2019 CASEM Podium Presentations

Stability of Preseason Values of the Sport Concussion Assessment Tool 5 (SCAT5) in University Level Collision and Combative Sport Athletes

Ben Cameron, MD,*,† Tin Jasinovic, MD,† Victor Lun, MD,* Cody van Rassel, MKin,‡ Bonnie Sutter, BPE, BEd, CAT(C) DOMP,* Preston Wiley, MD,* and Kathryn Schneider, BHScPT, PhD*,‡,§,¶

*Affiliations: *University of Calgary Sport Medicine Center, Calgary, AB, Canada; †Department of Family Medicine, Cumming School of Medicine, University of Calgary, Calgary, AB, Canada; ‡Sport Injury Prevention Research Centre, University of Calgary, Calgary, AB, Canada; §Alberta Children's Hospital Research Institute, Calgary, AB, Canada; and ¶Hotchkiss Brain Institute, Cummings School of Medicine, University of Calgary, Calgary, AB, Canada.*

Objective: The objective of this study is to determine if there is a difference in Sport Concussion Assessment Tool 5 (SCAT5) scores over 1 year in university level collision and combative sport athletes.

Study Design: Case series.

Subjects: University of Calgary men's ice hockey, women's rugby, men's wrestling and women's wrestling athletes.

Intervention: Subjects completed preseason SCAT5 questionnaires in August 2017 and 2018.

Outcome Measures: The SCAT5 subscale scores were the primary outcomes of interest. Summary statistics including mean/median (SD/interquartile range) as appropriate were calculated for each of the following measures: number of symptoms reported on the Post Concussion Symptom Score (PCSS), immediate (/30) and delayed (/10) ten-word recall, percentage of athletes able to recite months of the year in reverse order (yes/no); digits correctly recited backwards (range of 3-6); neurological screen score (/5); total number of errors on the Balance Examination Score (BES) (/30). Dependent t-tests or Wilcoxon signed rank tests were used to evaluate the agreement between scores over 1 year.

Results: A total of 41 varsity athletes (aged 18-26 years; median age 20 years) completed the SCAT5 at the start of the 2017 and 2018 seasons and were included in this analysis (17 women's rugby, 7 men's wrestling and 5 women's wrestling, 12 men's hockey). A previous history of concussion was reported by 26 athletes. There was no difference in the total number of symptoms reported ($z = 0.82$, $P = 0.41$), the symptom severity score ($z = -0.16$, $P = 0.88$), rating of percentage of normal ($z = 1.48$, $P = 0.14$), immediate 10 word recall ($z = -0.095$, $P = 0.92$), concentration ($z = -0.81$, $P = 0.42$) or the 10 word delayed recall ($z = -0.74$, $P = 0.46$) between the 2017 and 2018 scores. However, there was a significant difference in the number of errors on the Balance Examination Score with a higher number of errors in 2018 {median = 5 [Interquartile range (IQR) = 5-8]} compared to 2017 [median = 2 (IQR = 0-4)] ($z = -2.62$, $P = 0.0089$).

Conclusions: The majority of SCAT5 subscale scores, with the exception of the Balance Examination Score, did not differ when tested after 1 year in university level collision and combative sport athletes.

Dance Exposure and Musculoskeletal Injuries in Elite Adolescent Ballet Dancers

Valeriya G. Volkova, BSc* and Sarah J. Kenny, PhD*,†,‡

*Affiliations: *Sport Injury Prevention Research Centre, Faculty of Kinesiology, University of Calgary, Calgary, AB, Canada; †Alberta Children's Hospital Research Institute, University of Calgary, Calgary, AB, Canada; and ‡O'Brien Institute for Public Health, University of Calgary, Calgary, AB, Canada.*

Objective: To describe dance exposure and musculoskeletal injuries in elite adolescent ballet dancers across one training season.

Study Design: Cohort.

Subjects: Elite adolescent dancers registered in full-time pre-professional ballet training participated.

Observation Technique: Throughout one 40-week training season, dancers completed a weekly online dance exposure questionnaire and modified Oslo Sports Trauma Research Centre questionnaire on health problems using 3 injury definitions: (1) time loss (unable to complete ≥1 class/rehearsal/performance for ≥1 day(s) beyond onset), (2) medical attention, and (3) physical complaint. On-site physiotherapists completed individual injury report forms to capture dance-related medical attention and time-loss injuries.

