

3RD World Congress of Sports Physical Therapy

Final Scientific Program
(September 2019)



Vancouver Convention Centre
Vancouver, Canada
October 4-5, 2019

Scientific Program: Table of Contents

Conference schedule	3
Invited speakers	5
Sponsors	31
Abstracts accepted for presentation (list)	32
Abstracts accepted for presentation (details).....	36
Thanks to our reviewers!	108

FRIDAY, OCTOBER 4th 2019

8:00-8:15	OPENING: WELCOME TO SPC 2019!	
8:15-9:15	OPENING KEYNOTE High performance to clinical practice <i>Room 211-214</i>	Prof. Kay Crossley (Australia) <i>moderator: Dr. Chris Napier</i>
9:15-10:45	EXPERT PANEL DISCUSSION Screening athletes for injury prevention and return to play: What, how and why? <i>Room 211-214</i>	Dr. Clare Ardern (Sweden) Prof. Roald Bahr (Norway) Dr. Rod Whiteley (Qatar) <i>moderator: Dr. Mario Bizzini</i>
10:45-11:15	NETWORKING BREAK EXHIBITORS & POSTERS	
11:15-12:15	PLENARY SESSION The athlete's brain: neuroplasticity in rehabilitation and concussion update <i>Room 211-214</i>	Dr. Lara Boyd (Canada) Dr. Anthony Schneiders (Australia) <i>moderator: Dr. Carolyn Emery</i>
12:15-1:30	LUNCH BREAK EXHIBITORS	
1:30-2:30	PLENARY SESSION Bridging the gap between research and clinical practice <i>Room 211-214</i>	Dr. Christian Barton (Australia) Dr. Karen Litzy (USA) Dr. Rod Whiteley (Qatar) <i>moderator: Prof. Karim Khan</i>
2:30-4:00	EXPERT PANEL DISCUSSION Surgical or non-surgical management of the injured athlete? <i>Room 211-214</i>	Dr. Clare Ardern (Sweden) Prof. Lars Engebretsen (Norway) Prof. Bob McCormack (Canada) Prof. Ewa Roos (Denmark) <i>moderator: Dr. Allison Ezzat</i>
4:00-4:45	NETWORKING BREAK EXHIBITORS & POSTERS	
4:45-5:45	ABSTRACT COMPETITION Top 5 rated abstracts battling for the best podium presentation <i>Room 211-214</i>	Judges: Dr. Clare Ardern (JOSPT) Prof. Karim Khan (BJSM) Prof. Michael Voight (IJSPT) <i>moderator: Dr. JF Esculier</i>
6:00-8:00	OPENING RECEPTION	All speakers and attendees Exhibitors

SATURDAY, OCTOBER 5th 2019

8:00-9:00	BREAKOUT SESSION 1A: UPPER EXTREMITY REHAB Dr. Ann Cools (<i>Belgium</i>) Prof. Bill Vicenzino (<i>Australia</i>) <i>Room 211</i> <i>moderator: Dr. Ebonie Rio</i>	BREAKOUT SESSION 1B: LOWER EXTREMITY REHAB Dr. Kristian Thorborg (<i>Denmark</i>) Prof. Ewa Roos (<i>Denmark</i>) <i>Room 212-214</i> <i>moderator: Dr. Jackie Whittaker</i>
9:00-9:40	NETWORKING BREAK EXHIBITORS & POSTERS	
9:40-10:40	BREAKOUT SESSION 2A: TECHNOLOGY IN SPORT Dr. Kerry MacDonald (<i>Canada</i>) Dr. Johann Windt (<i>Canada</i>) <i>Room 211</i> <i>moderator: Dr. Amy Arundale</i>	BREAKOUT SESSION 2B: PAIN SCIENCE IN SPORT Dr. Alex Hutchinson (<i>Canada</i>) Dr. Greg Lehman (<i>Canada</i>) <i>Room 212-214</i> <i>moderator: Prof. Bill Vicenzino</i>
10:45-11:45	BREAKOUT SESSION 3A: LEARNING FROM MAJOR GAMES Dr. Mario Bizzini (<i>Switzerland</i>) Dr. Luciana De Michelis (<i>Brazil</i>) <i>Room 211</i> <i>moderator: Prof. Michael Voight</i>	BREAKOUT SESSION 3B: WOMEN'S HEALTH IN SPORT Dr. Sarah Haag (<i>USA</i>) Dr. Jane Thornton (<i>Canada</i>) <i>Room 212-214</i> <i>moderator: Dr. Karen Litzy</i>
11:45-12:45	LUNCH BREAK EXHIBITORS	
12:45-2:15	EXPERT PANEL DISCUSSION Leadership in sport physical therapy	Dr. Amy Arundale (<i>USA</i>) Prof. Bob McCormack (<i>Canada</i>) Dr. Emma Stokes (<i>Ireland</i>) Dr. Jane Thornton (<i>Canada</i>) <i>moderator: Dr. Anthony Schneiders</i>
2:15-2:45	NETWORKING BREAK EXHIBITORS & POSTERS	
2:45-4:00	PLENARY SESSION Exercise in the clinic: beyond 3 sets of 10 reps	Dr. Keith Baar (<i>USA</i>) Dr. Christian Barton (<i>Australia</i>) Dr. Ebonie Rio (<i>Australia</i>) <i>moderator: Dr. Kristian Thorborg</i>
4:00-4:30	SPORTS SCIENCE: ASK THE EXPERT	Dr. Alex Hutchinson (<i>Canada</i>) <i>moderator: Dr. Chris Napier</i>
4:30-5:00	CLOSING AND PRIZES	

Dr. Clare ARDERN PT, PhD*Linköping University, Sweden**Journal of Orthopaedic & Sports Physical Therapy (JOSPT)***@Clare_Ardern**

Dr. Clare Ardern is a physiotherapist and clinical researcher addressing questions around return to play after injury. She has worked in Australia, Qatar and Sweden and currently works as a clinical researcher in the Division of Physiotherapy at Linköping University, Sweden. She has an interest in how return to play can be improved with specific clinical interventions and superior clinical decision-making. Clare is part of an international team that is developing a smartphone app to help athletes return to play after injury. Clare is Editor-in-Chief of the Journal of Orthopaedic & Sports Physical Therapy (JOSPT).

**READ DR. ARDERN'S RESEARCH**

1. **Ardern CL**, Ekås G, Grindem H, et al. International Olympic Committee consensus statement on prevention, diagnosis and management of paediatric anterior cruciate ligament (ACL) injuries. Br J Sports Med 2018;doi:10.1136/bjsports-2018-099060 (article co-published by Knee Surgery Sports Traumatology Arthroscopy, Journal of ISAKOS and Orthopaedic Journal of Sports Medicine).
2. **Ardern CL**, Glasgow P, Schneiders A, Witvrouw E, Clarsen B, Cools A, et al. Consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern. Br J Sports Med 2016;50:853-864.
3. **Ardern CL**, Taylor NF, Feller JA, Webster KE. Fifty-five per cent return to competitive sport following anterior cruciate ligament reconstruction surgery: an updated systematic review and meta-analysis including aspects of physical functioning and contextual factors. Br J Sports Med 2014;48:1543-1552.

Dr. Amy ARUNDALE PT, PhD, DPT, SCS*Brooklyn Nets (National Basketball Association), USA***@SoccerPT11**

Amelia (Amy) Arundale, PT, PhD, DPT, SCS is a physiotherapist and researcher. Originally from Fairbanks, Alaska, she received her Bachelor's Degree in Biology with honors from Haverford College. Gaining both soccer playing and coaching experience through college, she spent a year after as the William Penn Fellow and Head of Women's Football (soccer) at the Chigwell School, in London. Amy completed her DPT at Duke University, and throughout as well as after gained experience working at multiple football clubs including the Carolina Railhawks F.C. (now North Carolina F.C.), the Capitol Area Soccer League, S.K. Brann (Norway), and the Atlanta Silverbacks. In 2013, Amy started a PhD examining primary and secondary ACL injury prevention as well as career length and return to sport, primarily in football players. After a short post-doc in Linköping, Sweden in 2017, Amy took a role as a physiotherapist and biomechanist at the Brooklyn Nets (NBA), and as a post-doc at Mount Sinai Health System. Outside of work, Amy continues to play some football, however primarily plays Australian Rules Football for both the New York Magpies and US National Team.

**READ DR. ARUNDALE'S RESEARCH**

1. **Arundale AJH**, Kvist J, Häggglund M et al. Jumping performance based on duration of rehabilitation in female football players after anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2019;27(2):556-563.
2. **Arundale AJH**, Bizzini M, Giordano A et al. Exercise-Based Knee and Anterior Cruciate Ligament Injury Prevention. *J Orthop Sports Phys Ther* 2018;48(9):A1-A42.
3. **Arundale AJH**, Silvers-Granelli HJ, Marmon A et al. Changes in biomechanical knee injury risk factors across two collegiate soccer seasons using the 11+ prevention program. *Scand J Med Sci Sports* 2018;28(12):2592-2603.
4. Grindem H, **Arundale AJ**, Ardern CL. Alarming underutilisation of rehabilitation in athletes with anterior cruciate ligament reconstruction: four ways to change the game. *Br J Sports Med* 2018;52(18):1162-1163.
5. **Arundale AJH**, Silvers-Granelli HJ, Snyder-Mackler L. Career Length and Injury Incidence After Anterior Cruciate Ligament Reconstruction in Major League Soccer Players. *Orthop J Sports Med* 2018, 24;6(1):2325967117750825.

Dr. Keith BAAR *PhD*

*Department of Physiology and Membrane Biology,
University of California Davis School of Medicine, USA*



@MuscleScience

The goal of Dr. Baar's laboratory is to understand the molecular determinants of musculoskeletal development and the role of exercise in improving health and performance. To achieve this goal, he works on muscle, tendon, and ligaments from 2- and 3-dimensional tissue culture, in vivo wild type and genetically modified animals, and humans.

These studies have direct clinical applications as they work closely with colleagues in orthopedics, internal medicine, and the cancer center to develop resistance exercise, nutritional, and novel small molecule interventions that prevent muscle wasting from cachexia and sarcopenia and improve muscle function and quality of life.

**READ DR. BAAR'S RESEARCH**

1. West DW, Baehr LM, Marcotte GR, Chason CM, Tolento L, Gomes AV, Bodine SC, **Baar K**. Acute resistance exercise activates rapamycin-sensitive and -insensitive mechanisms that control translational activity and capacity in skeletal muscle. *J Physiol*. 2016 Jan 15;594(2):453-68.
2. Marcotte GR, West DW, **Baar K**. The molecular basis for load-induced skeletal muscle hypertrophy. *Calcif Tissue Int*. 2015 Mar;96(3):196-210.
3. Hughes DC, Marcotte GR, Marshall AG, West DWD, Baehr LM, Wallace MA, Saleh PM, Bodine SC, **Baar K**. Age-related Differences in Dystrophin: Impact on Force Transfer Proteins, Membrane Integrity, and Neuromuscular Junction Stability. *J Gerontol A Biol Sci Med Sci*. 2017 May 1;72(5):640-648.

Professor Roald BAHR MD, PhD

*Oslo Sports Trauma Research Center, Norway
Aspetar, Doha, Qatar*



@RoaldBahr

Dr. Bahr is Professor of Sports Medicine in the Department of Sports Medicine at the Norwegian School of Sport Sciences and the Chair of the Oslo Sports Trauma Research Center. He is also the Chief Medical Officer for Olympiatoppen and Chair of the Medical Department at the National Olympic Training Center, and also heads the Aspetar Sports Injury & Illness Prevention Programme.



His main research area is sports injury prevention, and he has published more than 200 original research articles, review papers and book chapters, in addition to several books, with a citation index (H-index) of >50. He is the main editor of the widely acclaimed textbook "IOC Manual of Sports Injuries", which is published in seven languages, as well as the "IOC Handbook of Sports Injury Prevention".

READ PROFESSOR BAHR'S RESEARCH

1. Bakken, Arnhild; Targett, Steven; Bere, Tone; Eirale, Christiano; Farooq, A; Mosler, Andrea; Tol, Johannes; Whiteley, Rod; Khan, Karim; **Bahr, Roald**. Muscle strength is a poor screening test for predicting lower extremity injuries in professional male soccer players - a 2-year prospective cohort study. American Journal of Sports Medicine 2018;46(6):1481-1491.
2. Mosler, Andrea; Weir, Adam; Serner, Andreas; Agricola, R; Eirale, Christiano; Farooq, A; Bakken, Arnhild; Thorborg, Kristian; Whiteley, Rod; Hölmich, Per; **Bahr, Roald**; Crossley, Kay. Musculoskeletal screening tests and bony hip morphology cannot identify male professional soccer players at risk of groin injuries: a 2-year prospective cohort study. American Journal of Sports Medicine. 2018;46(6):1294-1305.
3. Krosshaug, Tron; Steffen, Kathrin; Kristianslund, Eirik Klami; Nilstad, Agnethe; Mok, Kam-Ming; Myklebust, Grethe; Andersen, Thor Einar; Holme, Ingar; Engebretsen, Lars; **Bahr, Roald**. The Vertical Drop Jump Is a Poor Screening Test for ACL Injuries in Female Elite Soccer and Handball Players: A Prospective Cohort Study of 710 Athletes. American Journal of Sports Medicine 2016;44(4):874-883.

Dr. Christian BARTON *PT, PhD*

*La Trobe Sport and Exercise Medicine Research
Centre, Australia*

*Department of Surgery, St Vincent's Hospital,
University of Melbourne, Australia*



@DrChrisBarton

Dr Barton works in research and private practice treating sports and musculoskeletal patients in Melbourne. He currently holds a Post-Doctoral Research Fellow focused on knowledge translation, and is the Communications Manager at La Trobe's Sport and Exercise Medicine Research Centre, and has a Master's degree in Communications and Journalism Innovation. Dr Barton is an Associate Editor and Deputy Social Media Editor at the British Journal of Sports Medicine.



Dr Barton's research interests focus on knee, running injuries and knowledge translation including the use of innovative digital technologies. He is regularly an invited speaker both nationally and internationally, presenting on these topics. Additionally, he runs popular courses on knee pain and running injury management in Australia, the United Kingdom, Europe and Scandinavia.

READ DR. BARTON'S RESEARCH

1. **Barton, C.J.**, Merolli, M.A. It is time to replace publish or perish with get visible or vanish: opportunities where digital and social media can reshape knowledge translation (2018). British Journal of Sports Medicine.
2. Holden, S., **Barton, C.J.** 'What should I prescribe?': Time to improve reporting of resistance training programmes to ensure accurate translation and implementation (2018). British Journal of Sports Medicine
3. Lack, S., Neal, B., De Oliveira Silva, D., **Barton, C.J.** How to manage patellofemoral pain—Understanding the multifactorial nature and treatment options (2018). Physical Therapy in Sport, 32, pp. 155-166.
4. **Barton, C.J.**, Lack, S., Hemmings, S., Tufail, S., Morrissey, D. The 'Best Practice Guide to Conservative Management of Patellofemoral Pain': Incorporating level 1 evidence with expert clinical reasoning (2015) British Journal of Sports Medicine, 49 (14), pp. 923-934.

Dr. Mario BIZZINI *PT, PhD**Schulthess Clinic, Zürich, Switzerland**Swiss Association of Sports Physiotherapy**British Journal of Sports Medicine***@SportfisioSwiss**

Mario Bizzini, PhD, MSc, PT is a research associate at the Schulthess Clinic in Zürich, Switzerland, where he works since 1989. He earned a Master of Science degree from the University of Pittsburgh (School of Health and Rehabilitation Sciences, 2001), and completed his PhD at the Oslo Sports Trauma and Research Center at the Norwegian School of Sports Sciences (2010). Mario was also 12 years (2002-2016) with the FIFA Medical Research and Assessment Center (F-MARC), and currently he is with the Human Performance Lab and the Swiss Concussion Center. His research interests focus on prevention and rehabilitation of sports injuries. Mario has authored 83 peer-reviewed publications, 6 books, and 17 book chapters on these topics, and is Deputy Editor of the British Journal of Sports Medicine. He is also a specialist in sports physiotherapy and a committee member of the Swiss association of Sports Physiotherapy. He was also on the Executive Board of the International Federation of Sports Physical Therapy between 2009 and 2017. Dr. Bizzini is a rehabilitation consultant for professional ice hockey and football/soccer teams, and has worked at three FIFA World Cups (2006, 2010, 2014), two FIFA Women's World Cups (2007, 2015) and three Olympic Games (2008, 2012, 2016).

READ DR. BIZZINI'S RESEARCH

1. Donaldson, A., Callaghan, A., **Bizzini, M.**, Jowett, A., Keyzer, P., Nicholson, M. A concept mapping approach to identifying the barriers to implementing an evidence-based sports injury prevention programme (2019). *Injury Prevention* 25(4):244-251
2. Rössler, R., Junge, A., **Bizzini, M.**, Verhagen, E., Chomiak, J. et al. A Multinational Cluster Randomised Controlled Trial to Assess the Efficacy of '11+ Kids': A Warm-Up Programme to Prevent Injuries in Children's Football (2018). *Sports Medicine* 48(6):1493-1504.
3. Casartelli, N.C., **Bizzini, M.**, Kemp, J., Naal, F.D., Leunig, M., Maffiuletti, N.A. What treatment options exist for patients with femoroacetabular impingement syndrome but without surgical indication? (2018). *British Journal of Sports Medicine*, 52(9):552-553.

Dr. Lara BOYD PT, PhD

*Brain Behaviour Laboratory,
Department of Physical Therapy,
University of British Columbia,
Canada*



@LaBoyd47

Canada Research Chair and Michael Smith Scholar, Dr. Lara Boyd, is a physical therapist and neuroscientist who is leading the effort to

understand what therapies positively alter patterns of brain activity. Her group uses a combination of functional magnetic resonance imaging and transcranial magnetic stimulation to map changes in brain activity. Her studies are among the first to comprehensively examine the patterns of brain activation as they relate to motor learning and parameters of practice especially after stroke.



READ DR. BOYD'S RESEARCH

1. Ferris JK, Neva JL, Francisco BA, **Boyd LA**. Bilateral Motor Cortex Plasticity in Individuals With Chronic Stroke, Induced by Paired Associative Stimulation. *Neurorehabil Neural Repair*. 2018 Aug;32(8):671-681.
2. Schmidt J, Rubino C, **Boyd LA**, Virji-Babul N. The Role of Physical Activity in Recovery From Concussion in Youth: A Neuroscience Perspective. *J Neurol Phys Ther*. 2018 Jul;42(3):155-162.
3. Sun Y, Ledwell NMH, **Boyd LA**, Zehr EP. Unilateral wrist extension training after stroke improves strength and neural plasticity in both arms. *Exp Brain Res*. 2018 Jul;236(7):2009-2021.
4. Mang CS, Brown KE, Neva JL, Snow NJ, Campbell KL, **Boyd LA**. Promoting Motor Cortical Plasticity with Acute Aerobic Exercise: A Role for Cerebellar Circuits. *Neural Plast*. 2016;2016:6797928.
5. Lakhani B, Borich MR, Jackson JN, Wadden KP, Peters S, Villamayor A, MacKay AL, Vavasour IM, Rauscher A, **Boyd LA**. Motor Skill Acquisition Promotes Human Brain Myelin Plasticity. *Neural Plast*. 2016;2016:7526135.

Dr. Ann COOLS PT, PhD

*Department of Rehabilitation Sciences &
Physiotherapy, Ghent University, Belgium
Bispebjerg Hospital, University of Copenhagen,
Denmark*

**@AnnCools4**

Dr. Cools is a physiotherapist, working as an associate professor at the Department of Rehabilitation Sciences and Physiotherapy at the Ghent University, Belgium, and as senior researcher at the Dept of Occupational and Physical Therapy and the Institute of Sports Medicine, Bispebjerg Hospital, University of Copenhagen, Denmark. Her topic of research and teaching expertise, as well as her clinical work is shoulder rehabilitation in general, and sport specific approach and scapular involvement in particular. She has published numerous papers in peer-reviewed international journals, and gives several courses on a national and international level. She was head of the Physical Therapy Education at Ghent University 2008-2016, and founding member and president of the European Society of Shoulder and Elbow Rehabilitation (EUSSE) 2008-2012.

**READ DR. COOLS' RESEARCH**

1. **Cools AM**, Borms D, Castelein B, Vanderstukken F, Johansson F: Evidence-based rehabilitation of athletes with glenohumeral instability. *Knee Surg Sports Traumatol Arthrosc.* 2016 Feb;24(2):382-9.
2. **Cools AM**, Johansson FR, Borms D, Maenhout A. Prevention of shoulder injuries in overhead athletes: a science-based approach. *Braz J Phys Ther.* 2015 Oct;19(5):331-9.
3. **Cools AM**, Borms D, Cottens S, Himpe M, Meersdom S, Cagnie B. Rehabilitation Exercises for Athletes With Biceps Disorders and SLAP Lesions: A Continuum of Exercises With Increasing Loads on the Biceps. *Am J Sports Med.* 2014, 42(6):1315-1322.
4. **Cools AM**, Struyf F, De Mey K, Maenhout A, Castelein B, Cagnie B. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. *Br J Sports Med* 2014;48(8): 692-7.

Professor Kay CROSSLEY PT, PhD

*La Trobe Sport and Exercise Medicine
Research Centre, Australia*



@KayMCrossley



Professor Crossley's research focuses on the prevention and management of knee and hip pain and early-onset osteoarthritis after sports-related injuries. Kay is a Physiotherapist, who worked in in a large multi-disciplinary sports medicine centre in Melbourne for more than 20 years. She contributed to sports medicine and physiotherapy texts, including every edition of "Brukner and Khan's Clinical Sports Medicine. Kay is now the Director of the La Trobe Sport and Exercise Medicine Research Centre in Melbourne Australia. She leads a large, innovative, active and talented group of researchers in this field. Kay's work is funded from major competitive granting bodies (including NHMRC and ARC), published more than 200 peer-review papers and graduated 18 PhD/Mphil students. Kay contributes to the publication of knowledge through service as an Editor for the British Journal of Sports Medicine and serves on the editorial board for the Journal of Physiotherapy.

READ PROFESSOR CROSSLEY'S RESEARCH

1. Patterson B, Culvenor AG, Barton CJ, Guermazi A, Stefanik JJ, Morris HG, Whitehead TS, **Crossley KM** (2018). Worsening knee osteoarthritis features on magnetic resonance imaging one to five years following anterior cruciate ligament reconstruction. American Journal of Sports Medicine. 46(12):2873-2883.
2. Heerey JJ, Kemp JL, Mosler AB, Jones DM, Pizzari T, Souza RB, **Crossley KM** (2018). What is the prevalence of imaging defined intra-articular hip pathologies in people with and without symptoms? A systematic review and meta-analysis. British Journal of Sports Medicine. 52(9):581-593.
3. Collins NJ, Barton CJ, Van Middelkoop M, Callaghan MJ, Rathleff MS, Vicenzino BT, ... **Crossley KM** (2018). 2018 Consensus statement on exercise therapy and physical interventions (orthoses, taping and manual therapy) to treat patellofemoral pain: Recommendations from the 5th International Patellofemoral Pain Research Retreat, Gold Coast, Australia, 2017. British Journal of Sports Medicine. 52(18):1170-1178.

Dr. Luciana DE MICHELIS MENDONÇA *PT, PhD*

*Physical Therapy Department - Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM), Brazil
Brazilian National Society of Sports Physical Therapy (SONAFE), Brazil*

 **@luludemichelis**

Dr. De Michelis Mendonça is a SONAFE associate since 2007 and took part on Organizing Committees of 3 SONAFE's Conferences since then. She now has 6 years of dedication on SONAFE's Executive Board. Dr. De Michelis Mendonça is the first female president of SONAFE, in a country with many restrictions to women participation in sport and politics. Since last year, she has also been part of IFSPT's executive board. Dr. De Michelis Mendonça is a teacher in a Federal University in Brazil where she conducts research in Sports Physical Therapy. She also engaged on the organization of the Physical Therapy services of the Rio 2016 Olympics and Paralympics Games.



