($p > 0.05$, mean improvement 1.27). The difference in House score improvement is statistically significant with combined therapy showing better results than BTX-A alone ($p < 0.05$). The combined therapy group also showed statistically significantly greater improvement in active and passive ROM in supination, wrist extension, and finger extension, while BTX-A alone group showed significant improvements only in supination.

Discussion and Conclusion: Combined therapy gives better clinical and functional outcomes in ULCP patients than BTX-A alone therapy as evident from the statistically greater improvement in House score and postoperative ROM. Augmentation by Botox injections makes surgery a favourable option for ULCP.

FP2.5**Arthroscopic management of STTJ arthritis: a decade's review of local case series****Henry Pang, Michael Chu Kay Mak, Wing Lim Tse, Pak Cheong Ho***Department of Orthopaedics and Traumatology, Prince of Wales Hospital*

Introduction: Isolated STTJ arthritis is not uncommon, and the latest development in treatment of symptomatic STTJ arthritis involves arthroscopy, which includes STTJ arthroscopic debridement and pyrocarbon implant insertion.

Materials and Methods: We describe a case series from 2008 to 2020 in patients with isolated STTJ arthritis who received arthroscopic management from PWH and AHNH. STTJ was confirmed by plain radiography and/or MRI. Preoperative and postoperative X-rays were reviewed for presence of STTJ arthritis, CMCJ arthritis and DISI. Clinical profile including demographic data, pain scores and functional scores were retrieved from electronic records.

Results: A total of 13 STTJ arthroscopy was performed from 2008 to 2020 in 10 patients (mean age 67 years; range, 57-84 years; male: 20%). All of them had predominant STTJ arthritis with relatively spared CMCJ. 60% STTJ arthritis was predominant in the right side, 30% left side, and 10% bilaterally. 7 patients received arthroscopy debridement, and 6 received arthroscopic pyrocarbon implants. 7 patients opted for arthroscopic debridement as their first treatment modality, whereas 3 patients directly opted for pyrocarbon implant. All patients had improvement in pain and functional scores.

Discussion and Conclusion: Of the 7 patients who received debridement as the first operation, 70% had satisfactory pain improvement without further treatment required, whereas remaining 30% required pyrocarbon implantation. There was no complication in all cases of STTJ arthroscopy, implying arthroscopic management is a feasible and safe approach for patients with STTJ arthritis.

FP2.6

Extra thumb Wassel type 6: a morphological and clinical study

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Introduction: Wassel type 6 extra thumb is a rare presentation of radial polydactyly and there is minimal information in the literature. This study attempts to describe the different morphological types and associated joint pathologies.

Materials and Methods: 10 children presented with Wassel type 6 radial polydactyly between 2009 and 2017 were reviewed. Soft tissue status and stability of joints of the duplicated thumbs and the different morphological radiological features were studied in detail. The operative findings and final functional and cosmetic outcome were also reviewed.

Results: 1 has bilateral type 6 and 1 with contralateral dangling extra thumb. 3 patients have family history of polydactyly. All patients received operation at mean age 12 months (range, 9-20 months). 4 radiographic subtypes were identified: L, O, V, y. No surgery was performed on IPJ and upon final follow-up 2 were stiff and straight, 3 were stiff and angulated, and 5 were stable with good ROM. For MCPJ, 6 showed UCL instability on follow-up with 4 of them unrecognised during operation. All CMCJ required repair of radial collateral tissue and all were stable on final follow-up. 3 required flap surgeries for 1st web widening. Ulnar thumbs were retained in all except one (subtype y) which on-top-plasty was performed. Cosmetic outcome was satisfactory in 6.

Discussion and Conclusion: We reported different morphological presentations of type 6 extra thumb and we found high incidence of IPJ stiffness and MCPJ instability which early recognition and surgical intervention may improve outcome.

FP2.7

Arthroscopic bone grafting in scaphoid non-union: what predict failure? An analysis of outcome on 128 wrists over 21 years

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Introduction: Scaphoid non-union can cause substantial functional impairment. Arthroscopic bone grafting (ABG) first originated from Prince of Wales Hospital in 1997 has become the treatment of choice in many centres internationally. Aim of the study is to evaluate prognostic factors for union and management of failure cases.

Materials and Methods: In total, 128 wrists in 123 patients from April 1997 to January 2017 were reviewed retrospectively. Confounding variables such as demographic characteristic, injury mechanism, arthroscopic findings, fixation method as well surgeon's experience were explored to determine their significance.

Results: Majority of patients were male (115:8) of mean age 28.3 years. 53.1% injured the right non-dominant hand. Mean duration of non-union was 41.8 ± 11.5 months (range, 1-480 months). In wrist arthroscopic surveillance under no tourniquet, 73.8% showed osseous bleeding from the proximal scaphoid fracture fragment while 26.2% had no bleeding. The median follow-up duration was 26 months (range, 3-216 months). 114 wrists had bone union (union rate 89.1%) while 14 wrists failed. Eight cases required revision surgery (3 vascularised bone graft, 5 revision ABG) with bone union in all afterwards. Poor bleeding from the proximal scaphoid fragment was the only statistically significant factor affecting bone union rate. Other factors made no difference.

Discussion and Conclusion: This is the largest study in the literature demonstrating ABG can achieve favourable results in scaphoid non-union treatment. The only identifiable factor that contributed to non-healing is the poor bleeding from proximal bone fragment. Revision ABG is a viable option to deal with failure cases, as an alternative to vascularised bone graft.

FP2.8

Assessment of web space morphology with 3D modelling: a new assessment tool for hand reconstruction

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Introduction: Syndactyly is the second most common congenital hand anomalies. Various reconstructive techniques have been introduced to improve patient outcomes. Nonetheless, there is no tool for postoperative assessment of 3D webspace morphology. This is the first study that utilises 3D printing technique for webspace assessment.

Methods: 10 adult volunteer subjects were recruited. For each subject, a Plaster of Paris (POP) mould was fabricated over both hands. Subjects were instructed to maximally abduct the fingers. The position of the fingertips was recorded to control the symmetrical positioning of the fingers. The POP mould was assessed by 3D printing technique (3D scanner: Shining 3D-EinScan Pro-2X; software: Geomagic Sculpt). The symmetry of the 3rd webspace in each subject was assessed by the volume symmetry index (VSI) and the Hausdorff distance (HD). The level of resemblance of the left 3rd webspace between subjects were also analysed.

Results: 5 male and 5 female subjects were recruited. The mean VSI, maximum and mean HD was $96.05\% \pm 1.11\%$, $2.11\text{ mm} \pm 0.53\text{ mm}$ and $0.45\text{ mm} \pm 0.12\text{ mm}$, respectively. Three subjects with comparable hand size, body build, and finger abduction angle were compared. The mean VSI, maximum and mean HD was $93.08\% \pm 0.57\%$, $3.59\text{ mm} \pm 0.95\text{ mm}$ and $0.73\text{ mm} \pm 0.07\text{ mm}$ respectively.

Discussion and Conclusion: Our current study provides a novel assessment tool for webspace assessment in a three-dimensional manner.

FP2.9

Cross-cultural adaptations and psychometric testing of Brief Michigan Hand Questionnaire for Hong Kong

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Introduction: The Brief Michigan Hand Questionnaire (BMHQ) is a self-report questionnaire for measuring functional outcome and quality of life of patients with hand and wrist disorders. The aim of this study is to translate BMHQ into traditional Chinese with cross-cultural adaptations for the Hong Kong population, and to assess the psychometric properties of the translated questionnaire.

Materials and Methods: BMHQ was translated into traditional Chinese (HK-BMHQ) with cross-cultural adaptations by the Beaton Protocol. Eighty patients with hand and wrist disorders were recruited to complete the HK-BMHQ, Chinese QuickDASH, VAS pain scale, SF-12 and Mayo Wrist Score questionnaires for reliability and validity testing. Receiver operating characteristic (ROC) curve was used to generate a cut-off score for HK-BMHQ.

Results: The test-retest reliability of HK-BMHQ was excellent (ICC=0.898). HK-BMHQ shows good correlation with Chinese QuickDASH part I and II ($r=-0.796$, $p<0.001$) and moderate correlation to Chinese QuickDASH part III ($r=-0.748$, $p<0.001$), Mayo Wrist Score ($r=0.590$, $p<0.001$), SF-12 physical component ($r=0.567$, $p<0.001$), SF-12 mental component ($r=0.535$, $p<0.001$) and fair correlation with VAS pain scale ($r=-0.472$, $p<0.001$). ROC curve identified a cut-off score of 61.46 for HK-BMHQ, for differentiating patients with satisfactory and poor hand functions.

Discussion and Conclusion: This is the first reported traditional Chinese version of BMHQ and has been proven to be a reliable instrument for assessing patients with hand and wrist disorders. The cut-off score generated could facilitate the screening and management of patients by hand surgeons worldwide.

FP2.10**STTJ dorsoradial portal: a cadaveric study of its safety and clinical applications**

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Introduction: STTJ arthritis is a common degenerative disease in wrist, and recent advances in its treatment involves arthroscopy. Specific arthroscopic portals are used, including STT-U portal by Whipple in 1991, STT-R portal by Carro in 2003, and the STT-P portal by Bare in 2003. Here, we present an additional STT dorsoradial portal which provides more working space in the dorsal aspect of the STTJ for easier instrumentation.

Materials and Methods: Scouting for the location of the portals was first performed by preliminary dissection on a cadaver. Wrist arthroscopy utilising STT-U, STT-R and the dorsoradial portals were performed on 5 human cadaveric wrist specimens. The STT dorsoradial portal was located at 2 mm radial to the EPL tendon, was created by careful blunt dissection technique, followed by insertion of 1.9 mm arthroscope. Dissection was performed after arthroscopy to document the portals' distance to the surrounding neurovascular structures.

Results: The mean distance between STT dorsoradial portal and radial artery and branch of superficial radial nerve was 3.63 mm and 2.61 mm respectively. The mean distance between STT-U and branch of superficial radial nerve was 2.50 mm. The mean distance between STT-R and radial artery was 6.25 mm. Superficial radial nerve was found to cross EPL at level of STTJ in all cadaveric specimens.

Discussion and Conclusion: The above findings support the feasibility of STT dorsoradial portal for arthroscopy, which can be used for STTJ arthritis management. Gentle soft tissue spreading technique during portal creation prevents injury to the important structure surrounding the portals.

FP2.11**Review of clinical and radiological outcome of self-locking finger joints in proximal interphalangeal joints arthroplasty**

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Introduction: PIPJ arthritis is a common disease entity faced by orthopaedic surgeons. Fusion is the gold standard. However, it may limit hand function in patients with higher demand. Some patients may opt for the silicon implant replacement or pyrocarbon (a surface replacement arthroplasty). The durability is questionable and has high failure rates in the long term. More recent option is SLFJ which has the advantages of being uncemented; bone ingrowth for long-term survival; collateral ligaments preserving. The aim of our study is to evaluate mid- to long-term postoperative outcomes and patient satisfaction of SLFJ.

Materials and Methods: A total of 19 PIPJ SLFJ arthroplasties from 18 patients performed from 2008-2018 were reviewed. The postoperative motion arc, VAS and deformity were compared with preoperative data. Postoperative X-rays were also reviewed for loosening and wear. Patient's satisfaction was evaluated.

Results: Mean follow-up was 58.2 months. Male:female ratio was 5:13, with mean age 53.2 ± 10.1 years. 13 PIPJs were osteoarthritic, 6 were inflammatory. Motion arc improved from 29.5° to 56.8° . VAS improved from 5.3 to 1.7. 75% of the patients would choose the same surgery if they could choose again. 67% of them would recommend this surgery if indicated. Satisfaction averaged 3.2 points on a 5-point Likert scale. Complications included implant fracture (one joint), instability (2 joints), loosening (3), and revision (2) and tenolysis (2).

Conclusion and Discussion: The SLFJ implant is an effective way of treating PIPJ arthritis with comparable results and less complications than other arthroplasties.

FP2.12

Syndactyly release without using skin graft: a long-term follow-up and postoperative assessment with a 3D model

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Introduction: Syndactyly is the second most common congenital hand abnormalities. The aim of this study is to review all syndactyly cases that were treated with a dorsal-2 wings flap without using skin graft. The postoperative shapes of the finger webspace were analysed using a 3D model technique.

Materials and Methods: Syndactyly cases treated with the dorsal-2 wings flap design without skin graft from June 2009 to June 2014 were reviewed with ≥ 5 years' follow-up. Exclusion criteria include: symbrachydactyly, polydactyly, and oligodactyly. The patients were assessed objectively and subjectively. Three cases with unilateral involvement were assessed by a 3D model to assess the level of left and right symmetry.

Results: There were total 7 patients with 9 web spaces operated. The mean age at operation was 19.1 months. The average follow-up time was 95.4 months. None of the cases required skin grafting. There was no flap necrosis, wound infection, hypertrophic scar or revision surgery. All the cases achieved normal hand function. The average abduction angle was 29° . The average parents' satisfaction score was 8.4/10. There was one case of web creeping (Withey grade 2). Three cases of unilateral involvement were assessed with a 3D model, with the volume symmetry index 0.957 ± 0.026 (vs control 0.961 ± 0.011 , $p=0.866$). The mean Hausdorff distance was 0.476 ± 0.385 mm (vs control 0.452 ± 0.124 mm, $p=0.612$).

Conclusion: The dorsal-2 wings flap design is a good option for syndactyly release. It can restore normal finger function, create a web space with good cosmetic appearance, while avoiding donor site morbidity.

Free Paper Session III: Basic Science

FP3.1

Simvastatin inhibits cell viability and enhances osteogenic differentiation of the neoplastic stromal cells in giant cell tumour of bone

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Giant cell tumour of bone (GCTB) is a locally aggressive destructive bone lesion. Local recurrence after the surgical curettage of GCTB remains high. Pathologically, stromal cells in GCTB are known as primary neoplastic cells which carry the histone 3 (H3F3A) driver mutation and are recognised as incompletely differentiated preosteoblasts. Therefore, inducing GCTB stromal cells to differentiate into cells with a mature osteoblastic phenotype may stop tumour growth and recurrence. In this study, we aimed to investigate how simvastatin, a clinically approved and commonly used statin that has been known to promote osteogenic differentiation of osteoblasts, affects GCTB stromal cells. We found that simvastatin effectively inhibited cell viability by suppression of proliferation and by induction of apoptosis in GCTB stromal cells. Moreover, simvastatin increased the expression of genes related to osteogenic maturation, including runt-related transcription factor 2, osteopontin and osteocalcin, and increased the mineralisation of the extracellular matrix. Importantly, vitamin D receptor pathway was involved in the simvastatin-induced osteogenic differentiation of GCTB stromal cells by upregulating the 1,25-dihydroxyvitamin D metabolism. In summary, this study demonstrates the antitumour and differentiation-promoting effects of simvastatin on GCTB stromal cells and suggests the possibility of using simvastatin as an adjuvant therapy for GCTB. These findings support further clinical investigation of the efficacy of using simvastatin as an adjuvant therapy for GCTB to reduce recurrence and distant metastasis after surgical treatment.

FP3.2

Systematic investigation of metallosis associated with magnetically controlled growing rod implantation for early onset scoliosis

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Introduction: Magnetically controlled growing rods (MCGRs) have revolutionised surgery for early onset scoliosis. Complications especially metallosis is concerning as pseudo-capsule formations with black/grey particles are found. This study systematically investigates metallosis to reveal the complete metal particle profile of the tissues surrounding the rod and the phagocytic immune response.

Materials and Methods: This was a prospective observational study of patients treated with MCGRs undergoing rod exchange. Metal-on-metal contact in the form of ring-like wear marks was found on the distracted portion of the piston immediately outside the barrel opening. Biopsies of paraspinal muscles and control tissue samples were taken. Spectrum analyses of the rod and biopsies were performed to reveal the metal components and concentrations. Histological analyses of the biopsies were performed with haematoxylin and eosin staining.

Results: Ten patients were recruited. Titanium (Ti), Vanadium (V) and Neodymium (Nd) concentrations in the biopsies taken near the wear marks were found to be significantly higher than those in the control tissue samples. Significantly increased Nd concentrations were also found in the tissues near the barrel of the MCGR. Chronic inflammation was revealed by the histological studies with fibrosis and macrophages infiltration. Black particles were present within the macrophages in the fibrotic tissues.

Discussion and Conclusion: Ti and V were generated mainly at the barrel opening due to metal-on-metal contact, whereas the Nd from the rotor of the MCGR is likely released from the barrel opening during distractions. Phagocytotic immune cells with black particles raise cautions of the long-term implications of metallosis.

FP3.3

The active component of Ginkgo biloba extract increases the muscle mass and functionality in the postmenopausal animal model

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FP3.4

Epistatic interactions between MBL2 and SOST modulate BMD in AIS and control females

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Background: Adolescent idiopathic scoliosis (AIS) can be regarded as complex genetic disorder resulting from interplay between multiple genes and environment. Low bone mineral density (BMD) is characteristic systemic phenotype in AIS. Despite an increasing number of genes identified to have independent effects on BMD, few studies focused on gene-gene interaction. This study examined the epistatic interaction between selected genes on BMD in AIS and controls.

Methods: Girls with AIS were recruited from Scoliosis Clinic. Patients having a history of congenital deformity, neuromuscular diseases, endocrinal causes of scoliosis, autoimmune disorders and having scoliosis due to abnormal bone metabolism were excluded. Controls were recruited from secondary schools. Areal BMD (aBMD) at bilateral femoral neck was measured with DXA while 3D assessment on bone quality with HR-pQCT was conducted at non-dominant distal radius. Ten SNPs were selected and genotyped by IPLEX Sequenom MassARRAY platform. Epistatic interactions were analysed by generalised multifactor dimensionality reduction (GMDR).

Results: In total, 318 AIS patients and 201 controls were recruited. SPTBN1_rs4233949 and MEPE_rs6532023 not passing the Hardy-Weinberg equilibrium were excluded from subsequent analyses. GMDR analyses revealed significant multiple-locus interactions for different BMD parameters: 3-locus and 6-locus interactions for Z-score of left femoral neck (FN)-aBMD, 3-locus, 4-locus, 5-locus and 6-locus interactions for Z-score of right FN-aBMD, 3-locus interaction for total volumetric BMD (vBMD), and 3-locus and 4-locus interactions for trabecular vBMD. MBL2_rs1373004 and SOST_rs4792909 were the SNPs most consistently associated with various BMD parameters.

Conclusions: Epistatic interactions are detected among MBL2_rs1373004 and SOST_rs4792909 modulating BMD in AIS and controls.

FP3.5**Surface biofunctionalisation with Notch ligands to activate repair Schwann cells in the management of peripheral nerve injury****Victor Hin Ting Yick, Xiaotong Liang, Graham Ka Hon Shea***Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: Peripheral nerve injury occurs in a substantial proportion of patients admitted for trauma. Management of segmental nerve gaps has a poor prognosis, and is limited by premature loss of the repair phenotype in Schwann cells. We aimed to tackle this dilemma through surface biofunctionalisation with Notch ligands, which may be ultimately applied towards nerve guidance channel design.

Materials and Methods: We previously established a method for deriving Schwann cells from human bone marrow towards autologous cell therapy. These were seeded upon immobilised recombinant Jagged-1 orientated via a capturing anti-Fc secondary antibody (treatment group) and control cells were seeded upon culture dishes coated by anti-Fc antibody alone. We compared the immunoexpression of Schwann cell markers (Sox10, p75), activated Notch-1 receptor, and markers of repair phenotype (cJun, Olig1) after 4 days of culture. We also conducted a growth factor assay to determine for upregulation in neurotrophin expression subsequent to treatment.

Results: Both treatment and control groups demonstrated expression of Schwann cell markers. The Jagged-1 treated group had a significantly higher ($p < 0.05$) immunoexpression of repair Schwann cell markers subsequent to Notch pathway activation. The treatment group also upregulated hepatocyte growth factor expression upon adopting the repair phenotype.

Discussion: Notch ligands are key mediators of the repair phenotype. Upon adopting the repair phenotype, neurotrophin upregulation facilitates nerve regeneration. Surface biofunctionalisation with Notch ligands in synthetic nerve guidance channels may enhance regeneration in the treatment of segmental nerve gaps. This will be exciting news for patient suffering from disabling peripheral nerve injuries.

FP3.6**Epididymal adipose tissue macrophages secrete osteopontin to regulate bone homeostasis****Bingyang Dai***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Introduction: Epididymal white adipose tissue (eWAT) secretes an array of cytokines to metabolically regulate a variety of organs and tissues during high-fat diet (HFD)-induced obesity, but its regulation on bone metabolism is far to be clear.

Methods: Twelve-week-old male C57BL/6 mice were fed with HFD or normal-fat diet (NFD) for 0, 4, 8, 12, and 16 weeks, respectively. Mice were euthanised to analyse the alterations in tibial trabecular bone mass and fat tissue contents, as well the histological analysis.

Results: Micro-CT results showed that the greater mass of regulated bone marrow adipose tissue (rBMAT) in the HFD-fed group versus the NFD-fed group peaked at week 12. Micro-CT analysis of the trabecular bone at the proximal tibia showed that bone volume fraction was lower in the HFD-fed group than that of the NFD-fed group, starting at week 8. Linear regression analysis showed that the body weight was negatively correlated with bone volume fraction. We demonstrated that F4/80+ and CD11b+ macrophages in eWAT-secreted osteopontin. Osteopontin in the eWAT might selectively home to the bone marrow through the circulatory system to compensate for reductions in local osteopontin synthesis by bone marrow. eWAT-secreted osteopontin enhanced bone loss by promoting osteoclast-mediated bone matrix degradation. In addition, osteopontin induced lipo-phagocytosis of bone marrow-derived macrophages.

Discussion: We find that eWAT-secreted osteopontin induces lipophagocytic mobilisation of bone marrow-derived macrophages to a lipid-rich pool of rBMAT in the bone marrow, while osteopontin also promotes bone matrix degradation via activating osteoclasts in HFD-fed mice.

FP3.7

Macrophage polarisation landscape is associated with biomechanical properties during Achilles tendon healing

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FP3.8

Assessment of graft remodelling following anterior cruciate ligament reconstruction (ACLR) in a rat model using spectral computed tomography (CT)

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Introduction: Tendon graft remodelling to regain the ACL-like properties after anterior cruciate ligament reconstruction (ACLR) is essential. We developed the use of spectral CT to differentiate muscle, tendon and ligament tissues based on channels of different energy levels (ISLT 2019). In this study, we will use spectral CT to examine the effect of magnesium/vit C irrigation saline on early graft remodelling.

Methods: Twelve male SD rats were randomly assigned to receive four different irrigation saline (normal, vitamin C (VC), low-dose Mg/VC, high-dose Mg/VC) during ACLR according to established protocol and were euthanised at week 2. Knee samples were harvested for scanning in a spectral CT machine (MARS, New Zealand), along with intact flexor tendon grafts and intact ACLs from non-operated limbs. CT images from 7.0, 18.1, 30.1, 44.9 and 75.0 keV channels were reconstructed, and the soft tissue signal ratios (STSR) relative to 75.0 keV were measured at standardised volume of interest referring to graft mid-substances.

Results: STSR were lower in fresh tendon graft as compared to intact ACL, and the ratio was decreased at 2 weeks after surgery. Low-dose Mg/VC group led to an increased STSR as compared to saline group.

Discussion: STSR may indicate fibrous tissue density, which is higher in ligament as compared to tendon. The postoperative decrease in signal ratio coincided with the early graft deterioration during inflammatory phase, while low-dose Mg/VC saline may reduce the deterioration. These findings suggest that spectral CT may be useful to monitor graft remodelling.

FP3.9**Designed and translation of osteogenic Mg-based biodegradable implants for skeletal fixation and regeneration****Ling Qin***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Magnesium (Mg) attracts numerous attentions to become biodegradable medical implants for orthopaedic applications. Mg and its alloys are suitable for degradable bone implants with sufficient initial stability while avoiding a second operation to remove after the tissue has healed. This lowers overall associated healthcare costs. Regarding safety, Mg dissolution is unlikely to have adverse effects since Mg is the fourth most plentiful cation in the human body. My group collaborates with biomaterial scientists for developing Mg and its alloys as biodegradable orthopaedic implants, including fixation implants, scaffolds or injectable materials. We are investigating their bone regeneration potentials using different experimental models. Human pilot or Phase I studies are conducted to investigate its biosafety and efficacy for orthopaedic indications. My presentation generated from this R&D programme on Mg, its alloys, and scaffolds is based on a translational R&D roadmap, i.e., from observations to mechanisms, then to proof-of-concept before clinical tests, followed by clinical trials. Testing standards and guidelines are also essential for this translational roadmap. We have been working on necessary modifications for current ISO standard for testing cytotoxicity relevant for biodegradable implants.

Funding: Hong Kong RGC Collaborative Research Fund (Ref C4026-17WF), General Research Fund (Ref 14121918 and 14173917), and RGC Theme-based Research Scheme (Ref T13-402/17-N).

FP3.10**Biodegradable magnesium pins enhanced the healing of transverse patellar fracture in rabbits****Dick Ho Kiu Chow,¹ Jiali Wang,¹ Peng Wan,² Lizhen Zheng,¹ Michael Tim Yun Ong,¹ Le Huang,¹ Wenxue Tong,¹ Lili Tan,² Ke Yang²***¹Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong**²Institute of Metal Research, Chinese Academy of Sciences*

Introduction: Displaced fractures of patella often require open reduction surgery and internal fixation to restore the extensor continuity and articular congruity. Fracture fixation with biodegradable magnesium (Mg) pins enhanced fracture healing. We hypothesised that fixation with Mg pins and their degradation would enhance healing of patellar fracture radiologically, mechanically, and histologically.

Materials and Methods: Transverse patellar fracture surgery was performed on 32 18-week-old female New Zealand White Rabbits. Fracture was fixed with a pin made of stainless steel or pure Mg, and a stainless-steel figure-of-eight band wire. Samples were harvested at week 8 or 12, and assessed with micro-CT, tensile testing, microindentation, and histology.

Results: Microarchitectural analysis showed that, compared to the control group, Mg group showed 12% higher in the ratio of bone volume to tissue volume at week 8, and 38.4% higher of bone volume at week 12. Tensile testing showed that the failure load and stiffness of Mg group was 66.9% and 104% higher than the control group at week 8, respectively. At week 12, Mg group was 60.8% higher in ultimate strength than the control group. Microindentation showed that, compared with the control group, Mg group showed 49.9% higher Vickers hardness and 31% higher elastic modulus at week 8 and 12, respectively. At week 12, the new bone of Mg group remodelled to laminar bone but those of the control group remained woven bone-like.

Discussion and Conclusion: Fixation of transverse patellar fracture with Mg pins and its degradation enhanced healing of patellar fracture.

FP3.11

AlignPro: a robust deep learning-based prediction of spinal alignments irrespective of image qualities acquired from smartphone photographs of radiographs displayed on PACS

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Introduction: Original X-rays are not easily accessible for telemedicine and existing deep learning-based automated Cobb angle (CA) predictions are not accurate on suboptimal quality X-rays.

Objective: To develop an automated CA prediction system irrespective of image quality: AlignPro, with no restrictions on curve patterns to facilitate clinical practice and telemedicine.