Outcome Measures: Descriptive statistics [proportions, means, 95% confidence intervals (95% CI)] of dance exposure (hours) and each injury definition were estimated. Weekly injury prevalence [proportion of dancers injured/week (95% CI)], and severity (total days lost) were examined for each definition and registration method.

Results: One hundred nine dancers participated [95 female, 14 male; median age 15 years (range 10-20)]. Mean weekly questionnaire response was 93% (range, 73%-100%). Mean individual weekly dance exposure was 19.1 hours (95% CI, 17.8-20.5). Based on 866 self-reported physical complaints, 69% (601/866) resulted in medical attention, and 32% (279/866) were first reports. Mean weekly prevalence of self-reported physical complaints was 21% (95% CI, 19.7%-23.0%), while the mean weekly prevalence of self-reported

medical attention injuries was 15% (95% CI, 13.3-16.1 injuries). Of the 121 individual injuries (representing 65 dancers) reported by on-site physiotherapists, 39% (47/121) resulted in time loss (range, 1-74 days), 48% (58/121) were traumatic, and 52% (63/121) were overuse. Overall, weekly self-reported physical complaints and medical attention injuries mirrored the increases and decreases in weekly dance exposure hours across the 40 weeks of training.

Conclusions: Elite adolescent dancers report long hours of training in a typical week with variation across one training season. Regardless of definition and registration method, dance-related injury estimates are high in this population. Overall, as dance exposure hours increase, so do self-reported injury estimates. Further research is needed to explore associations between intensity of dance exposure (ie, training load) and injuries in this high-risk group of elite adolescent ballet dancers.

The Effect of Glucocorticoids in Sport—A Systematic Review and Meta-Analyses

Kevin Jia Qi Chen, BHSc (cand),* Dion Diep, MD (cand),†
and Kien V. Trinh, MD, PhD*

*Affiliations: *Faculty of Health Sciences, McMaster University, Hamilton, ON, Canada; and †Faculty of Medicine, University of Toronto, Toronto, ON, Canada.*

Objective: To investigate the effect of glucocorticoids on athletic performance.

Data Sources: Three databases (MEDLINE, EMBASE, and SPORTDiscus) were searched with the aid of a librarian from their beginning to November 2018. The eligibility criteria included any published study that examined between-group differences between glucocorticoids and placebo regarding their potential impact on athletic performance. Two independent reviewers conducted abstract and full-text screening of eligible studies and extracted data using standardized forms. Included studies were assessed for risk of bias and quality of evidence.

Main Results: There were 9 eligible studies involving 100 patients included in this review. The most commonly reported outcome, time to exhaustion (TTE), was reported by 7 of the 9 studies. Qualitative analysis demonstrated that 4 studies suggested TTE was significantly longer in the glucocorticoids group compared to the placebo group. However, 3 studies did not find any significant between-group differences. For the meta-analysis, studies were stratified according to the following categories determined a priori: treatment duration and drug used. Meta-analysis of 5 pooled studies (n = 49) showed a standardized mean difference (SMD) in TTE of 1.37 [0.51-2.22] in favor of 1-week administration of glucocorticoids. Furthermore, meta-analysis of 2 pooled studies (n = 18) showed SMD of 1.64 [0.86-2.42] in favor of 1-week administration of prednisolone specifically. According to GRADE guidelines, there was very-low quality evidence and moderate-quality evidence that TTE was significantly

improved by 1-week glucocorticoids administration and 1-week prednisolone administration, respectively.

Conclusions: There was very-low quality evidence that 1-week of glucocorticoids and moderate quality evidence that 1-week of prednisolone may be more beneficial than placebo in enhancing athletic performance. However, there was a lack of high-quality evidence due to limitations, imprecision, and inconsistency. In particular, the small number of studies and patients necessitates that further research must be done before these results may be used to change or justify current and future doping policies.