READ DR. DE MICHELIS MENDONÇA'S RESEARCH

1. **Mendonça LD**, Ocarino JM, Bittencourt NFN, Macedo LG, Fonseca ST. Association of Hip and Foot Factors With Patellar Tendinopathy (Jumper's Knee) in Athletes. J Orthop Sports Phys Ther. 2018 Sep;48(9):676-684.
2. **Mendonça L de M**, Ocarino JM, Bittencourt NF, Fernandes LM, Verhagen E, Fonseca ST. The Accuracy of the VISA-P Questionnaire, Single-Leg Decline Squat, and Tendon Pain History to Identify Patellar Tendon Abnormalities in Adult Athletes. J Orthop Sports Phys Ther. 2016 Aug;46(8):673-80.
3. **Mendonça LD**, Macedo CSG, Antonelo MC, Alves MAF, Medeiros LT, Tadiello FF. Preparation and organization of Brazilian physical therapy for the Rio 2016 Olympic and Paralympic Games. Phys Ther Sport. 2017 May;25:62-64.
4. Bittencourt NFN, Meeuwisse WH, **Mendonça LD**, Nettel-Aguirre A, Ocarino JM, Fonseca ST. Complex systems approach for sports injuries: moving from risk factor identification to injury pattern recognition-narrative review and new concept. Br J Sports Med. 2016 Nov;50(21):1309-1314.

Professor Lars ENGBRETSSEN MD, PhD

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@LarsEngbretsen



Professor Engbretsen is currently a Professor of Orthopedic Surgery at Oslo University Clinic and Head of Medical Sciences in the International Olympic Committee. He has published over 450 articles and book chapters and is among the world's most productive in clinical, epidemiological and basic science research in the areas of general sports medicine, knee ligaments, cartilage and prevention of sports injuries and illnesses. Professor Engbretsen has been the President of the Norwegian Sports Medicine Society, the Scandinavian Foundation of Sports Medicine and European Society of Sports Traumatology and Arthroscopy (ESSKA). He is or has been a board member of the Norwegian Society of Sports Medicine, the Scandinavian Foundation of Medicine & Science in Sports, the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS), the Orthopedic Research Society and International Knee Society. He is the Editor of the British Journal of Sports Medicine (IPHP edition), Associate Editor of Journal of Bone and Joint and on the editorial board of American Journal of Sports Medicine, Scandinavian Journal of Medicine and Science in Sports, Knee Surgery, Arthroscopy and Sports Traumatology, and The Knee.

READ PROFESSOR ENGBRETSSEN'S RESEARCH

1. DePhillipo NN, Moatshe G, Chahla J, Aman ZS, Storaci HW, Morris ER, Robbins CM, **Engbretsen L**, LaPrade RF. (2019) Quantitative and Qualitative Assessment of the Posterior Medial Meniscus Anatomy: Defining Meniscal Ramp Lesions. Am J Sports Med. 47(2):372-378.
2. Grindem H, Granan LP, Risberg MA, **Engbretsen L**, Snyder-Mackler L, Eitzen I. (2015) How does a combined preoperative and postoperative rehabilitation programme influence the outcome of ACL reconstruction 2 years after surgery? A comparison between patients in the Delaware-Oslo ACL Cohort and the Norwegian National Knee Ligament Registry. Br J Sports Med. 49(6):385-9.
3. Grindem H, Eitzen I, **Engbretsen L**, Snyder-Mackler L, Risberg MA. (2014) Nonsurgical or Surgical Treatment of ACL Injuries: Knee Function, Sports Participation, and Knee Reinjury: The Delaware-Oslo ACL Cohort Study. J Bone Joint Surg Am. 6;96(15):1233-1241.

Dr. Sarah HAAG PT, DPT*Women's Health Certified Specialist**Entropy Physiotherapy and Wellness, Chicago, USA***@SarahHaagPT**

Sarah graduated from Marquette University in 2002 with a Master's of Physical Therapy. She has pursued an interest in pelvic health, and feels passionately that anyone treating people should be aware of pelvic issues. Sarah was awarded the Certificate of Achievement in Pelvic Physical Therapy from the Section on Women's Health. She went on to get her Doctorate of Physical Therapy and Masters of Science in Women's Health from Rosalind Franklin University in 2008. In 2009 she was awarded a Board Certification as a specialist in women's health (WCS). Sarah now speaks internationally to 'non-pelvic' practitioners about not shying away from the pelvis, but rather understanding its importance in performance, as well as every day quality of life.



Dr. Alex HUTCHINSON *PhD*

Journalist, Outside Magazine, Canada



@SweatScience

Alex Hutchinson is a journalist who writes about the science of endurance, fitness, and health. A former physicist and national-team distance runner, he writes the Sweat Science column for *Outside* and is the author of the *New York Times* bestseller *ENDURE: Mind, Body, and the Curiously Elastic Limits of Human Performance*. He lives in Toronto, Canada.



Dr. Greg LEHMAN *PT, MSc, DC**Private practice, Toronto, Canada***@GregLehman**

Greg has been in clinical practice for more than 15 years as both a chiropractor and physiotherapist. Currently, he balances his patient caseload with both research and teaching commitments. During his previous faculty and research positions, Greg conducted biomechanical research into the mechanisms of manual therapy, muscle activation during rehabilitation exercises and sports medicine publishing more than 20 papers in peer reviewed journals. He has lectured at numerous global conferences on biomechanics, injury rehabilitation and the biopsychosocial model, giving several keynote talks and 80 workshops throughout the globe helping clinicians incorporate best evidence into clinical practice and develop skills to practice in a manner consistent with the biopsychosocial model of care.

**READ DR. LEHMAN'S RESEARCH**

Lehman GJ. The Role and Value of Symptom-Modification Approaches in Musculoskeletal Practice. J Orthop Sports Phys Ther. 2018 Jun;48(6):430-435.

Vigotsky AD, Halperin I, **Lehman GJ**, Trajano GS, Vieira TM Interpreting Signal Amplitudes in Surface Electromyography Studies in Sport and Rehabilitation Sciences. Front Physiol. 2018 Jan 4;8:985.

Lehman GJ, Lennon D, Tresidder B, Rayfield B, Poschar M Muscle recruitment patterns during the prone leg extension. BMC Musculoskelet Disord. 2004 Feb 10;5:3.

Dr. Karen LITZY PT, DPT*Karen Litzy Physical Therapy, New York City, USA***@KarenLitzyNYC**

Dr. Litzy is currently the owner of Karen Litzy Physical Therapy, PLLC, a concierge physical therapy practice in New York City. Karen is also proud to serve as part of the social media team for the non-for-profit PT Day of Service. She is an elected member of the Nominating Committee for the Private Practice Section of the APTA as well as an official spokesperson for the APTA. She is also the co-founder of the Women in PT Summit.

Karen is the host of the weekly podcast Healthy Wealthy & Smart where she interviews influencers in the world of physical therapy, health, wellness and entrepreneurship.



Dr. Kerry MacDONALD PhD

*University of British Columbia, Vancouver, Canada
Volleyball Canada, Canada*



@KerryJMac

Dr. MacDonald was recently appointed Director of Sport Science, Sport Medicine & Innovation at Volleyball Canada. He was also a recent Head Coach for the Men's Volleyball team at the University of British Columbia in Vancouver, Canada. Dr. MacDonald serves as a Sessional Instructor for the UBC Faculty of Kinesiology. He is interested in training loads monitoring in athletes with the goal of preventing overuse injuries and optimizing performance.

**READ DR. MACDONALD'S RESEARCH**

1. **MacDonald KJ**, Palacios-Derflingher LM, Emery CA, Meeuwisse WH. (2018) The Effect of Injury Definition and Surveillance Methodology on Measures of Injury Occurrence and Burden in Elite Volleyball. *Int J Sports Med.* 39(11):860-866.
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3. **MacDonald K**, Bahr R, Baltich J, Whittaker JL, Meeuwisse WH. Validation of an inertial measurement unit for the measurement of jump count and height. *Phys Ther Sport.* 2017 May;25:15-19.

Professor Bob McCORMACK MD

*Department of Orthopaedic Surgery, University of
British Columbia, Vancouver, Canada
Chief Medical Officer, Canadian Olympic Team*

Dr. McCormack is a Professor at the University of British Columbia, Director of the Simon Fraser Orthopaedic Research Foundation and a founding member of COTS and JOINTS (Canadian research groups to facilitate multicenter trials). Dr. McCormack's clinical interests include knee and shoulder injuries. His research activities focus on articular cartilage injuries and knee ligament reconstruction. He is involved in the care of several sports teams and elite athletes at the varsity, national and professional levels. This includes serving as the Chief Medical Officer for the Canadian Olympic team, head physician for the BC Lions Football Club and two National teams. He is also the Orthopaedic Surgeon for the Vancouver Whitecaps FC and varsity athletes at two local universities.

**READ PROFESSOR McCORMACK'S RESEARCH**

1. Arthroscopy Association of Canada, Wong I, Hiemstra L, Ayeni OR, Getgood A, Beavis C, Volesky M, Outerbridge R, Sheehan B, **McCormack R**, Litchfield R, Whelan D, Mohtadi N, Coady C, MacDonald PB. Position Statement of the Arthroscopy Association of Canada (AAC) Concerning Arthroscopy of the Knee Joint-September 2017. *Orthop J Sports Med*. 2018 Feb 26;6(2):2325967118756597.
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Dr. Ebonie RIO PT, PhD

*La Trobe University Sport and Exercise Medicine
Research Centre, Melbourne, Australia*



@LaTrobeSport

Ebonie is a National Medical Research Centre postdoctoral research fellow at La Trobe University Sport and Exercise Medicine Centre. She completed her PhD in neuroscience and tendon pain. Her research has been awarded Victorian Fresh Scientist of the year 2015, ASICS SMA Best New Investigator 2004, 2013 & 2014 in Clinical Sports Medicine, best clinical science Pain Adelaide 2013, BJSM young investigator Best Clinical Paper 2014 and the Professor Mollie Holman medal for the best thesis of the faculty of Medicine, Nursing and Health Sciences Monash University 2015. Her clinical career has included Australian Institute of Sport, The Australian Ballet Company, Melbourne Heart football club, Alphington Sports Medicine Centre, Victorian Institute of Sport, Commonwealth Games 2006, 2010 Vancouver Winter Olympics, 2010 Singapore Youth Olympics, 2012 London Paralympics, 18 months travelling with Disney's The Lion King stage show.



READ DR. RIO'S RESEARCH

1. **Rio EK**, Ellis RF, Henry JM, Falconer VR, Kiss ZS, Girdwood MA, Cook JL, Gaida JE. (2018) Don't Assume the Control Group Is Normal-People with Asymptomatic Tendon Pathology Have Higher Pressure Pain Thresholds. *Pain Med.* 19(11):2267-2273
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Professor Ewa ROOS *PT, PhD**Research Leader, University of Southern Denmark**Adjunct professor, La Trobe University, Australia**Honorary professorial fellow, Melbourne University***@Ewa_Roos**

Professor Roos is the author of 211 peer-reviewed publications. She has published in high impact journals such as the New England Journal of Medicine, the British Medical Journal and The Lancet. Her work has been cited in total 11770 times and her h-index is 55 (Web of Science, May 2018). She has been able to successfully translate her research into clinical practice. More than 30.000 patients across four continents have taken the Good Life with Osteoarthritis from Denmark (GLA:D) program to treat their osteoarthritis symptoms. In 2014, her contribution to public health was recognised when she won the OARSI (Osteoarthritis Research Society International) Clinical Research Award for her "outstanding work in exercise as prevention and treatment of joint pain, joint injury and osteoarthritis". The same year she was awarded the Queen Ingrid of Denmark's prize for outstanding arthritis research by Queen Margrethe II of Denmark, and the Danish Rheumatism Association (Gigtforeningen).

**READ PROFESSOR ROOS' RESEARCH**

1. Frobell R B, **Roos EM**, Roos HP, Ranstam J, Lohmander LS. A Randomized Trial of Treatment for Acute Anterior Cruciate Ligament Tear. N Engl J Med. 2010;363(4):331-42.
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4. **Roos EM**, Barton CJ, Davis AM, McGlasson R, Kemp JL, Crossley KM, Liu Q, Lin J, Skou ST. GLA:D to have a high-value option for patients with knee and hip arthritis across four continents: Good Life with osteoarthritis from Denmark. Br J Sports Med. 2018;52(24):1544-1545

Dr. Anthony SCHNEIDERS PT, PhD

Professor & Head of Department, Exercise & Health Sciences, School of Health, Medical and Applied Sciences, Central Queensland University, Australia



@TonySchneiders

Dr. Schneiders has been a registered Physiotherapist for over 30 years with significant clinical and research expertise in Sports and Exercise Medicine. His research expertise has focused on sports-related concussion and injury prevention. He has authored more than 80 peer-reviewed journal publications as well as book chapters and expert opinion pieces. He is currently a Senior Associate Editor of the British Journal of Sports Medicine and international advisor to the Journal of Sports Physical Therapy. He is also the President of the International Federation of Sports Physical Therapists (IFSPT).

**READ DR. SCHNEIDERS' RESEARCH**

1. Balasundaram AP, **Schneiders AG**, Sullivan SJ. Rest and return-to-sport recommendations following sport-related concussion (PEDro synthesis). Br J Sports Med. 2018 May;52(9):616-617.
2. Moran RW, **Schneiders AG**, Mason J, Sullivan SJ. Do Functional Movement Screen (FMS) composite scores predict subsequent injury? A systematic review with meta-analysis. Br J Sports Med. 2017 Dec;51(23):1661-1669.
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5. **Schneiders AG**. Blood, sweat and tears: reclaiming the ethical high ground in sports physiotherapy. Br J Sports Med. 2015 Jul;49(14):904.

Dr. Emma STOKES *PT, PhD*

President, World Confederation for Physical Therapy



@EKStokes

Dr. Stokes is an associate professor and a Fellow of Trinity College Dublin. She teaches on the university's entry to practice programmes in Dublin and Singapore. Her research focuses on matters related to professional practice (e.g. leadership in the profession). From 2018 to 2019, she is an associate professor at Qatar University, leading the development of their new Physiotherapy education programme. She has been a member of the WCPT board since 2007 and was elected President in 2015.

**READ DR. STOKES' RESEARCH**

1. McGowan E, Walsh C, **Stokes EK** (2017) Clinical physiotherapists' experiences of leadership in physiotherapy in Ireland. *BMJ Leader* 1(4): 57-63.
2. McGowan E, Walsh C, **Stokes EK** (2017) Physiotherapy managers' perceptions of their leadership effectiveness: a multi-frame analysis. *Physiotherapy* 103(3):289-295.
3. McGowan E, **Stokes EK** (2017) Leadership and leadership development within the profession of physiotherapy in Ireland. *Physiotherapy Theory & Practice* 33:62-71.

Dr. Kristian THORBORG PT, PhD

Associate Professor, Sports Orthopedic Research –
Copenhagen, Amager-Hvidovre hospital, Denmark
Copenhagen University, Denmark

 **@KThorborg**

Dr. Thorborg is a senior researcher and associate professor as well as the Vice President of the International Federation of Sports Physical Therapy (IFSPT), a worldwide organization with more than 30 member countries. His main interests are the prevention and treatment of musculoskeletal injury and pain. Kristian Thorborg has published more than 10 systematic reviews and 10 RCTs related to the effect of specific exercise interventions to reduce the burden of musculoskeletal pain and injury.

Publications: 131 peer-reviewed Medline indexed publications since 2010, including 10 editorials, reviews and current concepts papers. His H-index is 32 and his papers have been cited more than 3500 times. He has co-authored more than 20 book chapters on issues related to musculoskeletal rehabilitation and sports medicine.

**READ DR. THORBORG'S RESEARCH**

1. **Thorborg K**, Kraemer O, Madsen AD, Hölmich P. Patient-Reported Outcomes Within the First Year After Hip Arthroscopy and Rehabilitation for Femoroacetabular Impingement and/or Labral Injury: The Difference Between Getting Better and Getting Back to Normal. *Am J Sports Med*. 2018 Aug 3;363546518786971.
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Dr. Jane Thornton MD, PhD

Fowler Kennedy Sport Medicine Clinic, Canada
Western Centre for Public Health and Family
Medicine, London, Canada



@JaneSThornton

Dr. Jane Thornton is a Canadian Clinician-Researcher in primary care and sports medicine with a special interest in sport injury prevention, particularly musculoskeletal and female athlete health. A Senior Associate Editor for the British Journal of Sports Medicine, Thornton also serves as an Expert Advisor for the IOC-supported Active Well-being Initiative. She is a World Champion and Olympic Rower with a passion for medical education surrounding musculoskeletal medicine and physical activity for the prevention and treatment of chronic disease.

**READ DR. THORNTON'S RESEARCH**

1. **Thornton, J.S.**, P. Fremont, K. Khan, P. Poirier, G. Wells, J. Fowles, R. Frankovich. Physical activity prescription: a critical opportunity to address a modifiable risk factor for the prevention and management of chronic disease: a position statement by the Canadian Academy of Sport and Exercise Medicine. Br J Sports Med 2016 Sep;50(18):1109-14.
2. **Thornton, J.S.**, A. Vinther, F. Wilson, M. Wilkinson, C. Lebrun, S. Di Ciacca, K. Orlando, T. Smoljanovic. Rowing Injuries – an updated review. Sports Medicine 2016; 47(4):641-61.
3. **Thornton JS** & Vinther A. Prevention of rib stress injury in rowers: what do we know and where do we need to go? Sports Orthop Traumatol 2018; 34(3):278-286.
4. Lion A, Vuillemin A, **Thornton JS**, Theisen D, Stranges S, Ward M. Physical activity promotion in primary care: a Utopian quest? Health Promotion International 2018.

Professor Bill Vicenzino *PT, PhD*

School of Health and Rehabilitation Sciences,
University of Queensland, Australia



@Bill_Vicenzino

Bill enthusiastically pursues an understanding of the best approach to managing musculoskeletal conditions, and to its dissemination. He focuses his scholarship in the areas of injuries related to physical activity and sports participation. He achieves this as the Chair in Sports Physiotherapy, Director of the Master of Physiotherapy (Musculoskeletal, Sport) and Sports Injuries Rehabilitation and Prevention for Health (SIRPH) research unit at the University of

Queensland. His clinical research has focused on such conditions as tennis elbow, gluteal tendinopathy, chronic ankle instability and patellofemoral pain, with a number of randomized clinical trials attracting NHMRC funding and being published in high impact medical journals (BMJ, Lancet, JAMA). Bill has over 200 peer reviewed publications, 2 books, 26 book chapters and over 300 invited presentations.

**READ PROFESSOR VICENZINO'S RESEARCH**

1. Bisset L, Beller E, Jull G, Brooks P, Darnell R, **Vicenzino B**. Mobilisation with movement and exercise, corticosteroid injection, or wait and see for tennis elbow: randomised trial. *BMJ* 2006; 333(7575):939–930.
2. Coombes B, Bisset L, Brooks P, Khan A, **Vicenzino B**. Effect of Corticosteroid Injection, Physiotherapy, or Both on Clinical Outcomes in Patients with Unilateral Lateral Epicondylalgia. *JAMA*. 309(5):461–9.
3. Coombes BK, Bisset L, **Vicenzino B**. Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: a systematic review of randomised controlled trials. *Lancet*. 2010; 376(9754):1751–67.
4. Heales LJ, **Vicenzino B**, MacDonald DA, Hodges PW. Forearm muscle activity is modified bilaterally in unilateral lateral epicondylalgia: A case-control study. *Scandinavian Journal of Medicine & Science in Sports*. 2015; 26(12):1382–90.
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Dr. Rod Whiteley *PT, PhD*

Aspetar Sports Medicine Hospital, Doha, Qatar



@RodWhiteley

Rod is a Specialist sports physiotherapist whose PhD was in throwing-related injury, but over the last 10 years has shifted focus to the lower limb in general, and acute muscle injuries and overuse tendon injury in particular. He spent time on the College of Sports Physiotherapy's Board in Australia as Chief Examiner and has worked with a number of professional and international teams and individuals in Rugby League, Rugby Union, Baseball, Football, Squash, and Athletics.

**READ DR. WHITELEY'S RESEARCH**

Bakken A, Targett S, Bere T, Eirale C, Farooq A, Mosler AB, Tol JL, **Whiteley R**, Khan KM, Bahr R. Muscle Strength Is a Poor Screening Test for Predicting Lower Extremity Injuries in Professional Male Soccer Players: A 2-Year Prospective Cohort Study. *Am J Sports Med*. 2018 May;46(6):1481-1491.

van Dyk N, Bahr R, Burnett AF, **Whiteley R**, Bakken A, Mosler A, Farooq A, Witvrouw E. A comprehensive strength testing protocol offers no clinical value in predicting risk of hamstring injury: a prospective cohort study of 413 professional football players. *Br J Sports Med*. 2017 Dec;51(23):1695-1702.

Tol JL, Hamilton B, Eirale C, Muxart P, Jacobsen P, **Whiteley R**. At return to play following hamstring injury the majority of professional football players have residual isokinetic deficits. *Br J Sports Med*. 2014 Sep;48(18):1364-9.

Jacobsen P, Witvrouw E, Muxart P, Tol JL, **Whiteley R**. A combination of initial and follow-up physiotherapist examination predicts physician-determined time to return to play after hamstring injury, with no added value of MRI. *Br J Sports Med*. 2016 Apr;50(7):431-9.

van der Made AD, Almusa E, Reurink G, **Whiteley R**, Weir A, Hamilton B, Maas M, Ngai ASH, Moen MH, Goudswaard GJ, Tol JL. Intramuscular tendon injury is not associated with an increased hamstring reinjury rate within 12 months after return to play. *Br J Sports Med*. 2018 Apr 13.

Dr. Johann Windt PhD

Head of Data Science, Vancouver Whitecaps FC,
Canada



@JohannWindt

Johann Windt is the Head of Data Science – Performance with the Vancouver Whitecaps FC of the Major League Soccer (MLS).

His research interests include how athlete training and wellness data should be analysed to best understand injury risk and performance. Co-supervised by Professors Karim Khan and Tim Gabbett, his doctoral work at the University of British Columbia specifically focused on athlete monitoring and injury aetiology.

**READ DR. WINDT'S RESEARCH**

1. **Windt J** & Gabbett TJ. How Do Training and Competition Workloads Relate to Injury? The Workload—Injury Aetiology Model. Br J Sports Med 2017;51:428-435.
2. **Windt, J** & Gabbett TJ. Is It All for Naught? What Does Mathematical Coupling Mean for Acute:Chronic Workload Ratios? Br J Sports Med 2018 May 28.
3. **Windt J**, Ardern CL, Gabbett TJ, Khan KM, Cook CE, Sporer BC, Zumbo BD. Getting the Most out of Intensive Longitudinal Data: A Methodological Review of Workload–Injury Studies. BMJ Open 2018;8(10):e022626.
4. **Windt J**, Zumbo BD, Sporer B, MacDonald K, Gabbett TJ. Why Do Workload Spikes Cause Injuries, and Which Athletes Are at Higher Risk? Mediators and Moderators in Workload–Injury Investigations. Br J Sports Med 2017;51(13):993-994.
5. **Windt J**, Gabbett TJ, Ferris D, Khan KM. Training Load--Injury Paradox: Is Greater Preseason Participation Associated with Lower in-Season Injury Risk in Elite Rugby League Players? Br J Sports Med 2017;51(8):645-650.

Conference sponsors



Abstracts accepted for presentation

Podium presentation competition

Abstract number	Presenting author	Title
101	Tao	Use of a novel, individualized running journal to guide return to competition in collegiate runners with running-related injuries: a case series
102	Bramah	Running kinematics differ between male and female runners with ITBS.
103	Riel	Self-dosed versus pre-determined progressive heavy-slow resistance training for individuals with plantar fasciopathy: a randomised clinical trial
104	Emery	Implementing a school prevention program to reduce injuries through neuromuscular training (isprint): a cluster-randomized controlled trial
105	Ezzat	What is the impact of anterior cruciate ligament injury on levels of physical activity, sport participation, and other health outcomes in young females?