Methods: In total, 367 consecutive patients attending a scoliosis clinic were recruited prospectively and their coronal X-rays were re-captured using mobile phones. Five-fold cross-validation was conducted (5 experiments, each with 294 images to train a deep neural network named HRNet for endplates landmarks and end-vertebrae detection, and the remaining 73 images were used to test). The predicted heatmaps of the vertebral landmarks were visualised to enhance interpretability. Per-landmark-absolute-errors and recall of the landmark detection results were calculated to assess the accuracy of the predicted landmarks. Further calculated CAs were quantitatively compared with the spine specialists measured ground truth (GT).

Results: The average per-landmark absolute distance error and the recall of the detected endplates landmarks were 2.8 pixels and 0.99, indicating a highly accurate detection. The predicted CAs were all significantly correlated with GT ($p < 0.01$). Compared with GT, the mean error was 3.73-4.15° and standard error of the measurement was 0.8-1.7° for the predicted CAs at different spinal regions.

Conclusion: This is the first study using HRNet on non-original X-rays to automatically and accurately predict vertebral landmarks of the scoliotic spine. HRNet's applicability is evidenced by our thorough cross-validation, which can be used with telemedicine to facilitate fast reliable auto-diagnosis and follow-up.

FP3.12

Pulsed electromagnetic field augments the effect of hydrogel-based tissue engineering for cartilage repair

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FP3.13

A novel high slew rate pulsed electromagnetic field promotes distraction osteogenesis via enhancing osteogenesis and angiogenesis in a rat model

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FP3.14**Col2a mediated Wnt16 deficiency promote callus formation during femur bone fracture healing****Wenxue Tong, Jiankun Xu, Dick Ho Kiu Chow, Ling Qin***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Bone fractures are the most common large-organ, traumatic injuries to humans, especially for senior citizens with low bone quality. The callus formation is an important process for fracture healing, and it involves the haematoma phase and endochondral ossification stage. We have established the type 2 collagen (Col2a) promoter mediated Wnt16 knockout mouse strain (Wnt16-cKO), and proved that Wnt16 inhibit chondrocyte hypertrophy and the Wnt16-cKO mice developed more severe osteoarthritis after ACLT surgery compared with the wild type mice. Since the chondrocyte hypertrophy is also a typical process during endochondral ossification, we aim to investigate if the Wnt16 deficiency affects the callus formation during fracture healing. We found that the Wnt16-cKO mice developed much bigger callus compared with the wild type mice, and the callus of Wnt16-cKO mice had better mechanical property and trabecular parameters at the early phase of fracture healing. Local injection of adenovirus delivered Wnt16-shRNA to the wild type mice also showed similar outcomes as the Wnt16-cKO mice. In contrast, the overexpression of Wnt16 delivered by adenovirus (Ad-Wnt16) in wild type mice showed decreased callus volume compared with the vector injection control group. Taken together, these results indicate that Wnt16 dramatically suppress callus formation while Wnt16 deficiency promotes this process during fracture healing. This study disclosed a potential therapeutic target to accelerate fracture healing by reducing the Wnt16 expression, especially on the early stage post-fracture.

FP3.15**Identification of diagnostic biomarker candidates for AIS with proteomic analysis****Wayne Yuk Wai Lee, Yujia Wang, Jiajun Zhang, Tsz Ping Lam, Alec Lik Hang Hung, Jack Chun Yiu Cheng***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Introduction: Abnormal paraspinal muscle has been reported in AIS. Recently, a study on 5299 children firstly reported that increase in lean mass resulted in reduction of scoliosis risk by 20%, suggesting the likelihood of systemic problem of skeletal muscle in AIS. Muscle acts as an endocrine organ through myokines secretion. This study aimed to identify dysregulated muscle-related metabolic pathways contributing to AIS progression through analysis of proteomic profiles.

Materials and Methods: Paraspinal muscle biopsies were taken intraoperatively from concave and convex side of the apex of the major curve in AIS, age- and curve severity-matched congenital scoliosis (CS) patients and non-scoliosis subjects undergoing surgery. Myogenic genes and myokines expression were examined. Plasma was collected from healthy subjects, non-progressive and progressive AIS for myokines assay and proteomics analysis.

Results: Key myogenic genes and myokines expression were significantly different between AIS concave vs convex paraspinal muscles which was not seen in CS. Compared with the control, circulating myokines such as FABP3 and osteocrin were significantly lower in AIS. Proteomics analysis of plasma samples revealed the highest level of muscle structural proteins in progressive AIS compared with the control and non-progressive group.

Discussion and Conclusion: This study firstly demonstrates asymmetric myogenic genes expression in AIS paraspinal muscles and impaired myokines secretion in AIS. Importantly, higher level of muscle structural proteins in AIS plasma indicated the likelihood of muscle structural injury/damage in AIS at microscopic level. Collectively, current findings suggest a new pathological role of skeletal muscle in AIS.

FP3.16

Deletion of SIRT3 inhibits osteoclastogenesis and alleviates bone loss in ageing and ovariectomised mice

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Background: SIRT3 is a NAD[±] dependent deacetylase and plays important roles in mitochondrial function and energy homeostasis. Given that osteoclasts consist of large amounts of mitochondria owing to high energy demand for bone-resorption activity. We hypothesised that SIRT3 regulates osteoclast function, thus affecting bone homeostasis upon physiological ageing process and ovariectomy induced bone loss.

Materials and Methods: First, SIRT3 expression was investigated during osteoclasts differentiation in vitro, and in fresh bone marrow cells collected from aged and ovariectomised mice. Next, we knockdown SIRT3 expression in RAW264.7 cell line to determine its effect on osteoclasts differentiation. Moreover, both male and female mice with global deletion (KO) of SIRT3 gene were used for the characterisation of bone phenotypes. Finally, the impact of SIRT3 deficiency on OVX-induced bone loss was investigated.

Results: The SIRT3 level was found to be positively correlated with the cathepsin K (CTSK) level in mouse primary bone marrow-derived macrophages (BMMs) derived from aged mice and ovariectomised mice. SIRT3 level was markedly increased during the differentiation of BMMs to mature osteoclasts, while inhibition of SIRT3 significantly inhibited osteoclastogenesis and bone resorption. Female KO mice showed more bone mass, which could be attributed to lower osteoclasts activity. Furthermore, deletion of SIRT3 reduced the magnitude of bone loss in ovariectomised mice through inhibition of osteoclastogenesis.

Discussion and Conclusion: SIRT3 has important roles in the bone homeostasis and oestrogen deficiency-induced bone loss via regulation of osteoclast activity, suggesting that SIRT3 and its downstream effectors might be novel therapeutic targets for osteoporosis.

FP3.17

Oral magnesium supplementation attenuates age-related muscular changes in sarcopenia

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Introduction: Sarcopenia is an age-related geriatric syndrome which is associated with subsequent disability and morbidity. Magnesium (Mg) is associated with better indices of skeletal muscle mass, strength, and power in elder adults. The study aims to investigate the effects of oral Mg supplementation on sarcopenic skeletal muscles and explore the related mechanisms in vivo.

Materials and Methods: Senescence-accelerated mouse P8 (SAMP8) mice at month 6 were randomised into control (Con) and Mg groups. Mg was administered to animals through oral gavage of 0.2 mL MgCl₂ solution at the dosage of 98 mg/mL/day, 5 days per week. Ex vivo functional assessment, myofibers staining and DXA were performed at month 8,9,10. Data analysis was done with t test, and the significance level was set at p<0.05.

Results: At month 10, lean mass and percentage lean mass of Mg group were significantly higher than control group. Mg showed significantly higher type IIa and type IIb muscle fibres and lower type I fibre than the control group. Mg group showed significantly higher muscle strength and contractibility at month 9 and month 10.

Discussion and Conclusion: In this study, the results showed that Mg could increase muscle strength and muscle function in vivo, which indicates that Mg could attenuate sarcopenia changes in skeletal muscle.

FP3.18**The role of dentin matrix protein 1 (DMP1) in LMHFV accelerated osteoporotic fracture healing**

Michelle Meng Chen Li, Zhengyuan Bao, Simon Kwoon Ho Chow, Ronald Man Yeung Wong, Wing Hoi Cheung
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Introduction: Osteoporotic fracture has become a major problem in ageing population and often requires prolonged healing time. Low-magnitude high-frequency vibration (LMHFV) can significantly enhance osteoporotic fracture healing through alteration of osteocyte lacuno-canalicular network (LCN). DMP1 in osteocytes is responsible for maintaining LCN and mineralisation. This study aims to investigate osteocyte-specific DMP1's role in enhanced osteoporotic fracture healing in response to mechanical loading.

Materials and Methods: Bilateral ovariectomy was done on 6-month-old female Sprague-Dawley rats to induce osteoporosis. Metaphyseal fracture was created at left distal femur using oscillating micro-saw. Rats were randomised to groups: (1) DMP1 KD, (2) DMP1 KD + vibration, (3) Scramble + vibration, or (4) vehicle control + vibration, where KD stands for knockdown done by injection of shRNA into marrow cavity 2 weeks before surgery. Assessments included weekly X-ray, micro-CT, dynamic histomorphometry and immunohistochemistry on DMP1, sclerostin and E11.

Results: DMP1 KD significantly impaired vibration-enhanced fracture healing at week 6 as shown by comparing KD + vibration group to vehicle control + vibration group in dynamic histomorphometry ($p=0.034$) and X-ray relative opacity ($p=0.011$). DMP1 KD also significantly altered the expression of osteocyte-specific DMP1, E11 and sclerostin during healing process.

Discussion and Conclusion: The lower mineralisation rate and relative opacity in DMP1 knockdown groups indicated that knockdown of DMP1 was associated with poorer fracture healing process compared to control group. The similar results between knockdown group with and without vibration showed that blockage of DMP1 would negate LMHFV-induced enhancement on fracture healing.

Funding: General Research Fund (Ref 14113018).

FP3.19

Ageing-related neuromuscular junction degeneration in sarcopenia is attenuated by cyclic mechanical loading

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Introduction: Neuromuscular junction (NMJ) degeneration has been proven one of the critical pathophysiological factors for sarcopenia. Our previous studies confirmed that low-magnitude high-frequency vibration (LMHFV) treatment could enhance muscle performance in the elderly and improve skeletal muscle function in sarcopenic SAMP8 mice. However, the detailed mechanisms are still not clear. This study aims to investigate the effects of LMHFV on NMJ degeneration in sarcopenia and the related mechanism of Agrin-Lrp4-MuSK-Dok7-Rapsyn pathway.

Materials and Methods: Male SAMP8 mice aged 6 months were randomised into control and vibration (VIB) groups. The mice in VIB group were treated with LMHFV (35 Hz, 0.3 g) 20 minutes/day and 5 days/week. NMJ ex vivo function and acetylcholine receptors (AChRs) structure were evaluated at 0, 2, 3, 4, and 6 months post-treatment. Expression of Agrin-Lrp4-MuSK-Dok7-Rapsyn was assessed by qPCR and western blot.

Results: VIB treatment increased AChRs area early at 2 months post-treatment ($p < 0.01$). The discreteness and fragmentation appearance of endplate were significantly improved in VIB group compared with the control group at 4 months ($p < 0.05$). Alleviated degeneration of endplate morphology contributed to the attenuation of sarcopenia phenotype at 4 months ($p < 0.01$). In NMJ ex vivo function test, NMJ function was significantly improved at 6 months ($p < 0.05$). mRNA and protein expression of Dok7 were significantly increased at 4 months ($p < 0.05$).

Discussion and Conclusion: LMHFV treatment had a positive effect on NMJ in terms of both function and morphology in SAMP8 mice and these improvements may contribute to the alleviation of sarcopenia during ageing, whereas Dok7 may play an important role.

Free Paper Session IV: Foot and Ankle

FP4.1

Arthroscopic repair of the anterior talofibular ligament for chronic lateral ankle instability

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Introduction: This is a retrospective study to evaluate the clinical outcome of arthroscopic repair of the anterior talofibular ligament for chronic lateral ankle instability. We reviewed 20 patients treated with arthroscopic repair using JuggerKnot suture anchors from August 2018 to January 2020. The average follow-up time was 10.6 months.

Materials and Methods: There were 10 female and 10 male patients. The mean age was 42.5 years (range, 22-62 years). All patients had ankle arthroscopy with medial midline and accessory anterolateral portals. The talofibular ligament was repaired with Lasso loop technique using two JuggerKnot suture anchors. Short leg complete cast was given for 3 weeks after surgery. Patients were advised to do full-weight-bearing walking with cast for 3 weeks, after which the cast was changed to a short leg walker for another 3 weeks and range of movement exercise was allowed. All patients were evaluated with the visual analogue scale (VAS) and the American Orthopedic Foot and Ankle Society (AOFAS) hindfoot score.

Results: The mean AOFAS hindfoot score was 58.6 before and 86.5 after surgery. The mean VAS was 6.9 before and 2.9 after surgery. Five patients had concomitant lesions including osteochondral lesions of talus, syndesmosis injury, peroneus brevis tendon subluxation and loose bodies; with concurrent treatment done at the same surgery. Three patients required mini-open incisions due to intraoperative technical difficulty. There was no complication.

Discussion and Conclusion: Arthroscopic repair of the talofibular ligament is a reliable option to traditional open Brostrom-Gould procedure for treatment of chronic lateral ankle instability.

FP4.2

Early surgery in displaced intra-articular calcaneal fracture using sinus tarsi approach

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Introduction: Displaced intra-articular fractures (DIACF) are traditionally treated by open reduction internal fixation (ORIF) using the lateral extensile approach, and require waiting for swelling to subside before operation in terms of weeks. However, this approach is associated with a high rate of wound complications such as necrosis, sural nerve injury, and prolong preoperative stay. Minimally invasive and limited open approaches have become popular to address these problems. We report on the outcome of ORIF of DIACF using the sinus tarsi approach in our centre.

Materials and Methods: Patients who received ORIF of the calcaneum using the sinus tarsi approach are included in this study. Preoperative and postoperative wound condition, radiological status, and functional status were evaluated.

Results: 12 patients were included. All patients have swelling or blister on injury. Fixation was performed at 9.09 days after injury on average. The mean time for OT was 107 minutes. The mean acute LOS was 10.8 days. There were no early wound complications. The mean time to FWB was 109.7 days. One patient developed late wound infection and required removal of implant. The average Bohler's angle improved from 11.7° before to 26.5° after surgery ($p=0.0005$). There was no difference in the average angle of Gissane (113.4° before surgery, 112.6° after surgery; $p=0.875$). The mean postoperative AOFAS was 78.6.

Discussion and Conclusion: The sinus tarsi approach allows adequate reduction with a low rate of early wound complications, and avoids delay of OT. Patients are able to achieve good functional outcome.

FP4.3

Percutaneous repair of Achilles tendon—a review of our experience using the ‘8-hole technique’

Keith Hay Man Wan,¹ Ryan Lok-Tin Moy,¹ Ho Ming Li,¹ Christine Yuen San Lai,¹ Kam Lung Tung,¹ Richard Hin Lun Lee,¹ Michael Siu Hei Tse,¹ Irene Oi Lam Lo,² Chi Pan Yuen,² Kam Kwong Wong¹

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²*Private Practice*

Introduction: To review the early results of percutaneous repair of Achilles tendon in our institution.

Materials and Methods: A retrospective analysis of patients with complete rupture of Achilles tendon managed surgically with the percutaneous method from January 2016 to December 2019. The inclusion criteria were 1) a closed complete Achilles tendon rupture; 2) an acute injury occurred less than 7 days before the surgery; 3) a rupture over the tendinous part of the tendon with a least 3 cm distal stump; 4) no previous surgical procedures or history of rupture of Achilles tendon; 5) patients who provided informed consent. Preoperative ultrasonography was performed in the theatre to identify the rupture site and to document the size of the distal stump. Sites for eight stab incisions were marked. A non-absorbable, braided suture was passed through the substance of the tendon with the assistance of a Beath pin, achieving a cross configuration of sutures at both the proximal and distal stumps. Intraoperative ultrasonography was used to ensure intra-substance passage of the sutures.

Results: In total, 22 patients with mean age of 41.2 years (range, 21 to 78 years) were included. The mean follow-up time was 35.4 months (range, 6 to 55 months). There was no re-rupture. No patient developed sural neuritis. There were no cases of infection or skin necrosis.

Discussion and Conclusion: The proposed method of percutaneous repair of Achilles tendon offers a reasonable treatment option for acute Achilles tendon rupture, with low risk of complication.

FP4.4

How to perform minimally invasive tibial cortex transverse transport surgery for diabetic foot ulcer management

Gang Li, Samuel Ka-Kin Ling

Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong

Introduction: Diabetic foot ulcer is a severe complication of diabetes mellitus, which is associated with high mortality and high cost. The tibial cortex transverse transport (TTT) surgery has been reported for the treatment of severe diabetic foot ulcers with satisfactory clinical outcomes. TTT surgery can effectively regenerate the microvascular network in the lower limbs of these patients to promote ulcer healing and increase the chance of limb salvage.

Materials and Methods: In this report, the authors provide a technical guide to perform minimally invasive TTT surgery through the use of a specially designed external fixation frame and tibial corticotomy guide plate.

Results: This minimally invasive technique utilises smaller skin incisions and preserves the local blood supply. Our minimally invasive TTT surgery technique is simple, significantly increased the efficacy and reduced the complications of TTT surgery.

Discussion and Conclusion: In this detailed report the authors proved a step-by-step guide on how to perform minimally invasive transverse tibial transport surgery. The use of specially designed external fixator and corticotomy guide plate is the key for a reproducible and successful TTT surgery.

FP4.5**Comparison of foot and ankle injuries between pre-professional ballet, contemporary, and Chinese dancers**

Samuel Ka-Kin Ling, Jojo Hoi-Ching Lai, Stacey Tsz-Wai Yeung, Ronald Wing-Hei Siu, Naomi Pui-Yan Fung, Nigel Keith Pak, Gene Chi-Wai Man, Patrick Shu-Hang Yung

Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong

Introduction: The risk of foot and ankle injuries has been noted the most common incidence in dancers. However, the variability of such epidemiology across dance genres has not been clearly evaluated. Herein, this study aims to evaluate the prevalence and incidence of foot and ankle injuries among pre-professional ballet, contemporary and Chinese dancers.

Materials and Methods: Participants were recruited from the Hong Kong Academy of Performing Arts. Demographic characteristics and specifics of dance-related foot and ankle pain in one academic year from September 2018 to June 2019 were collected through an online self-reporting survey. Descriptive statistical analysis, including injury incidence and risk rates, were conducted.

Results: The overall response rate was 69%, with a total of 56 subjects eligible for analysis. The incidence of foot and ankle pain during the academic year of 2018-19 was highest in contemporary dancers (0.41 per 1000 dance hours) when compared to that of ballet (0.36) and Chinese dancers (0.24). Likewise, ballet dancers were 6-times more likely to suffer from pain in the Achilles region than those in Chinese and contemporary dancers ($p < 0.01$). When comparing with contemporary dancers, ballet and Chinese dancers had more severe pain over the forefoot/midfoot and hindfoot/ankle region, respectively ($p < 0.05$).

Discussion and Conclusion: Our results indicated that there is a high incidence of foot and ankle injury among pre-professional dancers, particularly in contemporary dancers. Our data also showed significant differences between dance genres and anatomical subregions. Importantly, this study can further suggest the need for better genre-specific injury prevention programmes.

FP4.6**Comparison of sinus tarsi approach versus extensile lateral approach and conservative treatment for displaced intra-articular calcaneal fractures**

Alex Ching-Lik Hui

Department of Orthopaedics and Traumatology, United Christian Hospital

Introduction: Displaced intra-articular calcaneal fracture (DIACF) has been traditionally treated by open reduction internal fixation using extensile lateral approach, however, it was commonly associated with complications like wound infection, skin necrosis, and implants impingement. With the use of sinus tarsi approach, we can achieve direct reduction of fracture, stable fixation and less wound complications.

Materials and Methods: A retrospective review of all calcaneal fractures admitted from Nov 2017 till May 2020 was performed. From 77 patients with calcaneal fractures identified, 35 patients were excluded, and the remaining 32 cases of DIACF (11 conservative, 13 sinus tarsi approach, 8 extensile lateral approach) were reviewed. Data including length of stay, return to work, operative time, intraoperative blood loss, Bohler's angle, intra-articular displacement, implants failure, and complications were compared.

Results: Sinus tarsi approach showed lower complication rates compared to extensile lateral approach. Also, there was relatively shorter operative time, less intraoperative blood loss, and shorter length of stay.

Discussion and Conclusion: Sinus tarsi approach is a good alternative to extensile lateral approach for treating DIACF.

FP4.7

Can shoes really “boost” your performance and “zoom” your run?

Samuel Ka-Kin Ling, Ching Hei Lam, Sze Wing Lee, Lok-Yi Tsui, Chi Yan Wong, Pak Laan Wong, Patrick Shu-Hang Yung

Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong

Introduction: A market of “performance-enhancing” running shoes has emerged in recent years. Many of these claims are not fully supported by scientific data. The objective of this study was to compare the performance of one such high-priced performance shoes with the low-priced plimsolls (白飯魚).

Methods: This is a prospective, controlled, crossover, non-inferiority study with 29 participants aged 19 to 27 years. The subjects underwent a 1500-m running trial wearing either performance shoes (Adidas Ultraboost) or ordinary plimsolls (Double Coin) at an outdoor running tracks in January and February 2020. The outcome measures were the running time and a post-intervention participant experience survey.

Results: The mean completion time of 1500 m with plimsolls and performance shoes are 503.27 seconds and 480.69 seconds respectively with a p value of 0.008. On a scale of 1 to 5, participants rate the comfort of plimsolls at 2.0/5 and performance shoes at 3.9/5 respectively.

Discussion and Conclusion: Our results show that performance shoes improve the running speed of participants when compared to ordinary plimsolls.

FP4.8

Prognosis of elite basketball players after an Achilles tendon rupture

Samuel Ka-Kin Ling, Ronald Wing-Hei Siu, Naomi Fung, Nigel Pak, Patrick Shu-Hang Yung

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Introduction: Professional Basketball players are at high risk of Achilles tendon rupture. Our aim is to quantify the effect of a player’s Achilles tendon rupture on their post-injury performance, and also to explore for correlations between their recovery timeline and pre-injury characteristics.

Materials and Methods: Professional basketball players who sustained a unilateral Achilles tendon rupture from 1992 to 2016 were collected. In total, 12 players met our inclusion criteria and their Player Efficiency Ratings (PERs) were obtained as primary outcome measures; matched controls were chosen based on the PER, age and playing position. The player’s index season PER was compared with the PER during the 10 games immediately following the player’s return, and the PER of their post-injury peak performing season. The same data analysis was performed against their control group.

Results: Two of 12 players failed to return to play following an Achilles tendon rupture, others returned after a mean recovery time of 10 months. The mean PER reduction during return was 7.15 ($p < 0.000$). Players on average took 1.8 seasons to reach their post-injury peak performance, with only one player returning to his pre-injury performance. Others suffered a mean PER reduction of 3.5 ($p = 0.004$) and 5.4 ($p = 0.045$) against their matched controls.

Discussion and Conclusion: Achilles tendon rupture can be a career-ending injury for professional basketball players. They are expected to miss 10 months for rehabilitation and reach their post-injury peak performance level at the 2nd season back.

FP4.9

Radiological and functional outcomes of Ludloff osteotomy for hallux valgus reconstruction**Leo Tsz-Ching Chau,¹ Fiona Hoi Yan Lam²**¹*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*²*Department of Orthopaedics and Traumatology, Alice Ho Miu Ling Nethersole Hospital*

Introduction: Ludloff osteotomy for moderate to severe hallux valgus reconstructive surgery has been gaining popularity since its proposal in 1918. Intermediate results from overseas studies showed improvement in radiological and functional outcomes. However, both local and long-term data are lacking.

Materials and Methods: Patients with preoperative HVA ≥ 40 , who received Ludloff osteotomy for hallux valgus reconstruction from 2010 to 2019 were retrospectively retrieved. Mean follow-up was 51.4 months (6-118 months). Hallux valgus angle (HVA), intermetatarsal angle (IMA), distal metatarsal articular angle (DMAA) and sesamoid position was measured on standing X-ray at 6-month, 1 year, 2 year, annually afterwards for statistical analysis. Function outcome was measured before and after surgery with AOFAS metatarsophalangeal-interphalangeal score for hallux.

Results: Data from 33 patients with 35 feet were retrieved. All radiological parameters including HVA, IMA, DMAA and sesamoid position showed statistically significant improvement after surgery. Mean HVA improved from 45.81 ± 5.05 to 18.40 ± 8.22 . Mean IMA improved from 17.88 ± 3.39 to 11.36 ± 4.95 . Mean HVA correction was 27.77 ± 8.76 . Mean AOFAS score also showed statistically significant improvement from 61.40 ± 11.61 before to 86.28 ± 9.71 after surgery. All osteotomy sites were healed by 1 year. One case of delayed union and two cases of hallux varus were observed.

Discussion and Conclusion: Ludloff osteotomy is an effective method for hallux valgus correction, with satisfactory outcome and low complication rate.

FP4.10

The deformity of the tarsometatarsal joint and the first metatarsal in the coronal plane in hallux valgus**Rachel Xiaoyu Wei, Samuel Ka-Kin Ling, Chun Sing Chui, Sai Chuen Fu, Vivian Wing-Yin Hung, Patrick Shu-Hang Yung***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Hallux valgus (HV) is one of the most common diseases of the forefoot. Recently, the deformities in the coronal plane have attracted attention especially with the recent claims of torsional changes within the 1st metatarsal (MT) instead of the sole rotation at the tarsometatarsal joint (TMTJ). However, utilising X-ray to measure coronal deformity has limited accuracy. We hope to establish a reliable method using CT and 3D analysis software to differentiate how much of the overall pronation is related to TMTJ rotation and bony torsion, respectively. The scans were performed using Xtreme CT II and the data were imported into Mimics and 3-Matic for further analysis. The landmarks were determined on the medium cuneiform and 1st MT. Lines were connected accordingly and angles between them presented the rotation at TMTJ and torsion within 1st MT, respectively. Eight patients and six normal subjects were recruited. The TMTJ rotation in HV and normal were $15.36 \pm 3.94^\circ$ and $7.07 \pm 1.74^\circ$, respectively ($p=0.002$). No significant difference was found in the 1st MT torsion between the two groups. It seems that the joint rotation at TMTJ could contribute more to the coronal deformity in HV. Thus, the Lapidus TMT joint arthrodesis or soft tissue reconstruction may be a better option than 1st MT osteotomies. However, a larger subject pool is required to provide more powerful results to our conclusion, which may help us know the actual localisation of the coronal deformity and eventually improve the guidelines for HV treatment.

FP4.11

Review on surgical outcomes on foot polysyndactyly

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Introduction: Foot Polysyndactyly is a congenital anomaly with variable frequency among populations. It may be an isolated condition or part of a syndrome. The condition usually presents with parents of a young child seeking treatment, either for cosmesis, footwear problem or rarely, pain. The aim of our review is to look for possible complications from surgery and their risk factors. This could lead to better counselling to parents when they contemplate surgery.

Methods: Operated cases of foot polysyndactyly/ syndactyly between 2003-2019 were reviewed. Surgical outcomes and complications were reviewed, including infection, hypertrophic scar, keloid, web creep, physeal disturbance, nail deformity. Potential factors that affect surgical outcomes were assessed: which web was reconstructed, month of the year of operation, age, flap design and need for skin graft.