The Effect of Testosterone on Athletic Performance—A Systematic Review and Meta-Analysis

Dion Diep, MD (cand),* Kevin Jia Qi Chen, BHSc (cand),†
and Kien V. Trinh, MD, PhD†

*Affiliations: *Faculty of Medicine, University of Toronto, Toronto, ON, Canada; and †Faculty of Health Sciences, McMaster University, Hamilton, ON, Canada.*

Objective: To investigate the effect of testosterone on athletic performance.

Data Sources: A search strategy was designed with the aid of a health sciences librarian for MEDLINE, EMBASE, and SPORTDiscus to identify all studies from inception to January 2019. Studies were included if they examined between-group differences between testosterone and placebo regarding their potential impact on body composition, aerobic, or anaerobic parameters. Two independent reviewers screened for eligible studies, extracted data using standardized criteria, and assessed studies for risk of bias independently and in duplicate. Outcomes were further stratified a priori based on treatment duration and type of testosterone. Subsequently, quality of evidence was assessed based on GRADE guidelines.

Main Results: Approximately all studies recruited male participants and about half of the studies administered a testosterone ester. The most commonly reported outcomes were body mass, fat-free mass, body fat percentage, $\dot{V}O_2max$, and bench press. Qualitative analysis revealed that 2 studies (n = 41) demonstrated significantly increased body mass in the testosterone ester groups compared to the placebo groups after 10 to 12 weeks of treatment and exercise. However, 4 studies (n = 90) did not find any significant differences in body mass between other non-testosterone esters and placebo given similar treatment duration and exercise conditions. Additionally, no significant between-group differences were found for changes in fat-free mass, body fat percentage, and $\dot{V}O_2max$ based on 7 studies (n = 153), 5 studies (n = 80), 2 studies (n = 60), respectively, after 4 to 12 weeks of treatment. Meta-analysis of 3 pooled studies (n = 51) revealed no significant difference between the testosterone ester groups and placebo groups for the 1-repetition-max bench press exercise [(SMD 0.396 (95% CI, 0.19-0.93, $P = 0.196$)] after 10 to 12 weeks of treatment and exercise. There was low-quality evidence for all outcomes.

Conclusions: The retrieved studies suggest that testosterone does not have a significant effect on some commonly reported body composition, aerobic, and anaerobic parameters after up

to 12 weeks of treatment compared to placebo. However, the lack of high-quality evidence due to limitations and imprecision warrants extreme caution when interpreting these findings.

Towards Improving the Identification of Anterior Cruciate Ligament Tears in Primary Care

Jackie L Whittaker PT, PhD,*,† Imran Hassan,‡ Bo Pan,‡ Terry Defreitas, MD,†,§ Catherine Hui, MD,†,¶ and David Otto, MD†,¶

*Affiliations: *Department of Physical Therapy, Faculty of Rehabilitation Medicine, University of Alberta, Edmonton, Canada; †Glen Sather Sports Medicine Clinic, University of Alberta, Edmonton, Canada; ‡EPICORE Centre & Alberta SPOR Support Unit, Consultation & Research Services, University of Alberta, Edmonton, Canada; §Department of Family Medicine, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Canada; and ¶Department of Surgery, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Canada.*

Objective: To develop and assess statistical models to accurately identify Anterior Cruciate Ligament (ACL) full-thickness tears based upon a combination of patient-reported and/or clinician-generated variables.

Study Design: Retrospective Cohort Study.

Subjects: Electronic Medical Records (EMRs) of all patients aged 15 to 45 years, with ICD-9 codes corresponding to intra-articular knee injuries and a confirmed (ACL^+) or denied (ACL^-) ACL-tear seen at a University-based sports medicine clinic between January 2014 and July 2016 were eligible for inclusion.

Observation Technique: Data were manually extracted from individual EMRs by research personnel using a customized data extraction instrument, and audited for accuracy by one team member.

Outcome Measures: Extracted data included demographics, relevant diagnostic indicators (injury details, clinical and imaging exam findings), and ACL status (ACL^+ or ACL^-) by one-of-three clinical criterion standards (orthopaedic surgeon assessment, MRI and/or surgery). Missing data were identified and descriptive statistics [mean or proportion (95% CI) or median (range)] calculated for all outcomes by ACL status and criterion standard. Univariable logistic regression and clinician surveys (n = 17) were used to select items for inclusion into multivariable logistic regression models that assessed the odds (95% CI) of an ACL-tear based on patient-reported variables alone, or in combination with clinician-generated variables. Accuracy, sensitivity and specificity (95% CI) were used to assess model performance.