Morning (AM) poster presentations

Abstract number	Presenting author	Title
001	Otsudo	Gender differences in reliability of strain measurement of medial elbow ligaments and forearm flexor muscles using ultrasound elastography
003	Secchi	Injury prevalence and CrossFit movements: an epidemiological study
005	Secchi	Injuries surveillance in Brazilian`s male elite youth soccer athletes - a retrospective study
007	King	Assessing movement strategies in hip-related pain. Do we need to consider sex in evaluating three-dimensional biomechanics?
009	Shiroshita	Initial foot contact affects dynamic parameters in running.
011	Bramah	Kinematic characteristics of male runners with a history of recurrent calf muscle strain injury
013	Takeuchi	Injuries tendency during fall league match in the Japanese Chushikoku area collegiate American Football league match, past 7 seasons (2012 - 2018)
015	Paterson	What do the stories of experienced sports physiotherapists' tell us about their continuing professional learning
021	Lagniaux	Reference values for the closed kinetic chain upper extremity stability test for elite handball players
023	Mendonça	Passive hip stiffness influences hip kinematics on transverse plane during the single-leg squat
025	Mendonça	The prevalence and incidence of injuries in Brazilian elite volleyball players
027	Riel	Heavy-slow resistance training in addition to an ultrasound-guided corticosteroid injection for individuals with plantar fasciopathy: a feasibility study

029	Anami	A survey on self-care implementation status and sports injuries prevention in collegiate male baseball players
031	Holt	Sticking to it: a scoping review of adherence to exercise therapy interventions in children and adolescents with musculoskeletal disorders
033	Urabe	Niseko resort changes Japanese ski safety
037	Heick	A comparison of scapular position and the Davies closed kinetic chain stability test
039	Truong	The roles of psychological, social, and contextual factors in recovery after a sport-related knee injury: a scoping review
041	Ithurburn	Development and predictors of age- and activity-relevant functional recovery targets in young athletes after ACL reconstruction
043	Preece	Between-day repeatability of lower limb muscles during running
045	Ajiboye	Injury patterns and perceived risk factors among basketball players in Nigeria
047	Owoeye	Sticking with it? Adherence to a neuromuscular training injury prevention warm-up program in youth basketball
049	Sinsurin	Clinical and performance assessments in athletes with anterior cruciate ligament reconstruction after return-to-sports
051	Besomi	Shear wave elastography of the iliotibial band: an exploratory study in pain-free runners
053	Wang	Effect of pressure biofeedback in abdominal drawing-in maneuver on transversus abdominis activation level in patients with chronic low back pain
057	Declève	The upper limb rotation test: reliability and validity study of a new upper extremity physical performance test
059	Grindstaff	Establishing normative benchmarks for strength and hop test measures in collegiate athletes
061	Carvalho	Effect of two massage protocols on clinical parameters of swimming athletes: a randomized controlled clinical trial
063	Oke	Combat sports training programme enhances physical performance attributes in children
065	Arundale	Head and knee injuries cause the most missed work in US women playing AFL
067	Roch	Sensitivity of the MyotonPro to measure the changes in the viscoelastic properties of a trigger point on the infraspinatus in non-traumatic chronic shoulder pain after a dry needling intervention
069	Gabrick	SierraSil as an ergogenic aid to performance in athletes
071	Ruan	The proprioception and postural stability characteristics of perceived instability subgroups in chronic ankle instability
073	Qian	Differences in muscle activities of the scapular muscles in open and closed kinetic chain exercises

Afternoon (PM) poster presentations

Abstract number	Presenting author	Title
002	Akasaka	Effects of deep hopping training on ankle sprain in junior high school basketball players: A clustered randomized control trial
004	Secchi	Correlation between shoulder functional assessment and thermography analysis in volley athletes with shoulder pain: a comparative study
006	King	Lower limb joint mechanical work during the single leg drop jump: a cross-sectional comparison of women with and without hip-related pain
008	Torchia	Posterior shoulder instability classification, assessment and management: an international Delphi study
010	Bramah	A single session of gait retraining improves pain, function and running kinematics in runners with patellofemoral pain
012	Shimizu	A survey of acute injury in wheelchair basketball players: relation to the functional classification
014	Arisu	The change of the sesamoid rotation angle in patient with hallux valgus at walking position
016	Paterson	Female sports physiotherapists' experiences of their work in the context of a Gulf Corporation Council (GCC) country
018	Hughes	The effectiveness of blood flow restriction vs. heavy load resistance training during post-surgery rehabilitation of anterior cruciate ligament reconstruction patients: a UK National Health Service randomised controlled trial.
020	Wolski	Can wearable sensors validly measure lower limb kinematics during high speed running?
022	Mendonça	The evidence for conservative treatment in reducing pain and improving function in patellar tendinopathy is of low quality: a systematic review of randomised controlled trials including GRADE recommendations
024	Mendonça	Financial costs of musculoskeletal injuries in elite female volleyball players
026	Mendonça	Preventive effect of tailored exercises on patellar tendinopathy in youth athletes
030	Klemp	The relationship between foot sole sensitivity and lower limb biomechanics during single-leg stance and single-leg jump landing
032	Murakami	Relationship between mechanical stress and injury around the hip joint due to kicking action in Football
036	Andersen	Guided load management for female soccer athletes: a case series using global positioning system technology (GPS) during return to sport
038	Scholes	What is the domain-specific burden of hip-related pain in men and women who play competitive football?
040	Dhamnaskar	Early use of anti-gravity treadmill training for return to running following tibial stress fracture
042	Preece	Abnormal muscle coordination rather than hip abductor muscle weakness may underlie increased pelvic drop during running
044	Le	Scared to move: kinesiophobia in the acute stages of youth sport-related knee injuries
046	Fagundes	Effectiveness of dry needling combined with a treatment programme for musculoskeletal-related chronic pain: a systematic review and meta-analysis

048	Zhang	Morphological features of deep cervical muscles between patients with poor posture and healthy controls: a high-frequency ultrasound imaging study
050	Besomi	Tensor fascia latae muscle structure and activation in individuals with lower limb musculoskeletal conditions: a systematic review and meta-analysis
052	Rambaud	Evaluation of sprinting force production capacities in athletes at 6th month after anterior cruciate ligament reconstruction: a pilot study
054	Samukawa	Effects of exposure to cold on stiffness of muscle tendon unit at ankle plantar flexors
056	Atkinson	Pain and articular cartilage response to a challenging dynamic loading stimulus in patients after traumatic knee injuries
058	Pinto	Effect of knee aspiration and intra-articular corticosteroid injection on gait biomechanics and strength in patients with knee osteoarthritis
060	Batista	Effect of cold-water immersion on perceptions of recovery in swimming athletes: a randomized placebo-controlled clinical trial
062	Primeau	Pain trajectories and perceived exertion during a 12-week neuromuscular exercise program in patients with knee osteoarthritis
064	Brown	A comparison of medical encounters of older and younger athletes participating at major games
066	Chaaban	Landing kinetics in collegiate female athletes with and without a history of ACL injury
068	Dhillon	Perceptions about running footwear and assessment of an online educational module
070	Khan	Long-term 3T MRI-defined morphological changes after acute Achilles tendon rupture
072	Zaccheo	The effect of sleep on explosive strength gains in female collegiate soccer players during off-season training: a pilot study

ABSTRACT # 101

TITLE Use of a novel, individualized running journal to guide return to competition in collegiate runners with running-related injuries: a case series

AUTHORS Tao H^{1,2}, Ness BM^{1,2}, Zimney K¹

AFFILIATIONS ¹ Department of Physical Therapy, University of South Dakota, Vermillion, SD, USA

² Department of Athletics, University of South Dakota, Vermillion, SD, USA

ABSTRACT **Objective:** Collegiate distance runners often train year-round with high acute and chronic running loads in order to maintain a competitive level throughout the entire competition year. It is common for these runners to exceed weekly running volumes of 40 miles per week. For injured runners, following traditional return to run protocols that adhere to the “10% rule” of weekly progression can take up to 16 weeks to reach their competitive training volumes. Yet, there is a lack of evidence to support expedited running progression programs for injured runners. The objective of this report is to describe positive outcomes in injured, collegiate distance runners who adhered to expedited running progressions using a patient-centered running journal.

Methods: This study utilized a case series design. One physical therapist (PT) with five years of clinical experience, including one year of sports PT residency training, evaluated and treated all runners. Four collegiate Division I distance runners with persistent running-related injuries (RRIs) progressed weekly running volumes using the Running Individualized Progression with Evaluative Modification (RIPEM) journal. The PT used the RIPEM to evaluate individual responses while guiding acute and chronic workload progression.

Results: Runners increased running volumes by $24.8 \pm 16.4\%$ per week (excluding deload weeks). All runners successfully returned to weekly running volumes of 33-50 miles per week in 6-12 weeks, including return to competition in their respective events.

Conclusion: Guided, expedited running progressions using the RIPEM allowed collegiate distance runners to progress running volumes and return to competition at a faster rate than traditional running progressions using the “10% rule.”

Clinical implications: Sports PTs should consider using the RIPEM to guide collegiate distance runners in expedited return to run protocols.

NOTES Top 5 abstracts. Podium presentation competition. Friday Oct 5, 4:45pm-5:45pm.

ABSTRACT # 102

TITLE Running kinematics differ between male and female runners with ITBS

AUTHORS Bramah C^{1,2}, Preece SJ¹, Gill N¹, Herrington L¹

AFFILIATIONS ¹ School of Health Sciences, University of Salford, Salford, UK

² Manchester Institute of Health & Performance, Manchester, UK

ABSTRACT **Objective:** To investigate whether running kinematics differ between male and female runners with iliotibial band syndrome (ITBS) and injury free controls.
Methods: Seven male and 7 female runners diagnosed with ITBS and 14 injury free controls (7 males, 7 females) participated in this study. A 12-camera Qualysis Oqus system recorded 3D running kinematics as participants ran on a treadmill at 3.2m/s. One-way analysis of variance (ANOVA) compared differences in 3D running kinematics between groups.
Results: Both male and female ITBS runners demonstrated significantly greater contralateral pelvic drop when compared to controls. Female ITBS runners also demonstrated significantly greater hip adduction and transverse plane pelvis rotation during stance phase of running when compared to the male ITBS and control group. Male ITBS runners demonstrated a significantly more extended knee at initial contact when compared to the female ITBS and control group.
Conclusion: Males and female runners with ITBS demonstrate differences in running kinematics. In particular female runners with ITBS demonstrate greater kinematic deficits at the hip and pelvis when compared to male runners with ITBS and controls while male runners demonstrate differences in knee kinematics at initial contact.
Clinical implications: Based on these results, clinicians should consider potentially different mechanical patterns influencing ITBS development amongst male and female runners. Management and rehabilitation strategies may need to be varied according to sex and the associated kinematic patterns.

NOTES Top 5 abstracts. Podium presentation competition. Friday Oct 5, 4:45pm-5:45pm.

ABSTRACT # 103

TITLE Self-dosed versus pre-determined progressive heavy-slow resistance training for individuals with plantar fasciopathy: a randomised clinical trial

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ABSTRACT **Objective:** The aim was to compare the efficacy of a self-dosed versus a pre-determined heavy-slow resistance training (HSR) programme in improving the Foot Health Status Questionnaire (FHSQ) pain score in individuals with plantar fasciopathy.
Methods: We recruited 70 participants with plantar fasciopathy for this prospectively-registered (NCT03304353), participant-blinded, superiority trial. Participants were randomised to a self-dosed or pre-determined 12-week HSR programme of heel raises. The self-dosed group performed as many sets as possible at 8RM guided by perception of symptoms, whereas the pre-determined group followed a standardised protocol. Primary outcome was FHSQ pain. Secondary outcomes included a 7-point Global Rating of Change (GROC) dichotomised to “improved” or “not improved”, Patient Acceptable Symptom State (PASS), and training sessions performed.
Results: There was no between-group difference in FHSQ pain after 12 weeks (adjusted mean difference: -6.9 points, 95% CI: -15.5, 1.7, P=0.115) and both groups had similar clinically important improvements. According to GROC, 24/33 (72.7%) in the self-dosed group and 20/32 (62.5%) in the pre-determined group achieved improvement. 3/35 (8.6%) in the self-dosed group and 1/35 (2.9%) in the pre-determined group achieved PASS. Both groups performed an equal number of training sessions (P=0.412).
Conclusion: There was no significant or clinically relevant difference between self-dosed and pre-determined HSR programmes. Both were associated with similar response over 12 weeks, which was not sufficient to achieve acceptable symptom state.
Clinical implications: Loading programmes for tendinopathies are usually pre-determined, but our findings suggest there is no need for a standardised programme in patients with plantar fasciopathy. HSR provides clinicians with an alternative to other conservative treatments, but the effect compared to wait-and-see and less time-consuming treatments need to be established.

NOTES Top 5 abstracts. Podium presentation competition. Friday Oct 5, 4:45pm-5:45pm.

ABSTRACT # 104

TITLE Implementing a school prevention program to reduce injuries through neuromuscular training (isprint): a cluster-randomized controlled trial

AUTHORS Emery CA^{1,2}, van den Berg C¹, Richmond S³, Palacios-Derflingher L^{1,3}, McKay CD⁴, Doyle-Baker PK¹, McKinlay M⁵, Toomey CM^{1,6}, Nettel-Aguirre A^{2,6}, Hagel B^{2,6}

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ABSTRACT **Objectives:** To evaluate the effectiveness of iSPRINT, a school-based program to reduce injury rates (IR) through neuromuscular training (NMT), in junior high school physical education (PE), in reducing the rate of sport and recreational (S&R) injuries.
Methods: This is a cluster-randomized controlled trial. Students were recruited from 12 Calgary junior high schools (2014-2017). iSPRINT is a 15-min NMT warm-up including aerobic, agility, strength, and balance exercises. Following a teacher workshop, teachers were asked to implement iSPRINT (N=6) or a standard-of-practice warm-up (N=6) at the beginning of PE classes for 12 weeks. Injuries included those that resulted in the inability to complete a session, time loss and/or medical attention. Incidence rate ratios (IRR) were estimated based on multivariable Poisson regression analyses [adjusting for sex (considering effect modification), previous injury, and clustering by class, offset by S&R participation hours] for intent to treat analyses.
Results: 1,067 students (ages 11-16) were recruited across 12 schools (53.7% female, 46.3% male). The iSPRINT program was protective of all S&R injury for females (IRR=0.53, 95% CI; 0.32-0.89) but not males (IRR=0.85, 95% CI; 0.42-1.71). The iSPRINT program was also protective of lower extremity (LE) injuries (IRR=0.38, 95% CI; 0.22-0.66) and medical attention injuries (IRR=0.28, 95% CI; 0.14-0.53) for females but not males for LE injuries (IRR=0.16, 95% CI; 0.47-2.38) or medical attention injuries (IRR=0.63, 95% CI; 0.25-1.62).
Conclusion: The iSPRINT NMT warm-up was effective in preventing all injury, lower extremity injury, and medically treated S&R injuries in female junior high school students but not males.
Clinical implications: A NMT warm-up program is recommended as best practice for injury prevention in youth S&R. Physical therapists are ideally positioned to provide leadership in delivering teacher/coach NMT injury prevention workshops that will have significant impact.

NOTES Top 5 abstracts. Podium presentation competition. Friday Oct 5, 4:45pm-5:45pm.

ABSTRACT # 105

TITLE What is the impact of anterior cruciate ligament injury on levels of physical activity, sport participation, and other health outcomes in young females?

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ABSTRACT **Objective:** To evaluate differences in levels of physical activity (PA), sport participation, and other health outcomes between female youth and young adults with a previous anterior cruciate ligament (ACL) injury, at 1-2 years following reconstruction and uninjured age-and-sport-matched controls.

Methods: Participants in this historical cohort included 51 females with primary unilateral ACL reconstruction (ACLR) for a sport-related ACL injury in the previous 1-2 years and 51 age-and-sport-matched controls. Outcomes included: objectively measured PA (GT3X accelerometers); previous/current sport participation and return to sport (RTS); body mass index (BMI); Knee Injury and Osteoarthritis Outcome Score (KOOS); Triple Single Leg Hop (TSLH); and One Leg Rise (OLR). Multivariable linear regression (clustered by pair) examined whether ACLR females had lower levels of PA participation and poorer health-related outcomes than age-and-sport-matched controls.

Results: Participant median age was 17.8 years (range, 14-22 years). In the injury group, 28 (54%) had RTS, 14 (27.5%) at performance level. Across both groups, over 1/3 changed their most important sport, shifting towards individually-based sport. The injury group had lower mean minutes/day of vigorous PA (-1.22; 95%CI -2.40, -0.04); poorer KOOS scores (all subscales) below minimally clinically important difference thresholds; and lower TSLH distance. No significant group difference was seen for combined moderate and vigorous PA, BMI, or OLR.

Conclusion: At 1-2 years after ACLR, females demonstrated reduced vigorous PA, clinically-significant levels of self-reported knee pain and symptoms, reduced knee function in sport, lower quality of life; and poorer objective knee function compared to matched-controls. Sport type had evolved in both groups.

Clinical implications: Young females, 1-2 years after ACLR, demonstrated negative health-related outcomes that could shape future health behaviours and joint health.

NOTES Top 5 abstracts. Podium presentation competition. Friday Oct 5, 4:45pm-5:45pm.

ABSTRACT # 001

TITLE Gender differences in reliability of strain measurement of medial elbow ligaments and forearm flexor muscles using ultrasound elastography

AUTHORS Otsudo T¹, Hattori H², Akasaka K¹

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ABSTRACT **Objective:** To compare gender differences in reliability of strain measurement of anterior bundles of ulnar collateral ligament (AUCL) and forearm flexor muscles (FFM) using ultrasound elastography.
Methods: Fourteen males (20.9±0.3 years) and fourteen females (20.8±0.4 years) participated in this study. All participants were fully informed about the study and provided signed consent. This study was approved by the Ethics Committee at the Saitama Medical University (M-82). Strain elastography (ALOKA Noblus, Japan) was placed at the medial aspect of the elbow with longitudinal orientation of AUCL. ICC (1,2), ICC (2,1), 95%CI and standard error of measurement (SEM) were analyzed. Additionally, the maximum circumference of forearm (Max-FA [cm]) was tested using a tape measure. Spearman rank correlation coefficient was used to analyze the relationship between the measurement differences of AUCL or FFM and Max-FA.
Results: Male AUCL ICC (1,2), 95%CI, and SEM were 0.92, 0.82-0.98 and 0.12, while female were 0.89, 0.59-0.95 and 0.31. Male AUCL ICC (2,1), 95%CI and SEM were 0.93, 0.86-0.98 and 0.13 while female were 0.94, 0.85-0.98 and 0.11. Male FFM ICC (1,2), 95%CI and SEM were 0.60, 0.43-0.92, and 0.04 while female were 0.49, 0.06-0.85 and 0.05. Male FFM ICC (2,1), 95%CI and SEM were 0.53, 0.28-0.89 and 0.06 while female were 0.07, 0.40-0.64 and 0.14. Male and female Max-FA were 25.8±1.7 and 23.3±1.4 respectively. There was significant positive correlation between the measurement differences of AUCL and Max-FA in male (r=0.64).
Conclusion: Stiffness of FFM ICC, 95%CI and SEM in female were lower than that in male. Additionally, the larger Max-FA became, the larger measurement differences of stiffness of AUCL occurred in male.
Clinical implications: Stiffness of FFM in female was lower reliability than that in male. Reliability in measurement of stiffness of AUCL may become lower as Max-FA increases in male.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 002

TITLE Effects of deep hopping training on ankle sprain in junior high school basketball players: a clustered randomized control trial

AUTHORS Akasaka K^{1,2}, Ono K^{1,3}, Otsudo T^{1,2}, Hattori H^{1,4}, Hasebe Y^{1,3}

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ABSTRACT **Objective:** In Japan, about 70,000 ankle sprains per year occurred in junior high and high school basketball players, which numbers exceeded those in soccer and baseball. In recent years, neuromuscular training using a deep hopping training (DHT) has become a common form of exercise to prevent ankle sprain. The purpose of this study was to clarify the effect of the DHT upon ankle injury in junior high school basketball players.

Methods: 105 junior high school basketball players without concurrent injuries were recruited. All players were randomly assigned as a cluster by school to a control group and the DHT group. 40 players at 3 schools were allocated to a control group and 65 at 4 schools were to the DHT group. Subjects in the DHT group completed an ankle injury prevention program including jump squats, front hopping, back hopping, right side hopping, left side hopping on the floor for 8 weeks. Ankle injury rates were calculated and compared by occurrence of injury per 1000 athlete hours (1000AH) and relative risk in the control and the DHT groups.

Results: There was no significant between-group difference in age, height, weight, and years of competition. The number of ankle sprain were 17 in the control group and 17 in the DHT group. Practice time was 4122 hours for control group, while 6867 hours for DHT group. The 1000 AHs calculated by the total practice time and the number of injuries were 4.21 (95%CI: 2.7, 6.0) in the control group and 2.47 (95%CI: 1.4, 3.5) in the DHT group. The relative risk compared to the control group was 0.61 in the DHT group. The number of injuries occurring at Chi-squared test (one tailed) was $P = 0.045$.

Conclusion: Our study showed that DHT for 8 weeks would reduce the occurrence of ankle sprain in junior high school basketball players.

Clinical implications: Our study suggests that high school basketball players should participate in DHT to reduce the occurrence of ankle sprain.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 003

TITLE Injury prevalence and CrossFit movements: an epidemiological study

AUTHORS Secchi LLB^{1,2}, Souza GT², Grüninger BL^{2,3}, Barusso Grüninger MS², Gomes JR AO^{3,4}, Araújo FRA^{1,3}, Machado EM¹, Shiraishi FG², Mendonça LD^{1,5}

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² Faculdade Sudoeste Paulista - Sport Physical Therapy Academic League - Itapetininga – Brazil
³ Nacional Society Sports Physical Therapy - SONAFE/IFSPT – Brazil
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⁵ Universidade Federal dos Vales do Jequitinhonha e Mucuri - Physical Therapy Department, Diamantina - Brazil

ABSTRACT **Objective:** CrossFit is a sporting practice that is growing worldwide, with a lot of supporters and followers. There are some ideas that this modality brings a lot of injuries and pain. However, the CrossFit movement probably can be related to injuries. Our objective was to investigate the prevalence of injury and CrossFit movement. Furthermore, verify which CrossFit movement is the most injurious.

Methods: Seventeen questions concerning training (frequency, length of practice, movement injury during CrossFit practice and location of injury) and demographics (gender, age, affiliation) were asked. Data were collected from September 2018 to February 2019 through an electronic questionnaire, which was created and hosted using an online questionnaire and survey software (SurveyMonkey; www.surveymonkey.com). The study was approved by the ethics committee of State University of São Paulo (UNESP- Botucatu Campus).

Results: 5,189 Brazilian athletes (51.9% woman; 47.7% aged between 21-29 years and 36.7% aged between 30-39 years) answered the questionnaire. 1,528 athletes (29%) had no injury with CrossFit. Deadlift was the main injury movement in 576 athletes (11%), Snatch in 322 athletes (6%) and Box Jump in 201 athletes (4%). There were 49 more movements with lower injury prevalence. Shoulder, low back and knee were the most injured body parts.

Conclusion: The Deadlift, Snatch and Box jump movements were the most injurious movements and shoulder, low back and knee were the most often injured body parts.