Results: A total of 27 patients (33 feet) were operated on, including 26 polysyndactyly and seven syndactyly cases. The mean age at operation was 26 months. Major complications included infection (11.1%), hypertrophic scar (30%), and keloid (6%). Infection rate was not correlated to the age, month of surgery, or which web. Hypertrophic scar was found to be correlated to skin grafting and bilateral surgeries. Two patients with keloid were refractory to a lot of treatments and required subsequent procedures.

Conclusion: Operations for polysyndactyly/syndactyly are not without complications. Major complications include infection, hypertrophic scar and keloid. Subsequent treatments could be labour-intensive to carers and healthcare workers, as well as stressful to the child. Therefore, parents should be well-informed of these complications prior to operation.

Free Paper Session V: Spine I

FP5.1

What imaging profile exists for subjects with lumbar developmental spinal stenosis?

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FP5.2

Pedigree analysis of lumbar developmental spinal stenosis: determination of potential inheritance patterns

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FP5.3

Population-based prevalence of multilevel lumbar developmental spinal stenosis

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FP5.4

Clinical implications of lumbar developmental spinal stenosis on back pain, leg pain, and disability—results from a cohort of 2206 subjects

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FP5.5

EOS-3D assessment of axial rotation of upper end vertebra, apical vertebra and lower end vertebra in thoracic adolescent idiopathic scoliosis with different curve severity

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FP5.6

Implant failure in spinal metastasis surgery: incidence and risk factors

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Introduction: The spinal column is the most common site for skeletal metastasis. Surgical stabilisation with instrumentation is an established method for the treatment of spinal metastasis. The aim of this study is to investigate the incidence of symptomatic and asymptomatic implant failure in spinal metastasis surgery and identify potential risk factors.

Methods: This retrospective cohort study includes 88 patients who received surgical stabilisation with instrumentation for the treatment of spinal metastasis from 2007-2017 at a single institution. Their medical records and postoperative X-rays were reviewed for evidence of implant failure. Statistical analyses with logistic regression of nine potential risk factors for the development of implant failures was performed to identify potential contributing risk factor.

Results: Implant failure was identified in nine of 88 cases (10.2%) with two cases required implant removal: one case for a non-healing sore secondary to progressive kyphosis and the other case for a deep-seated wound infection involving the implants. One case required wound debridement due to superficial wound infection. The remaining 6 cases were asymptomatic. No case required implant revision. Logistic regression analyses showed patients who received radiotherapy either before or after surgery were less likely to develop implant failure.

Conclusion: Radiological implant failure after instrumented surgery for the treatment of spinal metastasis is common. However, symptomatic implant failure leading to revision surgery is uncommon. Our result suggests radiotherapy either before or after spinal surgery is not associated with development of implant failure.

FP5.7**Where does vertebral growth occur during distraction by magnetically controlled growing rods in patients with early onset scoliosis?****Andy Hon Fai Yee,¹ Kenneth Man Chi Cheung,² Xiong Shen Jian,² Kenny Yat Hong Kwan²**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: Previous studies have indicated that distraction by magnetically controlled growing rods (MCGRs) can stimulate spinal growth; yet the effect on individual vertebral bodies is unknown. The aim of this study was to investigate the effect of MCGR on three-dimensional (3D) vertebral body growth of the segments around the DIV in EOS patients.

Materials and Methods: EOS patients who underwent MCGR distractions for a minimum of 6 months were included. Target distraction of 2 mm per month was performed. Height, coronal width, and sagittal depth of individual vertebral bodies, and height of intervertebral spaces (IVS) were measured at two segments proximal to the DIV (DIV-), DIV, and two segments distal to the DIV (DIV+).

Results: In total, 21 EOS patients with a mean age at index surgery of 10 ± 3.2 years were included. Average duration of MAGEC treatment was 3.7 years. Both the total and annual percentage growth of vertebral height was higher in DIV- group than those observed in DIV and DIV+ group. On the other hand, the reduction in IVS in the DIV group demonstrated the greatest reduction in total and annual growth.

Discussion and Conclusion: Distraction force from MCGR was likely to stimulate the longitudinal growth of individual vertebral bodies. Among the vertebrae around the distal instrumented vertebrae, the DIV- group had both the highest total growth and the fastest annual growth of vertebral height.

FP5.8**Efficacy and safety of nucleo-annuloplasty using radiofrequency ablation for discogenic back pain in a local Hong Kong population****Joyce Oching Yam, Philip Cheung, Wing Yuk Mok***Department of Orthopaedics and Traumatology, Pamela Youde Nethersole Eastern Hospital*

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FP5.9**Minimally invasive anterior vertebral body tethering for scoliosis in skeletally immature children in Hong Kong: a prospective case series****Kenny Kwan, Kenneth Cheung***Department of Orthopaedics and Traumatology, The University of Hong Kong*

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FP5.10**Prediction of final body height for female patients with adolescent idiopathic scoliosis****Prudence Wing Hang Cheung, Abhishek Mannem, Jason Pui Yin Cheung***Department of Orthopaedics and Traumatology, The University of Hong Kong*

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FP5.11

Long-term follow-up shows sustained improvement in patients following surgery for neuromuscular scoliosis

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Royal College of Surgeons Ireland (Dublin Ireland)

Introduction: Surgical fusion for neuromuscular scoliosis has high complications. Previous studies have reported high patient satisfaction level and improved quality of life, but few have focused on objective parameters. The aim of this study was to evaluate long-term objective changes after surgery for neuromuscular scoliosis.

Materials and Methods: Patients who underwent surgical fusion for neuromuscular scoliosis between 2008 and 2012 were included in this study. Demographic, radiologic parameters, pressure mapping, ambulatory status, and activities of daily living (ADL) were analysed.

Results: In total, 21 patients (10 boys, 11 girls) with a mean age at surgery of 13.8 ± 2.7 years were included. The mean follow-up was 9.14 years (range, 7-11 years). The mean Cobb angles were $68.7^\circ \pm 19.8^\circ$ before surgery, $31.9^\circ \pm 16.5^\circ$ after surgery, and $30.1^\circ \pm 14.5^\circ$ at final follow-up. Five patients required revision surgeries and 12 patients required surgery for other neuromuscular related symptoms. 11 patients were non-walkers and 10 were independent ambulatory. Among the 11 non-walkers, pressure mapping and sitting pressure showed objective improvements in nine patients for localised pressure (<80 mmHg), area and sitting interface force. Comparing the ADL status, modified Barthel Index (mBI) showed seven patients remained the same, 10 improved, and four worsened compared with before surgery.

Discussion and Conclusion: Surgical fusion for patients with neuromuscular scoliosis results in long-term objective benefits with decreased localised pressure and area, improved sitting interface force and improved mBI, despite a high rate of complications and revision surgeries.

FP5.12

Does posture alter the shape of the lumbar spine? A comparison between the standing and supine position

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Introduction: Altered sagittal contour and spinal balance can cause back pain. Surgical correction of the lumbar spine aims to restore sagittal balance based on pelvic parameters. Roussouly has classified spinal morphologies based on them. This study aims to compare lumbar spine shapes between X-rays and MRIs.

Methods: The shapes of lumbar spines are determined by apex of lumbar lordosis and inflection point. Supine MRI and erect lateral X-rays from 46 patients (mean 45 ± 5.8 years) were analysed between two observers. The apex, inflection point, pelvic incidence, pelvic tilt and sacral slope were measured on both scans.

Results: The mean level of apex is L4 on both scans, and the mean inflection point is L1 on X-ray and L2 on MRI. The inflection angle decreases from standing to supine, with a mean of $52.8^\circ \pm 8.76^\circ$ on X-ray and $45.0^\circ \pm 8.38^\circ$ on MRI, and a mean difference of $7.86^\circ \pm 5.98^\circ$. Mean sacral slope is $35.9^\circ \pm 12.5^\circ$ on X-ray and $36.8^\circ \pm 6.80^\circ$ on MRI, with a mean difference of $0.89^\circ \pm 11.8^\circ$. The mean pelvic tilt is $12.0^\circ \pm 7.62^\circ$ and the mean pelvic incidence is $48.2^\circ \pm 16.4^\circ$.

Discussion: Spinal balance changes with postures, evidenced by differences in shape and sacral slope between positions, representing possible pelvic compensation for sagittal balance compensation during standing. Female patients have larger degrees of inflection, but no other correlation noted. Our study was limited to supine and erect position, but other postures like sitting should ideally be studied.

FP5.13**Brace effectiveness is related to three-dimensional plane parameters in patients with adolescent idiopathic scoliosis****Kenny Yat Hong Kwan,¹ Amy Ka Po Cheung,¹ Hui Yu Koh,² Kenneth Man Chee Cheung¹**¹*Department of Orthopaedics and Traumatology, The University of Hong Kong*²*The University of Hong Kong*

Introduction: The purpose of this study was to determine the effect of axial plane parameters on the outcomes of bracing with a thoracolumbosacral orthosis (TLSO) for AIS.

Materials and Methods: A prospective longitudinal cohort study of AIS patients for bracing was performed from brace wear initiation and followed through minimum 2-year follow-up or surgery. Radiographs using EOS Imaging System were used to reconstruct 3D images of the spine at pre-brace, immediate in-brace, 1-year in-brace and minimum 2-year out-of-brace. Univariate and multiple linear regressions were performed to determine the association between axial rotation correction and curve progression at final follow-up. Logistic regressions were performed to model the probability of risk of progression.

Results: 53 patients were enrolled and 46 patients were included in the analysis. At final follow-up, 30 patients did not have curve progression and 16 patients had curve progression. There was no difference in baseline characteristics between the groups. For the transverse plane parameters, significant difference was found between non-progressive and progressive groups in pre-brace apical vertebral rotation (AVR) ($4.5^\circ \pm 11.2^\circ$ vs $-2.4^\circ \pm 9.8^\circ$, $p=0.044$) and 1-year in-brace AVR correction velocity ($2.0^\circ \pm 5.0^\circ$ per year vs $-1.7^\circ \pm 4.4^\circ$ per year, $p=0.016$). Logistic regression analysis showed that pre-brace AVR (OR=1.063; 95% CI: 1.000-1.131; $p=0.050$) and AVR CV at 1-year (OR=1.19; CI: 1.021-1.38; $p=0.026$) were associated with an increased risk of curve progression.

Discussion and Conclusion: We demonstrate that axial plane parameters and their correction during bracing are related to brace success in this prospective study.

FP5.14**Comparison of dynamic radiographs in determining fusion level in adolescent idiopathic scoliosis correction (FLEXIS)****Kenny Yat Hong Kwan,¹ Amy Ka Po Cheung,¹ Hui Yu Koh,² Caglar Yilgor,³ Ahmet Alanay,³ Kenneth Man Chee Cheung¹**¹*Department of Orthopaedics and Traumatology, The University of Hong Kong*²*The University of Hong Kong*³*Acibadem University*

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FP5.15

Prognosis of functional recovery in central cord syndrome using quantitative MRI assessment and scoring systems for acute traumatic cervical injury

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Introduction: The management of central cord injury syndrome (CCS) remains controversial. We determined whether quantitative MRI parameters in combination with radiological scoring systems were responsive to functional recovery in patients with CCS as novel indicators of prognosis.

Materials and Methods: Between 2011 and 2015, 41 patients with CCS were identified with a minimum of 6-months of follow-up. American Spinal Injury Association motor scores (AMS) and Japanese Orthopaedic Association (JOA) scores were collected. MRI findings were quantitatively assessed in combination with Brain and Spinal Injury Center scores and sagittal grading, which have previously been described for high-energy cervical cord injury.

Results: In total, 24 patients were managed conservatively and 17 received operative intervention. All patients achieved significant AMS improvement in the first 6 months after injury ($p < 0.01$) and a higher magnitude of recovery was observed subsequent to surgical intervention ($p = 0.01$). Maximal canal compromise was negatively correlated with admission JOA score ($p = 0.03$), whereas a higher sagittal grade was a predictor of higher admission JOA ($p = 0.002$) and AMS scores ($p = 0.01$). A higher admission JOA score lead to a higher final follow-up JOA score and JOA recovery rate ($p < 0.01$). Admission AMS ($p < 0.01$) and a larger axial area of spinal cord at maximal compression ($p = 0.02$) were associated with a higher AMS upon final follow-up. A higher admission AMS was predictive of excellent recovery ($p = 0.02$).

Discussion and Conclusion: These clinical and radiological parameters may be used to facilitate patient selection for decompression after injury.

Free Paper Session VI: Adult Joint Reconstruction II

FP6.1

The burden of disease in patients awaiting joint replacement surgery—a study of 2091 patients

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Background: In Hong Kong, due to limitations in resources in the public sector, patients indicated for joint replacement are placed on a waiting list and may need to wait for years for their procedure. The effect of this delay in joint replacement on a patient's overall morbidity and mortality is currently unknown and no study has examined this previously. The aims of this study were to 1) quantify the degree of and 2) identify factors related to patient morbidity and mortality associated with joint replacement waiting list.

Methods: All patients that were put on waiting list primary total hip, knee and unicompartmental knee replacements in our cluster from November 2009 till March 2020 were included for analysis. CDARS system was used for data retrieval. Incidence of all-cause hospital admissions, AED attendances and occurrence of major medical events was calculated.

Results and Discussion: In total, 3715 patients had been placed on waiting list for primary joint replacement from 11/2009 till 3/2020. After exclusion of 965 cancellations, 2972 replacements in 2109 patients were included for analysis. 3.2% died while awaiting joint replacement. Incidence of all-cause hospitalisation and peptic ulcers were higher during the waiting period than at baseline and after operation. NSAID use was significantly related to increased hospitalisation and cardiovascular events during the waiting period.

Conclusion: Patients waiting for joint replacement are at an increased risk of hospitalisation and peptic ulcer events. NSAID usage is a major factor leading to patient morbidity while awaiting joint replacement.

FP6.2

Enhanced recovery after surgery (ERAS): How does it affect the postoperative length of stay after unilateral primary total hip and knee arthroplasty in a private hospital?

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Introduction: Enhanced Recovery After Surgery (ERAS) has been shown to improve postoperative recovery and reduce postoperative length of stay (LOS) in primary total hip arthroplasty (THA) and total knee arthroplasty (TKA). Our study aims to investigate whether the same promising results could be reproduced in a private hospital setting in Hong Kong.

Materials and Methods: In total, 228 patients were included in the study cohort, with 117 patients from 2012 to 2014 being put in the conventional group and 111 patients from 2017 to 2018 being put in the ERAS group. All patients had undergone unilateral primary THA or TKA by a single surgeon at Hong Kong Sanatorium and Hospital. Primary outcome was postoperative LOS. Factors affecting LOS were also investigated.

Results: No significant difference was found in all the baseline parameters between two groups of patients. In the ERAS group, mean LOS was significantly lower (3.28 ± 1.04 vs 5.16 ± 2.06 days, $p < 0.001$) and a significantly higher proportion of patients were able to be discharged on or before postoperative day 3 (77.5% vs 13.7%, $p < 0.001$). Significant difference in LOS was observed between patients staying in general and private ward (3.06 ± 0.59 vs 3.66 ± 1.46 days, $p = 0.003$). Gender, age and nature of surgery (TKA vs THA) was not found to have significant effect on LOS.

Conclusion: ERAS can also produce significant improvement in postoperative LOS compared to conventional practices for patients who underwent unilateral primary THA or TKA in a private hospital.

FP6.3

Patterns of musculoskeletal injury among joint replacement surgeons in Hong Kong

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Background: Work related injuries are a well investigated area among numerous manual labour professions, with the development of safety guidelines and legislation. In joint replacement surgery, repetitive use of certain joints and muscle groups may place the surgeon at risk of overuse issues and other musculoskeletal disorders especially if case load is substantial. There is currently no information regarding the incidence and patterns of injury among arthroplasty surgeons in Hong Kong. If such information were available, pre-emptive measures, e.g., counselling, physical and occupational therapy can possibly be implemented to minimise the physical, psychological and negative effect on productivity in surgeons.

Methods: A standardised web-based questionnaire assessing musculoskeletal problems was sent to members of the Hong Kong Orthopaedic Association Adult Joint Reconstruction chapter. Data were collated and then analysed.

Results and Discussion: In total, there were 40 participants, 39 male and one female. Mean age was 46.8 ± 9.6 years (range, 31-73 years). Mean time in orthopaedic practice was 20.7 ± 9.4 years (range, 8-41 years). 90% and 29% reported having experienced ache, pain or discomfort in the past 12 months and 7 days, respectively. 38.7% reported trouble with their hands in the past 12 months. Cervical spondylosis was the most common musculoskeletal diagnosis (19.3%) followed by finger triggering (10%), De Quervain disease (10%), hand osteoarthritis (10%), and tennis elbow (10%).

Conclusion: Musculoskeletal injuries are common among joint replacement surgeons in Hong Kong. Ergonomic education and occupational therapy may be of benefit to decrease the burden of disease in this population.

FP6.4**Impact of COVID-19 on joint replacement services in Hong Kong****LS Lee,¹ PK Chan,² WC Fung,¹ VWK Chan,² A Cheung,² MH Cheung,¹ H Fu,² CH Yan,¹ KY Chiu¹**¹*Department of Orthopaedics and Traumatology, The University of Hong Kong*²*Department of Orthopaedics and Traumatology, Queen Mary Hospital*

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FP6.5**Incidence and risk factors of hypovitaminosis D in patients undergoing joint replacement surgery—a multiple regression analysis****PK Chan,¹ WC Fung,² A Cheung,¹ VWK Chan,¹ H Fu,¹ MH Cheung,² CH Yan,² KY Chiu²**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*

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FP6.6**Antibiotic prophylaxis in total joint arthroplasty—the usual practice and variability among joint replacement surgeons in Hong Kong****Chi Him Tong,¹ Amy Cheung,¹ Ping Keung Chan,¹ Chun Hoi Yan,² Fu Yuen Ng,³ Kwong Yuen Chiu²**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*³*Private Practice*

In the current ageing population, the incidence of osteoarthritis and total joint arthroplasties is increasing each year. One rare but devastating complication after arthroplasty is periprosthetic joint infection (PJI), which may expose the patient to repeated operation subsequently and impose a high financial cost to the healthcare system. Joint replacement surgeons have been undertaking various measures to prevent PJI. One of the most well-established measures is to prescribe perioperative intravenous antibiotic as a prophylaxis to PJI. This has led to the creation of numeral guidelines published by different institutions around the world. However, many of these guidelines did not include specifics of the prescription, such as the choice of antibiotics, how the surgeon should proceed when patient has documented allergy, whether the dose given should be weight-adjusted, whether a combination of antibiotics is beneficial, and whether giving additional doses after the operation can reduce the risk of PJI. Without specific recommendations from guidelines, the usual practice might vary widely from surgeon to surgeon. We conducted an online survey of practising orthopaedic surgeons in Hong Kong. Questions comprise the usual choice of antibiotics, the usual dose of antibiotics, their approach when patients have documented antibiotic allergy, their adjustments for overweight patients, and regarding additional doses after the operation. The purpose of this study is to investigate and compare the usual practice and variability of prescribing antibiotic prophylaxis among different joint replacement surgeons in Hong Kong.

FP6.7**Culture in automated blood culture system (BACTEC) is more sensitive when compared with conventional culture methods for detection of bacteria in synovial fluid in periprosthetic joint infection****PK Chan,¹ DL Hung,² WC Fung,³ A Cheung,¹ H Fu,¹ VWK Chan,¹ MH Cheung,³ CH Yan,³ KY Chiu³**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Microbiology, Queen Mary Hospital*³*Department of Orthopaedics and Traumatology, The University of Hong Kong*

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FP6.8

The sky's the limit? Adaptation of Oxford criteria can improve utilisation of unicompartmental knee arthroplasty without compromising clinical outcome: experience of first 150 cases of Oxford mobile bearing UKA

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FP6.9

Simple method to predict the feasibility to correct varus deformity with unicompartmental knee arthroplasty

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FP6.10

Would the change in joint line orientation after Oxford unicompartmental knee replacement affect early clinical outcome?

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FP6.11

Does component axial rotational alignment affect clinical outcomes in Oxford unicompartmental knee arthroplasty?

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FP6.12**Robotic arm–assisted total hip replacement: early experience in Hong Kong****Henry Fu,¹ Amy Cheung,¹ Man Hong Cheung,² Vincent Wai Kwan Chan,¹ Ping Keung Chan,¹ Chun Hoi Yan,² Kwong Yuen Chiu²**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: Acetabular cup placement is crucial in preventing complications and ensuring implant longevity in total hip arthroplasty (THA). Robotic arm assistance enables accurate acetabular bone removal and allows precise cup placement. This study analyses the early clinical experience.

Methods: All robotic arm–assisted Mako THAs performed from 1 February 2019 to 9 July 2020 in Queen Mary Hospital were analysed. Posterior approach with robotic arm–assisted acetabular reaming and cup impaction were performed, followed by intraoperative verification with software. Postoperative radiographs, intraoperative verification and preoperative planning were compared for inclination and anteversion angles. Harris hip scores, complications and mortality were documented.

Results: 52 robotic arm–assisted THAs were performed in 45 patients. Mean age was 63 years and mean BMI was 24.6. Most patients suffered from osteoarthritis (18) followed by avascular necrosis (15). Mean surgical time was 125 minutes with learning curve of nine cases. Average follow-up was 9.4 months. Mean Harris hip scores improved from 46 before surgery to 90 at 6 months after surgery ($p<0.001$). All components were well fixed upon latest follow-up. No complications including loosening nor dislocations occurred although one patient died 8 months after surgery from medical cause. Intraoperative verification of robotic arm–assisted cup position correlated strongly with preoperative planning in both inclination ($r=0.7$, $p<0.001$) and anteversion ($r=0.82$, $p<0.001$). Postoperative radiographic inclination ($r=0.38$, $p=0.01$) and anteversion ($r=0.37$, $p=0.02$) correlated moderately with preoperative plan. Postoperative analysis showed 96% of robotic positioned cups fell within Lewinnek’s safe zone (inclination 30°-50°, anteversion 5°-25°).

Conclusion: Robotic arm–assisted THA enables accurate cup placement with promising early clinical results.

FP6.13

Robotic arm-assisted total hip replacement: the perfect solution for complex hip pathologies

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Introduction: Complex hip deformities often poses challenge for total hip arthroplasty (THA). Identification of the true acetabulum is the cornerstone to success, often necessitating identification of anatomical landmarks and fluoroscopic guidance. With accurate three-dimensional computer tomography based planning and robotic arm-controlled reaming, managing acetabular deformities can be simplified.

Methods: This was a prospective study of the early clinical and radiological results of 15 complex hip deformities including four Crowe III/IV hip dysplasias, three fusion takedowns, two rapidly progressive avascular necrosis requiring acetabular augments, two acetabular revisions, two post traumatic osteoarthritis with implants, one prior acetabular osteotomy, one old tuberculosis and one Perthes disease. All operations were performed using Mako Robotic Arm Interactive Orthopaedic System by a single surgeon (HF) experienced in primary THAs. Operative details, clinical and radiological outcomes were analysed.

Results: Fifteen complex THAs were analysed. Mean age was 54.5 years (range, 22-87 years). 60% were female. Mean BMI was 24.7. Intraoperative fluoroscopy was not required in any of the cases. 53.3% used single-sized reamer whereas 40% used two-sized reamers. Dual mako planning was utilised for the two cases for reaming of acetabular defect to fit augments. Average surgical time was 168 minutes. Mean Harris hip scores improved from 49 before surgery to 90 at 6 months ($p < 0.001$). All components remained well fixed at latest follow-up. All cups were placed at the anatomical hip centre (Ranawat's triangle) and were within Lewinnek's safe zone (inclination 30°-50°, anteversion 5°-25°).

Conclusion: Complex primary THA can be simplified with robotic arm-assisted THA.

FP6.14

Early results of robotic unicompartmental knee arthroplasty—experience in a local hospital

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Knee osteoarthritis is the leading cause of musculoskeletal disability. Apart from traditional total knee arthroplasty, unicompartmental knee arthroplasty serves as a viable alternative. Recently, robot-assisted procedure promised much improved accuracy in component positioning and alignment. In Hong Kong, robotic-assisted procedures have just made its way into the operating theatre. United Christian Hospital was fortunate enough to have a hands-on period with the Mako system in the second half of 2019 and performed total of 18 robotic-assisted robotic unicompartmental knee arthroplasty. This study aims at analysing the early clinical outcomes of patients who underwent robot-assisted unicompartmental knee arthroplasty in our local population. 14 Patients who underwent the procedure were recruited. The range of motion, pain score, knee score and weight bearing status before and after operation were compared. Other parameters such as first day of weight bearing, postoperative time to wean off patient controlled analgesic device, and the length of hospital day were considered. Postoperative complications, if any, were also recorded. All patients have shown improvement in the parameters we measured. Upon follow-up, patients showed better range of movement, less pain, better mobility performance and functional scores. The differences were statistically significant. Regarding the postoperative complications, only one case of wound infection was seen. Robotic-assisted unicompartmental knee arthroplasties gave promising results in our local patients. From our case series, we could observe that compared with traditional total knee arthroplasty, it provided the same excellent functional improvement with additional benefits of faster rehabilitation and shorter hospital stays.

FP6.15**Could patients recover faster after direct anterior approach total hip replacement compared with posterior approach?****Kelvin Chin Hei Lo, Jason Chi Ho Fan***Department of Orthopaedics and Traumatology, Alice Ho Miu Ling Nethersole Hospital*

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FP6.16**Comparison of radiological and early clinical outcomes between conventional and robotic medial unicompartmental knee replacement****Wai Lun Tang,¹ Chi Lok Cheung,¹ Yan Ho Tang,¹ Tai Fong Wong,² Chun Yin Lee,¹ Kwok Hung Leung,¹ Hon For Tsui,³ Hok Leung Wong¹**¹*Department of Orthopaedics and Traumatology, Tuen Mun Hospital*²*Department of Nursing, Tuen Mun Hospital*³*Department of Orthopaedics and Traumatology, Pok Oi Hospital*

Introduction: Accuracy of implant positioning and limb coronal alignment in unicompartmental knee replacement (UKR) are important for good clinical outcome and implant survivorship, especially in fixed-bearing UKR. Robotic technology was introduced in knee replacement to improve the surgical accuracy. We performed a retrospective case-control study to compare the operation time, radiological and clinical outcome of conventional UKR versus robotic UKR.

Materials and Methods: From 2012 to 2020, a total of 59 fixed-bearing medial unicompartmental knee prostheses were implanted in 47 patients, of whom 31 using conventional instrumentation technique and 28 using robotic-assisted technique. The coronal and sagittal alignment of femoral and tibia components, joint line level change were assessed radiologically and compared. The operation time, haemoglobin drop, length of hospital stay, complication rate and clinical outcome in terms of Knee Society knee score (KSS) were also compared.

Results: The mean operation time was significantly longer in robotic-assisted group than conventional group by 15 minutes ($p=0.031$). There were no differences in haemoglobin drop ($p=0.141$), length of hospital stay ($p=0.059$) and Knee Society knee score ($p=0.429$). There were no significant differences between implant orientations in terms of femur coronal ($p=0.691$), tibia coronal ($p=0.248$), femur sagittal ($p=0.285$), tibia sagittal ($p=0.692$), and joint line level ($p=0.189$). There were more femoral component sagittal alignment outliers in the conventional group although the difference is not statistically significant.