Results: Of 1512 potentially relevant EMRs 725 were included. Participant median age was 26 years (range, 15-45), 48% were female and 60% had an ACL-tear. A combination of patient-reported (age, sport-related injury, immediate swelling, family history of ACL tear) and clinician-generated variables (Lachman test result) was superior for ACL-tear diagnosis [accuracy; 95% (95% CI 90-98), sensitivity; 0.97 (0.88-0.98), specificity; 0.95 (0.82-0.99)] compared to patient-reported variables alone [accuracy; 84% (77-89), sensitivity; 0.60 (0.44-0.74), specificity; 0.95 (0.89-0.98)].

Conclusions: Despite demonstrating that an ACL-tear diagnosis is best supported by a combination of patient-reported and clinician-generated variables, these finding suggest that 95% of individuals without an ACL tear can be accurately identified by considering age, injury setting, immediate swelling and family history of ACL-tear. This information provides preliminary evidence to support the development of an online triage tool using patient-reported variables alone for ACL-tear diagnosis in primary care settings.

Post-Running Cartilage Recovery in Runners With and Without Tibiofemoral Osteoarthritis: A Pilot Study

Jean-Francois Esculier, PT, PhD,* Michael Jarrett, MSc,* Natasha M. Krowchuk, BSc,* Alexander Rauscher, PhD,* Vanessa Wiggermann, MSc,* Jack E. Taunton, MD,* David Wilson, PhD,* Anthony Gatti,† and Michael A. Hunt, PT, PhD*

*Affiliations: *University of British Columbia, Vancouver, BC, Canada; and †McMaster University, Hamilton, ON, Canada.*

Objective: This pilot study sought to compare the immediate effects of a 30-minute run on tibiofemoral cartilage T2 and T1ρ relaxation times in female runners with and without tibiofemoral osteoarthritis (TFOA).

Study Design: Case-control, experimental laboratory and magnetic resonance imaging (MRI) study.

Subjects: Ten female runners with symptomatic TFOA (mean age: 52.6 ± 7.6 years) and 10 without TFOA (mean age: 52.5 ± 7.8 years) participated. Participants were included if they were 40 years and older and running at least 10 km per week for at least 2 years.

Intervention: All participants underwent knee MRI at 3T. They then ran on a treadmill for 30 minutes at a self-selected speed before undergoing repeated post-run MRIs.

Outcome Measures: Tibiofemoral cartilage T2 and T1ρ relaxation times were measured prior to, and immediately after, the bout of running. Post-run imaging data were collected up until 90 minutes after the end of the run. Between-group differences across scanning times were compared using repeated-measures analyses of covariance (ANCOVA). Alpha level was set at 0.05 and Bonferroni adjustment for multiple comparisons.

Results: Overall, no Group × Time interactions were found for T2 ($P \geq 0.076$) or T1ρ ($P \geq 0.288$) relaxation times. No changes in T2 or T1ρ were evident immediately after running in either group. However, runners with TFOA showed increased T2 values compared with pre-running in the medial and lateral femur 55 minutes after the run (+5.4 and 5.5%, $P < 0.022$) and in all 4 tibiofemoral compartments 90 minutes after running (range, +6.9 to 11.1%; $P < 0.01$). A significant Group effect was found for T1ρ in the medial femur, with greater values in those with TFOA compared with controls.

Conclusions: While Group × Time interactions in T2 and T1ρ relaxation times remained statistically insignificant, the

observed significant increases in T2 in runners with TFOA may suggest slower and continuing changes in the cartilage and thus a need for longer recovery after running. Future research should investigate the effects of repeated exposure to running on cartilage in that population.

