STUDENT GRANT RECIPIENTS

**2020-2021**

**Validity of Sweat Rate Estimates Using Various Durations of Exercise**

Courtney Zickmund, AT, ATC: Central Michigan University

*Research In progress*

**The Quality of Cardiopulmonary Resuscitation Skills in Athletic Trainers**

Jenna Moreno: Adrian College

*Research In progress*

**2019-2020**

**CWI Cooling Rates Using a Secondary School Water Bath Preparation Protocol**

Ethan Launstein: Central Michigan University

*Research In progress*

**The Effects of Blood Flow Restriction on Muscle Activation during Y-Balance Exercises in Individuals with Chronic Ankle Instability**

Michael Burkhardt: Adrian College

**Context:** Dynamic balance exercises have been recommended and utilized as therapeutic exercises to improve ankle function in individuals with chronic ankle instability (CAI). Blood flow restriction (BFR) has been used to increase neuromuscular activity in patients with CAI during resistance exercises but have yet to been studied during more functional exercises. The purpose of this study was to determine whether BFR enhances muscle activation during Y-balance exercises in individuals with CAI. **Methods:** A convenience sample of 25 young-adults with a history of CAI participated (15 males, 10 females, 20.3±1.5 years, 4.2±2.3 ankle sprains). We used a cross-over design in a laboratory setting. Participants completed two study visits. At each study visit participants performed two trials of Y-balance exercises with one-of-two conditions, BFR or control (no BFR). Conditions order was randomized between visits. For the Y-balance exercise trials, participants balanced on their CAI ankle while cycling through reaches with their contralateral limb in the anterior, posteromedial, and posterolateral directions. Each reach was performed at 80% of participants maximum reach distance, which was established on their first visit. Each trial included four sets with repetitions of 30-15-15-15 reaches. Each set was performed at a 2:1 second reach:relax ratio using electronic metronome. For the BFR condition, a pneumatic cuff was placed around the proximal thigh and inflated to 80% of the participant’s arterial occlusion pressure. For the control condition, no cuff was worn. Muscle activation of the tibialis anterior, fibularis longus, soleus, and vastus lateralis was collected through surface electromyography (EMG) and normalized by maximum voluntary isometric contraction EMG (%MVIC). Average muscle activation across all four sets was calculated for each muscle and trial. We compared the effects of conditions and trials on muscle activation using separate 2 x 2 repeated-measures ANOVAs and Cohen’s d effect sizes [95% confidence intervals]. Results below describe the conditions main-effects with effect sizes (ES). **Results:** We observed significantly greater vastus lateralis (P<.001, BFR=38.51±16.7%, Control=27.2±8.9%, ES=0.85 [0.44, 1.25]) and soleus (P=.03, BFR=36.1±16.1%, Control=31.5±12.8%, ES=0.32 [-0.08, 0.71]) activation during the Y-balance exercises performed with BFR compared to the control condition across both trials. We observed no differences in tibilais anterior (P=.33, BFR=21.9±11.2%, Control=21.0±10.8%, ES=0.09 [-0.30, 0.48]) or fibularis longus (P=.13, BFR=31.9±10.5%, Control=31.3±10.3%, ES=0.06 [-0.33, 0.45]) activation between the BFR and control conditions during the Y-balance exercises. **Conclusions:** Patients with CAI demonstrated increased soleus and vastus lateralis muscle activation when performing Y-balance exercise with BFR; however, there was no effect of BFR on activation in the smaller tibialis anterior and fibularis longus muscles. Incorporating BFR into dynamic balance exercises may provide an opportunity to enhance muscle activity during exercises. Future research is warranted to examine the training effects of dynamic balance exercises with BFR on clinical outcomes.

**2018-2019**

**The Effects of a Four Week Home Exercise Plan using Low Load Plyometric Exercise After ACL Reconstruction**

Thomas Birchmeier MS, ATC, CSCS: Michigan State University

**Context**: Home-based rehabilitation, including plyometric exercise, has been recommended as an effective adjunct to traditional care for individuals with ACL reconstruction (ACLR) with persistent quadriceps strength asymmetry. However, it is challenging to monitor patient compliance with home exercise programs (HEP) and the intensity with which a patient completes the recommended exercises. Compliance and performance monitoring using wearable technology may promote enhanced patient