Discussion and Conclusion: The operation time of robotic UKR was longer in robotic than conventional UKR. Robotic technique may improve femoral component sagittal alignment. The other outcomes of conventional and robotic UKR were comparable.

FP6.17

Robotic arm–assisted cementless cruciate retaining total knee arthroplasty: the Hong Kong experience

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Introduction: Robotic arm technology improves bone cut precision and facilitates cementless fixation in total knee arthroplasty (TKA). While the China Food and Health Administration (CFDA) has yet to approve its application in Mainland, Hong Kong is the first region to report on early results in Chinese patients.

Materials and Methods: We retrospectively analysed all robotic arm assisted TKAs performed between January 2019 and May 2020 at a tertiary hospital. All operations were performed using Mako TKA 3.0 application with cementless cruciate retaining implants. Complications, Knee Society knee score (KSKS) and Knee Society functional assessment (KSFA) were analysed. Postoperative mechanical axes were independently assessed by two observers on standing long films.

Results: In total, 77 knees from 64 patients were included with mean follow-up of 9 months. Mean age was 63 years and 29 were male. Mean preoperative alignment was 10.6° varus. Mean KSKS improved significantly from 53 before surgery to 91 at 6 months ($p<0.001$) and 93 at 1 year ($p<0.001$) after surgery, while KSFA improved from 47 before surgery to 66 at 6 months ($p<0.001$) and 71 at 1 year ($p<0.001$) after surgery. There were no complications apart from one tibial pin site infection treated by debridement. Mean mechanical alignment after surgery was 0.1° varus with 98% within 4° of neutral and demonstrated moderate correlation with intraoperative plans ($R=0.41$, $p<0.001$). All implants were well fixed at latest follow-up with no sign of loosening.

Discussion and Conclusions: This is the first study to report on early results of robotic TKA in Chinese patients. Early clinical and radiological results are promising.

FP6.18

When robots fail—the local experience with robotic-assisted joint replacement surgery

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Introduction: Robotic-assisted joint replacement surgery offers individualised planning and improved accuracy in implant positioning. However, problems may occur during planning and bone bed preparation. This study gathers the local experience in robotic-assisted joint replacement surgery, along with its possible problems and solutions.

Methods: A 33-item questionnaire was sent out to via email to members of the Adult Joint Reconstruction Chapter of HKOA. Participants were invited to comment on four aspects of robotic-assisted joint replacement. The first part of the questionnaire looks into the general feedback and satisfaction. Remaining areas investigated the potential problems and corresponding solutions during the planning phase of the surgery and mechanical or software failures during surgery.

Results: From our preliminary data, 10 surgeons participated in the survey. They were generally satisfied with robotic-assisted surgery with a score of 8.13 of 10. They also gave positive response towards the accuracy (8.75 of 10) and ease of use (7.88 of 10) of robotic-assisted joint replacement surgery. Of the 10 participants, seven surgeons reported problems with operative plan, two surgeons reported problems with software, and six surgeons reported mechanical problems that interrupted surgery.

Discussion: Despite bringing convenience to surgeons in achieving accurate, patient-specific joint replacement, robotic-assisted surgery also brings in new technical problems that requires unique solutions. These problems may steepen the learning curve for surgeons who are new to the technology.

FP6.19**Navigated geometry scanning system for imageless navigation-guided robotic joint surgery****Chun Sing Chui,¹ Kwong Yin Chung,² Chun Man Lau,² Shu Hang Yung,¹ Ki Wai Ho¹**¹*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*²*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*

Introduction: Imageless navigation-guided robotic surgery is popular in knee replacement surgery. However, the registration procedure is time consuming as it relies on the surface-matching of the knee condyle manually using the navigation tracked probe. A semi-automatic scanning system was developed to replace the manual landmarks plotting procedures, which could drastically reduce the registration time.

Materials and Methods: The scanning system consisted of two parts: a 3D optical scanner and a surgical navigation system. The 3D optical scanner scanned the surgical site and a 3D image of the surgical site was constructed. The surgical navigation system consisted of binocular cameras and targets. The binocular camera tracked the target position in real time, and used the parallax principle to calculate the 3D coordinates of the target. Accuracy test was conducted with femur, tibia and acetabular bone models for 3D reconstruction and navigation tracking.

Results: An average of 1 minute were needed to scan the surgical region, which is much faster than using the existing manual plotting method (3 minutes). Root-means-square distances between the actual value and the detected value using the developed system on femur, tibia and acetabulum were 1.85 mm, 1.80 mm and 3.4 mm respectively.

Discussion and Conclusion: The developed system could 1) facilitate auto-plotting of anatomy; 2) reduce intraoperative time for imageless navigation-guided robotic surgery significantly; 3) generate 3D models with reasonable accuracy. Further work will be done in order to improve the accuracy of the system. With the help of the system, more patients could be benefited from the robotic technology.

Free Paper Session VII: Spine II

FP7.1

MRI-SegFlow: a deep learning–based unsupervised pipeline for vertebral segmentation of spinal MRI image

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Most deep learning–based vertebral segmentation methods require laborious manual labelling tasks. We aim to establish an unsupervised deep learning pipeline for vertebral segmentation of MR images. We integrate the suboptimal segmentation results produced by a rule-based method with a unique voting mechanism to provide supervision in the training process for the deep learning model. Preliminary validation shows a high segmentation accuracy achieved by our method without relying on any manual labelling. The clinical relevance of this study is that it provides an efficient vertebral segmentation method with high accuracy. Potential applications are in automated pathology detection and vertebral 3D reconstructions for biomechanical simulations and 3D printing, facilitating clinical decision-making, surgical planning and tissue engineering.

FP7.2

The use of Floseal right before closing of the percutaneous stenoscopic lumbar decompression (PSLD) operation: a retrospective review

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Introduction: Percutaneous stenoscopic lumbar decompression (PSLD) via a single portal is a full-endoscopic minimally invasive option for decompressing the spinal canal in patients suffering from lumbar spinal stenosis. In this study we would like to see if using Floseal at the end of the operation could further reduce the postoperative blood loss.

Materials and Methods: We retrospectively reviewed patients who underwent PSLD from October 2018 to July 2020. The use of Floseal at the end of the operation, postoperative haemoglobin drop and postoperative drain output were recorded and analysed.

Results: There were 40 patients with 42 levels received PSLD within the study period. 14 levels were done without Floseal at the end of the operation and Floseal were used in 28 levels right before closing. Postoperative drain output in the Floseal group (29.7 mL) was significantly lower than the non-Floseal group (50.0 mL) [p=0.02]. Postoperative haemoglobin drop between the Floseal group (0.55 g/dL) and non-Floseal group (0.56 g/dL), and improvement of walking distance between the groups (5.4 times vs 5.3 times) showed no significant differences.

Discussion and Conclusion: Use of Floseal right before closing provides an effective mean of further haemostasis after the endoscopic irrigation is stopped. Patients have further improvement in postoperative blood loss via the drain and can potentially have an even faster postoperative rehabilitation.

FP7.3

Reconstruction after total en bloc spondylectomy: does bony fusion mean long-term stability?

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FP7.4

High-resolution peripheral quantitative computed tomography (HR-pQCT) is superior to dual-energy x-ray absorptiometry (DXA) and fracture risk assessment tool (FRAX) in predicting asymptomatic vertebral compression fractures in postmenopausal women

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FP7.5

Development of spine proprioception testing using motion capture analysis

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Background: While the Vicon system is the gold standard in motion analysis, it has never been used to analyse spinal proprioception. We developed a skin marker system to evaluate regional differences in spinal proprioception in people with and without scoliosis.

Objectives: To determine the reliability of a novel skin marker system in evaluating spinal proprioception in healthy volunteers.

Methods: Four volunteers without back pain or scoliosis were recruited. Reflective markers were attached to participants' chin, right scapula, and six spinous processes (C7, T3, T7, T12, L3, L5). Participants were blindfolded and instructed to reposition to the reference upright sitting posture twice, while the Vicon system captured the motions. Reliability was evaluated by intraclass correlation coefficient (ICC). Absolute error was defined as the magnitude of difference in angles between repositioning and the reference trial. Relative error included directionality to the angular deviation.

Results: T7-T12-L3 angle (sagittal) showed excellent reliability on absolute error (ICC=0.917), standard deviation (SD) of absolute error (ICC=0.938) and SD of relative error (ICC=0.939); good reliability on relative error (ICC=0.801). L3-L5-vertical angle (coronal) also showed moderate reliability on absolute error (ICC=0.682), relative error (ICC=0.532), SD of absolute error (ICC=0.644) and SD of relative error (ICC=0.665). While both chin-C7-T3 angle (sagittal) and T3-T7-T12 angle (coronal) reported with an ICC range greater than 1.5.

Discussion: The marker system demonstrated good to excellent reliability in measuring spinal proprioception although within-subject variations in regional spinal proprioception were noted. Future studies with a larger sample size are warranted to confirm this observation.

FP7.6

Effectiveness of a secondary osteoporotic vertebral fragility fracture prevention pathway after 3 years

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Introduction: Osteoporotic vertebral fragility fractures are common and associated with significant morbidity and mortality, but it remains under-diagnosed and under-treated. The model and preliminary findings had been reported and now the model has passed more than 3 years.

Materials and Methods: In total, 370 participants were assessed between 2016 and 2019. Of them, 311 (84.1 %) were female. Mean age was 76.33 years. All participants underwent follow-up questionnaires at baseline, 1- and 2-year intervals. Physical functional score (SF12v2, ODI, RMDQ, NPRS) and BMD were also collected.

Results: The OVFP has been launched for more than 3 years, 75% of the patients were recruited from the out-patient department and 25% from the in-patients. The mean total spine T-score was -2.4 ± 1.66 at baseline and -1.74 ± 1.52 at 4 months, and at the mean total hip T-score was -1.94 ± 1.18 at baseline and -1.73 ± 2.05 at 2 years. Results from questionnaires showed mean NPRS, RMDQ, and ODI scores were 4.04, 10.17, and 57.22, respectively, at baseline and 2.96, 6.75, 34.00, respectively, at 2 years. SF-12v2 mean summary scores (PCS-12 and MCS-12) were 30.53 and 48.37, respectively, at baseline and 31.28 and 49.92, respectively, at 2 years. All patients received calcium/vitamin D and/or osteoporosis medication at discharge and fall prevention education from the nurses. Only four (1.08%) of 370 patients got a second fracture at 1-year follow-up.

Discussion and Conclusion: OVFP has been established more than 3 years and the pathway was proved to lower the risk of subsequent fractures, re-admission and maintain functional capacity.

FP7.7

Measurement of classical and novel whole-body sagittal alignment in patients with osteoporotic vertebral fracture and its effect on quality of life

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Introduction: Vertebral compression fractures (VCFs) are the most common among all osteoporotic fractures. The body may compensate to kyphosis from vertebral compression fractures (VF) with lordosis of the adjacent spinal segments, posterior tilting of the pelvis, hip extension, knee flexion and ankle dorsiflexion. However, the detailed influence of classical and novel sagittal parameters in VCF patients remains to be clearly documented.

Methods: In total, 142 patients with VCFs aged >60 years and 38 age-matched asymptomatic controls were prospectively enrolled. Whole-body sagittal alignment including thoracic kyphosis (TK), lumbar lordosis (LL), pelvic tilt (PT), pelvic incidence (PI), sagittal vertical axis (SVA), T1-pelvic angle (TPA), knee-flex angle and ankle-flex angle were measured. Quality of life was assessed with short-form 12 (SF-12), Oswestry Disability Index (ODI) and visual analogue scale (VAS).

Results: Despite presence of vertebral fracture, TK and LL showed no significant difference between two groups. However, PT and PI were found to be increased in VCF patients ($p < 0.001$). TPA was significantly increased in VCF patients ($p < 0.001$). All questionnaires (including SF12, ODI and VAS) showed poorer quality of life and increased pain in vertebral fracture group than those without ($p < 0.001$).

Conclusion: Pelvic parameters are significantly worse in patients with vertebral collapse in elderly with VCF. In a previous younger cohort, spinal parameters were found to be worse in patients with VCF instead of pelvic parameters. This may be explained by the time needed for our body to accommodate to newly acquired deformities after osteoporosis related vertebral fractures.

FP7.8

Prediction of standing radiographic lumbar lordosis by using supine MRI

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Objective: To study the correlation between lumbar lordosis (LL) measured by standing radiographs and supine magnetic resonance imaging (MRI), and the possibility of predicting standing radiographic LL based on supine MRI-LL and severity of lumbar disc degeneration (LDD).

Materials and Methods: LL was measured from L1 to superior endplate of S1 on standing radiographs and supine MRI in 65 southern Chinese subjects aged 39 to 77 years. LDD score was calculated as sum of Pfirrmann gradings of the five discs levels. Relationship between X-ray and MRI-measurements were analysed by a paired sample t test and a scatter plot. Pearson's correlation coefficient was calculated to study the effect of MRI lordosis and LDD on the correlation. A prediction equation was also developed.

Results: Mean LL in standing radiographs (XR-LL) and supine MRI (MRI-LL) were $53.0^\circ (\pm 8^\circ)$ and $43.9^\circ (\pm 8^\circ)$ respectively. Intraindividual difference ($[\text{°}]$ standing XR-LL minus $[\text{°}]$ supine MRI-LL) ranges from -0.9° to $+21^\circ$, with a significant mean of $+9.1^\circ (\pm 5^\circ)$ ($p < 0.05$). A significant positive correlation between the two LL measurements was found ($R = 0.81$, $p < 0.05$). Regression equation with use of LDD score and MRI-LL as predictors of radiographic lordosis was $y = 24.18 - 0.562D + 0.815x$, where y was XR-LL, D was the LDD score, and x was MRI-LL. R-square of this equation was 71.0%.

Conclusion: A good clinical correlation between LL measured in standing radiographs and supine MRI was found. Combined use of LDD score and LL yielded a moderately good prediction model for standing radiographic LL.

FP7.9

Identifying the optimal instrumented level: prospective case series of 102 patients treated by vertebral body tethering (VBT) with 2-year follow-up**Chris Yuk Kwan Tang,¹ Kenny Yat Hong Kwan,² Stefan Parent,³ Ron El Hawary,⁴ Firoz Miyanji,⁵ Kenneth Man Chee Cheung²**¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*³*Department of Surgery, Faculty of Medicine, Université de Montréal*⁴*Department of Surgery, Dalhousie University*⁵*Department of Orthopaedics, Faculty of Medicine, University of British Columbia*

Introduction: Anterior vertebral body tethering (VBT) is a novel motion-sparing surgery to achieve correction in adolescent idiopathic scoliosis (AIS). We carried out this study to investigate the optimal instrumented level.

Materials and Methods: Prospectively collected multi-centre data from the international Pediatric Spine Study Group registry were reviewed. Inclusion criteria were patients diagnosed with thoracic AIS, skeletally immature, who underwent VBT surgery and had a minimum 2-year follow up. We hypothesised that there was no difference in selecting end vertebra (EV) or EV+1 as the lowest instrumented vertebra (LIV). Primary outcome was the presence of distal adding on radiographs at minimum 2-year follow-up.

Results: In total, 102 patients were stratified into three groups according to the selection of LIV: EV group (n=77); EV+1 group (n=11); and EV-1 group (n=14). EV-1 has significantly higher number of adding on (42.9%, 6 of 14) than the other two groups (EV: 9.1% (7 of 77), EV+1 group: 9.1% (1 of 11)) in 2-year follow-up.

Discussion and Conclusion: This is the largest prospective study to date in the world to address the important issue of lower instrumentation level, its effect on curve correction and adding on. While the study is limited by being non-randomised and with unequal group sizes, VBT does enable progressive correction of the scoliosis in this mid-term study. It supports instrumenting only to the end vertebra, with an increased risk of adding on if stopping short, and no additional benefit for going one beyond the EV.

FP7.10

Enhanced recovery after surgery (ERAS) protocol for scoliosis leads to improved postoperative outcome and earlier discharge from hospital

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Introduction: Enhanced recovery surgery (ERAS) is a multidimensional approach to improving the care of surgical patients using subspecialty and procedure-specific protocols to expedite functional recovery, decrease postoperative morbidity and improve patient's experience. There is no study examining the effect of ERAS in younger patients undergoing scoliosis surgery.

Materials and Methods: A retrospective evaluation of the current ERAS protocol used at Gleneagles Hospital (GHK) compared to standard care used at Hospital Authority (HA) The GHK ERAS protocol involves a multidimensional approach before, during and after surgery. Outcome measure involves pain score, time to normal diet, time to self-mobilisation and total length of hospital stay. Total of 18 matched cohort patients was selected. 10 patients received standardised care currently offered at Hospital Authority and eight patients received care under the GHK ERAS protocol.

Results: Patient age and fusion length were similar in HA and ERAS. Pain score was 4.4 (HA) vs 3.75 (ERAS), Time to sitting was 1.5 days (HA) vs 1.125 days (ERAS), Time to self-mobilisation was 2.7 days (HA) vs 1.625 days (ERAS), Nausea and vomiting was found in 40% patients (HA) vs 25% of patients (ERAS). Time to normal diet after surgery was 1.2 days for HA and 0.5 days for ERAS. The average length of stay was 6.6 days for HA and 4.75 days for ERAS.

Discussion and Conclusion: This pilot study showed that the use of a standardised protocol with ERAS principles improves patient's outcome by reducing postoperative pain, expediting mobilisation and reducing hospital stay.

FP7.11

Screening for scoliosis using computer vision and machine learning allows high throughput screening: a proof of concept study

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In a prospective case-control study with 84 radiographically proven scoliosis and 45 controls, a smartphone captured video was analysed using computer vision with machine learning. Gait asymmetry in scoliosis subjects can be identified and differentiated from normal subjects with a sensitivity of 0.90 and specificity of 0.71. The gait can be identified in fully clothed subjects and with use of a smartphone-based application. This could form the basis of a simple high throughput early detection programme in the future.

FP7.12**Can infrared camera images be used for screening for adolescent idiopathic scoliosis?**

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Introduction: Screening for adolescent idiopathic scoliosis (AIS) is crucial for early detection and intervention. Currently, the forward bend test, Moiré topography and X-rays (XR) are used. The pilot study explores the usage of infrared (IR) thermography to increase the accuracy of this multi-step screening process. IR involves detection of differences in surface temperature due to asymmetry in paraspinal muscles for scoliotic patients.

Methods: In total, 82 AIS patients diagnosed by XRs were referred for thermography, images taken using a FLIR E33 camera placed 1.5 m away. A thermal map was constructed and processed. 53 pairs of XR and IR images were suitable for comparison of location, directionality, and magnitude of the curves. Groups were divided by Cobb angle: Group 0: <20° (n=15), Group 1: 21°-30° (n=15), Group 2: 31°-40° (n=13), Group 3: >40° (n=10). Bootstrap method and resampling techniques were employed to improve the class-wise performance.

Results: For group 0 and 3, there was a high positive predictive value (PPV) (0.83; 0.77) and f1-score (0.91; 0.87). This was lower for groups 1 and 2, with PPV=0.73 for both, and f1-score 0.62 and 0.67. The overall accuracy was 0.77, suggesting a significant correlation between IR and XR images.

Discussion: For curves <20° and >40°, the high PPV and f1-score suggests the feasibility of thermography for screening. However, a larger sample size is required for validation, as there were only 15 and 10 cases respectively. IR images of healthy non-scoliotic individuals would also be needed to assess the effectiveness of thermography for general screening of AIS.

FP7.13**Outcome of patients with acute spinal cord compression due to tumour metastasis**

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Acute spinal cord compression is not an uncommon presentation for patient with malignancy. Decision for surgery is becoming complicated with presence of different treatment algorithms and scoring systems. This is a retrospective review of the patients with acute spinal cord compression due to tumour metastasis. Primary tumour, important clinical features (type/grade of neurological deficit), common scoring systems (ASIA, SINS, Tomita and Tokuhashi), treatment method and their relationship to patient's final outcome were evaluated. Statistical calculation is performed using SPSS version 13. A p<0.05 was regarded as statistically significant. 20 patients were included from 2018 to 2020. 10 were male and 10 were female. Mean age was 66.3 years. Surgery was performed in 50% (n=10) of the patients. Primary was unknown in 25% (n=5) of the patient. 85% (n=17) of the patient presented with incomplete neurological deficit. Patient's outcome in terms of 3-month survival and ambulatory status at 4 weeks were evaluated. There was no statistically significant correlation between surgery and 3-month survival or ambulation at 4 weeks. Neurological deficit, ASIA grading and presence of pleural effusion also showed non-significant relationship with patient's survival or recovery in walking. Patients with acute metastatic spinal cord compression usually present with advanced malignancy with multiple visceral/skeletal metastases. Their prognosis is generally poor. The above discussion has brought to the importance of early detection of vertebral metastases from malignancies and subsequent prompt non-operative therapy, before they become symptomatic or complicate with acute cord compression.

FP7.14

A handheld spine scanner for home monitoring of scoliosis patients can reduce clinic attendance by 47%: a prospective longitudinal study

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Introduction: Early diagnosis of scoliosis by school screening programmes generates a significant burden on the clinic follow-up. SpineScan3D has been proven to be reliable for home-based assessment of back topography. This study aims to demonstrate that SpineScan3D can be used for the home monitoring of non-progressive curves and avoid regular clinic visits for patients without back shape changes.

Materials and Methods: In total, 113 patients with adolescent idiopathic scoliosis (AIS), aged between 9 and 17 years, were recruited and followed prospectively. At each clinic visit, patients' backs were profiled using SpineScan3D with spine radiographs taken as routine protocol. Changes in back shape were measured as a "tilt" angle. A cut-off value was used to define a positive or negative tilt angle change.

Results: Cobb angle changes of 113 patients was measured as a mean of 2.8° (range, -12.0° to 19.8°). A mean of 0.4° (range, -6.9° to 11.0°) was found in overall tilt angle changes. Using a cut-off value of 0.7° in tilt angle changes, a true-negative rate of 47% and a false-negative rate of 11% were found.

Discussion and Conclusion: SpineScan3D is a handheld and portable electronic device with a low manufacturing cost and therefore a potential for widespread adoption within the community. In this prospective longitudinal study, we demonstrate its potential to help reduce clinic follow-up for non-progressive curves by 47%. Further work is needed to reduce false-negative rate by examining the value of repeat home scanning and the use of machine learning to refine accuracy.

FP7.15

Comparison of proprioceptive reweighting in middle-aged patients with chronic low back pain and healthy people: a cross-sectional study**Sabina Margaret Pinto,¹ Arnold Yu Lok Wong,¹ Yong Ping Zheng,² Jason Pui Yin Cheung,³ Jaro Karppinen,⁴ Dino Samartzis⁵**¹*Department of Rehabilitation Sciences, The Hong Kong Polytechnic University*²*Department of Biomedical Engineering, The Hong Kong Polytechnic University*³*Department of Orthopaedics and Traumatology, The University of Hong Kong*⁴*Finnish Institute of Occupational Health, Oulu, Finland, Finnish Institute of Occupational Health, Oulu, Finland*⁵*Department of Orthopedic Surgery, Rush University Medical Center*

Introduction: Young patients with chronic low back pain (CLBP) show reduced reliance on lumbar proprioceptive signals for balance control as compared to asymptomatic individuals. However, it remains unclear if deficits in lumbar proprioception/repositioning sense exist in middle-aged patients with CLBP.

Materials and Methods: Individuals with (n=78) and without CLBP (n=73) underwent postural sway tests on a force-plate with or without a foam while bilateral L5/S1 multifidi and bilateral calves were vibrated separately. Sagittal displacements of the centre of pressure (COP) before and after vibration were recorded. Proprioception reweighting ability was estimated by the relative proprioceptive reweighting (RPW). RPW was the ratio of absolute value of COP displacement (AVCOP) during calf vibration to the sum of AVCOPs of multifidi and calves during respective vibrations. Higher RPW values indicate less reliance on lumbar multifidus proprioceptive signals for balance. Participants also underwent lumbar repositioning tests in sitting by reproducing target lumbar flexion/extension positions. The repositioning error (RE) was analysed. Between-group differences were compared.

Results: Young CLBP patients demonstrated significantly higher RPW than age-matched asymptomatic controls. However, no between-group difference in RPW was noted in middle-aged people. Similarly, no between-group difference in RE was noted in all groups. RPW values were unrelated to RE in all groups.

Discussion and Conclusion: While young patients with CLBP relied less on lumbar proprioception for balance, both middle-aged individuals with and without CLBP showed decreased reliance on lumbar proprioception for balance control. The decrease reliance on lumbar proprioception in middle-aged people may indicate age-related deterioration in trunk proprioception.

FP7.16

Patients' perspective regarding surgical management for lumbar spinal stenosis: a qualitative study

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Introduction: While lumbar spinal stenosis (LSS) is the most common degenerative condition that leads to spine surgery in older adults, little is known with regards to patients' concern regarding LSS surgery and recovery. The current qualitative research aimed to understand LSS patients' perspective regarding (1) their concerns before spine surgery; (2) perceived treatment effects of surgery, and (3) factors affecting their recovery.

Materials and Methods: Sixteen LSS patients at 6 months after spine surgery were recruited to participate in focus groups or semi-structured interviews. Two facilitators asked open-ended questions related to the three research questions. Transcripts were coded and thematic analysis were performed.

Results: Five themes were identified. First, physicians and friends/relatives greatly affected patients' decision on LSS surgery. Second, patients had a strong desire to learn information related to LSS but they did not know how to find relevant information. Third, surgery could relieve symptoms but the effect might only be temporary. Fourth, regular postoperative exercise yielded less symptoms and better function. Fifth, factors affecting physical activity hindered patients' recovery.

Discussion and Conclusion: Since orthopaedic surgeons have strong influence on patients, they can play an important role in providing proper preoperative LSS education to reduce patients' uncertainty and enhance patients' postoperative recovery. Importantly, since patients performing regular exercise (e.g., hiking) demonstrate better clinical outcomes, clinicians should encourage patients to adopt a regular exercise habit to enhance their recovery and self-management of postoperative residual symptoms.

Free Paper Session VIII: Paediatric Orthopaedics, Musculoskeletal Oncology and Others

FP8.1

Minimal invasive versus open curettage in giant cell tumour of bone with perioperative bisphosphonate—retrospective comparison with follow-up of nine years

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Introduction: Minimal invasive surgery (MIS) has the benefit of reducing the morbidity of the surgery. Bisphosphonates have been used as adjuvant treatment in giant cell tumour of bone (GCTB). To date, there was no literature reporting the local recurrence (LR) rate of patients treated with MIS and perioperative bisphosphonates. The study is to compare the long-term oncological outcome of minimal invasive curettage (MIC) with conventional open curettage (OC) in a mean follow-up of 9 years.

Methods: We studied 33 patients with primary GCTB of extremities who underwent intralesional tumour curettage and cementation and perioperative bisphosphonates from February 2003 and June 2016. The LR-free estimates of the MIC and OC groups were compared. The hazard ratio of local recurrence was calculated.