Impacts of an Intervention to Reduce Sedentary Behaviour on Measures of Obesity in Primary School Children: A Cluster Controlled Study

Mike Loosemore, MBBS, Kush Joshi, MBBS, Florence Newton, MBBS, Catherine Hornby, MBBS, George Antoniades, MBBS, and Hugh Montgomery, MBBS, PhD

Affiliation: University College London, London, United Kingdom.

Background: Sedentary behaviour in children is an independent risk factor for poor health. *Active Movement* is a multicomponent school-based intervention intended to reduce sedentary behaviour and to integrate low level activity into the normal daily school routine. We sought to assess its impact on Waist to Height Ratio (WTHR, a measure of obesity), in primary school children from a low socioeconomic area in the UK.

Methods: A cluster-controlled study was performed. Participants were recruited (n = 214) from 3 year groups (age 5-6 years), 9 to 10 years and 10 to 11 years; years 1, 5 and 6 respectively) in each of 2 schools. In the intervention school, *Active Movement* was introduced (n = 140). The other school acted as a control (n = 74). Participants were studied at both sites over one academic year (September 2016 and July 2017). The primary outcome measure was WTHR, the secondary outcome being behaviour change (physical activity) measured by self-reported questionnaire.

Results: Overall, WTHR fell significantly in the intervention school compared to the control (9.1% vs 3.2% decrease $P < 0.0001$) and the effect was consistent across all year groups ($P = 0.006$, $P < 0.001$ and $P < 0.001$ for years 1, 5 and 6 respectively). Self-reported physical activity increased in the intervention school (95% CI) = 0.62 (0.36-0.88) $P < 0.0001$) but not in the control school (95% CI) = 0.17 (−0.15 to 0.49), $P = 0.28$).

Conclusions: The introduction of *Active Movement*—a simple, cheap behavioural intervention—appears to improve physical activity levels and reduce obesity in schoolchildren in a deprived area of London. Further studies are required to confirm these findings and, if successful, to improve the intervention and its impacts.

Dizziness Symptom Cluster as a Predictor of Recovery in Acute Sport-Related Concussion

SuFei Yue, MD, Michael Hutchison, PhD, Doug Richards, MD, and David Lawrence, MD

Affiliation: David L. MacIntosh Sport Medicine Clinic, Faculty of Kinesiology & Physical Education, University of Toronto.

Objective: To determine whether the severity of dizziness symptoms in acute concussion was associated with time to full return to (1) sport, and/or to (2) school or work.

Study Design: Retrospective survival analyses using multivariate Cox regression models.

Subjects: Two hundred thirty-six subjects (96 female and 140 male) diagnosed with acute sport-related concussion (presenting 14 days or less following injury).

Observation Technique: Our predictor variable of interest was the dizziness symptom cluster. This was a composite score out of 18, derived from the summation of individual scores for "dizziness," "nausea or vomiting," and "balance problems," from the symptom checklist on the Sport Concussion Assessment Tool (SCAT 5). Multivariate Cox regression models were used to examine the association between the (1) dizziness symptom cluster, (2) residual symptom score (total symptom severity minus dizziness symptom cluster), and (3) the total symptom severity score on time (days from injury) to physician assessed clearance to return to (1) sport and (2) school or work. Likelihood ratio (LR) tests were used to examine nested models.

Outcome Measures: Time (days from injury) to full return to (1) sport and (2) school or work. Clearance for full return was determined clinically, by sports physicians, using a combination of symptom state, current and premorbid baseline function, and objective assessments.

Results: Median dizziness symptom cluster score was 2 (IQR 0-5). Median total symptom severity score was 26 (IQR 13-45). Median time to return to sport was 28 days (IQR 16-43 days). Median time to return to school or work was 23 days (IQR 15-36 days). Multivariate Cox regression models identified that dizziness symptom cluster was not independently associated with time to return to (1) sport or to (2) school or work after adjusting for covariates. The full Cox regression models including the total symptom severity score did not significantly differ from the nested model including the residual symptom severity score (LR χ^2, 2.33; $P = 0.12$; and LR χ^2, 1.87; $P = 0.17$).

Conclusions: Dizziness symptom cluster did not prognosticate recovery from acute sport-related concussion. Using the residual symptoms was as equally valid as total symptoms in predicting concussion outcomes.