Clinical implications: This research shows the major movements that cause injury in CrossFit athletes. In clinical practice, this study strongly recommends that coaches monitor CrossFit movements to change or improve the movements. Furthermore, physical therapists need to do an assessment of musculoskeletal components and implement a preventive training focusing on the reduction of injury rates.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 004

TITLE Correlation between shoulder functional assessment and thermography analysis in volley athletes with shoulder pain: a comparative study

AUTHORS Secchi LLB^{1,2}, Pinheiro GR², Araújo FRA^{1,3}, Machado EM¹, Shiraishi FG², Mendonça LM^{1,4}

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ABSTRACT **Objective:** To perform a correlation between shoulder functional assessment and thermography analysis in volleyball players with and without pain.
Methods: Nine volleyball players with shoulder pain and 9 matched controls were evaluated with a thermography camera (TermoCam C2 Educational Kit, Flir Systems, Estonia) and they performed SPADI score and Score Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) to compare functional inter group. The pictures were analyzed on software VisionFy® (v.1.1, 2019, Thermofy Corp., Brazil), to range of interest's (ROI) quantification. The athletes were compared on maximal temperature (Max °C), minimal temperature (Min °C), average temperature (Average °C), amplitude (Ampl °C), deviation of the thermal center (DTC °C) and delta difference. Kolmogorov-Smirnov was used to identify normality distribution and Mann-Whitney test was applied to compare the groups.
Results: Symptomatic volleyball players had a mean age of 26.9 ± 6.7 years, body mass of 83.2 ± 15.9 kg and height of 182.7 ± 9.9 cm. Non-symptomatic athletes had a mean age of 27.1 ± 5.5 years, weight of 75.6 ± 9.3 kg and height of 175.9 ± 4.1 cm. Pearson's correlation showed stronger correlation (0.730 $p=0.026$) between CKCUEST and delta ROI mean in volleyball players with shoulder pain.
Conclusion: the functional movement pattern by CKCUEST, alteration of temperature by thermography analysis and SPADI scores are different in volleyball athletes with shoulder pain and there is stronger correlation with the functional movement pattern by CKCUEST and alteration of temperature between groups.
Clinical implications: This research shows one more assessment method to identify the parameters of pain and dysfunctions through thermography without risks for musculoskeletal structures.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 005

TITLE Injuries surveillance in Brazilian male elite youth soccer athletes: a retrospective study

AUTHORS Rapello F^{1,2}, **Secchi LLB**^{1,3}, Machado EM¹, Silva PLC², Dos Santos CRL², Yokoyama SM², Mendonça LD^{1,4}

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ABSTRACT **Objective:** To describe the injury incidence in an elite youth male soccer team over a season. **Methods:** A retrospective analysis of 2018 injuries data of 246 Brazilian elite male youth soccer athletes were performed. The athletes were divided in two groups: under 11 to under 15 (group A, n=149) and under 17 to under 20 (group B, n=107). Descriptive and Chi-Square statistical analysis were used to characterize the sample and compare groups A and B. **Results:** A total of one hundred and eleven injuries were recorded over the season. Athletes of group A had ten trauma injuries, eighteen non-contact acute injuries and thirteen overuse injuries. In group B, twenty-five athletes had trauma injuries, twenty-five had non-contact acute injuries and twenty had overuse injuries, with significant differences between groups for all types of injuries (p=0.01, p=0.17 and p=0.19 respectively). Eighty-eight training injuries and twenty-one during game injuries were identified, but only during game injuries showed differences between groups (p=0.01). Hip, knee and overuse injuries were more frequent in artificial grass field compared to natural grass field (p=0.01) in both groups. Athletes of group A had an injury-time loss of ten days, while group B had twenty-four days of absence. **Conclusion:** Elite youth soccer athletes under 17 to under 20 had suffered more total and during game injuries, and more injury-days loss than under 11 to under 15 players. Moreover, hip, knee and overuse injuries were more frequent on artificial grass field in both groups. **Clinical implications:** this research shows injury incidence in elite youth soccer players and can contribute to future researches in analysis and development of injuries risk patterns and preventive programs for these athletes.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 006

TITLE Lower limb joint mechanical work during the single leg drop jump: a cross-sectional comparison of women with and without hip-related pain

AUTHORS King MG, Semciw AS, Schache AG, Middleton KJ, Heerey JJ, Scholes M, Mentiplay BF, Sritharan P, Crossley KM

AFFILIATIONS La Trobe Sport and Exercise Medicine Research Centre, La Trobe University, Melbourne, Australia

ABSTRACT **Objective:** Women with hip-related pain (HRP) are underrepresented in the literature. As such, the movement strategies of women with HRP are not well understood. Therefore, the aim of the study was to compare the mechanical work completed by the lower limb joints during the single leg drop jump (SLDJ) in women with and without HRP.
Methods: Female football players, aged 18-50 years, with and without HRP were eligible to participate. Twenty-three women with HRP and 13 controls participated. Biomechanical data on the SLDJ were collected using a three-dimensional motion capture system and force plates. Total lower limb work was calculated as well as the relative contributions of the hip, knee and ankle. Differences between group were assessed using t-tests.
Results: The relative contribution to negative work done at the knee was significantly less in the women with HRP compared with the control group (mean difference -4.7%, 95%CI -9.1, -0.3; P=0.04). When comparing contributions across the three joints, the ankle provided the largest contribution to positive work for the HRP group (36.8%), with the hip being the largest contributor in the controls (35.4%).
Conclusions: Women with HRP absorbed significantly less energy at the knee compared to healthy controls. The reason why women with HRP do not use a knee dominant strategy for absorbing energy during the SLDJ requires further scrutiny. Despite no difference in total positive work between groups, we did observe some subtle differences amongst the joints in the relative contributions to positive work done. The ankle was the dominant source of positive work during the SLDJ for women with HRP, whereas the hip was for controls. This strategy adopted by women with HRP may be an attempt to 'offload' the symptomatic hip.
Clinical implications: The study demonstrates potential impairments that can be addressed in rehabilitation programs to normalise force attenuation and propulsive strategies in women with HRP.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 007

TITLE Assessing movement strategies in hip-related pain. Do we need to consider sex in evaluating three-dimensional biomechanics?

AUTHORS King MG¹, Heery JJ¹, Schache AG¹, Semciw AI¹, Middleton KJ¹, Sritharan PR¹, Lawrenson PR², Crossley KM¹

AFFILIATIONS ¹ La Trobe Sport and Exercise Medicine Research Centre, La Trobe University, Melbourne, Australia
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ABSTRACT **Objective:** People with hip-related pain (HRP) walk with different biomechanics compared with people without HRP. However, study conclusions are often drawn from mixed cohorts, ignoring the potential for the effect of pain on biomechanics to be sex dependent. Therefore, we aimed to investigate the differences between men and women with HRP in lower limb biomechanics during walking and the single leg drop jump (SLDJ).
Methods: Football players aged 18-50 years with HRP were eligible to participate. Symptoms were quantified using the Copenhagen Hip and Groin Outcome Score (HAGOS). Biomechanical data were collected via a three-dimensional motion capture system during walking and SLDJ. Lower limb kinematics and kinetics were calculated at the hip, knee and ankle. Differences between men and women were analysed using statistical parametric mapping and t-tests.
Results: Sixty-five men and 23 women participated with no difference between groups for HAGOS scores ($P>0.07$). Walking: During stance, men with HRP walked with less hip flexion ($P<0.01$) and internal rotation ($P<0.01$), as well as a greater ankle dorsiflexion moment ($P<0.01$) and impulse ($P<0.01$) compared with women. SLDJ: During early stance, men with HRP completed the SLDJ with less hip flexion ($P=0.03$) and a greater external knee flexion moment ($P<0.01$). In addition, men produced a greater ankle dorsiflexion moment ($P<0.01$) and impulse ($P=0.01$) compared with women.
Conclusion: Differences observed were task specific at the hip and knee and joint specific at the ankle. These results demonstrate that sex may be an effect modifier in people with HRP. The use of mixed cohorts without appropriate between sex considerations should be strongly discouraged in biomechanical evaluations of HRP.
Clinical implication: Evaluations and knowledge into the potential modifiable risk factors of HRP are in its infancy, however this research demonstrates that sex dependent prevention and intervention strategies may be required.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 008

TITLE Posterior shoulder instability classification, assessment and management: an international Delphi study

AUTHORS Sadi J¹, **Torchia E**¹, Faber KJ⁴, MacDermid J¹, Lalonde C¹, Watson L^{2,3}, Weber M¹, Wu N¹

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ABSTRACT **Objective:** The purpose of this study was to attain consensus among international shoulder experts for the early and appropriate assessment and management strategies of PSI based on classification, recovery timelines, outcome measures and risk.
Methods: A three round e-Delphi survey was released over a series of consecutive months to 70 clinical shoulder experts (physiotherapists, orthopaedic surgeons, sport medicine physicians and researchers). Phase 1 consisted of a structured literature review which was integrated with expert input to create 50 items on definitions, classification, assessments, prognosis, and management. The draft Delphi survey was revised through iterative consultation and pilot testing Phase 2 consisted of three rounds of questions; with analysis and survey revision after each round. Consensus was defined as 70% agreement. Descriptive statistics were used to describe the characteristics of the respondents, the response rate of the experts per round and the consensus for PSI classification, assessment, and management.
Results: The response rate from each round ranged from 81% in Round 1 to a high of 94% in Round 3. The final survey was completed by 47 individuals from 5 different countries with Canada having the largest representations at 24 (51.1%). Three sub-groups of PSI were identified: Traumatic (100% agreement), Microtraumatic (98% agreement) and Atraumatic (98% agreement). After 3 Delphi rounds the agreement of the clinical assessment, risk factors, management and recovery timelines of the PSI sub-groups were established.
Conclusion: This Delphi helps to streamline diagnostic subgroups and management strategies for PSI. This may in turn provide framework for future research in the field including randomized-controlled or prospective cohort studies with evidence-informed interventions.
Clinical implications: A shoulder expert consensus study on PSI will establish earlier recognition and management strategies for health care providers.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 009

TITLE Initial foot contact affects dynamic parameters in running.

AUTHORS Shiroshita T

AFFILIATIONS School of Physiotherapy, Faculty of Health Science, Gunma Paz University, Japan

ABSTRACT **Objective:** This study aims to clarify the relationships between foot strike patterns and dynamic parameters during running.
Methods: The study included 25 participants (17 males and 4 females; mean \pm SD age, 21.1 \pm 0.3 years; weight, 60.0 \pm 6.6 kg; and height, 166.7 \pm 7.4 cm) who had no reported foot or ankle injuries in the past 6 months. Dynamic parameters were collected with a 9-camera motion capture system using a Plug-in Gait full-body marker set, dynamic navicular drop marker set, and 3 force plates (sampling rate, 200 Hz). The participants each completed five running trials. Dorsiflexion angle during initial contact (IC) and ankle moment (AM) and dynamic dorsiflexion range of motion (DDR) peak values were calculated. Furthermore, dynamic navicular drop (DND) was determined by calculating the difference between the navicular height at heel contact and minimum navicular height during the stance phase. Pearson correlation coefficients were calculated between the IC and other variables, with p-value of <0.05 considered as statistically significant. This study was approved by the Ethics Committee for Human Research, Gunma Paz University, Takasaki, Japan.
Results: A significant positive correlation was found between IC and DDR during running ($p = 0.026$, $r = 0.444$). There were no significant correlations between IC and AM ($p = 0.609$, $r = -0.018$) or DND ($p = 0.165$, $r = -0.285$).
Conclusion: A relationship was found between IC and DDR, indicating that further the IC occurs into plantar flexion, the greater the decrease in dorsiflexion. However, IC was not associated with AM or arch.
Clinical implications: It may be possible to determine dynamic dorsiflexion during the stance phase in running based on IC. It should be determined whether this variable is a risk factor, taking the other physiotherapy assessments into consideration.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 010

TITLE A single session of gait retraining improves pain, function and running kinematics in runners with patellofemoral pain

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² Manchester Institute of Health & Performance, Manchester, UK

ABSTRACT **Objective:** To investigate whether a 10% increase in step rate improves kinematics, pain and function in runners with patellofemoral pain (PFP). Specifically, we targeted runners with aberrant hip and pelvis kinematics at baseline and aimed to investigate whether improvements could be made following a single session of gait retraining.

Methods: Runners with PFP underwent a 3D gait analysis to confirm the presence of aberrant frontal plane hip and pelvis kinematics at baseline. Ten participants completed a single 10-minute gait retraining session where step rate was increased by 10% using an audible metronome. Participants were asked to continue their normal running while self-monitoring their step rate using a global positioning system watch and audible metronome. Running kinematics along with clinical outcomes of pain and functional measures were recorded at baseline, 4 weeks and 3 months following retraining.

Results: Following gait retraining, significant improvements in running kinematics and clinical outcomes were observed at 4 weeks and 3 months follow up when compared to baseline. Peak contralateral pelvic drop, hip adduction and knee flexion during stance phase were significantly reduced. Numerical rating scale for worst pain and lower extremity functional scale showed significant improvements, while self-reported weekly running volume and longest run pain free significantly increased.

Conclusion: A single session of gait retraining results in significant improvements in running kinematics, pain and function in runners with PFP. These improvements were maintained at 3 months follow up.

Clinical implications: Step rate modification is a simple method of gait retraining that can be easily integrated into clinical practice. It is important to assess for aberrant running kinematics at baseline to ensure gait interventions are targeted appropriately.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 011

TITLE Kinematic characteristics of male runners with a history of recurrent calf muscle strain injury

AUTHORS Bramah C^{1,2}, Preece SJ¹, Gill N¹, Herrington L¹

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ABSTRACT **Objective:** To investigate whether running kinematics differ between male runners with a history of recurrent calf muscle strain injury (CMSI) and injury free controls.
Methods: Three-dimensional running kinematics were compared between 14 male runners with a history of CMSI and 28 male controls. A 12-camera Qualysis Oqus system recorded 3D running kinematics as participants ran on a treadmill at 3.2m/s. Independent t-tests were used to compare differences in select kinematic patterns during the stance phase of running.
Results: Several kinematic differences were observed between groups. The CMSI group demonstrated significantly longer stance times ($p = 0.02$), increased hip adduction ($p = 0.03$), contralateral pelvic drop ($p = 0.04$) and anterior pelvic tilt ($p = 0.03$) during mid stance. These differences highlight potential neuromuscular impairments of the calf muscle complex while also implicating altered hip neuromuscular control as a contributor to CMSI.
Conclusion: Runners with a history of recurrent CMSI demonstrate differences in stance phase running kinematics when compared to injury free controls. These differences may represent impairments to the stretch shortening function of the calf complex during running and reduced neuromuscular control at the hip and pelvis.
Clinical implications: The observed differences provide insight into potential kinematic mechanisms and consequences of recurrent CMSI. Based on the current results we suggest rehabilitation should focus on the restoration of stretch shorten function of the calf complex and improving neuromuscular control at the hip and pelvis.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

- ABSTRACT #** 012
- TITLE** A survey of acute injury in wheelchair basketball players: relation to the functional classification
- AUTHORS** Shimizu R, Urabe Y, Sasadai J, Maeda N
- AFFILIATIONS** Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan
- ABSTRACT**
Objective: Wheelchair basketball (WB) players are classified into eight groups depending on their degree of physical ability. The risk of acute injury is higher than chronic injury in WB. The intensity of shoulder pain has been reported to differ depending on the functional classification. Similarly, the type and cause of injury might be different. However, there is no research from this point of view. This study aimed to investigate the injury in WB players focused on the functional classification.
Methods: A questionnaire survey was conducted for 96 WB players in Japan. The question items were the basic information about the injury (type, cause, etc.). The definition of injury was "injury caused by a single impact, having left the game for a day or more, or having consulted a medical institution". According to the classification system, the players were grouped into four classes: Class 1 (most severe disability), 1.0 and 1.5 point; Class 2, 2.0 and 2.5 point; Class 3, 3.0 and 3.5 point; Class 4, 4.0 and 4.5 point.
Results: Valid answers were obtained from 85 people (89%). The incidence of injury for Class 1, 2, 3, and 4 were 36%, 20%, 19%, and 25%, respectively. The most common injury types were as follows: in Class 1, 2, and 4, soft tissue injury (41%, 50%, and 41%, respectively); in Class 3, fracture (53%). The cause of injury ranked in descending order was as follows: in Class 1, 3, and 4, fall (31%, 53%, and 91%, respectively), rebound (22%, 24%, and 5%, respectively); in Class 2, fall (44%), shooting (28%).
Conclusion: The tendency of the cause of injury differed from each class. Most injuries in Class 4 were caused by falls. Injuries in Class 1 were caused not only by falls but by WB play. It was suggested that WB players with severe disability are often injured by a minor impact.
Clinical implications: This study might provide information for injury prevention in consideration of the functional classification to reduce the risk of acute injury in WB players.
- NOTES** Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 013

TITLE Injuries tendency during fall league match in the Japanese Chushikoku area collegiate American Football league match, past 7 seasons (2012 – 2018)

AUTHORS Takeuchi T¹, Urabe Y¹, Maeda N¹, Sasadai J¹, Komiya M¹, Fukui K¹, Anami K¹, Moriyama N², Ishii Y³, Terahana S³

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ABSTRACT **Objective:** American Football (AF) is a sport with intense physical contact, and there are many injuries. According to the surveys on injuries in collegiate AF in Japan, ligament injuries were the most frequent (37 - 39%). These studies were conducted in the Kanto or Kansai leagues, which have sufficient players. However, no surveys on injuries has been conducted in leagues with a small number of players, such as in the Chushikoku league. Therefore, this study aimed to investigate the occurrence of injury in the Chushikoku Collegiate AF league.

Methods: The survey period spanned 103 games played over 7 seasons. The survey subjects had described in the injury report of the Japan AF Association. The injury report was described when a "timeout for the injured" was called by the referee. The survey items included the player's position, injury type, injury location, the quarter (Q) during which the injury occurred, and the number of injuries per game.

Results: The total number of injuries was 424. The number of injuries per games was 4.1 per game. The most frequent type of injury was bruising in 138 cases (32.5%). In addition, there were 114 cases (26.9%) of muscle cramps and 74 cases (17.5%) of ligament injuries. There were 189 cases among offensive players and 235 cases among defensive players. The timing of the injury was the 3Q in 127 cases and 4Q in 183 cases. Overall, 73.1% of injuries occurred late in the game.

Conclusion: Previous studies reported the number of injuries for the Kanto Collegiate AF league to be 1.3 per game. In contrast, the number of injuries in Chushikoku league was 4.3 per game, and the prevalence of bruises and muscle cramps was overwhelmingly large. This high number could be due to several factors, such as few players per team (few opportunities for substitution), and the participation of students with lower skills.

Clinical implications: The injury rates in the Chushikoku league tended to differ from those of other leagues.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

- ABSTRACT #** 014
- TITLE** The change of the sesamoid rotation angle in patient with hallux valgus at walking position
- AUTHORS** Arisu H, Urabe Y, Sasadai J, Sakai S, Shimizu R, Kobayashi T, Maeda N
- AFFILIATIONS** Department of Sports Rehabilitation, Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan
- ABSTRACT** **Objective:** Hallux valgus (HV) occurs frequently in athletes. HV includes changes in the alignment of rotating sesamoid bones and shifting abductor hallucis muscle (ABH) to the plantar direction. It is unknown if sesamoid rotation is promoted during walking and if the chronic tension stress of ABH from rotated sesamoid cause atrophy of ABH. No study investigated the difference of sesamoid rotation angle (SRA) between non-weight bearing position and walking position. Therefore, this study aimed to investigate the change of SRA at walking position and atrophy of ABH.
Methods: Participants were divided into HV angles of $> 20^\circ$ (HV group; 12 women, HV angle $27.4^\circ \pm 5.5^\circ$) and $< 20^\circ$ (control group; 13 women, HV angle $14.8^\circ \pm 2.0^\circ$). The SRA and CSA were measured using ultrasonography. The SRA was measured at the following positions; non weight bearing, standing, mid-stance, and pre-swing phase. Cross-sectional area (CSA) of the ABH was measured in the supine position. Independent t-test or Mann-Whitney's U test was conducted to compare the differences in the mean values of SRA compared with non weight bearing and CSA between the two groups using the 5% level of significance.
Results: In HV group, the SRA compared with non weight bearing increased $3.6^\circ \pm 0.1^\circ$ at standing ($p=0.09$), $4.4^\circ \pm 1.2^\circ$ at mid-stance ($p=0.06$), and $4.2^\circ \pm 0.4^\circ$ at pre-swing ($p < 0.05$) more than control group. The CSAs were 200.2 ± 47.7 and 204.7 ± 49.8 mm² in the HV and control group ($p=0.78$).
Conclusion: Our results suggest that weight bearing while walking would lead to increase SRA. However, CSA between the two groups was not different in this study. There was no atrophy of ABH. It is thought that the progression of HV angle is promoted by the reduction of the abduction torque of the ABH by the large outward displacement of the sesamoid at weight bearing on the forefoot.
Clinical implications: We concluded the SRA in the HV group increased more during weight bearing on the forefoot.
- NOTES** Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 015

TITLE What do the stories of experienced sports physiotherapists' tell us about their continuing professional learning

AUTHORS Paterson CB¹, Edmond N²

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ABSTRACT **Objective:** To gain understanding of the continuing professional learning of experienced sports physiotherapists in the United Kingdom. Currently there is a paucity of knowledge about sports physiotherapists' continuing professional learning.
Methods: Narrative Inquiry. Narrative interviews were conducted with 4 female experienced sports physiotherapists purposively recruited (19-34 years' experience) in the United Kingdom. A narrative thematic analysis was applied to the transcribed data to search for emerging themes.
Results: 3 main themes were identified; 1) intrinsic motivation and skills to continue to learn and succeed, with sub themes of seeking and taking learning opportunities, overcoming and rising to challenges and identifying learning needs and setting development goals, 2) patients and practice drive learning...the need for a big tool kit, with sub themes of formal learning and informal learning, 3) developing contextual intelligence.
Conclusion: This study provides insight into how sports physiotherapists continue to learn, supporting previous literature which identifies that both formal and informal learning are utilised by physiotherapists. The participants used both types of learning with formal learning activities dominating early, and informal dominating later in their careers. High levels of intrinsic motivation, in combination with identifying key required learning and methods to learn were evident. The ability to develop a large sports physiotherapy tool kit (skills and knowledge) was viewed as a requirement to be successful. However, this needed to be supplemented with developing contextual intelligence to cope with the pressures and required behaviours in the sporting environment.
Clinical implications: These insights into sports physiotherapists' continuing professional learning will assist appropriate support to be provided for future learning; acknowledging the variety of ways sports physiotherapists need to learn to be successful.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT #	016
TITLE	Female sports physiotherapists' experiences of their work in the context of a Gulf Cooperation Council (GCC) country
AUTHORS	Paterson CB, Felembaum K
AFFILIATIONS	School of Health Sciences, University of Brighton, UK
ABSTRACT	<p>Objective: To explore the female sports physiotherapists' experiences of their work in the context of a Gulf Cooperation Council (GCC) country, the role of gender in this experience, and the factors that the GCC region may play in it.</p> <p>Methods: The experiences of three expatriate sports physiotherapists working in GCC countries were explored. In-depth semi-structured interviews collected data which was analysed by adopting the principles of Interpretative Phenomenological Analysis (IPA).</p> <p>Results: Three super-ordinate themes emerged; the move to the unknown, professional paradigm shift and adapting to succeed. The study highlighted the varying career opportunities in the GCC for female sports physiotherapists and the participants' frustrations about the national attitude and commitment towards sports participation. The professional shift in attitude and expectation was the most challenging and the most crucial for the participant's professional success in the GCC. A negative attitude towards the use of physical contact when treating males stemmed from unease related to the sports physiotherapists gender rather than her aptitude or skill. There was a limited understanding and lack of professional clarity of a sports physiotherapist's role among some GCC nationals which influenced demands and expectation's relating to the role.</p> <p>Conclusion: The findings in the study have not been addressed before, providing new information on how some female sports physiotherapists experience their work in the context of a GCC country. Cultural adaptability and sensitivity along with cross-cultural communication skills were the most crucial skills for success of the expatriate female sports physiotherapist in the GCC.</p> <p>Clinical implications: The study allows for female sports physiotherapists, interested in working in the GCC, to learn about its sports scene and its frustrations, the opportunities it provides, alongside the skills needed to succeed.</p>
NOTES	Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 018

TITLE The effectiveness of blood flow restriction vs. heavy load resistance training during post-surgery rehabilitation of anterior cruciate ligament reconstruction patients: a UK National Health Service randomised controlled trial.