Results: The overall LR rate was 24.2% (8 of 33). There was no statistical difference in LR in MIC and OC groups (27.8 % versus 20%, $p=0.6$). The mean time to LR was 33.1 months (8 to 75). None of the risk factors studied led to a significantly higher hazard of LR.

Conclusion: Our results showed that adjuvant bisphosphonates might not reduce the LR rate in patients with GCTB undergoing intralesional curettage. MIC showed similar LR-free survival to OC. Further studies are necessary to investigate the possible superior limb function of MIC in GCTB of extremities. As there is no effective adjuvant drug treatment available, adequate local surgical tumour clearance with thorough curettage remains the critical factor in lowering LR of GCTB.

FP8.2

Identification of tumour-associated antigen in osteosarcoma: a machine learning approach

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Introduction: Osteosarcoma (OS) is highly malignant tumour of the bone and has high incidence rate in children and adolescents. Since the treatment of chemotherapy, the 5-year survival rate for localised and regional-OS patients has increase to 70%, but remained at 20% for metastatic-OS. As the improvement in cancer immunotherapy, the identification of tumour-associated antigen (TAA) has become inevitably important. Therefore, we proposed a machine learning approach on transcriptomic data to find the signature TAAs.

Materials and Methods: We gathered 107 osteosarcoma cases of transcriptomic data from public domains. After conducting standard RNA-seq data preprocessing and normalisation, two sets of differential analysis were performed. The upregulated genes (FDR<5%) were collected for machine learning training. Algorithms performed in our study include decision trees, extreme gradient boosting, random forest, support vector machine, neural network, k-nearest neighbours, logistic regression, and naïve Bayes.

Results: Features selected by each machine learning algorithms were organised with Venn diagram and the repeated selections were identified. 7 genes were identified from primary-OS and 10 genes were identified from metastatic-OS. Through literature search, 15 of the selected genes were found to be associated with cancers and were published in research.

Discussion and Conclusion: We performed selections for high-expressive TAAs of osteosarcoma by different machine learning algorithms. The identified genes were also found to be targets of other cancer research, suggesting the selected antigens could be tested as target antigens to osteosarcoma. However, further mechanism study on the selected genes is needed for validation on osteosarcoma research.

FP8.3

Association of serum 25(OH)Vit-D Levels with risk of paediatric fractures: a systematic review and meta-analysis

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Introduction: Vitamin D (Vit-D) insufficiency is highly prevalent in the paediatric population. This study aimed to review the literature on the association between serum 25(OH)Vit-D levels and the risks of fractures in children and adolescents, and to explore the sources of heterogeneity on reported results.

Materials and Methods: Systematic review and meta-analysis for observational studies comparing serum Vit-D levels between fracture and non-fracture paediatric cases were conducted.

Results: Analysis on 15 case-control and five cross-sectional studies reported before 24 February 2020 and involving a total of 7184 subjects (2709 fracture cases and 4475 controls) suggested that serum 25(OH)Vit-D was lower in fracture cases than in controls (pooled mean difference (MD): -3.28 nmol/L; 95% confidence interval (CI): -5.67 to -0.89). The pooled MD were -15.18 nmol/L (95% CI: -20.60 to -9.76) and 1.61 nmol/L (95% CI: -6.33 to 9.54) in summer and in winter, respectively. Rate of Vit-D deficiency (25(OH)Vit-D<50 nmol/L) was higher in fracture cases than in controls (pooled odds ratio=1.25; 95% CI: 1.06-1.48; p=0.01). Rate of Vit-D insufficiency (25(OH)Vit-D between 52.5 and 72.5 nmol/L) was similar between fractures cases and controls (pooled odds ratio=1.13; 95% CI: 0.78-1.63; p=0.53).

Discussion and Conclusion: This systematic review indicated that serum 25(OH)Vit-D levels were lower in children with fractures, particularly in summer. Children with fractures were more likely to have 25(OH)Vit-D levels less than 50 nmol/L.

FP8.4

Epidemiology and outcome of fractures in patients with spinal muscular atrophy in Hong Kong**Johnny Chun Yin Cheng,¹ Evelyn Kuong,² Sophelia Chan,³ Kenny Kwan⁴**¹*Private Practice*²*Department of Orthopaedics and Traumatology, Queen Mary Hospital*³*Department of Paediatrics and Adolescent Medicine, The University of Hong Kong*⁴*Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: Low bone mineral density (BMD) and fractures have been reported in paediatric patients suffering from Spinal Muscular Atrophy (SMA). The aim of this study was to investigate the prevalence and outcomes of fractures in SMA patients in Hong Kong.

Methods: We retrospectively reviewed the medical records of SMA patients between January 2000 and August 2019 for fracture history. Clinical details, radiographic parameters and dual-energy X-ray absorptiometry (DEXA) scans results were recorded.

Results: In total, 61 patients with SMA, of which 55 (M=24; F=31) had complete data and were included in this study. There were 13 SMA 1 patients, 29 SMA 2 and 13 SMA 3. 7 patients (12.7%) suffered from 11 fractures during the study period, with three patients suffering from more than one fracture. The mean age of first fracture was 7 ± 4.44 years. Femur was the commonest fracture location (82%) in all SMA subtypes, followed by humerus and tibia. The highest frequency of fractures was seen in patients with SMA 2 (n=4). DEXA scan results (available in 4 of 7 patients) showed a BMD Z-score of ≤ -2.0 . All patients with fracture had shown complete healing without further loss of activity.

Conclusion: This is the first study that reports on local data regarding the epidemiology and outcome of fractures in patients with SMA. The prevalence of fractures in SMA patients was 12.7% and all healed without complications. This data help clinicians to be vigilant of the burden of low BMD and fracture risk in SMA patients.

FP8.5

Changing epidemiology of paediatric supracondylar fracture in past decades: implications and challenges to surgeon's training**Henry Pang,¹ Lucci Lugee Liyeung,¹ Anubrat Kumar,¹ Tsz Ping Lam,² Jack Chun Yin Cheng,² Alec Lik Hang Hung¹**¹*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*²*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Introduction: Supracondylar fracture is the most common fracture in paediatric population with peak incidence at age 7 years. It is also the most commonly performed emergency operation in paediatric orthopaedics.

Materials and Methods: A retrospectively review on clinical records from 2005 to 2019 at Princes of Wales Hospital about patient demographics, injury patterns, treatment received and surgeon's experience.

Results: We observed a reducing trend in paediatric supracondylar fracture over the past 15 years, with 19.6 operations per year in the period of 2005-2011 versus 13.7 operations per year in the period of 2013-2019 ($p=0.046$). Complexity of fracture was also reduced with less Gartland type III fracture. There were less open reduction procedures performed, with 8 ORIF in 2005-2011 vs 4 ORIF in 2013-2019. However, the chief surgeon's operative experiences increased from 0.07 years before fellowship in the 2005-2011 period to 1.25 years after fellowship in the latest 5-year period, implying most of the fractures were fixed by specialists rather than trainees.

Discussion and Conclusion: With decreasing birth rate in paediatric population and reduced outdoor activities among children, we observed that there is a lower incidence of supracondylar fracture with decreased complexity, accounting for reduced surgical exposure among orthopaedic surgeons, especially at the higher trainee and young fellow level. This may affect optimal patient care ultimately. Hence, it is imperative to explore alternative ways of training opportunities for surgical management of supracondylar fracture, for instance, the e-learning platforms, saw-bone models and even virtual reality surgical models.

FP8.6

E-Fit: a potential lifestyle and exercise intervention for improving physical and psychological health among girls with adolescent idiopathic scoliosis (AIS)

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Introduction: AIS have lower physical activity level and are associated with poorer physical and psychosocial well-being. We aimed to assess E-fit exercise intervention on bone mineral density (BMD), muscle functions and quality of life (QoL) in girls with AIS.

Materials and Methods: In total, 40 girls with AIS (aged 11-14 years) were randomly assigned to E-Fit or control group. E-Fit group participated in 6-month home-based exercise intervention. At baseline and 6-month and 12-month follow-up, BMD using DXA, muscle strength and endurance tests, physical activity level using modified Baecke questionnaire, QoL using SRS-22 were investigated.

Results: In total, 14 in E-Fit and 16 in control group completed the study. Both groups had similar maturity and baseline characteristics. At 6-month follow-up, E-Fit group showed better improvement and significant interaction effect in left femoral neck bone mineral content ($p=0.021$) and isometric curl up test ($p=0.04$). Left arm lean mass showed better improvement between 6-month and 12-month follow-up ($p=0.046$) and the whole-body areal BMD had significant interaction effect at 12-month follow-up ($p=0.077$). Improvement on self-image, participation of work and sport activities were noted in E-Fit group across time, whereas control group showed a decline in physical activity level and QoL measures.

Discussion and Conclusion: Results showed some benefits of E-Fit on bone health and muscle functions for girls with AIS. The psychological benefits brought by E-Fit also indicated the potentials for using this intervention as a part of lifestyle education to promote regular exercise habits among relatively inactive girls with AIS. Further large-scale randomised controlled trial aiming to evaluate the therapeutic effects and optimal dosage of E-Fit is warranted.

Funding: HMRF (Ref 14152371)

FP8.7

Mismatch of the Risser staging, the distal radius and ulna classification and Sanders staging for peak growth in patients with adolescent idiopathic scoliosis

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FP8.8

A six-year prospective cohort study on the changes in bone density and bone quality up to peak bone mass in adolescent idiopathic scoliosis (AIS) with and without 2 years of calcium and vit-D supplementation

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Introduction: Adolescent idiopathic scoliosis (AIS) is associated with osteopenia which could persist into adulthood affecting attainment of peak bone mass thus resulting in osteoporosis in late adulthood. We previously reported a randomised double-blind placebo-controlled trial (the Cal study) showing significant bone health improvement with 2-year calcium and vitamin D (Ca+Vit-D) supplementation for girls with AIS. This study addressed the important issue whether bone health improvement from the initial 2-year Ca+Vit-D supplementation could persist as subjects approached towards peak bone mass at 6 years, i.e., after 4 years of supplement discontinuation.

Materials and Methods: This was an extension of the Cal study on girls with AIS (aged 11-14 years; mean age 12.9 years; Tanner stage <IV) with femoral neck areal BMD Z-score <0 and Cobb angle $\geq 15^\circ$. 330 subjects were randomised to Group 1 (placebo), Group 2 (600 mg Ca+400-IU-Vit-D3/day) or Group 3 (600 mg Ca+800-IU-Vit-D3/day) for 2-year supplementation after which supplementation was stopped. Investigations at baseline, 2 years and 6 years included high-resolution peripheral quantitative computed tomography (HR-pQCT) at distal radius and dual-energy X-ray absorptiometry (DXA) at both hips.

Results: In total, 270 (81.8%) subjects completed 2-year supplementation when changes in left femoral neck areal BMD, trabecular volumetric BMD, trabecular BV/TV, trabecular number, and trabecular separation showed significant bone health improvement with Ca+Vit-D supplementation ($p < 0.05$). At 6 years (mean age 19.2 years), no between-group difference on bone parameters was noted except increase in cortical thickness being greater only in Group 3 than in Group 1.

Discussion and Conclusion: After 4 years of supplement discontinuation, the treatment effect from the initial 2 years of supplementation mostly dissipated indicating the need of continued supplementation in girls with AIS to sustain therapeutic improvement on bone health as subjects approach peak bone mass.

Funding: RGC-HKSAR (Ref 14130216 and 14174517)

FP8.9

Predictors of poor outcome in idiopathic clubfoot patients in Hong Kong—a decade of experience

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FP8.10

The relationship between electromyographic amplitude of paravertebral muscles and curve progression in Chinese adolescents with idiopathic scoliosis: a preliminary study

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Introduction: The imbalanced electromyographic activity (EMG) of paravertebral muscle has been commonly presented in adolescent idiopathic scoliosis (AIS). This study aimed to define the relationship between EMG ratio of paravertebral muscles and progression risk in patients with AIS.

Materials and Methods: This was a preliminary, cohort matched study recruiting participants with AIS and age- and gender-matched healthy controls between January and July 2020. Participants with AIS were classified with major thoracic curves, major lumbar curves and double major curves. The paravertebral EMG ratio was defined as the root mean square (rms) value of EMG amplitudes of the total recording time of a convexity pair divided by a concavity pair at the trapezius, upper end vertebra, apical vertebra, and LEV levels. The progression risk was determined using the Lonstein and Carlson Risk of progression scale. The primary outcome was correlation analysis of the progression risk value with each paravertebral EMG ratio.

Results: A total of 96 participants were recruited. A pilot study revealed a satisfactory reliability of the rms-EMG (ICC_{3,3}=0.99) measures. Multiple regression analysis revealed that the rms-EMG ratio at the LEV was strongly correlated with progression risk of participants with AIS (R=0.69, p<0.05; R=0.81, p<0.01). Additionally, we found that the rms-EMG ratio at the transitional vertebral level was significantly correlated with curve progression in the double major curves (R=0.63, p<0.01).

Discussion and Conclusion: The higher rms-EMG ratio at the LEV was significantly correlated with the curve progression in this study, which implies that paravertebral EMG may be valuable for predicting curve progressions.

FP8.11**Too straight, or too curved? A model to study the effect of radial bowing in radius malunion and a strategy for computer-assisted corrective osteotomy****Michael Chu Kay Mak,¹ Roseanne Huang,² Elvis Chui,² Lucci Liyeung,¹ Alec Hung,¹ Wing Lim Tse,¹ Pak Cheong Ho¹**¹*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*²*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Introduction: Radius malunion results in disruption to the normal forearm rotation and stability. Configuration of the radius is critical for an unimpeded but congruent and constrained motion in two radioulnar joints. To predict the amount of malalignment that will cause problem in rotation, this study aims to investigate the effect of abnormal bowing on forearm motion by computer modelling based on normal anatomy from computed tomography. Secondly, a surgical method is proposed based on computer 3D planning and the use of rapid prototyping in two patients.

Materials and Methods: Based on computed tomography scans of four male patients (age 18-62) and one cadaver of their normal forearms and the distal humeri, a computer model was established using Materialise 3-matic software. A curved cylinder model simulating the curvature of the radius was created assuming a constant diameter just distal to the bicipital tuberosity. Simulated motion analysis was performed. Surgical planning and rapid prototyping were performed for two patients with radius malunion. During simulated pronation, 40% decrease in bowing led to a reverse in the direction of bowing and limited pronation range to 40°.

Results: A reduction in radius bowing of 30% resulted in reduction of pronation range, and bony impingement occurs in the proximal 20% of the radius from the bicipital tuberosity. X-ray assessment should include the lateral view and a calculation of the true bowing can be done for more accurate assessment. Computer-assisted planning and the use of an oblique rotational osteotomy can restore near normal radial bowing.

FP8.12**Short-term Result of Pilot Fracture Liaison Service (FLS) in a Local Hospital in Hong Kong for better management of osteoporotic hip fracture****Kwok Keung Chu, Yung Chak Hsu***Department of Orthopaedics and Traumatology, United Christian Hospital*

Osteoporosis has a major impact on healthcare systems, with hip fractures being the most common serious complications. Rate of subsequent fractures in patients with untreated osteoporosis increases significantly within the first 2 years, particularly after a hip fracture. However, intervention rate for osteoporosis in Hong Kong remains low. The "Blue Book" published by British Orthopaedic Association and British Geriatric Society has set the assessment for the need of anti-resorptive therapy as one of the six standards of care for fragility fracture. Recent studies show that Fracture Liaison Service (FLS) effectively increases rate of osteoporosis treatment and decreases subsequent fractures. In 2017, HA started a pilot FLS in three hospitals. This study reviews the results of one of the pilot centres. In 2017-2018, a total of 1441 geriatric fracture hip inpatients were screened. Prescription rate for calcium and vitamin D supplement is 73.67% and 79.50% respectively. Initiation rate of osteoporotic drug treatment is 15.83% in 2017 and 27.93% in 2018. Reasons for not starting treatment included limited mobility (15.27%), renal impairment (8.67%), refusal of treatment (8.19%), poor dental hygiene (6.94%) and hypocalcaemia (4.16%) DXA scan is the golden standard for treatment evaluation. After initiation of FLS, referral rate for DXA increased from 13.3% to 38.28%. We believed FLS is effective in improving evaluation and management of osteoporosis in Hong Kong, although there are still barriers to overcome.

FP8.13

Epidemiology and antibiotic susceptibility of septic arthritis in Hong Kong

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FP8.14

Does microorganism predict mortality in septic arthritis? Survival analysis with a mean 7.5-year follow-up

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FP8.15

Combating orthopaedic infection with machine learning for predicting antibiotic susceptibility and mortality in septic arthritis—a 17-year study with 447 subjects

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FP8.16**Postoperative improvement in health-related quality of life: comparative outcomes and cost-utility after surgical treatment of focal lumbar spinal stenosis compared with osteoarthritis of the knee and hallux valgus****Karen Hoi Ting So, Tsz Kin Chan, Adam Zhen Wei Yang, Angus Chao Kun Chan, Shui Wah Man, John Kwok Fai Wong, Ka Kin Li, Wilson Li***Department of Orthopaedics and Traumatology, Queen Elizabeth Hospital*

Introduction: In an ageing population, degenerative diseases especially musculoskeletal (MSK) disorders become a huge burden on our healthcare system. With limited resources, the allocation of funds and supplies must be carefully distributed towards diseases and management with the biggest impact and the most cost-efficient. In HK, the three degenerative MSK diseases that burden our healthcare system include osteoarthritis of the knee, hallux valgus (HV) and focal lumbar spinal stenosis (FLSS). Their associated treatment includes; total knee replacement (TKR), corrective osteotomy and decompressive surgery with or without fusion. Studies have shown that primary TKR has proved to be the most cost-effective surgical intervention in terms of improvement of QoL and durable treatment.

Objectives: This study aimed to use clinical and cost-utility data to compare the relative improvement in QoL after surgical intervention for HV and FLSS in comparison with OAK and whether improvement in health-related QoL after surgical intervention is sustainable over time.

Methods: This was a retrospective, single-centre cohort study. Using clinical and cost-utility data, we compared the relative improvement in quality of life after surgical intervention for the three conditions.

Results and Outcome: There was significant improvement in both function scores and quality of life after surgery compared with conservative treatment for all three diseases. All three surgeries were shown to be cost-saving treatment strategies with minimal clinically important differences and significant QALY gained. In addition, there was significant improvement in HRQoL after surgical treatment that was sustained for a minimum of 3 years for all three diseases.

FP8.17**Volumetric reduction and dissolution prediction of monosodium urate crystal during urate-lowering therapy—a study using dual-energy computed tomography****Charlotte Shek Kwan Chui,¹ Alexander Kai Yiu Choi,¹ Marianne Man Yan Lam,² Tze Hoi Kwan,³ On Chee Li,⁴ Yongmei Leng,⁴ Denise Long Yin Chow⁴**¹*Department of Orthopaedics and Traumatology, Tuen Mun Hospital*²*Department of Orthopaedics and Traumatology, Pok Oi Hospital*³*Department of Medicine, Tuen Mun Hospital*⁴*Department of Radiology, Tuen Mun Hospital*

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FP8.18

Screening of sarcopenia in community-dwelling older people in Hong Kong by portable bio-impedance analysis (BIA)

Keith Yu Kin Cheng, Can Cui, Carissa Hing Wai Wong, Yu Ning Chim, Wing Hoi Cheung, Ronald Man Yeung Wong, Simon Kwoon Ho Chow

Department of Orthopaedics and Traumatology, Prince of Wales Hospital

Introduction: Sarcopenia is defined as low muscle mass and low muscle strength, while together with low muscle performance is severe sarcopenia. It was recently classified as a disease; however, it is currently under-managed and public awareness is inadequate. The current study aimed to implement portable and reliable measurement modality for evaluating the prevalence of sarcopenia in the community.

Methods: Sarcopenia screenings were conducted to recruit subjects (based on Asian Working Group for Sarcopenia definition) with low muscle mass together with either low hand grip strength or low gait speed, or both. Sarcopenic subjects' diagnoses were confirmed at hospital using DXA, to allow comparison between BIA- and DXA-measured appendicular skeletal muscle mass (ASM).

Results: Older adults (n=1012) aged 65 to 94 years (mean age 76.9 years) were screened and 88% were women. The overall prevalence of sarcopenia was 11.4% (n=115) with 66 male and 49 female. Low muscle strength was observed in 47.5% of subjects screened (n=65, 53.3% of men; n=416, 46.7% of women). 12 subjects had their ASM validated by DXA and showed $20.6 \pm 2.1\%$ lower than that of BIA. A high correlation was found between two methods ($r=0.960$, $p<0.05$).

Conclusion: Among the elderly population in the Hong Kong community, 11.4% are estimated to have sarcopenia. Low muscle strength is more prevalent in the community than before, which has been found to predict adverse outcomes. With adjustments, the BIA can screen Chinese older adults in a reliable way in community to allow early intervention.

Funding: HCPS (Ref 02180118)

FP8.19

Harmfulness of category 2 sentinel events (retained instruments or other materials after surgery/interventional procedure): do we have bigger fish to fry? A 12-year experience in Hospital Authority Hong Kong

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Introduction: Retained instruments as a sentinel event (SE) is common in many countries. In Hong Kong, 'harm' is not necessarily considered in the classification of SE, and can include many insignificant complications. Performing a formal For Cause Analysis (RCA) investigation as required by a local policy can pressure panels to make ineffective recommendations that do not improve health outcomes of patients. This study aims to review the level of harm associated with Category 2 SE since the implementation of SE policy in Hong Kong.

Materials and Methods: Executive summaries of all RCA Reports (Cat 2) from 1 Oct 2007 till 30 Sept 2019 will be reviewed. The level of harm will be evaluated based on severity index as rated by the incident reporter and also patient outcomes including whether re-operation is required. Descriptive statistics will be used. The risks and outcomes of the orthopaedic cases will be further analysed according to the main subspecialty of interest, namely general orthopaedics, sports, adult joint reconstruction, trauma and spine.

Results: In total, 175 SE Cat 2 Cases were reported within the 12-year study period. The reported severity index (SI) was SI 1 in 57 cases (33%), SI 2 in 56 (32%), SI 3 in 15 cases (8%), SI 4 in 38 cases (22%). There was one death (0.005%) and eight cases with indeterminate SI (0.45%). Sports medicine is the highest risk among orthopaedic cases, where 100% of cases required re-operation under GA.

Discussion and Conclusion: The majority of cases have mild consequences.

Free Paper Session IX: Trauma and Rehabilitation

FP9.1

Effectiveness of intravenous tranexamic acid in reducing blood loss in hemiarthroplasty for geriatric hip fracture: a retrospective cohort study

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Introduction: Geriatric hip fracture is a common fragility fracture. Excessive perioperative blood loss has impacts on wound healing, rehabilitation and risk related to allogeneic blood transfusion. Tranexamic acid (TXA) is an inexpensive synthetic antifibrinolytic drug proven effective in reducing perioperative blood loss in total joint replacement but not yet in hemiarthroplasty. The purpose of this study is to evaluate efficacy of TXA in reducing blood loss and its related complications in geriatric hip fracture patients receiving hemiarthroplasty.

Materials and Methods: Geriatric patients with fracture neck of femur undergoing hemiarthroplasty in United Christian Hospital from January 2018 to December 2019 were recruited. Patients receiving surgery in 2019 were given 1 g intravenous TXA on induction of anaesthesia (TXA group). Those undergoing operation in 2018 were not prescribed TXA (control group). Postoperative haemoglobin and haematocrit decline, intraoperative blood loss, drain output, transfusion rate, operation time and thromboembolic events were compared by Student's *t* test.

Results: Total 343 patients (TXA group: 138; control group: 205) were included. There was significant reduction of intraoperative blood loss in TXA group comparing with control group (197.12 ± 109.21 mL vs 221.61 ± 99.42 mL, $p=0.036$). Postoperative haemoglobin decline was also less in TXA group (0.94 ± 0.93 g/dL vs 1.16 ± 1.12 g/dL, $p=0.049$). Thromboembolic events were not significantly higher in TXA group.

Discussion and Conclusion: Systemic administration of TXA in geriatric patients undergoing hemiarthroplasty is safe and effective in reducing blood loss and haemoglobin decline.

FP9.2

The use of local tranexamic acid in Chinese elderly patients undergoing short femoral nailing for intertrochanteric fracture: A randomised controlled trial

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FP9.3

A retrospective cohort study of the effect of intravenous tranexamic acid infusion on geriatric hip fractures patients undergoing proximal femoral nail antirotation

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Introduction: Tranexamic acid has been used in management of bleeding. We are conducting a retrospective cohort study to analyse the effect of intravenous tranexamic acid infusion on the surgical outcomes of geriatric hip fracture cases which undergoes proximal femoral nail antirotation.

Materials and Methods: In this study, 364 patients who had undergone proximal femoral nail antirotation between January 2018 and December 2019 in United Christian Hospital have been recruited. In total, 213 patients were in group 1 (without tranexamic acid infusion) and 151 patients were in group 2 (with tranexamic acid infusion). 1 g tranexamic acid was injected intravenously on induction of anaesthesia and before surgical incision. Outcomes including length of stay, operation time, intraoperative blood loss, haemoglobin drop and postoperative blood transfusion have been measured. Student's *t* test was used in our study.

Results: There was reduction of operative time, intraoperative blood loss, postoperative haemoglobin drop and postoperative blood transfusion in group 2, with the reduction in the intraoperative blood loss being statistically significant. There was an increase in length of stay in group 2, however this finding was not statistically significant

Discussion and Conclusion: Tranexamic acid is an antifibrinolytic agent which acts by binding to plasminogen which inhibits plasma formation. It has potential reduction in blood loss in major operations. There was a reduction in intraoperative blood loss in group 2 (76.0 ± 71.4 mL) compared with in group 1 (97.8 ± 67.7 mL).

FP9.4

Osteosynthesis-associated infection in osteoporotic fracture causes severe infection and further delayed healing than normal bone

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Introduction: Osteosynthesis-associated infection (OAI) is one of the most challenging complications in orthopaedic surgery. The objective of this study is to compare fracture healing and microbiological outcomes in osteoporotic bone with normal bone with OAI.

Materials and Methods: In total, 72 6-month-old Sprague-Dawley rats were randomised to four groups: sham with infection (SHAM-INF), OVX with infection (OVX-INF), sham (SHAM), and ovariectomised (OVX). Open femoral diaphysis fracture and K-wire fixation were performed. 5 μ L of 4×10^4 CFU/mL *Staphylococcus aureus* was inoculated. Radiography, micro-CT, and haematoxylin-eosin (H&E) staining were evaluated at 4 and 8 weeks after surgery. Bacterial load on bone and K-wire were quantified.

Results: At week 8, CA and CW in both SHAM-INF and OVX-INF groups were significantly higher than respective control ($p < 0.019$). From week 4 to 8, there was an increasing trend of CA and CW in OVX-INF group indicating poor callus remodelling. At week 4, H&E staining showed increased inflammatory cell infiltration but less cartilage formation in OVX-INF group compared to SHAM-INF group. Micro-CT showed no bony union in both OVX-INF and SHAM-INF groups at week 8. At week 8, the BV in SHAM-INF group was significantly higher than OVX-INF group ($p = 0.002$). At week 4, a higher trend of bacterial load was observed in the OVX-INF group compared SHAM-INF group.