The Stability Study. An RCT of Anterior Cruciate Ligament Reconstruction With or Without a Lateral Extra-Articular Tenodesis—Assessment of Failure at 2 Years

A. Getgood,*,† D. Bryant,*,‡ R. Litchfield,*,† R. McCormack,§,¶ D. Boyer,§ M. Heard,‖,** and P. MacDonald,††,‡‡ STABILITY Study Group

*Affiliations: *Fowler Kennedy Sport Medicine Clinic; †Department of Surgery, Schulich School of Medicine and Dentistry, Western University; ‡School of Physical Therapy, Western University; §Department of Orthopedics, University of British Columbia; ¶New West Orthopaedic & Sports Medicine Centre; ‖Deparment of Surgery, University of Calgary; **Banff Sport Medicine; ††Department of Surgery, University of Manitoba; and ‡‡Pan Am Clinic.*

Objective: We hypothesized that anterolateral complex reconstruction by Lateral Extra-articular Tenodesis (LET) in combination with ACL Reconstruction (ACLR) would reduce the risk of persistent rotatory laxity in high-risk young individuals.

Design: A multicenter randomized clinical trial.

Intervention: To compare standard hamstring tendon ACLR with or without an LET, utilizing a strip of iliotibial band (Modified Lemaire). Patients aged 25 years or less with an ACL deficient knee were included. They also had to have 2 of the following 3 criteria: (1) Grade 2 pivot shift or greater; (2) High risk/pivoting sports; (3) Generalized ligamentous laxity.

Outcome Measures: The primary outcome was graft failure defined as either the need for revision ACLR or symptomatic instability associated with a positive pivot shift. Secondary outcome measures included the P4 pain scale, KOOS, IKDC. Patients were followed with visits at 3, 6, 12 and 24 months postoperatively. A sample size of 300 per group was calculated based on a relative reduction in graft failure by 40%, with type 1 error of 5%, 80% power and 15% loss to follow-up rate.

Results: We randomized 624 patients, 293 male, with a mean age of 18.9 (range, 14-25). Four hundred thirty-six (87.9%) patients presented with high-grade rotatory laxity and 215 (42.1%) had generalized ligamentous laxity (Beighton Score >4). Five hundred twenty-three patients are at least 2 years postoperative with 29 lost to follow-up (5%). In the ACLR group 104/252 (41%) suffered the primary outcome compared to 61/252 (25%) of the ACLR + LET patients (RR = 0.61, 95% CI 0.47-0.79), $P < 0.0001$. Thirty-nine patients suffered graft rupture, 28/252 (11%) in the ACLR group compared to 11/242 (4.5%) in the ACL + LET group (RR = 0.41, 95% CI 0.21-0.80, $P < 0.001$). At 3 months postoperative, patients in the ACLR group had less pain ($P = 0.004$); at 3 and 6 months all KOOS subdomains and the IKDC favored the ACLR alone group ($P = 0.03$). At 12 and 24 months, no important between-group differences were observed in any patient reported outcome.

Conclusions: The addition of LET to a hamstring autograft ACLR in young active patients significantly reduces graft failure and persistent anterolateral rotatory laxity at 2 years post operatively.

Functional Outcomes and Quality of Life for ACL Reconstruction Patients With Meniscal Injury: Results From a 1814 Patient Cohort With 2-year Follow-up

Jessica L. Page MD,*,† Sarah Kerslake, MSc, BPhty,* S. Mark Heard MD,*,† Greg M. L. Buchko, MD, Laurie A. Hiemstra, MD, PhD,*,† and Michaela Kopka, MD*

*Affiliations: *Banff Sport Medicine, Banff, AB, Canada; and †Department of Surgery, University of Calgary, Calgary, Canada.*

Objective: To examine the functional outcomes and quality of life scores through 2 years in patients with or without concomitant meniscal surgery at the time of anterior cruciate ligament reconstruction (ACL-R).

Study Design: Case-series.

Subjects: One thousand eight hundred fourteen skeletally-mature patients with isolated primary ACL-R performed between January 2010 and December 2015.

Intervention/Observation Technique: All subjects underwent ACL-R with the addition of meniscal debridement and/or meniscal repair as required for meniscal pathology detected during diagnostic arthroscopy.