AUTHORS Hughes L^{1,2}, Rosenblatt B³, Haddad F², Gissane C¹, McCarthy D⁴, Clarke T⁴, Ferris G⁴, Dawes J⁴, Paton B², Patterson SD¹

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ABSTRACT **Objective:** To compare the effectiveness of light load personalised blood flow restriction resistance training (PBFR-RT) and standard care heavy load resistance training (HLRT) in the post-surgery rehabilitation of patients undergoing anterior cruciate ligament reconstruction (ACLR) in the National Health Service (NHS).

Methods: Twenty-eight patients with hamstring autograft were recruited for this single assessor blinded trial. Participants were block randomised to HLRT (n=14) at 70% of one repetition maximum (1RM) or PBFR-RT (n=14) at 30% 1RM and completed 8 weeks of biweekly unilateral leg press training alongside standard hospital rehabilitation, beginning at 3 weeks post-surgery. Isotonic strength (10RM), muscle morphology of the vastus lateralis, self-reported function, Y-balance test performance and knee joint pain and effusion were assessed at post-surgery, mid-training and post-training. Knee joint laxity was measured at pre-surgery and post-training.

Results: Twenty-four participants completed the study with no adverse events. 10RM strength significantly increased with PBFR-RT (104%) and HLRT (106%) with no group differences. Significant and comparable increases in muscle thickness (5.8-6.7%) and pennation angle (3.4-4.1%) were observed with no group differences. Significantly greater and clinically important increases in several measures of self-reported function (50-218% vs. 35-152%), Y-balance performance (18-59% vs. 18-33%) and reductions in knee joint pain (67% vs. 39%) and effusion (6% vs. 2%) were observed with PBFR-RT compared to HLRT, respectively. Knee joint laxity decreased with no group differences.

Conclusion: PBFR-RT can improve skeletal muscle hypertrophy and strength to a similar extent as HLRT with a greater reduction in knee joint pain and effusion, and greater overall improvements in physical function.

Clinical implications: PBFR-RT may be more appropriate for early rehabilitation in ACLR patient populations within the NHS.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 020

TITLE Can wearable sensors validly measure lower limb kinematics during high speed running?

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ABSTRACT **Objective:** To validate the use of an inertial measurement unit (IMU) system compared to a camera-based 3D motion analysis system, for high speed running assessment of lower limb kinematics.

Methods: One runner had three IMUs (Noraxon Myomotion) secured on their pelvis, left shank and thigh, and 24 retro-reflective markers generating left shank, left thigh and pelvis segments with a 16 infrared camera 3D motion analysis system (Cortex Motion Analysis). The runner completed two treadmill trials (T1, T2) involving incremental running from 12 to 18km/hr within 1 min, on two separate days. Point of contact (POC) was identified by IMU vertical acceleration and compared to POC identified via force plate. Agreement in the sagittal shank, knee, hip and pelvic angles between the systems was evaluated using root mean square error (RMSE) and at POC using intra-class coefficients (ICC) and Pearson's correlation (r).

Results: The IMU was highly accurate in determining time of POC (RMSE T1:0.0044s T2:0.0053s), hip angle (RMSE T1:4.0° T2:3.3°, ICC T1:0.89 T2:0.79, r T1:0.90 T2:0.93), pelvic tilt (RMSE T1:2.1° T2:2.5°, ICC T1:0.94 T2:0.74, r T1:0.96 T2:0.87), but was inconsistent for knee (RMSE T1:7.3°, T2:7.9°, ICC T1:0.07 T2:0.02, r T1:0.62 T2:0.38) and shank angle (RMSE T1:7.3° T2:6.3°, ICC T1:0.05 T2:0.05, r T1:0.65 T2:0.58).

Conclusion: Noraxon IMUs are suitable for use in high speed running for determination of POC and evaluation of sagittal hip and pelvic angles.

Clinical implications: Valid and reliable portable testing methods are integral for accuracy of on field testing. This study provides confidence in certain lower limb biomechanical variables for risk assessment, allowing for evidence-based injury prevention programs. It may offer a valuable feedback tool for clinical rehab/gait retraining. However, the findings need to be interpreted in light of the limitations (e.g. inertial marker movement) of 3D motion analysis systems.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 021

TITLE Reference values for the closed kinetic chain upper extremity stability test for elite handball players

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ABSTRACT **Objective:** Handball is an overhead sport in which upper quadrant joints experience significant stress, resulting in a high prevalence of shoulder pain from 15 to 28%. The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) is a validated functional test, evaluating the functional performance of the upper limbs. It is used to monitor functional recovery of the shoulder after injury and should be compared with reference values. However, such values do not exist in this sport. The purpose of this study is to determine a CKCUEST norm for handball players taking gender and playing positions into consideration.

Methods: The cohort is made up of 165 athletes (112 males), aged 17.6 ± 2.7 years, practising handball between 8 and 14 hours per week in high-level competition. Participants have had no shoulder, elbow or wrist complaints in the past 3 months. The test is conducted away from any physical activity. The CKCUEST is performed 3 times, the number of touches performed in 15 seconds being recorded for analysis. Power score and normalised score are calculated. Analysis of variance with post hoc correction is employed.

Results: The average score found in men is higher than in women (respectively 26.7 ± 3.6 . vs. 22.7 ± 3.3 ; $p < 0.001$). The analysis by playing positions shows a difference in number of touches, power score and normalised score ($p = 0.26$).

Conclusion: Our CKUEST values are similar to studies carried out on other throwing sports (i.e. baseball) but were dependent on the playing position. Shooting is a complex action involving multiple movements and varying player positions which could explain this difference.

Clinical implications: These values could be used as a benchmark during the season to detect a problem or improve the overall management of the shoulder. They could also be used as a reference for recovery tests after injury or to better understand people with shoulder injury risks, and to implement prevention strategies.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 022

TITLE The evidence for conservative treatment in reducing pain and improving function in patellar tendinopathy is of low quality: a systematic review of randomised controlled trials including GRADE recommendations.

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ABSTRACT **Objective:** To determine the effectiveness of conservative treatment (CT) on pain and function in patients with patellar tendinopathy (PT) compared with minimal (MI) or other invasive interventions (OI), or in addition to decline eccentric squat.
Methods: Searches were performed in MEDLINE, Embase, Cochrane, PEDro, SPORTDiscus, CINAHL and AMED databases. All randomised trials that evaluated CT in individuals with PT were included. Two reviewers screened studies, extracted data, and assessed risk of bias of all included studies. Meta-analyses were conducted and we assessed certainty of the evidence using GRADE methodology.
Results: When compared to MI, CT did not improve pain (mean difference = -0.2, 95% CI -1.5 to 1.1) or function (mean difference = -2.2, 95% CI -11.8 to 7.4) at medium/long-term follow-up. When compared with OI, CT did not improve pain (mean difference = -0.4, 95% CI -2.6 to 1.8) or function (mean difference = 5.9, 95% CI -17.1 to 29.0) at medium/long-term follow-up. No overall effects were found for combined CT (when a conservative intervention was added to decline eccentric squat) on pain (mean difference = -0.5, 95% CI -1.4 to 0.4) or function (mean difference = -2.3, 95% CI -9.1 to 4.6) at short-term follow-up. Single studies showed an effect on pain with iontophoresis at short-term follow-up (d=2.42) or dry-needling at medium/long-term follow-up (d=1.17) and function with exercise intervention at medium/long-term follow-up (d=0.83).
Conclusions: The estimates of treatment effect have only low-to very-low-certainty evidence to support them.
Clinical implications: There is low to very low certainty evidence to support the short- and long-term effects of exercise, dry needling and iontophoresis as treatments for PT. This field of sports medicine/sports physiotherapy urgently needs larger, high quality studies with pain and function considered among the potential primary outcomes.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 023

TITLE Passive hip stiffness influences hip kinematics on transverse plane during the single-leg squat

AUTHORS Diniz KMA^{1,2}, Resende RA^{2,3}, Mascarenhas RO¹, Silva HJ², Filho RGT^{1,2}, **Mendonça LD^{1,2}**AFFILIATIONS ¹ Departamento de Fisioterapia - Faculdade de Ciências Biológicas e da Saúde - Universidade Federal dos Vales do Jequitinhonha e do Mucuri (UFVJM) - Diamantina - Minas Gerais - Brazil.² Programa de Pós Graduação em Reabilitação e Desempenho Funcional da UFVJM - Diamantina - Minas Gerais - Brazil.³ Departamento de Fisioterapia -Escola de Educação Física, Fisioterapia e Terapia Ocupacional -Universidade Federal de Minas Gerais - Belo Horizonte - Minas Gerais - Brazil.

ABSTRACT **Objective:** To investigate the association of hip external rotators (ER) strength, hip ER passive stiffness and shank-forefoot alignment with hip adduction and internal rotation (IR) during single-leg squat.

Methods: Forty-six participants had shank-forefoot alignment, hip ER isometric torque, hip ER passive stiffness and hip kinematics during single-leg squat assessed. Multiple linear regressions were performed to identify the factors which predicted hip adduction and IR mean and peak movement during single-leg squat.

Results: Participants were aged 23.47 years (Standard Deviation [SD] =4.29); had a mean body mass of 60.40 kg (SD= 11.28), mean height of 1.67 m (SD = 8.9), mean shank-forefoot alignment of 12.82 degrees (SD = 12.8), mean passive hip IR range of motion (ROM) of 33.36 degrees (SD= 12.18) and hip ER torque of 0.44 Nm/kg (SD = 0.14). The results showed that passive hip IR ROM predicted only mean ($R^2 = -0.405$ (95% C.I. = -0.250, -0.048), $p=0.005$) and peak ($R^2 = -0.341$ (95% C.I. = -0.223, -0.210); $p = 0.019$) hip transverse plane during single-leg squat.

Conclusion: Hip ER passive stiffness influences hip movement in the transverse plane during the single-leg squat. Further prospective studies are necessary to establish the causative relationship between these two variables.

Clinical implications: Single-leg squat is commonly used as a test to assess lower limb function, especially for knee joint dysfunction. Increased hip adduction and IR are related to hip and knee overload. Our results showed that passive hip IR ROM predicted hip IR mean and peak during single-leg squat. Therefore, individuals with a single-leg squat pattern with excessive hip displacement on the transverse plane might have their passive hip IR ROM investigated by the physical therapist.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 024

TITLE Financial costs of musculoskeletal injuries in elite female volleyball players

AUTHORS Leite MMAG^{1,2}, Bittencourt NFN², Verhagen E³, **Mendonça LD^{1,4}**

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ABSTRACT **Objective:** To analyze direct and indirect costs of musculoskeletal injuries in Brazilian elite female volleyball players.
Methods: A retrospective cohort study was performed over two seasons, analyzing one elite female volleyball team database. The direct costs are related to the injury rehabilitation (number of physiotherapy visits per injury) and indirect costs are related to the low productivity or work absence and were calculated by time loss (number of time loss per injury x athlete's salary per day) and matches lost (the number of official matches lost x athlete's salary per match). Descriptive data were organized in Microsoft Office® Excel® 2016-2017.
Results: A total of 24 elite female volleyball players who participated in 2015-2016 and 2016-2017 seasons were considered in the analysis. Both seasons had the same coach and physiotherapist. The direct cost was 27,994.40 USD and the average cost per injury was 243.43 USD. Considering injuries without time loss the total cost was 2,849.50 USD and 25,144.96 USD for time-loss injuries. Indirect cost was 12,320.29 USD, which was a result of 249 days lost because of injuries. Fifteen official matches were lost as a result of musculoskeletal injuries, and the club spent 27,518.01 USD because of athlete absence. Analyzing the physiotherapy department budget to female volleyball, 45% represented the direct costs to injuries rehabilitation.
Conclusion: The results of the present study showed the financial impact of musculoskeletal injuries in one elite female volleyball team with a high infrastructure. Future research should be done with all the Super League Teams to represent the Brazilian Volleyball costs.
Clinical implication: The direct costs were higher than the indirect costs, showing the importance of the sports physiotherapist in the team monitoring, since most of the injuries did not lead to time loss from training and games.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 025

TITLE The prevalence and incidence of injuries in Brazilian elite volleyball players

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ABSTRACT **Objective:** To analyze the prevalence and incidence of musculoskeletal injuries in Brazilian elite female volleyball players.
Methods: A retrospective study was performed with an elite female volleyball team database from 2015 to 2017. Injuries were any musculoskeletal complaint that occurred as a result of training or competition that required medical assistance. Injury incidence was calculated by the number of injuries per 1,000 hours of exposure in total and also in matches, training and strength conditioning training, with a 95% confidence interval. Also, the injury burden was calculated by the number of time loss per 1,000 hours of exposure multiplied by 1,000.
Results: A total of 24 elite female volleyball players with mean age of 24.63 years old (± 5.22), mean body mass of 71.15kg (± 8.51) and mean height of 182.83cm (± 6.15) were considered in the analysis. A total of 115 injuries were observed during all seasons (5.48 injuries per athlete). Acute injuries were 79% and 21% were overuse injuries. A total of 35% were time-loss injuries and only 2 injuries were severe (greater than 21 days lost). The injury incidence was 5.65/1,000h and the time-loss injuries incidence was 1.97/ 1,000h, considering all matches, training and strength conditioning training. Most injuries occurred during training (73%), followed by matches (21%) and strength conditioning training (6%). Knee joint and cervical spine injuries were the most prevalent followed by ankle, lumbar spine and shin.
Conclusion: The most prevalent injuries were in the knee joint and cervical spine. The results could guide strategies for the prevention and rehabilitation of injuries.
Clinical implications: Effective prevention strategies should be implemented targeting the sports demand and injury prevalence. The prevalence of overuse injuries was lower than acute injuries, showing relevance of the entire sports staff job in load management.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 026

TITLE Preventive effect of tailored exercises on patellar tendinopathy in youth athletes

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ABSTRACT **Objective:** To analyze the effect of tailored exercises on patellar tendinopathy (PT) in Brazilian young athletes.

Methods: A prospective cohort study was performed during the 2016 and 2017 seasons. The incidence rates of PT injuries were registered from male basketball and volleyball players. In the first year, 277 players were tracked (mean age of 14.2 ± 1.9 years, mean height of 181.2 ± 1.2 meters and mean body mass of 71.1 ± 16.4 kilograms) and the eligibility criteria for PT were: 1) have tendon pain on jumping/landing, running or changing directions; and 2) have pain during tendon palpation. Tailored exercises were applied in the second year, which 269 athletes (mean age of 14.4 ± 2.13 years; height of 182.2 ± 5.8 cm; weight of 72.3 ± 12.7 kg) participated in the intervention period. The program was implemented for 10 months and all participants were part of regular training sessions 3 or 5 times a week during the second year. Cox regression for survival analysis was used to indicate the effect of tailored exercises on PT.

Results: Thirty-two athletes had PT in the first season, whereas only 12 athletes had PT in the second season. Patellar tendinopathy has decreased significantly in the intervention group (HR 2.388, 95%CI 1.30, 4.37, $p=0.05$) compared to the athletes of the first season.

Conclusion: Athletes that did not participate in the intervention season had 2.38 times more chance to have PT. Little is known about the development of tendinopathy in childhood and adolescence. PT prevention needs future studies to enhance new possibilities and strategies adopted.

Clinical implications: Tailored exercises could prevent PT injuries which is an overload injury that could lead to months of treatment and sport absence. Adding a weekly eccentric load squat training to a regular basketball and volleyball exercise routine enhances lower limb muscle power without triggering patellar tendon complaints.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 027

TITLE Heavy-slow resistance training in addition to an ultrasound-guided corticosteroid injection for individuals with plantar fasciopathy: a feasibility study

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ABSTRACT **Objective:** We aimed to evaluate the feasibility of combining heavy-slow resistance training with a corticosteroid injection for individuals with plantar fasciopathy.
Methods: We recruited 20 participants with plantar fasciopathy for this prospectively-registered feasibility study (clinicaltrials.gov: NCT03535896). Participants received an ultrasound-guided injection and performed heel raises on a step every second day for 8 weeks. To assess participant acceptability of the combined interventions and exercise compliance, we used a 7-point Likert scale dichotomised to “unacceptable” (categories 1-2) or “acceptable” (categories 3-7) and training diaries. $\geq 10/20$ had to rate the combination “acceptable”, $\geq 15/20$ had to perform ≥ 20 training sessions, and $\geq 15/20$ had to start exercising ≤ 7 days after injection to confirm feasibility.
Results: 18/20 rated the combination acceptable. 5 training diaries could not be retrieved. 10/15 participants performed ≥ 20 training sessions and 15/15 started exercising ≤ 7 days after injection.
Conclusion: Based on participant acceptability and time to exercise start, combining heavy-slow resistance training with a corticosteroid injection is feasible. Due to loss of 5/20 training diaries, firm conclusions regarding exercise compliance could not be drawn.
Clinical implications: As patients found this combination to be acceptable, it may be a relevant treatment modality in patients with refractory symptoms who do not respond to first-line treatment. However, the efficacy of this combination compared to other treatments remains to be investigated in future studies.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 029

TITLE A survey on self-care implementation status and sports injuries prevention in collegiate male baseball players

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ABSTRACT **Objective:** In baseball, there are many factors involved in the onset of throwing injuries. Previous studies have shown injuries types and frequency. However, it is unclear whether baseball players perform self-care and have knowledge about sports injuries prevention. The purpose of this study was to investigate the self-care activities such as stretching and attitudes toward sports injuries prevention in collegiate male baseball players.

Methods: An internet-based questionnaire was sent to 294 collegiate students who belong to the baseball club in Japan. This survey asked self-care implementation situation, specific body parts and effective methods of sports injuries prevention. If there were no appropriate options, they were asked to input using text boxes.

Results: Responses were obtained from 118 players, with a response rate of 40%. A total of 89 players (75%) performed self-care for injury prevention and most targeted upper extremity: shoulder joint (34%), thoracic spine (16%) and forearm (16%). 98 players (83%) were interested in sports injuries prevention, of which 79 players (82%) had little knowledge on how to prevent sports injuries.

Conclusion: In this study, a large number of collegiate baseball players performed self-care for shoulder joint. On the other hand, there were many players who had little knowledge for sports injuries prevention. Previous studies have indicated that not only shoulder joint but also thoracic mobility and forearm muscle flexibility were required to prevent throwing injuries. Therefore, it is necessary to increase the frequency of screening opportunities for injury prevention and therapists should suggest to baseball players how to implement self-care other than shoulder joint.

Clinical implications: In order to reduce throwing injuries, therapists should increase opportunities to provide more information to baseball players about the significance and method of performing self-care.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 030

TITLE The relationship between foot sole sensitivity and lower limb biomechanics during single-leg stance and single-leg jump landing

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ABSTRACT **Objective:** The purpose of this study was to investigate the correlation between foot sole sensitivity and postural control in single-leg stance as well as muscle activity during single-leg jump landing.

Methods: Twenty-two healthy subjects (24.2 ± 6 years) participated. Plantar cutaneous thresholds to light touch were determined at three locations of the foot sole using Semmes-Weinstein monofilaments. The center of pressure (COP) displacement during single-leg stance was measured using a force plate (Bertec, 1000 Hz). Vertical ground reaction forces (vGRF) and muscle activity of six muscles were recorded during a single-leg jump landing task using a force plate (Bertec, 1000 Hz) and surface electromyography (EMG, Noraxon, 1500 Hz). Correlations between plantar sensitivity, COP displacements, vGRF and EMG-data were determined using Spearman's rank correlation coefficient rho or Pearson's correlation coefficient ($p < 0.05$).

Results: Plantar sensitivity at the metatarsal head I was negatively correlated to the activity of the vastus lateralis muscle at peak vGRF ($r = -0.51$; $p = 0.02$) and during the stabilization phase after jump landing ($r = -0.54$; $p = 0.014$). The medio-lateral COP displacement was positively correlated to the activity of the peroneus longus muscle during the stabilization phase after jump landing ($r = 0.53$; $p = 0.018$).

Conclusion: A low cutaneous threshold at metatarsal head I seems to moderately correlate to an increased activity of the vastus lateralis muscle during single-leg jump landing. An increased medio-lateral COP displacement appears to relate to an increased peroneus longus muscle activation during the stabilization phase of jump landing.

Clinical implications: The findings of the study may be relevant for the prevention and rehabilitation of injuries to the lower extremity. Furthermore, results may be interesting for companies producing athletic shoes or therapeutic insoles.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 031

TITLE Sticking to it: a scoping review of adherence to exercise therapy interventions in children and adolescents with musculoskeletal disorders

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ABSTRACT **Objective:** Improving exercise therapy adherence after youth sport-related musculoskeletal injury is crucial for recovery and reducing long-term consequences. This scoping review consolidates reported barriers, facilitators, and strategies to boost exercise therapy adherence in youth musculoskeletal injuries to inform future research and clinical practice.
Methods: Arksey and O'Malley's framework and the PRISMA Extension for Scoping Reviews were followed. Six databases were searched using predetermined keywords and subject headings. English studies with original data featuring an adherence barrier, facilitator, or boosting strategy and youth (0-19 years) with musculoskeletal disorders treated with exercise therapy were included. Two authors independently conducted title/abstract and full-text reviews, and assessed study quality with the Mixed Methods Appraisal Tool. Descriptive consolidation and inductive thematic analysis were completed.
Results: Of 4,930 records, 34 studies representing 1,563 participants (65% female, 2-19 years old), 11 musculoskeletal disorders and multiple exercise interventions were included. Time constraints, physical environment (e.g., location), and negative exercise experiences were commonly identified barriers. Social support and positive exercise experiences were frequently identified facilitators. Reinforcement, exercise program modification, and education were recurring boosting strategies, despite being infrequent barriers or facilitators. Exercise experience, time, and environment (physical and social) emerged as key themes related to youth exercise therapy adherence.
Conclusion: A diversity of barriers and facilitators to exercise therapy for youth musculoskeletal disorders exist. Strategies to boost adherence are not consistent with identified barriers or facilitators.
Clinical implications: Making exercise enjoyable, social, and convenient may be important to maximizing adherence to exercise therapy in young injured athletes.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 032

TITLE Relationship between mechanical stress and injury around the hip joint due to kicking action in football.

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³ Graduate School of Comprehensive Human Science, University of Tsukuba

ABSTRACT **Objective:** In this study, we analyzed the association between kick-induced stress distribution and the clinical findings of injuries around the hip joint.

Methods: We selected 5 healthy football players. They performed the inside, instep, and infront kick 3 times each with right foot. 3D motion analysis device was used to record their motion. The motion analysis software was used to calculate stress between hip joints and the angle of the hip joint. In addition, the bone strength analysis software was used to analyze the CT and MRI data of each subject to develop a finite-element (FE) model. Then, hip joints calculated in dynamics analysis was input as a load value into the FE model for the stress analysis.

Results: At the time of BI, kicking motions produced a high-stress area in the pubic ramus compared with other areas. Stress generated in the superior and inferior rami of the pubic bone was 3.52 and 2.94 MPa for the inside kick, 7.15 and 5.40 MPa for the instep kick, and 4.47 and 3.33 MPa for the infront kick, respectively. Compared to the static posture, the stress distribution at the superior and inferior pubic ramus was 3-fold and 2-fold, respectively.

Conclusions: The high-stress area was the same area where groin pain syndrome occurs in the clinical examination of football-related hip joint injury and where fatigue fractures occur in pubic bone rami. Then, the values of equivalent stress generated by the inside kick, instep kick, and infront kick in the superior and inferior rami were approximately 3-fold, 5-fold, and 3-fold. We revealed the relationship between the clinical symptoms of the hip joint and previously reported kick-related injuries around the hip joint.