Discussion and Conclusion: Our preliminary findings suggested that oestrogen deficiency further delay fracture healing in OAI compared to normal bone with OAI, which was characterised by poorer callus remodelling, more severe bone lysis and higher bacterial load on bone.

FP9.5**Does sarcopenia affect osteoporotic fracture healing? Myostatin as a target to enhance repair**

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FP9.6**Longitudinal study of surgically treated fragility fracture patients: are we doing enough for osteoporosis investigations and treatment**

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Introduction: In this longitudinal study, we followed the surgically treated fragility fracture patient to see if appropriate investigations or treatment had been offered. On the other hand, the clinical outcome and financial implications related to those actively treated patients were also studied.

Materials and Methods: This is a 2-year longitudinal study about the patient admitted with fracture hip and distal radius. The clinical outcome was based on the comparison between the surgery only group and the group with additional osteoporotic therapy (active treatment group) in terms of re-admission rate of fragility fracture and symptomatic osteoporotic collapse.

Results: From 2017 to 2018, 250 patients were admitted with fragility hip and distal radius fracture and they were treated operatively. Overall, DEXA scan were arranged in only 10% (n=25) of the patient and only 10% (n=25) of the patients were given bisphosphonate. Calcium and Vitamin D3 supplements were given for 30% of them. On the other hand, 10% (n=25) were readmitted due to another fragility fracture and 5% (n=12) were suffered from new onset of osteoporotic back pain. There was significant difference in re-admission rate between surgery only group and the active treatment group treated with Bisphosphate (p=0.042).

Discussion and Conclusion: There is a great proportion of patients readmitted due to another episode of fragility fracture. The patients receiving Bisphosphate showed significant reduction in re-admission rate. The results implied that osteoporotic therapy should be started earlier after the first episode of fragility fracture.

FP9.7

Functional outcomes of reverse shoulder arthroplasty compared with hemiarthroplasty and open reduction and internal fixation

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Introduction: Three- or four-part fractures of proximal humerus were traditionally treated with open reduction and internal fixation. Hemiarthroplasty would be considered in case of poor bone quality or with high risk of avascular necrosis. A new modality of surgical treatment, reverse shoulder arthroplasty has been advocated recently. This study aims to compare the functional outcomes of these three groups of patients.

Materials and Methods: We included all patients aged >55 years who suffered from three- or four-part fracture proximal humerus or shoulder fracture dislocation and treated surgically in local hospitals from 2015 to 2019. The demographic data of patient (age, sex, premorbid status), the mechanism of injury, fracture pattern, postoperative functional outcomes (Oxford shoulder score [OSS] at 6 months and 1 years), revision rate up to 1-year follow-up were examined and compared between the study groups.

Results: In total, 27 patients who underwent RSA, six who underwent hemiarthroplasty, and 22 who underwent ORIF were included. The demographic factors and mechanism of injury showed no statistical significance. The fracture pattern in group of RSA and hemiarthroplasty is more associated with dislocation. It shows significantly longest operative time in hemiarthroplasty group while the ORIF group the shortest. The RSA patients showed better 1-year OSS, range of movement and lower revision rate than the other groups.

Discussion and Conclusion: RSA group outcome appeared to be more superior than the other groups in our study. Still, Careful case selection, preoperative planning, good surgical technique and rehabilitation are the keystones for successful surgery.

FP9.8

Biodegradable magnesium screws in elbow fracture fixation: clinical case series

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Biodegradable magnesium-based implants are innovative alternatives that potentially eliminate the need for implant removal. Recent studies have also demonstrated the osteogenic properties and bacterial inhibition potentials of magnesium screws. Due to these clinical advantages, the use of magnesium implants has become more popular recently. We reported a clinical series of three elbow fracture cases, where magnesium screws were used in the treatment of one radial head and two capitellum fractures. Postoperative clinical courses were uneventful, and fracture healing occurred within 3 months. In all cases, radiolucencies were observed around implants especially in the screw-head region at 2 months after operation, but disappeared with consolidation at 1 year after operation. All patients achieved near normal range of motion, minimal symptoms and good functional outcomes. No complication such as failure of fixation, loss of reduction, malunion or infection was seen. No implant revision or removal was necessary. Magnesium bioabsorbable screws are shown to be a viable option for these fractures.

FP9.9**Can perioperative prophylactic proton pump inhibitor prevent acute gastrointestinal haemorrhage in geriatric patients with acute hip fracture? A study in a Hong Kong local hospital****Tsang Yeung, Yung Chak Hsu***Department of Orthopaedics and Traumatology, United Christian Hospital*

Introduction: Acute upper gastrointestinal bleeding is one of the major causes of prolonged hospital stay and mortality in geriatric patients with hip fractures. Our department has implemented a universal prescription of a short course of proton pump inhibitor to all geriatric hip fracture patients since March 2019 to prevent this dreadful event. Daily dose of 40 mg of intravenous pantoprazole was given to all geriatric hip fracture patients since admission. It would then be changed to oral pantoprazole 40 mg daily after operation, if the patient can tolerate. The prophylactic treatment would be continued until at least 5 days after operation.

Materials and Methods: This is a retrospective cohort study. Data of a group of geriatric hip fracture patients admitted to our department from April 2019 onwards and were receiving the above proton pump inhibitor prophylaxis were retrieved from patient record. The data were then compared with the historical control arm, i.e., patients received no proton pump inhibitor prophylaxis before the implementation of our protocol.

Results: There were more than 600 patients in each arm. The mean duration of the course of pantoprazole was 8.9 days (range, 2-24 days). There is a trend of reduction in the incidence of acute upper gastrointestinal bleeding by prescribing proton pump inhibitor prophylaxis (3.0% to 1.7%), although not statistically significant ($p=0.31$).

Discussion and Conclusion: A short course of proton pump inhibitor might be effective for upper gastrointestinal bleeding prophylaxis. Further studies with larger sample size are needed to confirm our hypothesis.

FP9.10**Short external rotators repair in hemiarthroplasty via posterior approach for neck of femur fractures—randomised study on dislocation rate****CY To, Tycus Tse, WY Mok***Department of Orthopaedics and Traumatology, Pamela Youde Nethersole Eastern Hospital*

Introduction: Hip hemiarthroplasty is indicated for the displaced fracture of neck of femur and there is no consensus on soft tissue repair. Posterior capsule repair is routinely performed while short external rotators are left detached after hip hemiarthroplasty with posterior approach. This study was designed to evaluate whether there is additional benefit of short external rotators reattachment in reducing dislocation.

Methods: Study period was between 1 January 2015 and 31 December 2019. Cases were assigned into two groups. The study group involved cases had short external rotators repaired during hemiarthroplasty operation. The control group involved cases in which the external rotators were not repaired. The patients were followed up for at least 1 year after operation and assessed with plain radiography.

Results: Totally 905 cases had hip hemiarthroplasty performed during the study period (Austin Moore 68%, unipolar 21%, bipolar 11%). 49 cases (5%) had short external repaired and 906 cases (95%) had not. Incidence of hemiarthroplasty dislocation in study group was 4% (2/49) in which one case had prosthetic infection and that in control group was 2% (17/906) ($p=0.282$).

Conclusion: Short external rotator repair had no significant benefit in reducing dislocation after hip hemiarthroplasty via posterior approach.

FP9.11

Fracture incidence and related mortality are reduced with social distancing measures in the COVID-19 pandemic—an epidemiological study

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FP9.12

A multidisciplinary approach in a novel orthopaedic out-patient model: a review of clinical services provided by the Jockey Club specialist out-patient clinic in the MacLehose Medical Rehabilitation Centre (MMRC)

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FP9.13

Use of independent toileting to predict length of stay in patients with knee and hip joint arthroplasty

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Introduction: The aim of this article is to determine if independent toileting (Toilet Days) could be used as a functional discharge indicator in patients with total knee arthroplasty (TKA) and total hip arthroplasty (THA). Independent toileting after surgery, which requires the ability to manage the lower garment, transfer, ambulation, judgement and safety awareness, has been used as hospital discharge criteria.

Methods: All records with total joint arthroplasty done in 2019 at Queen Mary Hospital were analysed. The Toilet Days, age, gender, social support, and type of operations were included in multiple regression to identify the predictors for postoperative length of stay (LOS) in an acute hospital.

Results: A total of 305 cases (198 female, 107 male) were captured, mean age 68 ± 11.4 years (range, 17-97 years). Of them, 70% received TKA and the other 30% received THA. The average Toilet Days was 3.2 ± 2.7 days (TKA: 2.8 ± 2.9 days; THA: 3.9 ± 2.1 days). Multiple regression shows that Toilet Days was the only statistically significant predicting factor in LOS ($p < 0.001$, $R^2 = 0.27$), with positive correlation ($r = 0.52$, $p < 0.0001$).

Conclusion: Independent toileting could be used as a functional discharge indicator. Patients who can manage independent toileting are more confident to return home. Activity of daily living training after surgery, especially in toilet use, is essential in promoting early and safe discharge home.

FP9.14

Can a community-based multi-model rehabilitation programme improve balance and function of patients after total knee arthroplasty? A pilot randomised controlled trial**William WN Tsang,¹ Chun Hoi Yan,² Priscillia L Lam,³ Chun Ming Chan,⁴ Stephen R Lord,⁵ Arnold YL Wong,⁶ Cathy Lo,⁶ Matthew A Brodie⁵**¹*Department of Physiotherapy, The Open University of Hong Kong*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*³*Department of Physiotherapy, Queen Mary Hospital*⁴*Department of Orthopaedics and Traumatology, Yan Chai Hospital*⁵*Neuroscience Research Australia, University of New South Wales, Australia*⁶*Department of Rehabilitation Sciences, The Hong Kong Polytechnic University*

Introduction: The number of total knee arthroplasty (TKA) has been rising over the past two decades given the ageing population. While various rehabilitation programmes have shown clinical benefits, those programmes were conducted in out-patient clinics, which may overload physiotherapists. This pilot randomised controlled trial (RCT) aimed to evaluate the effects of a 12-week community-based multi-model intervention on balance and function of post-TKA patients.

Methods: In total, 40 patients undergoing primary TKA (aged 60-80 years) were randomly assigned to an intervention (n=20) and a usual care group (n=20) at 12 weeks after TKA. The intervention group received a 12-week supervised multi-model intervention including strengthening exercise, balance training, and Tai Chi (90 minutes per session per week). Primary outcomes included Knee injury and Osteoarthritis Outcomes Score (KOOS) questionnaire and Brief-BESTest. Additional outcomes included a self-administered 16-item Falls Efficacy Scale, history of falls, and active knee range of motion. Participants were assessed at baseline (before surgery), and at 12 and 24 weeks after surgery.

Results: Compared to baseline, all TKA patients demonstrated significant improvement in all outcomes at 12 and 24 weeks. At 24 weeks, the intervention group showed significantly better Brief-BESTest score and active knee range of motion than the usual care group. However, no significant between-group differences were noted for KOOS score, Falls Efficacy Scale score, and number of falls at 24 weeks.

Conclusions: The weekly community-based multi-model intervention may be a useful alternative to improve balance and knee range in post-TKA patients. Given the promising results, a definitive RCT is warranted to evaluate the long-term effects.

FP9.15

Application of additive manufacturing in prosthesis design and manufacturing for below-the-knee amputations patients

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Introduction: Traditional fabrication of prosthesis is material wasting, time consuming and labour-intensive. Additive manufacturing could solve these problems. However, there is still a gap between engineer, orthoptist and clinician. Lengthy conversation and a complicated design workflow were needed to 3D-print a prosthesis. A prosthetic socket designing software system was developed for orthoptist and clinician to improve the efficiency of the process.

Materials and Methods: A concise software system modularised for prosthetic socket design for below-the-knee amputations (BKA) patients was developed in python environment (Python, US) based on the Visualization Toolkit (Kitware, US). With the input of 3D-scanned stumps, prosthesis boundary and prosthesis thickness, a prosthesis can be designed easily by clinician and orthoptist solely. 18 stumps of BKA patients were 3D-scanned and all prosthetic sockets were designed by an experienced orthoptist using the software.

Results: An average 3D-scanning time of 5 minutes for each patient was recorded. The average prosthetic socket designing time was reduced from 2 days to 15 minutes. The average 3D-printing time for each socket was 5 hours. The average time for the overall prosthetic socket 3D-printing workflow reduced from 4 days to 0.5 days. Improvement of comfort was reported from all patients.

Discussion and Conclusion: With the developed system, the lengthy fabrication time is now shifted to 3D-printers. Without the need of discussion between engineer, clinician and orthoptist, the socket design time reduced drastically as well as the overall workflow. This study indicated the feasibility of applying 3D-scanning and 3D-printing in the design and manufacture of BKA sockets.

FP9.16

Back to community and being active again—exercise training programme for patients with knee osteoarthritis in MMRC

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Introduction: Since 2016, Comprehensive Osteoarthritis Management (COME) programme for patients with knee osteoarthritis (OA) began in the MacLehose Medical Rehabilitation Centre. COME programme consists of 3-hour multidisciplinary education, 10 physiotherapy exercise sessions and six occupational therapy sessions of coping skills. This presentation is to review the 2-year results.

Materials and Methods: Patients with radiological stages of Kellgren-Lawrence Grade I to III were recruited and assessed at baseline, 6 weeks, 3 months, and 1 year with telephone follow-up. Outcomes assessed: physical performance with 1-minute chair-stand test and quadriceps strength with dynamometer; pain on walking or stairs climbing; weekly time on physical activities and exercise training; functional status with patient-specific functional scale (PSFS) score and self-efficacy with self-exercise efficacy (SEE) score; QoL with Euro-QoL five dimensions in three levels (EQ5D3L) and health with EQ5D3L VAS scale (EQ-VAS).

Results: 163 patients completed programme with 1-year follow-up. Significant improvements observed: 1-minute chair-stand test increased by 13.1 ± 17.5 repetitions, quadriceps strength increased by 5.1 ± 7.8 kg and 5.7 ± 7.7 kg in left and right side respectively at 3 months ($p < 0.001$). Pain reduced by 1.1 ± 2.8 points, time spent on physical activities and training increased by 44.8 ± 44.2 minutes and 107.7 ± 113.2 minutes, PSFS improved by 3.6 ± 2.9 points, SEE improved by 14.6 ± 20.6 points, EQ5D3L increased by 0.1 ± 0.2 points, EQ-VAS improved by 8.0 ± 20 points at 1 year ($p < 0.001$). 80% of patient would continue exercise at fitness rooms of Leisure and Cultural Services Department.

Discussion and Conclusion: COME is effective to improve patients' physical performance, quality of life and self-efficacy to maintain exercise habit.

FP9.17

Tele-rehabilitation for patients with knee osteoarthritis during COVID-19 in MacLehose Medical Rehabilitation Centre

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Introduction: During the COVID-19 epidemic, tele-rehabilitation became an option to provide rehabilitation when all out-patient and day-patient services were affected. Tele-rehabilitation developed in the Physiotherapy Department of MacLehose Medical Rehabilitation Centre (MMRC) for patients with knee osteoarthritis (KOA). It is to review the use of tele-rehabilitation in MMRC.

Materials and Methods: From March to April of 2020, 12 and nine patients with KOA were recruited from orthopaedic clinics of MMRC and Queen Mary Hospital (QMH), respectively, for tele-rehabilitation. Physiotherapists of MMRC were able to perform physical assessment for patients during their orthopaedic consultations in MMRC clinic. Eight sessions of tele-rehabilitation via telephone with 10 minutes each, twice a week for 4 weeks were provided to patients. All patients learnt disease management and were encouraged to exercise regularly. For MMRC group, physiotherapist offered exercise progression for eight sessions. Pain intensity, walking tolerance, difficulties with stairs, EuroQoL Index and disease knowledge were assessed. Patient satisfaction and overall improvement in numeric global rating of change scale (NGRCS) were evaluated.

Results: For MMRC group, improvements were observed in stair walking (>50% patient better comparatively), EuroQoL Index (0.14 scores more), and knowledge (1.75 scores more). Patients only improved in disease knowledge (1.78 scores more) in QMH group. Both groups had improved in NGRCS (MMRC: 4.00 ± 2.05 scores, QMH: 1.56 ± 1.67). Both groups were satisfied with the service with no significant difference.

Discussion and Conclusion: The tele-rehabilitation programme for patients with KOA is feasible with good acceptance from patients.

FP9.18**Machine learning for continuous quality improvement and predictive model for length of stay for geriatric hip fracture****Ivan Chun Hei Lai, Prudence Kwan Lam Mok, Wai Wang Chau, Koko Ko, Sheung Wai Law***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Introduction: Artificial intelligence (AI) and machine learning (ML) techniques are making impacts predictive medicine. While conventional statistics analytic tools cannot handle big data, ML achieves relatively high predictive accuracy by incremental optimisation of a mathematical model. Accurate prediction of the length of stay (LOS) of geriatric hip fracture patients allows proactive resource allocation to the outcome and better matching of intensity of care according to the severity of the disease. This has huge implications since medical manpower can be optimised based on the prediction.

Materials and Methods: Data of 7285 hip fracture patients from 2010 to 2019 in Hong Kong were used as the input for the model to predict whether the LOS is longer than 21 days in each case. Those data contained features such as gender, age, diagnosis category of the hip fracture etc. Random forest classifier was chosen as the estimator.

Results: A precision score of 0.67 was obtained. Feature importance analysis indicated that type of residency before hospitalisation; age; and differences before and after hospitalisation in the elderly mobility scale, modified functional ambulation classification, and modified Barthel index were the five most significant features in the prediction.

Discussion and Conclusion: Since the database contains a considerable amount of invalid or heterogenous data and a limited amount of ML models was tested, the current prediction accuracy was relatively low. However, this paper illustrates the possibility of application of AI in predictive medicine with improved data collection methods and more sophisticated ML models.

FP9.19**Factors affecting the 1-year mortality rate after lower limb amputation in the Hong Kong Chinese population****Pui Man Chung,¹ Bolton Ka Hung Chau,² Esther Ching San Chow,¹ Raymond Nang Man Wong,¹ Kwok Hang Lam¹**¹*Department of Orthopaedics and Traumatology, United Christian Hospital*²*Department of Rehabilitation Sciences, The Hong Kong Polytechnic University*

Introduction: Lower limb amputation has significant morbidity and mortality. This study reviews the potential factors affecting the 1-year mortality rate after lower limb amputation in Hong Kong Chinese population.

Materials and Methods: Cases with lower limb amputations (toe, ray, below knee and above knee amputations) from a regional hospital from Jan 2016 to Dec 2017 were recruited. Amputations due to trauma were excluded. The 1-year mortality rate and the potential risk factors (age, sex, length of stay, multiple operations, extent of surgery (minor vs major), medical comorbidities including 1) end-stage renal failure, 2) cardiac diseases, 3) ischaemic heart disease, 4) peripheral vascular disease and 5) diabetes mellitus) were analysed by multiple logistic regression using Matlab 2018a.

Results: In total, 132 patients were recruited (173 operations). The 1-year mortality rate was 36.3%. Mean age at death was 72.2 years. The results of the regression analysis showed patients having end-stage renal failure ($\beta=2.195$, $t_{120}=3.008$, $p=0.003$) or a major amputation (including above or below knee amputation) ($\beta=1.079$, $t_{120}=2.120$, $p=0.034$), had a significant higher 1-year mortality. The remaining factors showed no significant effect ($|t_{120}| < 1.572$, $p > 0.116$). The 1-year mortality rate in ESRF patients was 77.8%; while the 1-year mortality rate without ESRF was 29.8%. The mean age at death in ESRF group was 62.9 years; while that without ESRF was 76.1 years. The 1-year mortality for patients with major amputation was 45.8% while that for minor amputation was 20.4%.

Discussion and Conclusion: ESRF and major amputation are factors that increase the 1-year mortality rate after lower limb amputation.

Free Paper Session X: Sports Medicine

FP10.1

Influence of hamstring autograft diameter on graft failure rate in Chinese population after anterior cruciate ligament reconstruction

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Introduction: The literature is scarce regarding the influence of hamstring autograft diameter on the outcome of anterior cruciate ligament (ACL) reconstruction in Asian population. This study was undertaken to investigate the failure rate after ACL reconstruction among Chinese patients treated with hamstring tendon autografts of different diameters. In addition, we would also want to investigate if the 'cut-off' point of 8.5 mm that is commonly quoted in the European and American studies could be applied to our Chinese patients.

Materials and Methods: A retrospective review of 394 consecutive patients who underwent ACL reconstruction using quadrupled semitendinosus and gracilis autografts from 2009-2018 at our centre was performed. Logistic regression analysis was used to determine the relationship between graft failure rate and predictor variables, including hamstring graft diameter, gender, and age.

Results: Hamstring graft diameter of 8.0 mm or more was found to be associated with significant reduction of risk in graft failure rate ($p=0.001$, Relative Risk 0.19). No significant associations were found between graft failure rate and gender or age.

Discussion and Conclusion: Hamstring graft diameter 8.0 mm or greater is associated with decreased graft failure rate and revision rate in our local Chinese population.

FP10.2**Classifying basketball free-throw skill level using a wearable sensor**

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Introduction: Basketball free-throw (FT) accounted for approximately 14%-18% of total scored points in each national basketball association game and accurate FT could determine game outcome. Previous biomechanical studies attempted to identify the kinematic differences of FT among players with different skill levels. However, even the best predictor i.e., wrist angular velocity, only displayed a fair association ($r=0.46$) with FT accuracy. Wearable sensor technology and machine learning algorithms have recently been applied in sports motion analysis. This study aimed to classify FT skill levels with these emerging technologies.

Materials and Methods: In total, 25 recreational and 18 professional right-handed basketball players were recruited. Each subject had 30 FT attempts. An inertial measurement unit (IMU) was affixed onto the dorsum of the mid-point of right 3rd metacarpal bone. 80% of raw data sampling at 50 Hz was input to a convolution neural network in order to establish an algorithm for binary classification of skill level. The remaining 20% of data were used to validate the prediction accuracy of the algorithm.

Results: Excellent accuracy of classification was obtained when all IMU data was utilised (accuracy=96%; $R^2=0.86$; loss=0.155). High accuracy was obtained when only data from the accelerometer (accuracy=0.94; $R^2=0.79$; loss=0.36) or gyroscope (accuracy=0.92; $R^2=0.71$; loss=0.37) were analysed.

Discussion and Conclusion: Our findings suggest the viability to use a single wearable sensor to classify skill levels of basketball players during FT. This study would help understand the biomechanical difference across skill levels. More importantly, specific training could be developed by reverse engineering for FT accuracy enhancement.

FP10.3**Injury epidemiology of Ultimate Frisbee in Hong Kong**

Florence Ou Suet Pang, Samuel Ka Kin Ling, Gene Chi Wai Man, Patrick Shu Hang Yung

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Introduction: Ultimate Frisbee (Ultimate) is a non-contact, self-refereed team sport that is rapidly gaining popularity in Hong Kong. It is a physically demanding competition with a substantial injury risk, but injury epidemiology data is lacking since it is a relatively novel sport. This study aims to identify and analyse the injury prevalence and risk factors for Ultimate players in Hong Kong.

Materials and Methods: Participants were recruited through the Hong Kong Ultimate Players' Association and independent local teams. Injury type, location, nature, severity and onset were recorded with an online self-reporting survey from June 3 to 16, 2020. Descriptive statistics including injury incidence and rates, were analysed using Chi-squared test for individuals playing Ultimate in 2019.

Results: The overall response rate was 75.6%, with 59 entries eligible for analysis. The injury prevalence is 62.7%, with both men and women having similar incidence ($p=0.63$). Increasing age correlated with more severe and recurrent injuries. The risk of in-tournament injury was three times higher than injuries during training ($p<0.001$) with lower limb injuries being the most prevalent.

Discussion and Conclusion: Our findings provide evidence that majority of Ultimate injuries involved the lower extremity with injuries occurring more in tournaments than training. In addition, players aged >25 years were more susceptible to recurrent and major injuries. This study provides the groundwork for tailoring prevention strategies to minimise injuries in Ultimate Frisbee.

FP10.4

Persistent quadriceps muscle atrophy after anterior cruciate ligament reconstruction was associated with defective exercise-induced changes in myokines

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Introduction: Quadriceps muscle atrophy is common after ACLR. Myokine Brain-derived neurotrophic factor (BDNF) has been identified for its potential role in muscle hypertrophy. The aim of this study was to examine the serum levels of myokines before and after exercise in ACL reconstructed patients. We hypothesised that exercise-induced myokines upregulation was disrupted, and patients with quadriceps muscle atrophy would have blunted myokines response to exercise compared with patients without atrophy.

Materials and Methods: Patients who underwent ACLR were recruited. Questionnaires (IKDC, Tegner and Lyshom) were obtained. Quadriceps muscle thickness and isokinetic muscle strength were assessed. Blood samples were taken before and after exercise, and serum BDNF levels were measured. Bivariate correlation analysis was used to examine the relationship between BDNF and other outcome measures, and Mann-Whitney *U* test was used to compare differences between groups with and without persistent muscle atrophy.

Results: Sixteen participants were recruited. Half of the patients had quadriceps muscle atrophy which can persist up to 40 months after surgery. It was observed that serum BDNF was decreased after exercise in patients with significant quadriceps atrophy, while serum BDNF was increased in the no atrophy group ($p=0.010$).

Discussion and Conclusion: BDNF was increased after exercise for patients without quadriceps atrophy, whereas for patients with atrophy, BDNF was decreased after exercise. This showed that persistent quadriceps atrophy is attributed by the potential deregulation of BDNF in response to exercise. This can potentially change our current approach for rehabilitation after ACLR as this deregulation of BDNF may render traditional rehabilitation exercises futile.

FP10.5

Case series: early outcomes of tibial tubercle chevron osteotomy

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Introduction: Tibial tubercle osteotomy is a well-described realignment procedure to treat patellofemoral joint disorders, including patellofemoral instability and patellofemoral osteoarthritis. While the conventional Fulkerson's operation consists of anteromedialisation of tibial tubercle, coronal plane chevron type osteotomy in addition provides distalisation by complete detachment of the distal periosteal hinge. This case series is to evaluate the early outcomes and complications of this alternative technique.

Materials and Methods: All patients who underwent tibial tubercle chevron osteotomy from April 2017 to May 2020 in United Christian Hospital were recruited with a minimum follow-up period of 6 months. Change in pain score, recurrence of patella dislocation, range of motion, Lysholm Knee scoring scale, osteotomy union, and complications were assessed. Data were collected from operative records, surgeon consultation notes, physiotherapist reports and phone interviews.

Results: Seven knees in seven patients were included. Indication of the procedure was recurrent patella dislocation in six patients, and patellofemoral osteoarthritis in one patient. Concomitant medial patellofemoral ligament reconstruction was done in six of them. All patients had improved pain and Lysholm knee score. All achieved radiological union of osteotomy. Six patients regained preoperative range of motion at 6 months. No recurrence of patella dislocation, or major complication was observed.

Discussion and Conclusion: Tibial tubercle chevron osteotomy provided favourable early outcomes with low complication rate for recurrent patella dislocation and patellofemoral joint arthritis. This technique also provided advantage of distalisation, whereas the potential increased risk of non-union was not observed in this study.