Outcome Measures: Functional testing of operative to non-operative limb performance was completed at 1- and 2-years post-operative. ACL-Quality-of-Life questionnaires (ACL-QoL) were completed pre-operatively and at 1- and 2-years post-operatively. Descriptive statistics were completed for patient demographics and intra-operative pathology. Unpaired t-tests using 95% confidence intervals were conducted to compare groups.

Results: The patient cohort was 45% female, with a mean age of 31 years (SD 11, range 14-66). Meniscal injury was detected in 1229/1814 knees (67.8%); 729 debridements and 538 repairs were performed. Pre-operative ACL-QoL scores were not significantly different between the groups.

At 2-years post-operative, 1269/1814 patients (69.9%) completed the ACL-QoL and 1225/1814 (67.5%) completed functional testing. ACL-QoL scores were statistically significantly higher for patients without meniscal injury (1-year: 73.0 vs 70.2; $P < 0.05$; CI, 0.51-5.1; 2-years: 79.2 vs 76.1; $P < 0.05$; CI, 0.79-5.4). ACL-QoL scores were also higher for isolated meniscal debridement compared to isolated meniscal repair patients (1-year: 71.4 vs 68.0; $P < 0.05$; CI, 0.4-6.4; 2-years: 78.3 vs 74.0; $P < 0.05$; CI, 1.3-7.3).

Patients with no meniscal injury demonstrated superior limb symmetry performance on triple-hop for distance compared to patients with meniscal pathology (98.4% vs 97.1%; $P < 0.05$; CI, 0.1%-2.5%). No other functional testing parameters demonstrated statistically significant differences between the groups.

Conclusions: Post-operative functional outcomes were not significantly different between patients undergoing meniscal repair versus debridement concomitant with ACL-R. ACL-QoL scores were statistically significantly higher post-operatively for patients with no meniscal pathology. Meniscal debridement patients demonstrated statistically significantly higher ACL-QoL scores compared with meniscal repair. Extended follow-up will determine the clinical significance of the differences in ACL-QoL scores as well as whether these differences are sustained over time.

Abstracts

2019 CASEM Injury Prevention Podium Presentations

Primary Prevention of Sport-Related Concussion in Youth Ice Hockey: A Pilot Randomized Controlled Trial

K. J. Schneider, PT, PhD,*,†,‡,§,¶ P. Eliason, MSc,*,†,‡ C. van Rassel, MKin,* C. Hilson,* S. Sick, BSc, CAT(C),*,§ L. Miutz, MS,* and C. A. Emery PT, PhD*,†,‡

Affiliations: *Sport Injury Prevention Research Centre, Faculty of Kinesiology, University of Calgary, Calgary, AB, Canada; †Alberta Children's Hospital Research Institute, University of Calgary, Calgary, AB, Canada; ‡Hotchkiss Brain Institute, University of Calgary, Calgary, AB, Canada; §Acute Sport Concussion Clinic, Sport Medicine Centre, Faculty of Kinesiology, University of Calgary, Calgary, AB, Canada; and ¶Evidence Sport and Spinal Therapy, Calgary, AB, Canada.

Objective: (1) To evaluate the feasibility of a concussion prevention training program in youth ice hockey players; and (2) evaluate the efficacy of a concussion prevention program in decreasing the risk of concussion.

Study Design: Pilot randomized controlled trial (RCT).

Subjects: Youth ice hockey players (ages 13-17) from Calgary, Alberta.

Intervention: A study physiotherapist visited teams weekly for six weeks and both teams received standard concussion education and identification. Players on control teams completed their typical warm-up and practice, and were observed by the study physiotherapist. Players on intervention teams completed a progressive training program (10-20 minutes per session) including neuromuscular and sensori-motor training, balance, adaptation, cervical spine strength and dividing attention, both on-and off-ice. A series of exploratory measures including symptoms, vestibulo-ocular reflex, dynamic balance, divided attention, cervical spine, oculomotor and Hockey Canada Skills Testing were completed before and after the intervention.

Outcome Measures: Recruitment rates, completion rates, retention rates, time to complete and safety were used to evaluate feasibility. Diagnosis of sport-related concussion was defined as per the fifth Consensus Statement on Concussion in Sport.