Clinical implications: It was found that the kicking motion in football includes not only muscle stress but also bone stress confirmed by clinical findings. It should be taken into consideration that not only the muscle tightness but also the kicking motion itself affects the bone.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 033

TITLE Niseko resort changes Japanese ski safety

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ABSTRACT **Objective:** Niseko is a town in Hokkaido which is located north of Japan. In Niseko, high quality powder snow is falling for many days in winter. There is famous for the best powder snow called “JAPOW”. Therefore, Niseko is visited by many tourists from all over the world and English is used more frequently than Japanese. In the past, number of accidents in Niseko increased because of backcountry skiing’s popularity. However, no severe accident has occurred in Niseko in recent years. We conducted a field work at Niseko for skiing safety. We investigated the frequency and severity of backcountry skiing injuries in Japan and Niseko. **Methods:** Interview survey was carried out in Niseko. We investigated the number of injuries in Niseko ski resort and the situation of severe ski accidents in Japan. **Results:** About 50 severe backcountry skiing injuries occur every year in Japan, and 20 of them were fatal. The severe injury means head, back injury and suffocation. 1985 to 2000, there were 9 skiing fatalities in Niseko every year. All fatalities were caused by avalanches. 8 fatalities were backcountry skiing. These Niseko ski resorts prohibited out of bounds skiing. These were called “Niseko Rule”. “Niseko Rule” was promulgated in 2001. No fatalities have occurred since 2001. **Conclusion:** The important point of “Niseko Rule” is that Niseko resorts and the local community respect the freedom of mountain users and place a strong emphasis on the sage usage of the mountain. Ski Patrol checks the conditions of each ski resort for the boundaries of the “Niseko Rule”. The helmet wearing rate of users of Niseko resorts has increased due to the influence of foreign tourists. It will contribute to skiing safety. **Clinical implications:** The number of skiers in Japan is one third of the peak period. Previously, many ski resorts closed during this contraction. Recently, new resorts opened and the skier population has stabilized. Niseko provides an opportunity to expand the skier population, further.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 036

TITLE Guided load management for female soccer athletes: a case series using global positioning system technology (GPS) during return to sport

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ABSTRACT **Objective:** Player availability post-surgery can be challenging, however, implementing a GPS guided load management program can maximise readiness.
Methods: In Fall 2017, Patient A (20 yrs, Centre Back) underwent patellofemoral realignment and Patient B (21 yrs, Centre Midfielder) underwent ACL reconstruction. Both players were cleared medically to play in the 2018 season and seventy-six sessions were monitored during the season. Modification of total distance (TD) and high-speed running (HSR) quantified by GPS was implemented with the medical staff to manage ongoing injury site symptoms. Training loads were based on absolute and relative values of individual match TD and HSR. TD and HSR (velocity >14.4km/h) were measured in metres (m).
Results: Patient A's average match duration was 84±23 minutes (min) and Patient B's average match duration was 90±12min. Overall team match duration was 95±8min. Patient A match loads were TD 8763±3826m and HSR 1039±509m. Patient B match loads were TD 8652±2281m and HSR 981±307m. Team match loads were TD 7431±1430m and HSR 1090±235m. Patient A training loads were TD 5201±1048m and HSR 463±352m; which was 59.3% of TD and 44.5% of HSR match load. Athlete B training loads were TD 4415±1650m and HSR 333±209m, which was 51% of TD and 33.9% of HSD match load. Team training loads were TD 4612±1296m and HSR 474±301m. This was 62% of TD and 43.4% of HSR match load.
Conclusion: As a result of implementing a GPS guided load management program, both athletes were available for starter selection for all matches throughout the whole competitive season and were able to play the majority of match duration.
Clinical implications: Successful collaboration between the medical and sport science teams can ensure injured player readiness and availability for matches. The prioritisation of drills is paramount for ensuring that players are maximising training potential despite being restricted to lower loads compared to the team.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 037

TITLE A comparison of scapular position and the Davies closed kinetic chain stability test

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ABSTRACT **Objective:** Appropriate evaluation of scapular dyskinesia can help in developing strategies for improving strength and functional sport-specific abilities. The purpose of this study was to explore the relationship between the reliability of scapular positions in recreational collegiate athletes as a comparison to the athletes' ability to perform the Davies Closed Kinetic Chain (CKC) Stability Test.

Methods: Data were collected to address the specific aims: evaluate the ability of a therapist and student physical therapist to identify Kibler types, and additionally to evaluate the association of Kibler types and performance on the Davies CKC Upper Extremity Stability Test. Inclusion criteria: 18-to-40 years and follow instructions in English. Exclusion criteria: no upper extremity injury in the last year, no history of head or neck injuries in the past year, and have not been diagnosed with hypertension.

Results: Seventy-four participants (36 males, 38 females; mean age 23.1±3.01 years) completed the study. Reliability between therapist and student physical therapist was excellent (Cronbach's $\alpha=0.96$) for static and dynamic scapula positions: hands by side, hands on hips, and bilateral flexion. Kibler type I was the most frequent presentation in all 3 testing positions and those with a Kibler type I performed better on the Davies CKC Upper Extremity Stability Test (25.38 touches averaged over 3 trials). Performance of touches Standard Error of Measurement for Kibler types ranged from 1.03 to 1.54. Older participants did better on the Davies CKC Upper Extremity Stability Test than younger participants.

Conclusion: Kibler scapular identification between students and therapists has excellent reliability in recreational athletes. Recreational athletes with Kibler Type I performed better than Kibler Type IV classifications.

Clinical implications: Kibler classifications do not indicate performance on the Davies CKC Upper Extremity Stability Test for recreational athletes.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 038

TITLE What is the domain-specific burden of hip-related pain in men and women who play competitive football?

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ABSTRACT **Objective:** Describe the domain-specific burden of hip-related pain (HRP) in competitive football players and explore whether sex-based differences exist within this population.
Methods: A cross-sectional study design was used to compare sub-elite football (Australian Rules and soccer) players with and without HRP. Symptomatic participants (HRP) were eligible for inclusion if they reported greater than six months of hip and/or groin pain and had a positive flexion/adduction/internal rotation (FADIR) test. Healthy control participants were included if they had no history of pain and a negative FADIR test. All participants completed the International Hip Outcome Tool-33 (IHOT-33) and Copenhagen Hip and Groin Outcome Score (HAGOS). For all HAGOS and IHOT-33 subscales, between-groups comparisons were made (symptomatic men (SM) vs symptomatic women (SW), SM vs asymptomatic men (AM), and SW vs asymptomatic women (AW)) using analysis of covariance (ANCOVA) and controlling for covariates (body mass index (BMI), symptom duration).
Results: 187 (149M, 38W) symptomatic and 55 (41M, 14W) asymptomatic football players were included. Symptomatic men reported longer symptom duration (MD 16 months [95% CI 2.28 to 30.30], P=0.023) and higher BMI (MD 3.4 kg/m² [95%CI 0.96 to 6.19], P=0.003) when compared to SW. Men and women with HRP were worse on all domain subscales when compared to healthy controls of the same sex ($p \leq 0.001$). Within the symptomatic football players, SW reported significantly worse symptoms (MD -5.84 [95%CI -11.13 to -0.55], $p = 0.031$) and pain (MD -7.07 [95%CI -12.02 to -2.11], $p = 0.005$) using the HAGOS subscales when compared to SM.
Conclusion: Football players with HRP report reduced function and performance during football when compared to asymptomatic players. There is no clinically important difference in the described burden between sexes.
Clinical implications: Clinicians should consider sport-specific function when managing football players with HRP.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 039

TITLE The roles of psychological, social, and contextual factors in recovery after a sport-related knee injury: a scoping review

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ABSTRACT **Objective:** Rehabilitation of sport-related knee injuries predominantly focuses on physical impairments despite calls to address psychological, social, and contextual (non-physical) factors. This scoping review aimed to explore the role of non-physical factors across the acute, rehabilitation and return to sport (RTS) stages of recovery following a sport-related knee injury.

Methods: This review followed the PRISMA Extension for scoping reviews and Arksey and O'Malley framework. Six electronic databases were searched. Included studies contained original data that described a non-physical factor related to rehabilitation, recovery, or RTS after a traumatic sport-related knee injury. Two authors independently conducted title-abstract and full-text reviews. Study quality was assessed with the Mixed Methods Appraisal Tool. Thematic analysis was undertaken.

Results: Of 7,289 records, 77 studies representing 5,540 participants (37% females, 84% anterior cruciate ligament tears, aged 14-60 years) were included. Psychological factors were reported in all studies, while only 39% and 25% of studies reported on social and contextual factors, respectively. 84% of studies investigated non-physical factors during the rehabilitation or RTS stage with few considering them at time of injury. A cross-cutting concept of individualization was present across four psychological (barriers beyond fear, active coping, independence, recovery expectations), two social (social support, engagement in care), and two contextual (environmental influences, sport culture) themes.

Conclusion: Diverse psychological, social, and contextual factors are present across all stages of recovery following a traumatic sport-related knee injury. A better understanding of these factors at the time of injury could assist with optimizing injury management.

Clinical implications: It is essential that psychological, social, and contextual factors are prioritized in the management of sport-related knee injuries.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 040

TITLE Early use of anti-gravity treadmill training for return to running following tibial stress fracture

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ABSTRACT **Objective:** Anti-gravity treadmill training (ATT) has been proposed as an effective treatment in the rehabilitation of tibial stress fractures in runners. This case study highlights the use of ATT early in the rehabilitation resulting in pain free return to running within 14 sessions. **Methods:** A 36-year-old female long-distance runner was diagnosed with a grade 2 stress reaction of the right distal tibial diaphysis. Primary intervention consisted of ambulation with a CAM boot for 6 weeks and complete cessation of running. At initial physical therapy evaluation, the patient scored a 3/6 on the step down test of her right leg and 69/80 on her Lower Extremity Functional Scale (LEFS). The patient's goal was to return to running at a pre-injury pace of 11 minutes per mile (min/mi) for 4 miles. Treatment included strength training, neuromuscular re-education and ATT with cadence training and verbal cues. The patient completed 7 sessions of ATT at a pace of 15 min/mi and body weight (BW) progressions of 10% weekly from 60% to 90%. Intermittent verbal cues of 'forward trunk lean' and 'core activation' were given. Cadence training was initiated at 90% BW running increasing from 163 steps per minute (spm) to 180 spm. Thereafter, through interval running on the treadmill she returned to steady running at her desired pace of 11 min/mi. **Results:** The patient completed a total of 14 sessions over 8 weeks including ATT at visits 3 through 9. At last visit, the patient reported having ran pain free for "4 miles at 9.5 min/mi at 180spm" exceeding her pre-morbid level of running. Scores on step down test improved to 0/6 and LEFS improved to 80/80. **Conclusion:** ATT offered progressive tibial loading and greater specificity of exercise to allow for a successful return to running following tibial stress fracture. **Clinical implications:** Future research may focus on comparing the use of ATT to other treatments in return to running following tibial stress fractures.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 041

TITLE Development and predictors of age- and activity-relevant functional recovery targets in young athletes after ACL reconstruction

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ABSTRACT **Objective:** National registry data have established Knee injury and Osteoarthritis Outcome Score (KOOS) functional recovery (FR) target values for adults after ACL reconstruction (ACLR). However, the specificity of these targets for young athletes is unclear. The purpose of our analysis was to develop age- and activity-relevant KOOS FR targets and test the hypothesis that higher hop test performance and strength would be associated with KOOS FR at the time of return-to-sport (RTS) after ACLR.

Methods: 222 young athletes (56 uninjured controls, 17.2±2.4 years, 73% female; 166 after ACLR, 16.9±2.2 years, 68% female) were included in this cross-sectional analysis from a larger cohort study. Controls completed the KOOS, and FR target values were defined as the lower bound of the 95% confidence interval for each KOOS subscale. ACLR participants completed laboratory testing within 4 weeks of RTS clearance, including: the KOOS, single-leg hop tests, and isometric quadriceps strength. Logistic regression determined predictors of KOOS FR among demographic/injury, hop, and strength data ($\alpha \leq 0.05$).

Results: KOOS FR targets from healthy young athletes were: Pain≥94, Symptoms≥92, ADL≥97, Sport≥92, Quality-of-Life≥92. ACLR participants met the KOOS FR targets in the following proportions: Pain, 63%; Symptoms, 42%; ADL, 80%; Sport, 45%; Quality-of-Life, 24%; overall FR (met all subscale targets), 17%. Predictors of overall FR were: younger age (OR: 0.8), hamstring graft (OR: 3.2), pediatric ACLR (OR: 8.9), single-hop limb-symmetry index (LSI)≥90% (OR: 9.0), crossover-hop LSI≥90% (OR: 8.4), and quadriceps strength LSI≥90% (OR: 3.5).

Conclusion: A small proportion of young athletes recently cleared for RTS after ACLR meet age- and activity-relevant targets for knee function.

Clinical implications: Ensuring that ACLR patients at RTS meet 90% LSI on single-leg hop tests and quadriceps strength may be associated with meeting age- and activity-relevant targets for knee function.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 042

TITLE Abnormal muscle coordination rather than hip abductor muscle weakness may underlie increased pelvic drop during running

AUTHORS Preece SJ, Elsaï WM, Herrington L, Jones R

AFFILIATIONS Health Sciences Research Centre, University of Salford, UK

ABSTRACT **Objective:** To investigate whether inter-subject differences in activity of the hip extensor muscles during running could explain differences in frontal pelvic angles.
Methods: A total of 25 healthy runners were tested during over ground running at 3.2m/s. Pelvic and lower limb kinematics were collected along with bilateral EMG data from three adductor muscles (longus, magnus and gracilis), gluteus medius, medial hamstrings and gluteus maximus. To eliminate potential crosstalk, an ultrasound-based protocol was used to place the adductor EMG electrodes. A maximal voluntary isometric contraction (MVIC) was collected for each muscle group and maximal isometric abductor strength assessed using a dynamometer. The timing and magnitude of the peak pelvic angle in the frontal plane was identified bilaterally for each subject. EMG activity, normalised to MVIC, was averaged across a window immediately preceding this peak angle. Univariate correlations were then investigated between muscle activity and peak pelvic angle.
Results: Significant positive correlations ($r=0.64$ to 0.65) were observed between adductor magnus activity and peak pelvic angle. Conversely, moderate negative correlations were found between the other hip extensors (gluteus maximus and hamstrings) and peak pelvic angles ($r=-0.41$ to -0.5). There were no correlations between abductor strength and peak pelvic angle.
Conclusion: Altered coordination of the hip extensor muscles, characterised by increased adductor magnus activity and decreased hamstring/gluteus maximums activity, may underlie increased frontal plane pelvic movements.
Clinical implications: Increased frontal plane pelvic angles are associated with running injuries, such as patellofemoral pain and ITBS. Future clinical intervention studies could focus on improving muscle synergy rather than on hip abductor strengthening.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 043

TITLE Between-day repeatability of lower limb muscles during running

AUTHORS Preece SJ, Elsais WM, Herrington L, Jones R

AFFILIATIONS Health Sciences Research Centre, University of Salford

ABSTRACT **Objective:** To investigate the reliability of a protocol for collecting EMG data from the lower limb muscles during over ground running.
Methods: EMG data were collected from 12 lower limb muscles. The SENIAM guidelines were used to position electrodes over gluteus maximus/medius, vastus lateralis/medialis, medial/lateral hamstrings, medial/lateral gastrocnemius and tibialis anterior. To eliminate potential crosstalk, an ultrasound-based protocol was used to place the adductor EMG electrodes. Data were collected from 10 healthy runners on two separate test sessions. At each session participants ran at 3.2m/s and also performed a maximal voluntary isometric contraction (MVIC) for each muscle group. During data collection force data was monitored to ensure no net acceleration or deceleration of the runner's centre of mass. Following data collection, the force data was used to define events and then create ensemble average profiles, normalised by MVIC, for each muscle/participant for the two separate days. A coefficient of multiple correlation (CMC) was then used to quantify waveform similarity of the muscle activation profiles between the two different testing sessions.
Results: Seven of the tested muscles exhibited a high level of repeatability (CMC=0.91-0.96). Good to moderate repeatability was observed for the two hamstrings (CMC=0.77-0.87), adductors longus (CMC=0.83), gracilis (CMC=0.7) and tibialis anterior (CMC=0.87).
Conclusion: This is the first study to assess between-day variability of EMG profiles during running. The data show that healthy runners have consistent muscle activation patterns which can be measured repeatably.
Clinical implications: We suggest that this EMG protocol should be used to quantify muscle activity differences between runners with different kinematic patterns or between healthy runners and those with pathology.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 044

TITLE Scared to move: kinesiophobia in the acute stages of youth sport-related knee injuries

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ABSTRACT **Objective:** Despite its association with poor long-term outcomes, little is known about the onset or physical manifestation of kinesiophobia early after youth sport-related knee injury. This research assesses the relationship between kinesiophobia and knee strength, balance, or moderate-to-vigorous physical activity (MVPA) in acutely injured compared to uninjured youth.

Methods: Participants included 44 youth (11-19 years) with an acute (<4 months) sport-related knee injury and 44 uninjured age-, sex-, and sport-matched controls. The outcome was the Tampa Scale for Kinesiophobia (TSK). Covariates included normalized bilateral knee extensor and flexor strength (isokinetic dynamometer; Nm/kg), bilateral Y-balance test (YBT), and average daily minutes of MVPA (ActiGraph). Descriptive statistics including matched-pair difference (95%CI) were calculated for all variables by study group. Unadjusted conditional (matched-pair) logistic regression assessed the odds of TSK score >37 by study group (odds ratio; 95%CI) and multivariable regression (95%CI) assessed the association between TSK score and each covariate, adjusting for injury history.

Results: Participant median age was 17 years (range 10-20) and 65% were female. The median time since injury was 1.5 months (range 0.4-4.2). The injured group had higher TSK scores [matched-pair difference (95%CI); 5 (3, 8)]; demonstrated weaker index (injured) knee extensor [-1.42 Nm/kg (-2.00, -0.84)], index flexor strength [-1.02 Nm/kg (-1.53, -0.51)], and non-index knee extensor [-0.56 Nm/kg (-1.08, -0.05)]; and had a 4.75-fold (95%CI 1.62, 13.96) greater odds of TSK score >37 compared to uninjured controls. No associations were found between TSK and strength, YBT, or MVPA.

Conclusion: Injured youth have increased kinesiophobia early after injury, but this fear does not appear to be related to physical outcomes.

Clinical implications: Kinesiophobia should be managed in the acute stages of a youth sport-related injury.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 045

TITLE Injury patterns and perceived risk factors among basketball players in Nigeria.

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ABSTRACT **Objective:** This study was designed to determine the prevalence, pattern of injury and perceived risk factors of basketball players in Nigeria.
Methods: The study was a cross-sectional survey involving 110 basketball players (96 males and 14 females) including amateur and professionals. The amateur players were recruited from various stadia in Lagos state and professional players were those who participated in the Dstv Basketball Premier League. The trainings and matches were watched and recording was done. Basketball-related injury data were collected during trainings and matches using a standardized basketball injury report questionnaire. Data was analysed using SPSS version 21.0 and was summarized with mean, standard deviation, frequency, percentage and tables.
Results: The 12-month prevalence of sport injury during training sessions for the basketball players was 80.8%. Sudden turn or twist (40.0%) was the most common cause of injury and the majority of injuries were to the lower extremities, especially at the ankle joint (39.1%). Ligament sprain (52.7%) was the most common type of injury and massage (41.8%) was the most frequently used modality for treatment. 81% of the players never made use of mouth guard and 83% always play on a concrete surface during training session.
Conclusion: The findings from this study show that the prevalence of basketball injury was relatively high compared with other studies. The major perceived risk factors were non-usage of mouth guard and playing on a concrete surface.
Clinical implications: As compared with previous studies, future research should further investigate on injury prevalence with regard to player's position and prevention strategies. These basketball injury cases could be significantly more rapidly reduced by ensuring the use of protective equipment, trained coaches, good technique, proper training floor with provision of physical therapists and medical doctors working with teams.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 046

TITLE Effectiveness of Dry Needling Combined with a Treatment Programme for Musculoskeletal-related Chronic Pain: A Systematic Review and Meta-analysis

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ABSTRACT **Objective:** To examine the effectiveness of dry needling (DN) combined with a treatment programme (TP) in comparison with TP alone in patients presenting musculoskeletal chronic pain, by analysing the differences in pain intensity from baseline to the last available follow-up.

Methods: A systematic review was performed according to the PRISMA guidelines. Pubmed, PEDro, Cochrane Library, Science Direct, SportDiscus, Web of Science and Ovid databases were searched. To assess changes in pain intensity, the effect size was calculated using Hedge's g (CI=95%). Considering the I-squared, the random effect model was adopted.

Results: 1,082 articles were identified. After assessing for relevance, six randomised controlled trials were included. Data was extracted from 581 participants. The Downs and Black quality assessment revealed that scores ranged from 20 to 27 (maximum score = 31; mean = 24). The heterogeneity between studies was significant ($I^2=73.21\%$; $p<0.001$), no publication bias was identified. 11 meta-analyses were performed. Both DN+TP and TP showed a statistically significant decrease in pain, however the DN+TP presented higher decreases in the immediate period ($\Delta=22.89\%$; $g=-0.687$; $p<0.001$), three-month follow-up ($\Delta=36.08\%$; $g=-0.629$; $p=0.005$) and six-month follow-up ($\Delta=27.03\%$; $g=-0.706$; $p=0.039$) when compared to TP alone.

Conclusion: Moderate-low to moderate-high quality evidence suggest that DN+TP is more effective than TP for decreasing chronic pain in the immediate and long-term.

Clinical implications: DN has a potential effect on the reduction of chronic pain associated with myofascial pain syndrome, as it seems to act directly on the trigger point. Although previous reviews have pointed out that DN alone is as effective as commonly utilized physiotherapy interventions, this study suggests that including DN as part of a TP may be a more effective clinical strategy for the management of musculoskeletal-related chronic pain.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 047

TITLE Sticking with it? Adherence to a neuromuscular training injury prevention warm-up program in youth basketball

AUTHORS Owoeye OBA^{1,2}, Pasanen K^{1,3}, Befus K¹, Palacios-Derflingher L^{1,5}, Emery CA^{1,6}

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ABSTRACT **Objectives:** To determine coach and player adherence and explore coach-related factors associated with adherence to the SHRED Injuries Basketball neuromuscular training (NMT) warm-up (SIB) in youth basketball.

Methods: This study is based on a cluster randomized controlled trial (RCT) investigating two different delivery methods for SIB. All teams were asked to perform the SIB before every practice and game sessions. Adherence was tracked prospectively, for 34 youth basketball teams, at the team level by team designates, through daily reports, and at the player level by study physiotherapist by random mid-season direct observation of six teams (three per RCT group). Team adherence was measured as utilization fidelity (UF, proportion of total number of expected exercises) and cumulative utilization (CU, proportion of total sessions possible); and player adherence as exercise fidelity (EF, proportion of player observations in which all aspects of exercise components were performed correctly). A cut-point of 80% was indicated as in optimal adherence based NMT dose-response literature. Factors explored included age, years of coaching experience, level of education and post-workshop intention to use SIB through the season.

Results: Overall, 31 teams with baseline coach information and all 63 observations from 45 players were analyzed. UF, CU and EF were 93.5%, 71.0% and 47.6%, respectively. Delivery methods for SIB had no impact on adherence. Among the factors evaluated, younger age ($t=2.40$; $p=0.023$) and less years of coaching experience ($z=1.99$; $p=0.047$) were significantly associated with optimal adherence.

Conclusion: While adherence to the SIB program was high based on CU, proper program execution was suboptimal at both the team and player levels. Determinants of optimal adherence to NMT programs need further evaluation.