FP10.6

The role of muscle strength, muscle elasticity and muscle coordination of quadriceps and hamstrings in knee stability during single leg hop landing in patients with anterior cruciate ligament reconstruction

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FP10.7

Retrospective study: outcomes of Latarjet operation using single malleolar screw

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Introduction: Latarjet operation is the choice of surgery in cases of anterior glenohumeral instability with significant bone defect. In a conventional Latarjet operation, 2 screws were used to the fixed coracoid process. However, Chinese population has smaller coracoid size and might not be large enough to accommodate two screws. In this study, we are investigating the outcomes of Latarjet procedure using single malleolar screw.

Materials and Methods: Eight patients who underwent Latarjet operation from January 2010 to December 2019 were included. Primary outcomes measured would be complications of recurrent dislocations, non-union of the coracoid transferred and loosening or breakage of screws. They were assessed both clinically and by postoperative X-ray and computed tomography. Secondary outcomes include a clinical assessment of range of motion, pain score, American Shoulder and Elbow Surgeons score, sense of apprehension or instability and ability to return to previous work and life. These parameters were assessed at 6 and 12 months after operation. Mann-Whitney *U* test and Chi-squared test were used to compare the results.

Results: Mean age of the patients was 28.9 years. All of them were male. Mean follow-up was 11.1 months. No patients suffered from any of the complications in the early postoperative period of 6 months and 12 months. All patients showed satisfactory results in terms of clinical outcomes and functional outcomes.

Discussion and Conclusion: Patients demonstrated good results in early postoperative period. Long-term follow-up would be carried out in order to assess these outcomes in long-run.

FP10.8

The effect of eccentric versus concentric isokinetic trainings on muscle strength after anterior cruciate ligament reconstruction (ACLR)—a randomised controlled trial

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Introduction: The role of eccentric exercise after ACLR remained controversial. Although it can increase muscle strength, it has also been considered to cause more exercise-induced muscle damage which can be detrimental to the patients' rehabilitation after surgery. Contrary to the traditional belief, recent literature has shown eccentric exercise to be safe. Since the current isokinetic training protocol in our centre only includes concentric exercise 4 months after ACLR, we aim to investigate for the benefits of eccentric over concentric isokinetic exercises and its value in later stage of rehabilitation.

Objectives: To compare the effect of eccentric and concentric isokinetic trainings on quadriceps and hamstrings strength after ACLR.

Materials and Methods: Fourteen subjects aged 16 to 35 years were recruited at Prince of Wales Hospital at 4 to 6 months after ACLR. They were randomly allocated into two groups and received either eccentric or concentric isokinetic training weekly for six weeks in addition to the standardised postoperative exercise protocol. The change in absolute peak torques and limb symmetry index (LSI) of quadriceps and hamstrings measured by pre- and post-training isokinetic tests were recorded.

Results: The eccentric group achieved significantly bigger gains in absolute peak torques at post-intervention time-point when compared with concentric group. The eccentric group also achieved significantly better hamstrings LSI.

Discussion and Conclusion: A 6-week course of eccentric training was more effective than concentric training in increasing quadriceps and hamstrings peak torques. Eccentric isokinetic training should be included in the rehabilitation protocol after ACLR to enhance muscle strength before returning to sport.

FP10.9**Measurement of muscle elasticity as an additional outcome for determining return to play after anterior cruciate ligament reconstruction****Cham Kit Wong,¹ Xin He,² Ji Hong Qiu,² Hio Teng Leong,² Sai Chuen Fu,² Michael Tim Yun Ong,² Patrick Shu Hang Yung²**¹*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*²*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Introduction: Better muscle function of quadriceps and hamstring is often considered as a key factor for return to play (RTP) after anterior cruciate ligament reconstruction (ACLR). In addition to muscle strength, muscle elasticity is a critical determinant of muscle performance. This study aims to (1) compare the difference in muscle strength and muscle elasticity of quadriceps and hamstring, and knee functional outcomes between patients who returned to play and who did not; (2) investigate the factors associated with RTP after ACLR.

Materials and Methods: In total, 37 male subjects (mean age 24.97 ± 4.19 years) with unilateral ACLR participated in this study. Muscle elasticity of quadriceps and hamstring determined by muscle shear modulus were quantified using ultrasound shear wave elastography. Isokinetic knee flexion/extension peak torque were measured at $60^\circ/\text{s}$ and $180^\circ/\text{s}$. Knee function was assessed by International Knee Documentation Committee (IKDC) and single leg hop test.

Results: Twenty-two subjects returned to play pre-injury sport and 15 did not. Subjects who returned to play showed increased shear modulus in vastus medialis (VM) and higher IKDC scores when compared to those who did not (3.33 ± 0.44 kPa vs 2.83 ± 0.42 kPa, $p=0.002$ and 86.37 ± 8.42 vs 79.63 ± 9.31 , $p=0.028$ respectively) while there was no difference in quadriceps and hamstring peak torque deficits and single leg hop performance ($p>0.05$). Regression analysis showed that time since surgery ($p=0.044$), IKDC ($p=0.036$) and VM shear modulus ($p=0.016$) were associated with RTP.

Discussion and Conclusion: Patients with longer time since surgery, better self-reported knee function and stiffer VM muscle are more likely to return to pre-injury sport activity. Measurement of muscle elasticity may be considered as an additional outcome for determining RTP after ACLR.

FP10.10**Prospective clinical and radiological evaluation of a bioinductive collagen scaffold to treat full-thickness rotator cuff tears****Michael Tim Yun Ong,¹ George Ying Kan Law,² Alex Wing Hung Ng,³ Patrick Shu Hang Yung,¹ Chun Kwong Lo⁴**¹*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*²*Department of Orthopaedics and Traumatology, Alice Ho Miu Ling Nethersole Hospital*³*Department of Radiology, Prince of Wales Hospital*⁴*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*

Purpose: To use a novel collagen implant to augment full-thickness rotator cuff repair through induction of new tissue formation.

Methods: Eight patients with small to medium-sized tear of supraspinatus tendon were enrolled in our study. Repairs of the cuff lesions were augmented with a bioinductive collagen implant anchored over the bursal surface of the repair. Tendon thickness and healing at the original tear site were evaluated using MRI. Clinical outcomes were assessed using UCLA and Constant-Murley scores before and after surgery.

Results: MRI revealed that the mean tendon thickness was increased at repair site due to implant induced new tissue formation which became indistinguishable from the underlying tendon at 3 months after surgery. At 1-year follow-up, all clinical scores also improved significantly. No serious complications related to the implant were detected.

Conclusion: Augmentation of small to medium-sized rotator cuff repair with this bioinductive collagen scaffold provides a safe and effective treatment for the healing of cuff repair.

FP10.11

Magnesium alloy wire facilitates bone tendon integration in bone tunnel after anterior cruciate ligament reconstruction in rabbits

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Introduction: Unreasonable tendon to bone integration after ACL reconstruction may be required revision surgery. In addition, early-stage rehabilitation training is concerned because of risk of re-injury. Extensive efforts have been made to develop novel biomaterials like magnesium implants aiming to enhance graft integration. In this study, Magnesium-zinc-gadolinium (MZG) wire was developed and tested for tendon graft weaving. We hypothesise that MZG wire could facilitate graft integration as a potential treatment for clinical problems.

Materials and Methods: Seventy-two rabbits were undergone ACL reconstruction using our established experimental model. The MZG wire weaved surrounding tendon graft. Samples were harvested at week 3, 6 and 9 after surgery. All the samples were evaluated radiologically, histologically, and mechanically.

Results: The MZG group presented narrower tunnel diameter and more peri-tunnel bone formation at all the time points ($p < 0.05$). For histological analysis at week 3, the control group presented fibrosis fibres degermation with slight degeneration while blood sinus coupled with chondrogenesis at interface were found in MZG group. At week 6, fibroblasts started to distribute along bone surface in the control group. In MZG group, fibrocartilage like tissues bridging tendon and bone were found. Mechanical test showed higher ultimate loading in MZG group ($p < 0.05$).

Discussion and Conclusion: Application MZG wire to suture tendon graft can promote peri-tunnel bone formation and fibrocartilage formation to enhance tendon to bone integration at early stage after ACL reconstruction. Thus, clinically it might contribute to reducing the revision rate and facilitating earlier rehabilitation of patients to start with muscle power training.

FP10.12**Type 2 diabetes mellitus increased the risk of symptomatic rotator cuff tendinopathy in older adults: an ultrasound study****Hio Teng Leong, Chun Cheong Ma, Yang Liu, Xin He, Patrick Shu Hang Yung***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Introduction: Type 2 diabetes mellitus (DM) have been shown to increase the risk of rotator cuff tendinopathy. The study aimed to examine the changes in the supraspinatus tendon structure, supraspinatus tendon thickness and subacromial space in older adults using ultrasound imaging.

Materials and Methods: A total of 106 older adults (mean age 73.8 ± 7.1 years) participated in this study, of which 32 have DM. Self-perceived shoulder pain and disability measured by Shoulder Pain and Disability Index (SPADI), and ultrasound measurement of the supraspinatus tendon thickness and subacromial space were compared between older adults with and without DM.

Results: Our results showed significant risk of having symptomatic rotator cuff tendinopathy in older adults with DM (odds ratio=2.3, 95% CI=0.98-5.4, $p=0.050$). Older adults with DM demonstrated more shoulder pain and dysfunction when compared to those without DM (SPADI= 21 ± 20.5 vs 11.8 ± 16.3 , $p=0.009$). Ultrasound imaging showed older adults with DM demonstrated significant structural changes in supraspinatus tendon ($p=0.002$), more reduction of the subacromial space ($p=0.017$), and increased thickness of the supraspinatus tendon ($p=0.023$) when compared to those without DM. Multiple logistic regression analyses revealed that structural changes of the supraspinatus tendon and reduction of the subacromial space to be significantly associated with increased risk of rotator cuff tendinopathy ($R^2=0.436$, $p<0.001$).

Discussion and Conclusion: Older adults with DM demonstrated structural changes in supraspinatus tendon, narrowing of the subacromial space and increased thickness of the supraspinatus tendon. Type 2 DM may increase the risk of symptomatic rotator cuff tendinopathy in older adults.

FP10.13**Sports injuries: population-based data on incidence, diagnosis, severity and high-risk group****Ashley Ying Wong, Michael Tim Yun Ong, Yuen Man Wu, Patrick Shu Hang Yung***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

Introduction: Exercise and sport have many health and social benefits but also involve a risk of injury. Injury prevention is essential in maintaining a healthy and physically active population and in reducing sport injury-related costs. As there are no established databases in Hong Kong containing sport injury data, the aim of this study was to identify patients with sports injuries presented at a University Hospital, therefore identifying targets which injury prevention programme should focus on.

Materials and Methods: Patients attended the sports clinic at Prince of Wales Hospital between 1/10/2017 and 30/9/2018 were recruited. Patients attended a survey-based data collection session with demographics, injury site, events leading to injury, exercise habit (type, level, frequency, experience), and functional scores were recorded.

Results: In total, 322 patients with mean age 34.4 years were recruited. Football (28.6%), basketball (25.5%) and rugby (8.6%) were the most commonly presented. Male patients were more likely to be injured playing football (39.3%) and basketball (30.3%), while female patients had more injuries playing rugby (20%) and basketball (16%). Knees were the most commonly injured region at 64.5%, with shoulder injuries at 11.8%. Knee injuries were also more common than shoulder injuries in football (62.9% vs 6.5%), basketball (78.6% vs 5.4%), rugby (55% vs 20%).

Discussion and Conclusion: This study reported the incidence of sports injuries presented at a University Hospital. Knee injuries were most commonly presented and football was the most common sports presented. The provides important information for future studies to devise an effective injury prevention programme.

FP10.14

Magnesium/vitamin C irrigation saline reduced postoperative quadriceps atrophy following anterior cruciate ligament reconstruction (ACLR) in a rat model

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Introduction: Postoperative quadriceps atrophy is a major obstacle for recovery after anterior cruciate ligament reconstruction (ACLR). We showed in rat model of ACLR that low-dose magnesium/vitamin C irrigation saline (MgVC) reduced knee swelling (HKOA 2017), but a higher dose of MgVC exaggerated muscle atrophy (HKOA 2019). The dose response of MgVC on muscle atrophy needs further investigation.

Materials and Methods: In total, 30 male Sprague-Dawley rats were randomly assigned to receive irrigation with normal saline, low-dose (45 mM MgCl₂) or high-dose (90 mM MgCl₂) Vitamin C (15 mM) isotonic irrigation saline during ACLR according to established protocol. Ten rats were included as healthy control. Spontaneous ambulatory activities and knee swelling was monitored. The rats were euthanised at week 2 or week 6 after operation for measurement of quadriceps muscles mass and muscle fibre size.

Results: Low-dose MgVC treatment significantly increased quadriceps muscle mass ($p=0.028$) at 2 weeks after surgery as compared with normal saline group, but high-dose MgVC had no effect. Low-dose MgVC group also alleviated knee swelling at day 1 after surgery ($p=0.01$), with a lesser drop in spontaneous ambulatory activities during the first 2 weeks after surgery. Significant correlations were observed between muscle atrophy and knee swelling as well as spontaneous ambulatory distance.

Discussion and Conclusion: Low-dose MgVC irrigation saline can reduce postoperative quadriceps atrophy after ACLR, which may be accounted by reducing knee swelling and maintaining spontaneous activity. This novel biological modulation may help ACLR patients to regain muscle function and facilitate earlier return to play.

FP10.15**Clinical and radiological outcome of arthroscopic massive rotator cuff repair with subacromial biodegradable balloon spacer implantation****Ying Kan Law,¹ Michael Tim Yun Ong,² Chun Kwong Lo,³ Patrick Shu Hang Yung²**¹*Department of Orthopaedics and Traumatology, Alice Ho Miu Ling Nethersole Hospital*²*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*³*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*

Introduction: Arthroscopic rotator cuff repair is one of the popular treatment modality of massive rotator cuff tear. Despite the satisfactory clinical outcome, re-tear rate is high. Cadaveric study showed subacromial biodegradable balloon spacer implantation is effective in reducing peak pressure with wider load distribution over the repaired cuff which may potentially prevent cuff re-tear after repair.

Materials and Methods: In this case series, 5 patients with massive rotator cuff tear who failed conservative management were treated with arthroscopic rotator cuff repair with subacromial biodegradable balloon spacer implantation. Clinical, functional and radiological assessment were carried out before and after surgery.

Results: Mean follow-up was 9.3 months (range, 6.5-11). Visual analogue pain score improved from 8.8 (8-10) to 1.8 (0-4). Constant score improved from 40.2 (34-52) to 80.2 (72-91). Disabilities of the Arm, Shoulder and Hand score improved from 71.3 (51.7-92.5) to 29.2 (3.3-72.5). Active flexion and abduction range improved from 84 (50-150) and 72 (40-120) to 126 (100-150) and 100 (90-120). Active external rotation range improved from 44 (20-70) to 64 (50-70). No complication was reported. All patients satisfied with their outcome. Follow-up magnetic resonance imaging 6 months after surgery showed one complete cuff healing and four re-tears.

Discussion and Conclusion: Arthroscopic rotator cuff repair with biodegradable balloon spacer implantation is a safe and effective management of massive rotator cuff tear in terms of pain relief and functional improvement. Further high-quality studies are needed to assess the clinical effectiveness of balloon spacer on the repaired cuff.

FP10.16

Estimation of upper trapezius muscle stiffness in office workers with chronic neck pain using shear wave elastography—a cross-sectional study

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Introduction: Pain, tightness and palpable tenderness of the upper trapezius are the major complaints of people with chronic neck pain. The aims of this study are: 1) to compare the upper trapezius muscle stiffness in office worker with and without chronic neck pain using shear wave elastography ultrasound imaging; 2) to determine the cut-off values of upper trapezius shear modulus for identifying office workers at risk of having neck pain; and 3) to determine whether increased upper trapezius stiffness is related to neck dysfunction, fear-avoidance belief and work ability.

Materials and Methods: In total, 57 office workers (16 asymptomatic and 41 with chronic neck pain; mean age 33.6 ± 7.1 years) participated this study. Upper trapezius shear modulus was measured using shear wave elastography ultrasound; and neck disability index, fear-avoidance belief questionnaire and work ability index were compared between office workers with and without chronic neck pain.

Results: Office workers with chronic neck pain exhibited higher upper trapezius shear modulus than asymptomatic controls (15.4 ± 3.0 kPa vs 11.2 ± 1.6 kPa, $p < 0.001$), with an optimal cut-off of 11.9 kPa (sensitivity=0.90, specificity=0.75, area under curve=0.909, $p < 0.001$) for identifying office workers at risk of having neck pain. Correlation analysis showed increased upper trapezius shear modulus was associated with neck dysfunction ($\rho = 0.362$, $p = 0.006$), fear-avoidance belief ($\rho = 0.321$, $p = 0.018$), and poorer work ability ($\rho = -0.253$, $p = 0.0058$).

Discussion and Conclusion: Office workers with chronic neck pain exhibited stiffer upper trapezius muscle when compared to asymptomatic controls. Increased upper trapezius stiffness was associated with neck dysfunction, fear-avoidance belief and poorer work ability.

FP10.17

Patellofemoral joint osteoarthritis after anterior cruciate ligament reconstruction: a novel assessment for early PFJ changes

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FP10.18

Incidence, prevalence and clinical characteristics of infection after anterior cruciate ligament reconstruction referred and managed by tertiary teaching hospital over a 15-year period

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FP10.19

Is a steep posterior tibial slope a risk factor for poorer outcome after lateral meniscus root tear repair in patients after ACL reconstruction?**Cham Kit Wong,¹ Michael Tim Yun Ong,² Johnathan Patrick Ng,¹ Chung Kwong Lo,¹ Alex WH Ng,³ Gene Chi Wai Man,² Patrick Shu Hang Yung²**¹*Department of Orthopaedics and Traumatology, Prince of Wales Hospital*²*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*³*Department of Radiology, Prince of Wales Hospital*

Introduction: Hoop stress is lost in meniscus root tear, leads excessive tibiofemoral contact pressure and early development of osteoarthritis. Repair of meniscal root injuries aims to restore joint kinematics and delay the development of OA. Stability of the knee should be restored after ACLR and the additional lateral compartment mobility caused by ACL tear should be eliminated. However, we lack evidence to conclude that ACLR is sufficient to limit the effect of large tibial slope on the healing of LMRT after repair. The aim of our study is to evaluate relationship of lateral tibial slope and outcomes of LMRT repair in patients after ACLR.

Materials and Methods: In this retrospective study, 26 knees with LMRT and unilateral primary ACL reconstruction between 2008-2020 were included. Lateral tibial slope and lateral-medial slope were measured. Correlation of the slopes with subjective (IKDC, Lysholm score, Tegner score) and objective (postoperative MRI) outcomes were studied by Pearson and Spearman correlation.

Results: Larger lateral tibial slope correlates with lower IKDC ($R=-0.595$; $p=0.02$) and Lysholm score; more meniscus extrusion and less healing. Patients with $>6^\circ$ lateral tibial slope; or $>3^\circ$ lateral-medial tibial slope difference also have lower IKDC, Lysholm score, more extrusion and less healing.

Discussion and Conclusion: A large lateral tibial slope and larger lateral-medial tibial slope are risk factors for a poorer outcome after LMRT repair in patients after ACLR. A more conservative rehabilitation plan for patients with $>6^\circ$ lateral tibial slope and $>3^\circ$ lateral-medial tibial slope should be considered.

Electronic Poster Presentations

P01

Femoral component sagittal position is an independent predictor of clinical outcome in total knee arthroplasty regardless of implant design: retrospective review of 1000 TKAs with up to 5 years follow-up

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P02

The effect of lateral wedge insole in pain reduction and improvement of ADL before TKR

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Introduction: Osteoarthritis of knee (OA knee) is a common type of arthritis that could affect one's activity of daily living (ADL). Total knee replacement (TKR) is the most common type of operative treatments for OA knee. Considering the lifespan of artificial knee joint, conservative treatment plays an important role to postpone TKR. Lateral wedge insole has been proven to reduce knee adduction moment and reduce pain in medial OA knee patients.

Objective: To evaluate the outcome of lateral wedge insole in pain reduction and improvement of ADL before TKR.

Methods: A pre-test vs post-test design was employed. Subjects suffering from OA knee but not yet eligible for TKR were recruited from SOPD ORT clinic. Knee function evaluation questionnaire (modified from KOOS and Lysholm knee score) was used to score pain reduction and improvement in ADL. Scores were compared among each follow-up.

Results: From May 2019 to June 2020, 139 subjects were recruited with lateral wedge insole prescribed and attended one follow-up session in P&O department. The pain intensity has reduced 11.1% compared with no insole. The self-perceived knee pain improvement was 45.7%. The overall average compliance of lateral wedge insole was 55.3% and the satisfaction level for lateral wedge insole was 69.8%.

Conclusion: Lateral wedge insole generally reduced level of knee pain and improve patient's ADL. Most of the patients were satisfied with lateral wedge insole. It can be served as an effective treatment associated with other conservative treatment before conducting TKR.

P03

Patellar resurfacing does not improve clinical outcome in patella-friendly total knee arthroplasty design—a randomised controlled trial

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P04

Phenotypic alteration of macrophages during osteoarthritis: a systematic review

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Introduction: Osteoarthritis (OA) has long been regarded as a disease of cartilage degeneration, whereas mounting evidence implies that low-grade inflammation contributes to OA. Among inflammatory cells involved, macrophages play a crucial role. Mediated by local microenvironment, macrophages are able to polarise towards different phenotypes. Therefore, we conducted a systematic review to uncover the phenotypic alteration of macrophages during OA and summarise the potential therapeutic interventions via modulating macrophages.

Materials and Methods: A systematic review of multiple databases (PubMed, Web of Science, ScienceDirect, Medline) was performed up to 29 February 2020. Included articles were discussed and evaluated by two independent reviewers. Relevant information was analysed with a standardised and well-designed template.

Results: A total of 28 studies were included. Data were subcategorised into two sections depending on sources. There were 12 human studies and 16 animal experiments. In each section, alterations of macrophage in both synovium and circulation were displayed. Elevated numbers of M1 macrophages were observed in synovium and circulation during OA, along with a lower number of M2 macrophages. Furthermore, interventions against OA were also highlighted in each section, including endogenous molecules and exogenous drugs.

Discussion and Conclusion: Our study emphasised that the phenotypic alteration of macrophages plays an important role during OA. However, the classical phenotypic subcategory of M1 and M2 macrophages was questionable due to some controversial results. With thorough understandings towards macrophages and improvements in methodology, further efforts should be made to categorise the macrophages in an exhaustive manner and identify the individual roles of each macrophage in OA.

P05

Could Wnt16 modulate the benefit of Vit-D supplementation on bone qualities during rapid growth phase?

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Introduction: Adolescent Idiopathic Scoliosis (AIS) is closely associated with lower bone mass and exhibits reduced circulating Wnt16 level. Curve progression in AIS is highly related to skeletal growth. Improvement on bone qualities by vitamin D (Vit-D) supplementation could reduce the risk of curve progression in AIS. There is lack of evidence on association between Wnt16 and bone qualities in patients with AIS and on the interaction between Wnt16 and Vit-D supplementation.

Materials and Methods: Wnt16 global knockout (Wnt16^{-/-}) and homozygous Wnt16^{+/+} mice were used to determine bone phenotypes in early rapid growth phase and effect of Vit-D (0 IU/kg, 1000 IU/kg or 20 000 IU/kg) at 7 and 10 weeks-old. Femora were collected for micro-CT analysis. Statistical analysis was performed with SPSS.

Results: Wnt16^{-/-} demonstrated lower cortical bone density compared with Wnt16^{+/+} mice in all dietary treatment groups. Mice with 1000 IU/kg Vit-D could improve cortical bone accrual when compared with 0 IU/kg and 20 000 IU/kg group. Wnt16^{-/-} were less prone to cortical bone loss induced by high dosage of Vit-D diet.

Discussion and Conclusion: This proof-of-concept study indicates the crosstalk between Wnt16 and Vit-D in the context of cortical bone mass and structure in mice undergoing rapid skeletal growth. Our findings suggested that the benefit of Vit-D supplementation on bone qualities could be modulated by Wnt16. Further studies with larger cohort and with in-depth mechanistic study could validate the rescue effect on bone quality.

P06

A novel mechanical parameter to quantify the microarchitecture effect on apparent modulus of trabecular bone: a computational analysis of ineffective bone mass

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Introduction: Previous studies showed microarchitecture can vary the apparent modulus of trabecular bone independent of bone volume fraction (BV/TV). However, the modulus is a mechanical quantity and there is no mechanical explanatory parameter. This study aims to reveal a novel mechanical parameter to quantify the microarchitecture effect on the apparent modulus of trabecular bone.

Methods: Fourteen human vertebrae were scanned with DXA followed by micro-CT. Four trabecular specimens were obtained per vertebrae and converted to micro-finite element models. The apparent modulus E was computed using linear micro-finite element analysis. Ineffective bone mass (InBM) was the bone mass with a negligible contribution to load-resistance, quantified as the low von Mises stress ratio (LSVMR), which is the ratio of the number of InBM elements to the total number of elements in the model. Correlation between E^* and LSVMR was analysed, with the experimental optimal stress threshold. Multiple linear regression of E against both BV/TV and LSVMR was further analysed.

Results: BV/TV alone can explain 59% of the variation in E ($E=2254.64BV/TV+1.04$, $R^2=0.59$, $p<0.001$), and LSVMR can explain 48% of the variation in E ($E=1696.4 - 1647.1LSVMR$, $R^2=0.48$, $p<0.001$). Combining these two predictors, 95% of the variation in E can be explained in a multiple linear regression model ($E=1364.89 + 2184.37BV/TV - 1605.38LSVMR$, adjusted $R^2=0.95$, $p<0.001$).

Conclusion: LSVMR can be adopted as the mechanical parameter to quantify the microarchitecture effect on the apparent modulus of trabecular bone.

P07

The role of skeletal macrophage in natural ageing osteoporosis

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P08

Pathological fibroblasts as therapeutic target for regenerating fibrocartilage in rotator cuff repair model

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P09**A systematic review on the effects of shoe collar height on ankle sprain mechanics in athletes****Jojo Hoi-Ching Lai, Samuel Ka-Kin Ling, Patrick Cacho, Sze Wing Mok, Patrick Shu-Hang Yung***Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong*

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P10**The effectiveness of novel internal fixation device versus Kirschner wire for proximal interphalangeal joint fusion in hammer toe: a systematic review****Rachel Xiaoyu Wei¹, Samuel Ka-Kin Ling¹, Tun Hing Lui², Patrick Shu-Hang Yung¹***¹Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong**²Department of Orthopaedics and Traumatology, North District Hospital*

Intramedullary devices have been developed to reduce the problems associated with Kirschner (K)-wire fixation in proximal interphalangeal joint (PIPJ) arthrodesis. The purpose of this systematic review is to compare the surgical outcomes of K-wires versus novel internal fixation devices in PIPJ arthrodesis in hammer toe surgery. The databases searched were PubMed, Scopus, Cochrane, and Embase with keywords "claw toe OR hammer toe" AND "proximal interphalangeal OR PIP" AND "fusion OR arthrodesis." Clinical trials published in English with evidence levels I, II, and III were included. The studies which were not published in English or looking at the surgical outcomes in children or adolescents were excluded. The methodology equality of included studies was assessed by checklists from the Critical Appraisal Skills Programme (CASP). Five studies, including one randomised controlled trial and four case-controlled studies, were identified to meet the inclusion criteria. Overall, the results showed that the novel internal devices may outperform K-wires in union rate for PIPJ arthrodesis in hammer toe deformity correction. However, these internal devices seem not to present advantages in clinical parameters such as pain levels, patient satisfaction, foot-related function, or surgical complication rates. It should be taken into consideration whether the theoretical advantages of the novel interval devices are able to compensate for their high price compared to K-wires.