Results: A total of 118 players [83 males; 35 females; median age: 14 (range, 13-18 years)] from 8 teams consented to participate in this study. All control teams and 3/4 of the intervention teams completed all 6 sessions over a median of 85 days (range, 42-102 days). Timing of training sessions (eg, too close to finishing school) and lack of space to complete the intervention or control resulted in a longer duration of the protocol. No adverse events were reported. There were 6 concussions in the intervention group (n = 65) and 4 in the control group (n = 53). Exploratory univariate Poisson regression analysis adjusted for cluster by team revealed no difference in concussion risk between groups [Incidence proportion (IP) = 0.99 (95% CI, 0.28-3.48)].

Conclusions: The implementation of a neuromuscular and sensorimotor training program with youth ice hockey teams appears safe and feasible. Future evaluation in a larger sample powered to understand the effects of intrinsic training strategies on the risk of concussion in youth ice hockey players, including consideration of sex and age group, is warranted.

A School-Based Neuromuscular Training Warm-up Program Is Effective in Preventing All Injuries: The Isprint Cluster-Randomized Controlled Trial

Carolyn Emery,*,†,‡ Carla van den Berg,* Sarah A. Richmond,*,§ Luz Palacios-Derflingher,*,† Alberto Nettel-Aguirre,*,†,‡ Megan McKinlay,¶ Patricia Doyle-Baker,* and Brent Hagel*,†,‡

Affiliations: *Sport Injury Prevention Research Centre, Faculty of Kinesiology, University of Calgary, Calgary, AB, Canada; †Department of Community Health Sciences, Cumming School of Medicine, University of Calgary; ‡Department of Pediatrics, Cumming School of Medicine, University of Calgary; §Public Health Ontario, Toronto, Ontario, Canada; and ¶Ever Active Schools, Calgary, Alberta, Canada.

Objective: To evaluate the effect of iSPRINT, a neuromuscular training (NMT) warm-up program implemented in physical education (PE) classes, on preventing sport and recreational (S&R) injuries in junior high school students.

Study Design: Cluster-randomized controlled trial.

Subjects: 1065 grade 7 to 9 students (53.7% female) from 12 junior high schools in Calgary and surrounding area between 2014 and 2017.

Intervention: iSPRINT ("Implementing a School Prevention program to Reduce Injuries through Neuromuscular Training") is a NMT warm-up including aerobic, agility, strength, and balance exercises. Teachers in intervention schools (n = 6)

implemented iSPRINT at the beginning of PE classes over a 12-week period; control schools (n = 6) used a standard-of-practice warm-up including aerobic exercises and static and dynamic stretching. All teachers participated in a pre-program workshop; only intervention schools participated in NMT components, receiving training resources including a NMT video and posters.

Outcome Measures: Included injuries were those sustained during a sport or recreational (S&R) activity that resulted in the inability to complete a session, time loss and/or medical attention. Injuries were assessed weekly and recorded by a Certified Athletic Therapist who was blinded from study group allocation. Incidence rate ratios (IRR) were estimated based on multivariable Poisson regression analyses (adjusting for sex, previous injury and clustering by class, offset by S&R participation hours) for all injuries, lower extremity injuries and medically-treated injuries.

Results: Students in the iSPRINT intervention schools demonstrated a 38% lower rate of all injuries [adjusted IRR (aIRR) = 0.62; 95% CI, 0.39-0.98], a 62% lower rate of lower extremity injuries (aIRR = 0.38; 95% CI, 0.22-0.66), and a 63% lower rate of medically-treated injuries (aIRR = 0.37; 95% CI, 0.20-0.67) compared with students in the control schools. The incidence rate of all injuries was significantly higher in females compared to males (1.58, 95% CI, 1.12-2.22) and in participants with a previous injury compared to no previous injury (IRR = 2.14; 95% CI, 1.40-3.24).

Conclusions: The iSPRINT program was effective in preventing all injuries, lower extremity injuries, and medically-treated injuries in junior high school students. Teachers should include NMT warm-ups in their PE programming for injury prevention and to support continued physical activity participation.