engagement in a cost-effective manner. The purpose of this study was to assess the efficacy of an objectively monitored four-week home-based plyometric exercise program on quadriceps strength and single leg hop performance among individuals with persistent quadriceps strength asymmetry following ACLR. **Methods:** Fifteen individuals (11 women/4 men) enrolled in this pilot efficacy study. Four individuals withdrew due to schedule constraints, and one individual withdrew due to knee pain. Assessments were completed pre- and post- the 4 -week HEP (5.0±0.6 weeks). At both study visits, self-reported knee function was evaluated using the International Knee Documentation Committee Subjective Knee Evaluation Form (IKDC). Quadriceps peak torque (PT) was assessed via isokinetic dynamometer (60°/s). Strength data were normalized to body weight (Nm/kg). Single (SH) and triple hop (TH) were assessed bilaterally and normalized to leg length. The six-meter timed hop (6m) was assessed using infrared timing gates (s). For all hopping tasks, an average distance or time of three successful trials were recorded for each leg. Limb symmetry indices (LSI) were calculated by dividing the ACLR limb values by the contralateral limb values and multiplying by 100. Following the pre-intervention assessment, participants were familiarized with the HEP (Figure 1) and, the Vert monitor and mobile application to ensure the patient’s ability to complete all study activities in the home environment. Compliance was monitored using the Vert jump count and jump height data stored in a cloud-based storage system. Separate repeated measures ANOVAs were used to assess change in IKDC and LSI between time points. Eta squared effect sizes were calculated to quantify magnitude of change post-intervention. **Results**: Four individuals withdrew due to schedule constraints, and one individual withdrew due to knee pain which resulted in 10 individuals (9 women/1 man; height=168.5±8.9 cm; weight=71.3±15.9 kg; age=18.0±2.3 years; months since surgery=27.1±20.8) completing the intervention. IKDC score and

quadriceps PT LSI (*p*=0.55, η=0.04) did not significantly improve post-intervention. The 6m-LSI (*p*=0.02, η=0.49) improved post-intervention, but SH (*p*=0.47, η=0.06) and TH (*p*=0.72, η=0.02) did not. **Conclusions**: Four weeks of low-load plyometric exercise improved 6m-LSI in individuals with ACLR but was insufficient training volume to improve quadriceps PT-LSI. Improved speed during the 6m may indicate improved quadriceps rate of torque development, that may stabilize the knee and reduce the risk

of injury. Future research should examine the effects of higher training volume using low-load plyometric exercise.

**Examining the Effects of Simulated Driving After Sustaining a Sport-Related Concussion in High School and Collegiate Athletes**

Jennifer Savage PhD, LAT, ATC: Michigan State University

**Context**: Driving is a very complex activity of daily living that consist of cognition, vision, and motor function, which are often areas that may be affected in concussed athletes. Furthermore, motor-vehicle collisions are among the leading cause of death among 16-19 years-olds in the United States, thus high school and collegiate athletes are at the greatest risk. Therefore, the purpose of this study was to compare simulated driving performance between concussed high school and collegiate athletes within 72 hours, asymptomatic and return to sport (RTS) stages.

**Methods**: A repeated measures study design was utilized in a research laboratory, to analyze simulated driving performance in a total of 19 (high school = 3; college = 16) concussed athletes, with a mean age of 20.00±1.67 years, from 11 sports. Participants completed 2 virtual driving scenarios [car following with divided attention (scenario 1); passing, gap judging, and merging (scenario 2)]. The independent variable was group (high school; college). The dependent variable was driving performance (number of pedestrian and car collisions, speeding and stop sign tickets, turn signal performance, centerline and road edge excursions, and divided attention responses and time). Participants were asked to sit in a motion platform simulator chassis, which had a reactive steering wheel and pedals. The STISIM Drive® software was displayed on three, 43” monitors. The first scenario had participants perform a divided attention task, as they navigated through a suburban and school zone areas with various hazards, while the second scenario required participants to drive through an urban area, while making left turns against on-coming traffic, with pedestrians crossing. Separate repeated measures multivariate analysis of variance (MANOVA) were performed to determine differences in simulated driving performance between concussed high school and college athletes. A *p*-value was set a priori at 0.05. **Results**: There were no group (F1,11=0.507, *p*=0.81) main effect or group-by-time (F1,56=0.55, *p*=0.89) interaction; however, there was a significant time main effect (F1,56=2.67, *p*=0.005) for the first scenario. Over time, concussed athletes performed better on divided attention responses and response time, while performing worse on speeding. For the second scenario, there were no group (F1,11=0.97, *p*=0.50) or time (F1,56=0.43, *p*=0.96) main effects or group-by-time (F1,56=1.00, *p*=0.47) interaction. Even though both scenarios were non-significant, it is important to note that 9 concussed athletes (47.0%) collided with pedestrians and automobiles over all three time points of their SRC recovery. **Conclusions**: Many healthcare clinicians have incorporated a RTS and return to learn protocols for their concussed athletes, but may not have considered the effects of driving and the influences of how concussed drivers think and act on the road. These results may guide future research efforts aimed at developing a comprehensive driving protocol for individuals with a SRC.