P11

Pilot study: effectiveness between kinesiology tape and hallux splint on hallux abducto valgus

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Introduction: Hallux valgus is a common condition with a prevalence of 30% in women and older adults. Taping and bracing are common first-line treatment options for mild to moderate deformities. This study aims to compare the effectiveness between these two interventions.

Materials and Methods: Patients attending the Podiatry Department at a regional hospital with symptomatic hallux valgus between Jan to Mar 2020 were included. Subjects were randomised into either the Kinesiology Tape (KT) or hallux splint group for a 30-day period. A logbook was used to record application hours. The Foot Function Index (FFI) Assessment Questionnaire was the main outcome measure parameters and was given before and after the treatment. Both logbook and the questionnaire were collected by post after 30 days.

Results: The VAS score of the FFI subscales pain, disability and activity limitation between the two intervention groups were analysed using paired t test and one-way ANOVA in SPSS (ver. 25). No significant difference was found in all subscales between the two groups as well as pre- and post-intervention within groups. The total FFI score differences between the groups were -5.74 VAS points for the KT group and 10.67 VAS points for the hallux splint group (p=0.34).

Discussion and Conclusions: There was a trend of decrease pain level using both interventions by observed, although statistically significant difference was not achieved. Repeating the study with a larger sample size and also comparing to non-treatment group are warranted. Objective measurements and additional patient-report outcome measures is also warranted.

P12

EMS device (Vital-pro-MC0777) improves lower limb circulation and pain

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Introduction: This study aims to evaluate the effectiveness of electrical muscle stimulation (EMS) device (Vital-pro-MC0777) on improving the lower limb condition. The mentioned device provided EMS signals to the soles of the feet and lower limbs.

Materials and Methods: The EMS device was applied for a healthy subject (male, 29 years) to measure the changes of the blood circulatory system of the foot. An ultrasound machine was used to measure the imaging results of the circulation before and after the application of this EMS device. Then the subjects with the ache of lower limb were recruited in this study for a two weeks study. The treatment time was 15 minutes every day with a moderate EMS signal. The visual analogue scale (VAS) pain index was applied to test the changes in pain.

Results: The circulation of lower limb was improved significantly during our device application. The VAS pain results of the ache of the lower limb and related symptoms were reduced after two weeks of treatment.

Discussion and Conclusion: The imaging results suggest that this EMS device can improve the circulation of lower limb. In addition, this EMS device can reduce the pain in the lower limb, which will be beneficial for the subjects with neuropathic pain of lower limb and related degenerative diseases.

P13

An unusual case of locked trigger thumb due to tophaceous infiltration of the flexor tendon over the wrist—a lesson learned

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P14

Isolated tuberculous abscess in biceps brachii muscle of a young man—a common diagnosis with a rare presentation

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Tuberculosis is a common diagnosis but manifestation over the musculoskeletal system is rare. We report a case of incidental arm swelling in which the diagnosis of tuberculous infection was challenging. Early recognition and treatment with image-guided drainage was done to achieve a satisfactory outcome.

P15

Therapeutic potential of mesenchymal stem cells in postmenopausal-related muscle wasting: a preclinical study

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P16

Raman spectroscopy for rapid evaluation of therapeutic effects of mesenchymal stem cell in glucocorticoid-induced muscle atrophy

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P17

Gender difference (bracing fatigue) in health-related quality of life (HRQOL) of adolescent idiopathic scoliosis (AIS) patients under bracing treatment using SRS-22 questionnaire

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Introduction: Offering brace for moderately suffering adolescent idiopathic scoliosis (AIS) patients is a recognised intervention to control further curve progression, and treatment period varies from each patient. Some AIS patients required to wear longer than expected with different clinical reasons. Health-related quality of life (HRQOL) of AIS patients who have undergone bracing from the 2nd year to 5th year has not been discussed. The aim of this study is to evaluate the HRQOL of patients who have undergone bracing between their 2nd to 5th year of treatment using SRS-22 questionnaire.

Materials and Methods: Patients with AIS (n=126) who were under brace treatment completed SRS-22 questionnaire at their 2nd, 3rd, 4th, and 5th year on brace. Five SRS-22 domain scores (function, pain, self-image, mental health, and satisfaction with management) collected longitudinally were compared among the four time points. Gender-specific analysis was performed to look for any difference between boys and girls.

Results: Mean numbers of months among visits were 8.99 (between 2nd and 3rd), 8.42 (between 3rd and 4th), and 7.89 (between 4th and 5th). Function, pain and satisfaction with management scores were significantly decreased in the 3rd year during bracing and increased steadily afterwards. Gender-specific analysis showed female patients experienced similar changes in function, pain and satisfaction at the 3rd year.

Discussion and Conclusion: Function, pain, and satisfaction scores were much affected at the 3rd year and recovered afterwards. Gender difference was found and the same significant changes were found in female patients but not in male patients.

P18

CUHK-M2 therapeutic device for treating knee osteoarthritis through popliteal fossa

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Introduction: This study aims to develop a medical device (branded as CUHK-M2) with multiple physical modalities to treat knee osteoarthritis (OA). We have tested the hypothesis that combined application of physical stimulations from the designed device may effectively impact the popliteal fossa for resolving circulatory problems and the related degenerative symptoms.

Materials and Methods: Three kinds of physical stimuli effective for OA therapy was integrated into this device, including deep acupressure stimulation, low-level laser (LLL), and heat. Deep acupressure stimulation by the cam module provided acupressure on the popliteal fossa. LLL system generated a set of high-wavelength and low-wavelength laser by the laser module. The heat therapy was provided by heating units.

Results: A therapeutic device for treating knee OA is designed, fabricated and tested. The acupressure force is around 4 N, 6 N, and 8.5 N in the popliteal fossa for light mode, middle mode, and high mode respectively. Heat therapy using heating wires leads to temperature in the kneecap, shank and thigh raised to around 41°C stably. LLL could provide medical use laser for degenerative OA treatment, the power density and dose of energy are designed by 5 mW/cm² and 4.5 J/cm² to meet the requirements.

Discussion and Conclusion: The acupressure in popliteal fossa generated by the device can enhance the circulation. The treatment of temperature around the knee joint is suitable for cartilage protection. The dosage of LLL is adequate for tissue regeneration and inflammation reduction.

P19**A systematic review on the effectiveness of motor control exercise in improving morphology of lumbar multifidus muscles in patients with low back pain**

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Introduction: Since low back pain (LBP) patients demonstrate morphological changes in lumbar multifidus muscles (LMM), motor control exercises (MCE) are used to improve LMM morphology and LBP. No relevant systematic reviews have summarised these findings. Therefore, this review aimed to summarise the evidence regarding the effectiveness of MCE in improving LMM morphology in LBP patients, and the temporal relationships between changes in LMM morphology and changes in LBP/LBP-related disability.

Materials and Methods: Comprehensive search of CINAHL, MEDLINE, Cochrane Central Register of Controlled Trials, PEDro, EMBASE and SPORTDiscus was conducted from inception to 30 October 2019. Randomised controlled trials (RCTs) addressing our objectives were included. Methodological quality of the included studies was evaluated by the PEDro scale. Level of evidence was graded using the criteria of Oxford Center for Evidence-Based Medicine.

Results: Thirteen RCTs involving 704 participants (663 chronic and 41 acute LBP) were included. MCE with/without additional intervention increased LMM CSA (level 1b evidence). MCE was better than no treatment and other interventions in increasing LMM CSA (level 1b and 2b evidence). Inconsistent evidence was noted regarding MCE altered LMM resting thickness. MCE/ McKenzie exercise/analgesics increased LMM contracted thickness (level-2b evidence). No significant correlations were noted between post-treatment changes in LMM morphology and LBP/disability.

Discussion and Conclusion: While MCE is superior to other interventions in increasing LMM CSA, there is insufficient evidence to support that changes in LMM morphology is related to changes in patients' outcomes. Future research should investigate the optimal exercise dosages for improving LMM morphology and LBP.

P20**A systematic review on lumbar developmental spinal stenosis**

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P21**Using the ulna physis in improving decision-making for brace weaning in adolescent idiopathic scoliosis**

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P22

A systematic review of gait patterns in adolescent idiopathic scoliosis reviews differences associated with curve severity and pattern. Implications for future non-invasive diagnosis

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P23

The crooked rod sign: a new radiological sign to detect deformed threads in the distraction mechanism of magnetically controlled growing rods and a mode of distraction failure

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Introduction: Despite the growing popularity of MCGR in the management of patients with EOS, postoperative complications and reoperations are not uncommon. Unique complications or unplanned reoperations are observed in patients with MCGRs that are not seen in traditional growing rods. The complications include rod slippage, mismatch between targeted and achieved distraction length, metallosis, and actuator pin fracture. We have identified an unreported failure mechanism whereby deformed threads occur in the internal distraction mechanism of the MCGR. This phenomenon may indicate increased MCGR internal screw friction and increased distraction resistance, which led to distraction failure and revision surgery.

Objective: To report a unique mechanical failure of magnetically controlled growing rods (MCGRs) that is related to continuous rod slippage.

Methods: A girl with EOS was treated by dual MCGRs. She developed proximal junctional kyphosis and continuous rod slippage. Distractions in the out-patient clinic and under sedation did not achieve rod lengthening. A tell-tale “crooked rod” radiological sign was identified by angulation between the actuator and the extendable portion of the rod.

Results: Rod exchange was performed and she is 2 years after revision surgery with successful lengthening episodes. Upon review of the extracted MCGR, distraction was not possible even after rod removal and was resumed after the screw was manually reinserted along its correct threads.

Conclusion: Deformed threads is a complication that cannot be reverted without rod removal and exchange. Users should be aware of this potential failure mechanism and proceed to early rod exchange rather than attempting any further distractions.

P24

Altered proprioception in teenagers with adolescent idiopathic scoliosis: a systematic review**Kenney Ki Lee Lau,¹ Jennifer Sze Kan Ha,¹ Kenny Yat Hong Kwan,¹ Kenneth Man Chee Cheung,¹ Arnold Yu Lok Wong²**¹*Department of Orthopaedics and Traumatology, The University of Hong Kong*²*Department of Rehabilitation Sciences, The Hong Kong Polytechnic University*

Introduction: Adolescent idiopathic scoliosis (AIS) is a three-dimensional spinal deformity developed during the adolescence rapid growth period. Although multiple studies have reported proprioceptive defects in AIS patients, no systematic reviews have summarised these findings. Therefore, the current review aimed to summarise evidence regarding proprioceptive deficits in AIS patients with reference to non-scoliotic controls.

Materials and Methods: AMED, CINAHL, Cochrane Library, EMBASE, MEDLINE, PubMed, and WoS were searched from inception to May 2020. English articles were included if they compared proprioception between teenagers with and without AIS. Articles were excluded if they were case reports, commentaries, conference proceedings, or study protocols. Newcastle-Ottawa Scale (NOS) was used to assess the methodological quality of the included studies with maximum of nine points.

Results: Of 604 identified citations, 13 case-control studies comprising 778 participants were included. Eight of them had moderate risk of bias (4-6 NOS points) and five had high risk of bias (0-3 NOS points). Proprioception were assessed by balance/posture control tests (n=8), somatosensory evoked potential tests (n=5), and functional movement test (n=1). Compared to non-scoliotic controls, AIS patients demonstrated significantly higher latency of somatosensory evoked potential in the tibial nerve, greater reposition errors in neck and knee, and poorer ability to stabilise spinal muscles.

Discussion and Conclusion: This is the first systematic review to summarise the evidence regarding proprioceptive deficits in AIS patients. Given that AIS patients have defective proprioception in multiple body parts comparing to non-scoliotic controls, future studies should comprehensively investigate the causes underlying proprioceptive deficits in AIS patients.

P25

Risk factors for symptomatic adjacent segment disease following lumbar fusion: a systematic review and meta-analysis

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Introduction: Given the growing number of lumbar fusion and associated adjacent segment disease (ASD), numerous studies have investigated the risk factors for ASD. However, no systematic reviews and/or meta-analyses have summarised these factors, which can inform clinical decision-making. Accordingly, this meta-analysis aimed to summarise risk factors for ASD after lumbar fusion.

Materials and Methods: Academic Search Premier, CINAHL, Cochrane Library, EMBASE, MEDLINE, and Web of Science were searched from inception to December 2019. Primary studies were included if they were English articles related to risk factors for ASD after lumbar fusion in human. The methodological quality of the included cohort and case-control studies was evaluated by the Newcastle-Ottawa Scale.

Results: Of 665 identified citations, 43 studies involving 12215 patients were included. Ten, 29, and four studies were classified as high, moderate, and low methodological quality, respectively. The mean occurrence rate of ASD was $16.4 \pm 10.0\%$, while the mean ASD-related re-operation rate was $11.9 \pm 8.6\%$. Meta-analyses revealed significant demographic (older age, high body mass index, adjacent segment decompression), surgical (≥ 2 fused segments), and radiographic (preoperative lumbopelvic mismatch, preoperative adjacent disc degeneration, preoperative facet sagittalisation, preoperative anterior shift of lumbosacral sagittal plumb line, decreased postoperative lumbar lordosis or sacral slope, and increased postoperative pelvic tilt) risk factors for ASD.

Discussion and Conclusion: This is the first meta-analysis to summarise evidence regarding various risk factors for ASD following lumbar fusion. Although it is impossible to alter non-modifiable risk factors for ASD, it is possible to mitigate modifiable risk factors by conservative and/or surgical means.

P26

Is muscle weakness a risk factor to the development of rotator cuff tendinopathy—a systematic review

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Introduction: Underlying muscle weakness may explain the inconsistency in the development of rotator cuff tendinopathy in population with similar activity levels. This systematic review aims to assess existing prospective studies to evaluate whether muscle weakness is a risk factor for the development of rotator cuff tendinopathy.

Materials and Methods: A systematic search was performed using the PRISMA guidelines. Prospective studies measuring muscle strength and the incidence of rotator cuff tendinopathy will be included. Data describing features suggestive of underlying muscle weakness, including muscle stiffness, posture, and movement patterns will also be extracted. Quality assessment was performed with the Newcastle-Ottawa Quality Assessment Scale.

Results: The search yielded six studies, with a total of 523 trained overhead athletes followed up for one season. Quantitative analysis of data was not possible, but risk factors were reported to be associated with the development of rotator cuff tendinopathy. Low internal rotation strength was reported in one study, low while external rotation strength and low external to internal rotation strength ratio was reported in two studies. Deficit in external rotation range of motion was also reported in one study.

Discussion and Conclusion: External rotation, internal rotation, supraspinatus weakness, and a low external rotation to internal rotation strength ratio is associated with the development of rotator cuff tendinopathy from qualitative analysis of five prospective studies. Strength deficit, or imbalance in other muscle groups and other parameters that may suggest muscle weakness, including stiffness, posture, and movement patterns are yet to be adequately investigated in existing prospective studies.

P27

Do patients with dominant side ACLR have different re-injury related biomechanics from those with non-dominant side ACLR at the time of return to sports?

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Introduction: Patients with ACLR on the non-dominant leg (NL) had higher incidence of contralateral ACL re-injury (16%) than those with ACLR on the dominant leg (DL) (3.5%). Abnormal biomechanical characteristics during landing have been demonstrated as predictors of ACL re-injury. Therefore, the purpose of this study is to investigate if patients with ACLR on DL and those with ACLR on the NL have different re-injury related biomechanics at the time of return to sports.

Materials and Methods: A case-control study was conducted and 26 male patients with primary unilateral ACLR were recruited (age 19-35 years; 6-15 months after operation). Quadriceps strength was measured by Biodex Isokinetic Dynamometer; knee function was estimated by IKDC; functional performance was evaluated by single leg hop. Kinematics and kinetics of lower limbs were recorded by Vicon motion capture system and force plates during single leg hop. Mann-Whitney *U* test was used to compare the outcomes between the two groups.

Results: Twelve patients underwent ACLR on the DL while 14 on the NL. There was no statistical difference ($p > 0.05$) on all demographical characteristics and functional outcomes between DL and NL groups. There was no significant difference in symmetry of sagittal plane knee moment at initial contact ($p = 0.53$), maximum hip internal rotation moment (NI: $p = 0.21$; I: $p = 0.90$), and knee range of motion in frontal plane (NI: $p = 0.46$; I: $p = 0.16$) during landing.

Discussion and Conclusion: There is no difference in re-injury related biomechanics between patients with ACLR on DL and those with ACLR on the NL at the time of return to sports

P28

Nightmare of repeated low-energy periprosthetic femoral fracture in a patient with severe osteoporosis—a lesson learned

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P29

Clinical outcomes of reverse shoulder arthroplasty for proximal humeral fracture in acute, delayed and salvage setting—a systematic review

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P30

Case report: an unusual case of sequential bilateral distal tibia fractures in a 60-year-old lady—review and algorithm on approach to stress fractures for community use

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Stress fracture is overuse injuries to the bone caused by repetitive compressive or tensile stress. Imbalance in bone resorption and formation causes final bone failure. It commonly occurs in athletes and military soldiers due to high physical demand at work. Yet, this phenomenon may be easily missed and hence being under-treated in the community. We report a case of rare sequential bilateral stress fractures of distal tibia in a 60-year-old sedentary lady. Bracing and intramedullary nailing were performed respectively. The fractures healed uneventfully with treatment. Thorough history taking, physical examination and investigations include blood tests and imaging reveal no definite cause. Lifestyle modification advice and supplements were given to the patient for prevention of future fractures. A literature review on the approach to stress fractures was performed. The key to prevention lies on optimising the risk factors which can be categorised into patient's activity level, biomechanics and hormonal effect. An approach algorithm targeted at primary care physician is also constructed for community use.

P31

Establishing an easily accessible testing system for bone hardness**Shengjie Cheng,¹ Mingxin Huang,¹ Teng Zhang,² Jason Pui Yin Cheung,² Takman Wong²**¹*Department of Mechanical Engineering, The University of Hong Kong*²*Department of Orthopaedics and Traumatology, The University of Hong Kong*

Introduction: Hardness and Young's modulus are two mechanical properties that influence bone quality, such as bone hardness and Young's modulus. Bone hardness refers to the ability of bones to resist the pressing of hard objects into their surface, and Young's modulus quantifies the shape-independent resistance of bone to elastic (reversible) deformation.

Objective: To examine the true bone hardness intraoperatively, it is necessary to establish an easily accessible testing system for bone hardness.

Materials and Methods: The trabecular hardness of four human cadaveric samples of proximal tibia and distal femurs with osteoporosis were tested with shore durometer. The femoral head and the tibia joint surface were surgically removed to mimic the joint replacement surgeries. 24 tests of the hardness were performed for each sample. The bone densities were measured using clinical CT with a phantom.

Results: The average trabecular bone hardness for each sample was 40.4 HD, 31.0 HD, 38.2 HA, and 57.7 HA. By calculating the difference (∇) between average trabecular bone hardness (α) and average trabecular bone hardness where we eliminated abnormal testing value during the calculation process (β), the frequency of those points with abnormal hardness value could be well reflected.

Conclusion: Large variance exists in the same sample for different testing spot of the trabecular at the surgical site and a high degree of consistency exists in the same testing spot for different sample. Thus, the current assumption of measuring bone quality by hardness and establishing an easily accessible testing system for bone hardness is reasonable.

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NNT = number-needed-to-treat. NSAIDs = non-steroidal anti-inflammatory drugs. OA = osteoarthritis.

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Product Name: Voltaren Emulgel 1%

Active Ingredient: 100g of Voltaren Emulgel contains 1.16g diclofenac diethylamine (equivalent to 1g of diclofenac sodium) **Indications:** For the local treatment of pain, inflammation and swelling caused by sports-related injuries or accidents. Also for local treatment of various rheumatic joint or muscle pain (e.g. stiffness in the shoulders and arthritis) if recommended by a doctor or pharmacist. **Dosage & Administration:** Adults and children over 12 years of age: Depending on the size of the painful area to be treated, gently rub in 2 to 4g of Voltaren Emulgel (an amount the size of a cherry or walnut) 3 to 4 times a day. **Children under 12 years of age:** Consult a doctor or pharmacist before use. **Contraindications:** Do not use if patients are allergic to diclofenac or to other substances which relieve pain and inflammation (in particular acetylsalicylic acid and ibuprofen), or to propylene glycol and isopropyl alcohol or to any of the other ingredients. **Precautions:** For external use only. Do not apply to an open wound or to skin that has a rash. Do not apply for long periods of time over large areas of skin unless prescribed by a doctor. Avoid contact with the eyes and mucous membranes. Consult a doctor or pharmacist if any discomfort persists. Stop using in case of any allergic reactions. Do not use in pregnant women, especially during the last 3 months of pregnancy. **Side effects:** Skin rash, itching, reddening and smarting of the skin.

Please read the full prescribing information prior to administration. Full prescribing information is available on request. Abbreviated Prescribing Information version prepared in August 2019.

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Help her move forward
with the relentless protection of Prolia®

Start strong with Prolia® for long-term
fracture protection and continuous BMD
gains for up to 10 years¹

Prolia® (Denosumab) Abbreviated Prescribing Information

Prolia® (denosumab) Solution for Injection in Pre-filled Syringe 60 mg/mL. **INDICATIONS** Prolia is indicated for: i) treatment of postmenopausal women with osteoporosis at high risk for fracture, defined as a history of osteoporotic fracture, or multiple risk factors for fracture; or patients who have failed or are intolerant to other available osteoporosis therapy; ii) treatment to increase bone mass in men with osteoporosis at high risk for fracture, defined as a history of osteoporotic fracture, or multiple risk factors for fracture; or patients who have failed or are intolerant to other available osteoporosis therapy; iii) treatment to increase bone mass in men at high risk for fracture receiving androgen deprivation therapy for nonmetastatic prostate cancer. In these patients Prolia also reduced the incidence of vertebral fractures; iv) treatment to increase bone mass in women at high risk for fracture receiving adjuvant aromatase inhibitor therapy for breast cancer. **DOSE AND ADMINISTRATION** The recommended dose of Prolia is 60 mg administered as a single subcutaneous injection once every 6 months. Administer Prolia via subcutaneous injection in the upper arm, the upper thigh, or the abdomen. All patients should receive calcium 1000 mg daily and at least 400 IU vitamin D daily. **CONTRAINDICATIONS** Hypocalcemia and pregnancy, as well as hypersensitivity to any component of the product. **SPECIAL WARNINGS AND PRECAUTIONS FOR USE** **Hypersensitivity:** Clinically significant hypersensitivity including anaphylaxis has been reported with Prolia. Symptoms have included hypotension, dyspnea, throat tightness, facial and upper airway edema, pruritis, and urticaria. **Hypocalcemia and Mineral Metabolism:** Hypocalcemia may be exacerbated by the use of Prolia. Pre-existing hypocalcemia must be corrected prior to initiating therapy with Prolia. Hypocalcemia following Prolia administration is a significant risk in patients with severe renal impairment [creatinine clearance < 30 mL/min] or receiving dialysis. Adequately supplement all patients with calcium and vitamin D. **Osteonecrosis of the Jaw (ONJ, ONJ)** has been reported in patients receiving Prolia. The start of treatment or of a new course of treatment should be delayed in patients with unhealed open soft tissue lesions in the mouth. A dental examination with preventive dentistry and an individual benefit-risk assessment is recommended prior to treatment with Prolia in patients with concomitant risk factors. All patients should be encouraged to maintain good oral hygiene, undergo routine dental check-ups, and immediately report any oral symptoms such as dental mobility, pain or swelling, or non-healing of sores or discharge during treatment with Prolia. While on treatment, invasive dental procedures should be performed with caution and avoided in close proximity to Prolia treatment. **Atypical Subtrochanteric and Diaphyseal Femoral Fractures:** Atypical low-energy or low trauma fractures of the shaft have been reported in patients receiving Prolia. Patients should be advised to report new or unusual thigh, hip, or groin pain. **Multiple Vertebral Fractures (MVF) Following Discontinuation of Prolia Treatment:** Following discontinuation of Prolia treatment, fracture risk increases, including the risk of multiple vertebral fractures. If Prolia treatment is discontinued, consider transitioning to an alternative antiresorptive therapy. **Serious Infections:** Serious infections leading to hospitalization were reported in clinical trial. Advise patients to seek prompt medical attention if they develop signs or symptoms of severe infection, including cellulitis. **Dermatologic Adverse Reactions:** Dermatitis, eczema, and rashes. Most of these events were not specific to the injection site. Consider discontinuing Prolia if severe symptoms develop. **Musculoskeletal Pain:** Severe and occasionally incapacitating bone, joint, and/or muscle pain. Consider discontinuing use if severe symptoms develop. **Suppression of Bone Turnover:** In clinical trials treatment with Prolia resulted in significant suppression of bone remodeling as evidenced by markers of bone turnover and bone histomorphometry. **Osteonecrosis of the external auditory canal:** Osteonecrosis of the external auditory canal has been reported with denosumab. Possible risk factors include steroid use and chemotherapy and/or local risk factors such as infection or trauma. **INTERACTIONS** In subjects with postmenopausal osteoporosis, Prolia 60 mg subcutaneous injection did not affect the pharmacokinetics of midazolam, which is metabolized by cytochrome P450 3A4 (CYP3A4), indicating that it should not affect the pharmacokinetics of drugs metabolized by this enzyme in this population. **PREGNANCY AND LACTATION** **Pregnancy:** Category X. **Breast-feeding:** It is not known whether Prolia is excreted into human milk. **PEDIATRIC, GERIATRIC AND RENAL IMPAIRMENT** **Pediatric:** Prolia is not recommended in pediatric patients. **Geriatric:** No overall differences in safety or efficacy were observed in clinical studies between elderly patients and younger patients and other reported clinical experience has not identified differences in responses between the elderly and younger patients, but greater sensitivity of some older individuals cannot be ruled out. **Renal Impairment:** No dose adjustment is necessary in patients with renal impairment. **UNDESIRABLE EFFECTS** The most common adverse reactions reported with Prolia in patients with postmenopausal osteoporosis are back pain, pain in extremity, musculoskeletal pain, hypercholesterolemia, and cystitis. The most common adverse reactions reported with Prolia in men with osteoporosis are back pain, arthralgia, and nasopharyngitis. The most common (per patient incidence ≥ 10%) adverse reactions reported with Prolia in patients with bone loss receiving androgen deprivation therapy for prostate cancer or adjuvant aromatase inhibitor therapy for breast cancer are arthralgia and back pain. Pain in extremity and musculoskeletal pain have also been reported in clinical trials. The most common adverse reactions leading to discontinuation of Prolia in patients with postmenopausal osteoporosis are back pain and constipation. **OVERDOSE** There is no experience with overdose with Prolia. Abbreviated Prescribing Information Version: HKPROPI01

Reference: 1. Henry G Bone, Rachel B Wagman, Maria L Brandi, et al. *The Lancet Diabetes & Endocrinology* 2017;7(Vol 5):513-523.

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