Clinical implications: Coaches and players need to be thoroughly educated on the importance of proper program execution for optimum injury risk mitigation.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 048

TITLE Morphological features of deep cervical muscles between patients with poor posture and healthy controls: a high-frequency ultrasound imaging study

AUTHORS Zhang E, Yang Z, Wang Z

AFFILIATIONS School of Sports Medicine and Physical Therapy, Beijing Sport University, Beijing, China

ABSTRACT **Objective:** This study aimed to observe the difference in morphologic characteristics of deep cervical muscles between young females with poor cervical posture and normal posture, and further evaluate the intervention effects of different methods.
Methods: 18 female patients with poor posture (forward head angle $> 41^\circ$) were selected as the experimental groups (EG) and 10 healthy counterparts as the control group (CG). EG were divided randomly into two groups: Craniocervical Flexion Exercise (CFE) group and Isometric Resistance Exercise (IRE) group. Both groups were required to complete the training plan. There was no intervention in the CG. High-frequency ultrasound imaging was used to observe deep cervical flexors (DCF) and extensor muscles' morphology in all participants. The test equipment was a full digital color doppler ultrasound diagnostic system (Apogee 1000). All participants were required to complete the muscles' morphology measurement of deep cervical flexion and extension muscle including DCF and semispinalis capitis (SSC). The cross-sectional area (CSA) of muscles were measured.
Results: 1) Compared with CG, there was a significant difference in CSA of right DCF and muscle endurance in the poor posture group; 2) The result of the muscle morphology measurement revealed that there was a significant improvement in cross-sectional area of right DCF and the transverse dimension of left SSC in CFE group ($P < 0.05$). As for the IRE group, the cross-sectional area of left DCF had a significant improvement ($P < 0.05$). The other indexes of two groups did not significantly differ.
Conclusion: Compared with the normal posture people, there was a significant difference of morphologic characteristics of deep cervical muscles in the poor posture people. Both of the CFE and the IRE can improve the function of the DCF.
Clinical implications: The high-frequency ultrasound imaging technique could be applied to the evaluation of deep cervical muscles.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 049

TITLE Clinical and Performance Assessments in Athletes with Anterior Cruciate Ligament Reconstruction after Return-to-Sports

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ABSTRACT **Objective:** To compare and evaluate clinical and laboratory performance assessments in athletes with anterior cruciate ligament reconstruction (ACLR).
Methods: Thirty athletes (15 ACLR and 15 healthy) were recruited. In return-to-sports situation of athletes with ACLR, they were assessed using a single-leg hop test, knee extension and flexion isokinetic tests, and landing performance with the landing error score system (LESS). Limb symmetry index (LSI) between sides was reported. Independent t-test and Mann-Whitney test were used when the sampled data was normal and non-normal distribution, respectively. For further analysis, 16 athletes from our sample (8 ACLR and 8 healthy) were asked to perform a single-leg landing in various directions (forward, diagonal, and lateral directions). Lower limb moments were collected in the motion analysis laboratory. Two-ways mixed ANOVA was used to analyze. Knee joint coordination was also measured.
Results: Average time after ACLR was 19 months (SD 10, 95%CI 14, 25). We found that single hop distance and LSI of knee extensor strength were significantly different ($p=0.006$) between ACLR and healthy groups. No significant difference ($p>0.05$) was observed in LESS score and LSI of knee flexion strength and single-leg hop distance. Directions significantly influenced joint moments of the lower limb at peak ground reaction force while group and interaction effect did not show.
Conclusion: Direction of jump landing influenced lower limb biomechanics in both groups. After return-to-sports, lower limb biomechanics of athletes with ACLR were similar to uninjured athletes during landing. However, athletes with ACLR still showed some deficits including single hop and knee muscle strength tests.
Clinical implications: After return-to-sports, risks of recurrent ACL injury should be monitored even in those who completed a rehabilitation program.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

- ABSTRACT #** 050
- TITLE** Tensor fascia latae muscle structure and activation in individuals with lower limb musculoskeletal conditions: a systematic review and meta-analysis
- AUTHORS** Besomi M, Maclachlan L, Mellor R, Vicenzino BT, Hodges PW
- AFFILIATIONS** School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Australia
- ABSTRACT** **Objective:** To systematically review the literature of structure and activation of the tensor fascia latae muscle (TFL) in individuals with lower limb musculoskeletal conditions. **Methods:** A comprehensive search in MEDLINE, EMBASE, CINHALL, and LILACS was undertaken from inception to 5 November 2018. Studies investigating the structure or activity of the TFL between individuals with a lower limb musculoskeletal condition and a pain-free control group were included. **Results:** Sixteen studies were included (n=524 participants), eight reporting structure and eight activation (electromyography [EMG]). Conditions included greater trochanteric pain syndrome (GTPS), hip joint pathology (including femoroacetabular impingement), ACL injury, iliotibial band syndrome (ITBS), and patellofemoral joint osteoarthritis (PFJ OA). Meta-analysis did not show significant differences in muscle size between groups. Moderate effect sizes were found for a higher cross-sectional area of the TFL/sartorius ratio (SMD=0.74, 95% CI [0.05, 1.43]) in GTPS, and a smaller body mass normalized volume (SMD=-0.61, 95% CI [-1.23, 0.0]) in PFJ OA. EMG amplitude did not differ between groups, but some normalization methods precluded between-group comparisons. Some differences in the pattern of TFL activation were observed when EMG pattern was analysed as linear envelopes or synergies in GTPS. **Conclusions:** Based on available evidence, the presence of dysfunction of TFL structure and activation in lower limb musculoskeletal conditions cannot be determined. There are inconsistent findings regarding relative muscle size, and it is currently difficult to make conclusions about TFL EMG. **Clinical implications:** The TFL has often been proclaimed problematic in conditions such as ITBS, patellofemoral pain, and GTPS. There is currently little evidence to support these clinical assumptions. This suggests that rehabilitation exercises that aim to minimize TFL activity are not yet based on sound evidence.
- NOTES** Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 051

TITLE Shear wave elastography of the iliotibial band: an exploratory study in pain-free runners

AUTHORS Besomi M, Salomoni S, Vicenzino BT, Hodges PW

AFFILIATIONS School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Australia

ABSTRACT **Objective:** To explore differences in the shear elastic modulus (SEM) of three anatomical regions of the iliotibial band (ITB) between different tasks/postures by sex, age and nutritional status (normal vs. overweight).
Methods: Fifteen recreational runners were recruited from the local community. SEM (as an index of tissue stiffness) was measured unilaterally using shear wave elastography in three regions of the ITB (proximal, middle and distal), during different tasks/postures: rest and contraction (pre- and post-15 minutes of running), Ober test, standing and pelvic drop in standing.
Results: Runners had a median age of 31 (interquartile range 27-36), 11 were females, with a body mass index of 23.5 (± 2.3) kg/m². Compared to rest, the middle region was stiffer during contraction, Ober test, and standing; and the distal region during contraction (mean differences [MD] from 47.6-67.6 kPa). Other conditions did not differ for any region. Stiffness of the middle region was higher in females than males during contraction (MD 38.5; 95%CI 8.4, 68.5), and higher in males than females in the middle (MD 82.4 95% 28.5, 136.2) and proximal (MD 49.9; 95%CI 12.0, 87.9) regions during pelvic drop. Stiffness of the middle region was higher in runners with a normal weight than overweight (MD 38.3; 95%CI -3.0, 79.7).
Conclusions: Stiffness of the ITB was greater in conditions where the ITB is put into strain through passive or active tension. SEM was different by sex and nutritional status during specific conditions. Comparisons between groups need to be considered in light of the small sample size and poor repeatability of some regions/conditions.
Clinical implications: High tension/stiffness of the ITB has been proposed to be associated in the pathogenesis of common running-related injuries, such as ITB syndrome and patellofemoral pain. Assessment of the mechanical properties of the ITB could help determine the potential role of the ITB in these conditions.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 052

TITLE Evaluation of sprinting force production capacities in athletes at 6th month after anterior cruciate ligament reconstruction: a pilot study

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ABSTRACT **Objective:** After anterior cruciate ligament reconstruction (ACLR), a test battery is often performed to allow the 2nd step of return to sport (RTS-2) continuum: the return to play. Lower limb force production capacities assessment during sprinting could be interesting because it is safe for the graft, provides complementary information in addition to usual functional assessments, and carry out evaluation of athletes' performance in line with sports reality. The aim of this study was to analyse the potential differences between the operated and healthy lower limbs in force production capacities during sprinting at the time of RTS-2 after ACLR.

Methods: Force-velocity relationship of each limb was assessed during a 6-s sprint on a motorized instrumented treadmill in 9 patients who practiced sports pivot/contact in competition (Marx: 14.2±2.1; Tegner: 8.4±1.1; 4 females; 173.6±10.1cm; 70.3±8.5kg) at the 6th postoperative month. Maximum power (Pmax), force (F0) and velocity (V0), and FVprofile (FV-slope) were calculated and compared between operated and healthy limbs.

Results: Pmax were higher for healthy than operated lower limbs (p=0.005, d=-1.3). For the FV relationships, FV-slope (p=0.009, d= 1.1) and F0 (p=0.004, d=-1.3) were statistically different, but V0 was not (p=0.10, d=0.6).

Conclusions: At the time of advancing to RTS-2, it seems that an asymmetry in sprint mechanics exist. It appears that the ACLR affects force production at low velocities (F0), and so does Pmax, resulting in side-to-side differences in FVprofile (operated vs. healthy). This showed an incomplete muscular recovery of the operated limb, which should be compared with specific muscular evaluations (isokinetic assessments).

Clinical implications: For RTS-2 tests batteries, it seems important to determine force capacities asymmetry objectively after ACLR from FVprofile during functional movements as sprinting or pedaling. These values could be helping decision later for RTS-3: the return to competition.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 053

TITLE Effect of pressure biofeedback in abdominal drawing-in maneuver on transversus abdominis activation level in patients with chronic low back pain

AUTHORS Wang LJ¹, Ruan B¹, Liu CR²

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² Department of Rehabilitation Medicine, Peking University First Hospital

ABSTRACT **Objective:** To investigate the effect of abdominal drawing-in maneuver (ADIM) with pressure biofeedback on percentage change of transversus abdominis (TrA) in patients with chronic low back pain.
Methods: 20 patients with low back pain who are eligible for lumbar stabilization training were randomly divided into verbal instruction group (n=10) and pressure biofeedback group (n=10), and received ADIM with verbal instruction and pressure biofeedback respectively. Ultrasound imaging was used to measure the percentage change of TrA thickness during supine lower extremity movement (external rotation of the hip, hip and knee flexion and straight leg raising) and upright loaded tasks (lifting task, loaded forward reach activity, stair stepping) before and after intervention.
Results: During supine lower extremity movement and uploaded lifting tasks, percentage change of TrA thickness increased significantly after ADIM training ($P<0.01$). During loaded forward reach activity and stepping stair tasks, percentage change of TrA thickness showed moderate increase after ADIM training ($P<0.05$). However, there were no significant differences between the two groups ($P>0.05$).
Conclusion: Chronic low back patients who meet the criteria of stabilization classification successfully performing ADIM in supine position could effectively increase TrA activation level during supine lower extremity movement and upright loaded tasks. Pressure biofeedback doesn't enhance the ability to increase TrA activation level.
Clinical implications: For patients with chronic low back pain who belong to stabilization classification, ADIM is an effective method to activate TrA. This study shows that the addition of pressure biofeedback doesn't enhance activation level when performing ADIM and verbal instruction remains effective in learning ADIM.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 054

TITLE Effects of exposure to cold on stiffness of muscle tendon unit of ankle plantar flexors

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ABSTRACT **Objective:** Exposure to cold is known to affect physiological reactions, such as decreasing tissue metabolic rates, neuromuscular functions, and athletic performance. Muscle tendinous stiffness is considered related to injury prevention, as well as to performance enhancement. However, precisely how cold exposure affects the stiffness of the muscle-tendon unit has not been well described. Therefore, the aim of this study was to determine the effects of exposure to cold temperatures on the stiffness of the muscle-tendon unit of the ankle plantar flexors. **Methods:** Twelve healthy young male subjects (age 21.3 ± 1.2 years; height 175.8 ± 5.2 cm; weight 70.7 ± 8.2 kg) participated in this study. All subjects were exposed to both conditions - either warm (25°C) or cold (10°C) for 30 minutes and measured skin temperature of calf, stiffness of muscle-tendon unit of ankle plantar flexors as well as range of motion in ankle dorsiflexion. A probe thermometer was used to monitor skin temperature. Stiffness of ankle plantar flexors and range of motion in ankle dorsiflexion were determined using an isokinetic dynamometer. **Results:** The skin temperature in the cold condition was significantly lower than the warm condition ($p < 0.05$). Likewise, the stiffness of the muscle-tendon unit was significantly higher in the cold condition than the warm condition ($p < 0.05$). The range of motion in ankle dorsiflexion was not significantly different between the conditions. **Conclusion:** The stiffness of the muscle-tendon unit in the ankle plantar flexors in cold condition was higher than in warm condition although range of motion in ankle dorsiflexion was unchanged. **Clinical implications:** The stiffness of the muscle-tendon unit was significantly higher during exposure to cold condition than to warm condition. In cold environments, warm-up routines should be considered just as important as stretching routines for both injury prevention and athletic performance.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 056

TITLE Pain and articular cartilage response to a challenging dynamic loading stimulus in patients after traumatic knee injuries

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ABSTRACT **Objective:** Traumatic knee injury is a substantial risk factor for osteoarthritis, with changes in articular cartilage often evident on MRI within 1 year. The purpose of this study was to compare the response to a dynamic loading stimulus, as measured by changes in pain and tibiofemoral cartilage MRI T2 relaxation, in patients with a history of knee injury and healthy controls.

Methods: We recruited 10 patients (7 ACL rupture, 2 traumatic meniscal tear, 1 cartilage lesion), and 10 healthy controls. We obtained T2 maps before and after the loading stimulus using 3T MRI. We segmented articular cartilage using 3D Slicer. Following the scan, all participants completed the loading stimulus, consisting of 25 minutes of walking on an instrumented, dual-belt treadmill, including changes in speed, inclines and declines, lateral sways, and random pre-specified perturbations. Patients were asked to report pain on a scale of 0-10 before and after the loading stimulus, as well as rating of perceived exertion (RPE, Borg Scale) at three points throughout.

Results: Mean RPE was 11.5±1.6 for patients and 10.4±2.3 for controls (mean difference 1.1, 95%CI -0.8, 3.0). The patients experienced a significant increase in pain (1.5, 95%CI 0.6, 2.4) following the loading stimulus, while all healthy controls reported no pain at all timepoints. T2 decreased by 1.9±1.5 ms in patients and 1.9±1.3 ms in controls (mean difference 0.0, 95%CI -1.3, 1.3).

Conclusion: Patients with a history of traumatic knee injury experience significant increases in pain with dynamic loading compared to healthy controls despite similar RPE and cartilage load response.

Clinical implications: Clinical guidelines suggest patients who experience knee pain exercise within limits that increase their pain score by no more than 2 points. These results suggest that moderate intensity exercise with changes in pain within those limits causes no additional stress to the articular cartilage compared to healthy controls.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 057

TITLE The upper limb rotation test: reliability and validity study of a new upper extremity physical performance test

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ABSTRACT **Objective:** Screening tests must be reliable, sensitive, specific, inexpensive, easy to perform and widely available. Physical performance tests (PPTs) meet these criteria and are routinely used for injury prediction, performance enhancement or post-rehabilitation outcome measures. The primary purpose was to evaluate the reliability of the Upper Limb Rotation Test (ULRT). The secondary objective was to evaluate the relationship between the ULRT and two PPTs (SMBT and CKCUEST), trunk rotation range of motion (STRT) and shoulder rotational isometric strength using the Self-Assessment Corner (SAC).

Methods: A sample of 91 healthy adults participated to establish the reliability and validity of the ULRT. We used a two-session measurement design separated by seven days to evaluate the reliability. We used the SMBT, CKCUEST, SAC and the STRT to determine relationships with the ULRT.

Results: Results showed good reliability ranging from 0.76 (DA) to 0.78 (NDA). The SEM95 varied from 1.14 touches (DA) to 1.18 touches (NDA). The MDC95 ranged from 3.15 touches (NDA) to 3.27 touches (DA). A moderate correlation was found between the ULRT and CKCUEST scores (r range = 0.505 - 0.553 for DA; r range = 0.566 - 0.615 for NDA). A moderate correlation was found between ULRT (NDA) and SMBT scores (r range = 0.544 - 0.556).

Conclusion: Results demonstrated good relative reliability and clinically acceptable absolute reliability values for the ULRT. Results showed that performances on the ULRT were moderately correlated with the CKCUEST and the SMBT (NDA).

Clinical implications: Results suggest that the ULRT may be valuable as a screening test to help athletic trainers and physical therapists to assess functional upper extremity performance in a field setting.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 058

TITLE Effect of knee aspiration and intra-articular corticosteroid injection on gait biomechanics and strength in patients with knee osteoarthritis

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AFFILIATIONS ¹ Faculty of Health Sciences, Western University, London, Canada

² Wolf Orthopaedic Biomechanics Laboratory, Western University, London, Canada

³ Department of Rheumatology, St. Joseph's Health Care Centre, London, Canada

ABSTRACT **Objective:** To evaluate the effect of knee aspiration and intra-articular corticosteroid injection on gait biomechanics and strength in patients with knee osteoarthritis (OA) and active inflammation.

Methods: Fifteen patients with knee OA, synovitis and effusion were tested before and 3 weeks after receiving a knee aspiration and triamcinolone injection. All patients' ultrasound (US) exam revealed signs of inflammation that aligned with symptoms. A standard of care knee aspiration and injection was performed under US guidance. Three-dimensional quantitative gait analysis included peak knee angles and moments during walking. Muscular strength testing included isokinetic knee flexion and extension torque at 90 deg/s. Ultrasound, gait and strength tests were completed by the same examiner to reduce variability. Paired t-tests were used to assess changes.

Results: Pre minus post mean changes (95% CI) were: peak knee varus angle -0.11 deg (-1.97, 1.76), first peak knee adduction moment (KAM) 0.01 %BW*ht (-0.33, 0.35), second peak KAM -0.05 %BW*ht (-0.49, 0.39), peak knee flexion excursion angle -2.5 deg (-4.50, -0.59), peak knee flexion moment -0.57 %BW*ht (-1.06, -0.68), peak knee extension moment -0.06 %BW*ht (-0.64, 0.52), peak quadriceps strength -6.14 Nm (-16.92, 4.65) and peak hamstring strength -5.59 Nm (-11.14, -0.03).

Conclusion: Preliminary results suggest patients undergoing aspiration and injection for knee synovitis and effusion experience increased sagittal plane angles and moments during walking and increased maximal hamstring strength.

Clinical implications: Future work will categorize patients as responders and non-responders based on OARSI-OMERACT responder criteria to analyze between group differences.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 059

TITLE Establishing normative benchmarks for strength and hop test measures in collegiate athletes

AUTHORS Grindstaff TL¹, Farmer B¹, Bagwell JJ², Katsavelis D³

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ABSTRACT **Objective:** To determine differences between limbs and sexes for quadriceps isometric peak torque, single leg forward hop, and the 30-second side hop test.
Methods: Eighty-six Division I collegiate student-athletes (27 males, 59 females) from six teams participated in this study. Primary outcome measures included quadriceps isometric peak torque normalized to body mass (Nm/kg), single leg forward hop distance normalized to height, and the number of successful repetitions during the 30 second side hop test. Paired t-tests were used to determine between limb differences and independent t-tests to determine differences between males and females. For descriptive purposes a limb symmetry index (LSI) was calculated for each measure with the best performance used as the denominator.
Results: There was no significant difference between limbs for quadriceps peak torque (LSI= 88.4±8.8%; p= 0.96), single leg forward hop (LSI= 96.0±3.2%; p= 0.48), or the 30-second side hop test (LSI= 89.2±9.1%; p= 0.60). Males had significantly greater (p<0.001) performance for quadriceps peak torque (males 3.47±0.88 Nm/kg; females 2.90±0.57 Nm/kg), single leg forward hop (males 1.09±0.08; females 0.87±0.10), and the 30 second side hop (males 65±9 repetitions; females 46±12 repetitions).
Conclusion: Performance between limbs was not significantly different, but average LSI values for quadriceps peak torque and the 30 second side hop were below the typical 90% threshold used for rehabilitation progression and return to sport decisions. Males had significantly greater performance values across all three tests.
Clinical implications: Although there was not a significant performance difference between limbs, the degree of asymmetry (e.g. LSI values) should be considered when utilizing an LSI of 90% as a clinical threshold. Additionally, the inclusion of normative values for male and female Division I collegiate athletes can serve as another relevant clinical benchmark.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

- ABSTRACT #** 060
- TITLE** Effect of cold-water immersion on perceptions of recovery in swimming athletes: a randomized placebo-controlled clinical trial
- AUTHORS** **Batista NP**, Carvalho FA, Machado AF, Pastre CM
- AFFILIATIONS** Laboratory of Sports Physical Therapy, Faculty of Science and Technology, São Paulo State University, Presidente Prudente, Brazil
- ABSTRACT** **Objective:** The aim of the study was to verify the acute effect of cold-water immersion on perceptions of recovery in swimming athletes compared to passive recovery and placebo condition.
Methods: 19 young athletes of both sexes performed nine days of physical training out of water followed by 12 minutes of a recovery intervention. Interventions were performed in a crossover design and were: passive recovery (CON), cold water immersion at $14\pm 1^{\circ}\text{C}$ (CWI) or neutral water immersion at $27\pm 1^{\circ}\text{C}$ with a skin cleansing solution as placebo condition (PLA). Well-being, heaviness, tiredness, discomfort and pain were measured immediately after the physical training and the intervention using a 5-point Likert scale. At the end of the trial, it was asked “With which of the interventions you felt more recovered?”. Mixed ANOVA was used to analyze the variables (Bonferroni post-hoc) and χ^2 to compare the preference of interventions ($p<0.05$).
Results: There was a significant effect for time ($p<0.05$) for all variables with medium and large effect size. However, post-hoc tests indicated a real improvement of well-being and heaviness only for CWI and PLA, and discomfort only for PLA. Tiredness also showed a significant effect for time*group indicating that CWI and PLA behaved differently from CON. χ^2 indicated a significant preference favorable to CWI [$p=0.021$; CWI (63.2%); PLA (21%); CON (0); both CWI and PLA (15.8%)].
Conclusion: CWI after a physical training demonstrated better results on perceptions of recovery than passive recovery in swimming athletes, but its benefits are not greater than placebo condition.
Clinical implications: The implementation of a recovery intervention in the athlete’s routine can be a strategy to optimize their recovery process, considering that both interventions provided more benefits compared to passive recovery. The preference of the athlete should be considered in choosing the best intervention, given that CWI was the one in which the athletes felt more recovered.
- NOTES** Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 061

TITLE Effect of two massage protocols on clinical parameters of swimming athletes: a randomized controlled clinical trial

AUTHORS Carvalho FA, Batista NP, Machado AF, Pastre CM

AFFILIATIONS Laboratory of Sports Physical Therapy, Faculty of Science and Technology, Sao Paulo State University, Presidente Prudente

ABSTRACT **Objective:** The aim of this study was to analyse the acute effects of massage with different intensities on clinical parameters of swimming athletes compared to control.
Methods: This was a crossover clinical trial in which 21 young swimming athletes of competitive level undertook 12 minutes of deep massage (DM), superficial massage (SM) and passive recovery (PR) after exercise. The athletes performed ~40 minutes of general exercises including squats, push-ups, sit-ups, vertical jumps, burpee, mountain climbers and resisted upper arm exercises. The DM was applied in 3 different intensities for 3 minutes on the anterior thighs, 3 minutes on the upper arms and 6 minutes on the back. The SM was applied superficially with only one intensity at the same sites and duration. For the PR the athletes maintained their normal routine out of the water. Before the beginning of the study the athletes were asked about their perceptions during a normal training to consider the specificity of the modality. Then they rated these perceptions (well-being, heaviness, tiredness, discomfort and pain) by a 5-point Likert scale (nothing, little, moderate, very much, extremely) before and after the interventions. The clinical variables were analysed with mixed ANOVA and Bonferroni post hoc with significance level of $p < 0.05$.
Results: All clinical variables improved over time ($p < 0.05$) for both massage groups. For pain there was a significant small group effect ($p < 0.05$; $ES = 0.041$) and post hoc analysis showed that SM and DM interventions differed from PR but not from each other.
Conclusion: Both massage interventions seem to improve clinical parameters after exercise when compared to PR, however there was no statistical difference between the two massage protocols.
Clinical implications: These results show that 12 minutes of massage may be an effective strategy for post-exercise recovery of swimming athletes.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 062

TITLE Pain trajectories and perceived exertion during a 12-week neuromuscular exercise program in patients with knee osteoarthritis

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⁶ Fowler Kennedy Sport Medicine Clinic, London, ON, Canada
⁷ Schulich School of Medicine & Dentistry, Western University, London, ON, Canada

ABSTRACT **Objective:** To evaluate trajectories of knee pain and perceived exertion during a neuromuscular exercise (NEMEX) program for patients with knee osteoarthritis (OA). **Methods:** Fifty-two participants with knee OA underwent a 12-week NEMEX program. At baseline, patients received instructions for a NEMEX program, consisting of 12 visits with a physiotherapist plus home exercises. We assessed the Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP) pre and post program and measured knee pain (pre, post, max) and the overall rating of perceived exertion (RPE) at each exercise visit. We calculated change in pain (PC; pre to post) and acute pain flare up (PF; pre to max level) for each visit. We evaluated mean changes (with 95%CI) for the ICOAP from pre- to post-program. We performed linear regression to investigate pain trajectory over time, using the group mean of PC for each exercise visit as the outcome and time as the predictor. The analysis was repeated for PF and RPE. **Results:** Fifty patients (96%) completed the program. Decreases in intermittent [12.2 (95%CI 5.1, 19.3)], constant [14.1 (95%CI 8.0, 20.1)] and total pain [13.2 (95%CI 7.3, 19.1)] over the 12-week program indicated substantial improvements. PC and PF levels decreased over time by 0.07 (95%CI 0.01, 0.12) and 0.07 (95%CI 0.02, 0.12) per exercise visit, respectively. RPE increased over time by 0.24 (95%CI 0.12, 0.34) per exercise visit. Time (i.e. increasing number of exercise sessions) explained 36% of the change in PC level, 42% of the change in PF level and 73% of the change in RPE. **Conclusion:** Exercise-induced pain decreased while perceived exertion while exercising increased during a 12-week NEMEX program for patients with knee OA. **Clinical implications:** Patients with knee OA and their therapists should expect that exercise-induced knee pain during a neuromuscular exercise program will decrease progressively over time, enabling gradual increases in exertion and perhaps intensity.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 063

TITLE Combat sports training programme enhances physical performance attributes in children

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ABSTRACT **Objective:** Karate is a type of martial arts which are ancient forms of combat, modified for modern sport and exercise. Participation in karate in Nigeria is beginning to increase, particularly among youth. The focus of this study was to investigate if a combat sports training programme can serve as a tool for improving physical performance attributes such as speed of movement, lower body muscle strength, coordination, and balance of male children. **Methods:** The study was conducted in 27 male children, with age range between 6 and 12 years, who are registered participants in a karate training programme in Benin City. The participants were randomly assigned to the experimental and control groups with each group containing 13 and 14 participants respectively. Age range of participants in the experimental and control groups were 6 to 11 years (mean= 8.3) and 6 to 12 years (mean age= 9.1) respectively. The study employed experimental research design involving pretest-posttest randomized control group. The participants were subjected to pretesting before and after the combat sports training programme. Data generated from the study were analyzed using independent samples t-tests with alpha level set at 0.05. **Results:** Findings from the study revealed that the combat sports training programme positively influenced lower body strength ($p = 0.002$), coordination ($p < 0.001$), and level of balance ($p < 0.001$) of participants. However, no significant improvement was observed in speed of movement ($p = 0.117$). **Conclusion:** The outcomes of this study suggest that combat sports training program designed for children with appropriate modification for their ages, can improve physical performance attributes and foster healthy physical development in children. **Clinical implications:** It is therefore recommended that inclusion of combat sports training programme should be considered in designing sports programmes for children in schools to foster a healthy, all-round development in the children.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 064

TITLE A comparison of medical encounters of older and younger athletes participating at major games

AUTHORS Brown MRC^{1,2}, Reaburn P², Constantinou M³

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ABSTRACT **Objective:** To identify and compare medical encounter data of older and younger athletes competing in similar events.
Methods: Medical encounters for athletes competing in four team sports (Basketball, Football, Hockey, and Netball) were recorded at the 2015 Australian University Games (AUG) and the 2016 Pan Pacific Masters Games (PPMG) using the same standardised medical encounter surveillance system. The de-identified encounter data was compared for injury types and rates between both groups and between the individual sports for each group.
Results: For the four sports a total of 1,756 medical encounters were recorded at PPMG and 1,650 at the AUG. Of those 81.04% were medical encounters for lower limb injuries at the PPMG and 72.73% at the AUG. Injuries to ligaments, muscles and tendons accounted for 75.11% of all encounters at the PPMG and 68.97% at AUG. Skin wounds were the next most common presentation at both events (PPMG 6.49%, AUG 11.15%), followed by fractures/dislocations (PPMG 1.94%, AUG 4.97%). There was a higher rate of muscle/tendon injuries at PPMG compared to AUG across all 4 sports (PPMG 36.31%, 29.31% AUG). The higher rate of encounters for muscle/tendon injuries at the PPMG was most evident for Football (PPMG 42.81%, AUG 27.27%).
Conclusion: Medical encounter data collected at both the PPMG and AUG demonstrated a higher percentage of lower limb musculoskeletal injuries in older compared to younger athletes participating in similar events. Also, older athletes sought attention for a higher percentage of muscle and tendon injuries compared to younger athletes.
Clinical implications: Injury prevention programs for older athletes should target the lower limb, and give particular attention to preventative strategies for muscle and tendon injuries. For planning purposes event medical program organisers should be aware of the likely differences in medical encounters between older and younger athletes.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

- ABSTRACT #** 065
- TITLE** Head and knee injuries cause the most missed work in US women playing Australian Rules Football
- AUTHORS** Arundale AJH^{1,2}, Putrino D¹
- AFFILIATIONS** ¹ Department of Rehabilitation, Icahn School of Medicine at Mount Sinai, New York, USA
² The Brooklyn Nets, Brooklyn, USA
- ABSTRACT** **Objective:** The purpose of this study was to examine the injury burden in women playing Australian Rules Football (AFL) in the United States.
Methods: All women registered to play AFL in the US were emailed a survey after the 2018 season. Questions asked the number and type of time-loss injuries experienced during the 2018 season, as well as mechanism, severity, and missed work. Athletes who had multiple injuries to the same body part reported on the most severe.
Results: 175 of 315 (55%) women responded (mean age 31.8+/-5.8). 109 athletes experienced 248 injuries (2.3 injuries/player). Injury type and severity information was available for 190 injuries (77%). Sprains (n=75, 30%) and strains (n=49, 20%) were the most common injury types. The hand/finger (n=67, 27%), knee (n=38, 15%), ankle (n=31, 12.5%), and head (n=24, 10%) were the most commonly injured body parts. A contact mechanism was responsible for 87 (35%) injuries, most frequently to the head (n=17) and knee (n=17). Foul play resulted in 21 (8%) injuries. Thirty-nine (16%) injuries resulted in athletes missing work, most frequently head (n=10) and knee (n=10) injuries. Moderate severity injuries (8-28 days absence from AFL) were the most common (n=58, 23%), followed by slight (<3 days, n=52, 21%), severe (>28 days, n=41, 17%), and minor (4-7 days, n=38, 15%). Knee injuries caused the largest number of severe injuries (n=15).
Conclusions: The results of this study mirror the injury findings of the professional women's AFL. Even though AFL is a contact sport, the number of contact injuries in this study were less than other women's sports, such as soccer. Similar to soccer, though knee injuries seem to be the most severe.
Clinical implications: Given the impact on work, head and knee injury prevention must be a high priority given the health implications and amateur status of US AFL athletes. This study could also indicate that investigation into the injury burden of other adult amateur sports may be beneficial.
- NOTES** Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 066

TITLE Landing kinetics in collegiate female athletes with and without a history of ACL injury

AUTHORS Chaaban C, Hearn D, Goerger B, Kong J, Padua D

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ABSTRACT **Objective:** To determine if female collegiate athletes who successfully return to sport following ACL injury (ACLI) differ from their previously uninjured teammates with regard to kinetics during a drop vertical jump (DVJ) task.

Methods: Collegiate female soccer and lacrosse players participated in this study. 18 athletes had at least 1 prior ACLI (age=20.6±1.3 yrs; height=169.0±6.0 cm; weight=65.7±6.1 kg), and 40 athletes had no prior ACLI (age=19.5±1.3 yrs; height=166.4±6.4 cm; weight=64.4±8.6 kg). Athletes completed 3 trials of a DVJ task. The involved limb was randomly assigned in those with no prior ACLI. Kinetics were collected via two inground force plates. Peak vertical ground reaction force (vGRF) of the involved limb, peak vGRF limb symmetry index (LSI), and time to peak vGRF of the involved limb were extracted and normalized to body weight (bw). Independent t-tests were calculated to compare each kinetic variable by ACLI history.

Results: Those with a prior ACLI had lower peak vGRF in their involved limb (1.92 ± 0.48 bw) than those without ACLI (2.24 ± 0.55 bw); $p=0.04$. They had less limb symmetry of their peak vGRF ($87.9 \pm 25.8\%$) than those without ($104.2 \pm 21.8\%$; $p=0.02$). They reached this peak later after ground contact (58.1 ± 33.7 ms) than those without (44.0 ± 19.3 ms; $p=.049$).

Conclusion: Females who play collegiate sports following ACLI have differences in their landing kinetics compared to their previously uninjured teammates. They have a lesser peak vGRF on their involved limb and take longer to reach this peak. These factors, combined with a greater asymmetry of the magnitude of this peak between limbs, suggest that they continue to offload and delay loading of their involved limb during double limb jumping tasks.

Clinical implications: Even athletes who successfully play collegiate sports following ACLI have kinetic differences relative to their uninjured peers. Further research should explore how these differences affect future injury risk and long-term joint health.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 067

TITLE Sensitivity of the MyotonPro to measure the changes in the viscoelastic properties of a trigger point on the infraspinatus in non-traumatic chronic shoulder pain after a dry needling intervention

AUTHORS Roch M, Morin M, Gaudreault N

AFFILIATIONS School of rehabilitation, Faculty of medicine and health sciences, University of Sherbrooke, Sherbrooke, Canada

ABSTRACT **Objective:** To investigate the sensitivity of the MyotonPro to detect changes in the viscoelastic properties of a trigger point (TP) in the infraspinatus muscle in participants with a non-traumatic chronic shoulder pain after a dry needling intervention.
Methods: Forty-eight individuals who presented non-traumatic chronic shoulder pain were recruited. The presence of a TP in the infraspinatus muscle of the painful side was confirmed by an experienced physiotherapist with a palpatory exam according to Travell and Simons criteria. The TP was marked and the viscoelastic properties including tone and stiffness were measured with the MyotonPro device by an evaluator. After the first set of measurements (T0), an experienced physiotherapist applied dry needling to the TP with an Optimed 40 x 0.30 mm single use acupuncture needle to obtain a twitch. The same set of measurements was repeated immediately after the dry needling (T1) and 30 minutes later (T2). Repeated measures ANOVA and post-hoc tests were used to assess changes in viscoelastic properties over time with a significant level set at 0.05.
Results: Significant decrease in stiffness and tone was found across time after the dry needling intervention. Post-hoc tests with Bonferroni corrections revealed significant differences in stiffness and tone between T0-T1 (Stiffness: T0 = 296.96±65.19 N/m; T1 = 277.25±62.14 N/m, $p \leq 0.001$, Tone: T0 = 15.99±2.63 Hz; T1 = 15.08±2.89Hz, $p=0.004$) and T0-T2 (Stiffness: T2 = 283.73±57.32 N/m; Tone: T2 = 15.68±2.42Hz, $p=0.013$).
Conclusions: Findings of this study reveal that the MyotonPro can detect changes in the measurements of stiffness and tone of a trigger point after a dry needling intervention.
Clinical implications: The effect of dry needling on stiffness and tone seem to be most important right after a dry needling intervention and the increases observed after 30 minutes may be attributed to an inflammation process occurring after the tissue is damaged by the needle.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 068

TITLE Perceptions about running footwear and assessment of an online educational module

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ABSTRACT **Objective.** The objectives of this study were to (1) assess the perceptions of runners, footwear retailers and healthcare practitioners (HCP) on the effects of running shoes on injuries; (2) evaluate the role of an evidence-based online educational module.

Methods. Using an online survey, we collected information on demographics and beliefs about injury risk and different shoe features (e.g. cushioning, drop) or selection strategies (e.g. based on foot arch). Agreement with survey items was assessed using continuous scales (0: not important/useful, 10: very important/useful). Subsequently, an optional educational module was presented after which beliefs were reassessed. We ran one-way ANOVA between subgroups and paired t-tests to analyze the effects of the module.

Results. A total of 1,425 participants completed the baseline survey, of which 781 completed the educational module. Overall, footwear was perceived as important in preventing injury (7.2/10, 95% CI 7.1, 7.3). HCP perceived footwear as less important (6.3/10, 95% CI 6.1, 6.6) than runners (7.6/10, 95% CI 7.5, 7.7) and retailers (7.9/10, 95% CI 7.3, 8.5) ($P < 0.001$); relevance of cushioning, drop and selection according to foot type were also lower in HCP than in other subgroups ($P < 0.001$). The educational module was deemed useful (8.3/10, 95% CI 8.2, 8.5) and 58.6% of respondents said it changed their perceptions. Perceived importance of footwear in preventing injuries decreased after the module (-1.0/10, 95% CI -0.9, -1.2; $P < 0.001$).

Conclusion. Running footwear is perceived as important in the prevention of running injuries; an evidence-based module can aid in educating individuals on the literature surrounding footwear allowing informed recommendations/choices.

Clinical implications. This online module can effectively be used to educate runners, retailers and HCP about the scientific research on running footwear and injuries. This could potentially translate into reduced injury rates among runners.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 069

TITLE SierraSil as an ergogenic aid to performance in athletes

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ABSTRACT **Objective:** SierraSil (SS) is a unique mineral complex and a Health Canada licensed Natural Health Product (NPN 80039305). This study examined whether SS could improve anaerobic power in a group of well-trained athletes. A secondary purpose was to examine the effect of SS on the severity of delayed onset muscle soreness (DOMS).
Methods: This was a double-blind, cross-over design with 10 male varsity football players (mean age = 22 years; height = 183.6cm; weight = 90.3kg). The athletes performed three Wingate cycle ergometer tests 5 minutes apart as a test of peak power, average power and fatigue index. DOMS were recorded on a 0-10 visual analogue scale (VAS) at 24, 28, and 72 hours post exercise. Prior to exercise and 5 minutes following the last Wingate test, blood was taken for analysis of selected cytokines. The athletes were randomly assigned to SS or placebo groups for three weeks and, following a three-week washout period, the experimental treatments were reversed.
Results: Following SS supplementation, the peak power increased by 33.8 W (a 3% increase) and mean power by 6.7 W (a 1% increase). In the placebo group the peak power decreased by 11.2 W (-2.6%) and the mean power decreased by 17.2 W (-1%). DOMS values on the VAS were higher in the placebo group at 24, 48, and 72 hours post-exercise (P= 3.2, 2.2, 1.3 vs. SS= 2.5, 1.6, 0.6). There were no statistically significant changes in the performance measures between the two groups however (p>0.05). There were no significant changes in the cytokine measures following supplementation with either SS or placebo.
Conclusion: All athletes completed the trial. SS was well tolerated and resulted in improvements in anaerobic power and in reducing the level of DOMS post-exercise. There were no adverse effects reported.
Clinical implications: SierraSil is safe to use in highly trained athletes and resulted in improvements in anaerobic power and in reducing the level of DOMS post-exercise in a 'sport significant' way.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 070

TITLE Long-term 3T MRI-defined morphological changes after acute Achilles tendon rupture

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ABSTRACT **Objective:** Long-term morphological changes after acute Achilles tendon rupture (AATR) are unknown. The purpose of the present study was to compare the appearance of the tendon and surrounding musculature in the injured and uninjured contralateral limbs of patients with AATR >10 years post-rupture.

Methods: Twenty-one patients (12 male) 15±1 years post-AATR (age: 57±7 years; BMI: 30±4 kg/m²) underwent bilateral 3T magnetic resonance imaging (MAGNETOM Prisma, Siemens). Imaging sequences included: sagittal and axial T1 and T2-weighted turbo spin echo (TSE); axial T1-weighted inversion recovery; and sagittal T2-weighted three-dimensional isotropic TSE. One trained reader (MK) and one experienced musculoskeletal radiologist (AS) measured the maximum antero-posterior tendon width and cross-sectional area (CSA) and calf musculature CSA using distance and area tools within the imaging software (AGFA Healthcare).

Results: Dependent t-tests indicated the injured tendon was significantly wider (mean difference [95% CI]: 6 mm [5, 7], p<0.001) and thicker (1 cm² [1, 2], p<0.001). Gastrocnemius medialis (4 cm² [3, 5], p<0.001), lateralis (3 cm² [2, 3], p<0.001), and soleus CSA (4 cm² [2, 6], p=0.001) were significantly smaller in the injured limb.

Conclusion: Substantial side-to-side differences in tendon diameter, thickness, and muscle bulk persist at over a decade past injury.

Clinical implications: Substantial morphological changes and side-to-side deficits suggest tissue healing and regeneration following AATR is an arduous process that current rehabilitation protocols do not fully ameliorate. Future work is needed to understand the association of structural measures with clinical and functional outcomes, and potential methods to lessen deficits.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

- ABSTRACT #** 071
- TITLE** The proprioception and postural stability characteristics of perceived instability subgroups in chronic ankle instability
- AUTHORS** Ruan B, Wang LJ, Li YN, Yang YY
- AFFILIATIONS** School of Sports Medicine and Physical Therapy, Beijing Sport University, Beijing, China
- ABSTRACT** **Objective:** The purpose of this original investigation was to determine if selected proprioception and postural stability are different among perceived instability subgroups of chronic ankle instability (CAI) and healthy control participants.
Methods: Fifty-five participants volunteered and were categorized into perceived ankle instability (PI) alone (n=11), PI in combination with recurrent ankle sprains (PI-RAS; n=11), PI in combination with mechanical ankle instability (PI-MI; n=11), PI in combination with mechanical ankle instability and recurrent ankle sprains (PI-MI-RAS; n=11) and controls (n=11). Participants completed assessments of proprioception and postural stability. The data between groups were statistically evaluated by one-way ANOVA.
Results: There were no significant differences in active closed chain proprioception and single-leg stance assessments between PI subgroups and healthy participants ($p>0.05$), or between the four subgroups of PI ($p>0.05$). There were significant differences in posteromedial and posterolateral direction of star excursion balance test between PI alone and healthy participants ($p<0.05$). There were great differences in posteromedial and posterolateral direction of Star Excursion Balance Test between PI alone and PI-RAS subgroups ($p<0.01$).
Conclusion: There were no difference between PI subgroups and healthy people in proprioception and static balance ability. Also, there were no differences between the subgroups of PI. Significant differences were only detected in dynamic balance test (posteromedial and posterolateral direction of Star Excursion Balance Test) between PI alone and PI-RAS subgroups.
Clinical implications: This study helps to find the balance characteristics of PI subgroups in CAI and to provide the clinical thinking and theoretical base for clinical treatment.
- NOTES** Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

ABSTRACT # 072

TITLE The effect of sleep on explosive strength gains in female collegiate soccer players during off-season training: a pilot study

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ABSTRACT **Objective:** In athletes, sleep quantity and quality are imperative to effective physiological and cognitive functioning. In addition, sleep quantity and quality may affect the outcome of an off-season resistance training program. This study aimed to investigate the effect of sleep quantity and quality on explosive strength in NCAA D1 female collegiate soccer players during an off-season training program.

Methods: Eleven female collegiate soccer players (19.8 ± 0.8 years) participated in an off-season resistance training program three days per week for five weeks. A jump mat and associated software was used to measure explosive strength (ES), defined as the maximum vertical jump height inches (in) in over three trials, prior to the start of the training program and at the end of a 5-week training program. Sleep quantity, in hours (h), was reported by each athlete at the initiation of the study and before the start of each resistance training session. Each athlete also reported sleep quality on a 5-point scale (1 = poor quality and 5 = great quality) at the same times as sleep quantity.

Results: No difference in ES was observed as a result of the 5-week resistance training program (initial = 17.8 ± 2.3 vs final = 18.3 ± 2.4). Initial average sleep quantity was 6.7 ± 0.6 while at study conclusion was 6.8 ± 0.9 . The median sleep quality at the start of the program was 3.2 ± 0.5 , and 3.8 ± 0.4 at study conclusion. A weak correlation between sleep quantity and ES ($r = 0.11$) was observed, while a moderate correlation between sleep quality and ES was noted ($r = -0.37$).

Conclusion: A weak correlation between sleep quantity and ES was observed, yet sleep quantity reported is more than one hour less than that recommended for college athletes. The moderate correlation between sleep quality and ES suggests improved sleep quality may benefit ES development.

Clinical implications: Practitioners should consider that sleep quality may mediate the development of ES during off-season resistance training.

NOTES Poster presentation. Friday Oct 4, 4:00-4:30pm. Saturday Oct 5, 2:15-2:45pm.

ABSTRACT # 073

TITLE Differences in muscle activities of the scapular muscles in open and closed kinetic chain exercises

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ABSTRACT **Objective:** To study the activation of the scapular muscles between healthy people and people with scapular dyskinesis (SD) in the open and close chain exercises (OKC & CKC), to explore the differences of these two exercises on the activation of scapular muscles, and to clarify the optimal strategy for shoulder injuries rehab.
Methods: 42 subjects were divided into SD group (n=22) and C group (healthy, n=20). The MVIC of target muscles were tested as well as 8 actions: CKC/OKC-flexion, CKC/OKC-extension, OKC/CKC-shoulder neutral external rotation, and OKC/CKC-shoulder 90° abduction external rotation. We calculated the IEMG% and input% of the target muscles.
Results: Between groups, for the CKC, the activation of SD group was more optimized, SA-IEMG%, LT-IEMG% and infraspinatus (IS)-input% were higher than C group in flexion. Intra-group: (1) In SD group UT-IEMG% and input% of CKC-flexion were significantly lower than that of OKC (P<0.05), while the IEMG% and input% of SA were higher (P<0.05). (2) The activation of MT, SA and especially LT in CKC-extension was higher than that in OKC (P<0.01). (3) Under the external rotation, the IEMG% of IS and post deltoid is largest at neutral-CKC, but IS-input% is the highest at 90° CKC.
Conclusions: (1) OKC/CKC exercises have no difference in healthy people, but CKC-flexion can promote coordinated contraction of stabilizing muscles in SD. (2) The CKC-extension is conducive to the contraction of MT, LT and SA, especially the mobilization of LT. (3) CKC-shoulder 90° abduction external rotation exercise can safely and effectively activate IS, which is a good exercise for shoulder external rotation, especially for early rehabilitation of rotator cuff injuries involving IS.
Clinical implications: CKC exercise is beneficial to balance the scapular muscles. It is suggested that CKC training can be safely applied to shoulder injury patients' early rehabilitation.

NOTES Poster presentation. Friday Oct 4, 10:45-11:15am. Saturday Oct 5, 9:00-9:30am.

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