Muscle Activation Patterns of the Upper Limb and Trunk During an Unexpected Descent on the Outstretched Hands in Young Women

Lattimer L, Arnold C, Lanovaz J
College of Kinesiology, University of Saskatchewan, Saskatoon, Saskatchewan

Introduction: A fall on the outstretched hand (FOOSH) is a protective mechanism to arrest the body and avoid injury. A FOOSH is the most common cause of upper extremity (UE) injury. Arresting a fall with the UE demands speed, coordination, motor control, and appropriate hand placement.

Rationale: Understanding muscle activation patterns during a FOOSH is critical for developing injury prevention strategies. The purpose of this study is to investigate muscle activity during three phases of an unexpected FOOSH in healthy young women.

Methods: Twenty healthy females (mean age: 22.9 years, SD ± 3.69) performed 10 trials of unexpected descents on outstretched UE. Participants were suspended in a safety harness with UE outstretched and hands hovering 1 cm above force plates at an angle of 60° from horizontal. Participants were randomly released between 2 and 5 seconds after a verbal cue. Muscle activations were collected using surface electromyography (EMG) at a sample rate of 2000 Hz for six muscles in the left arm: anterior deltoid (ANDEL), pectoralis major (PEC), triceps brachii (TRI), biceps brachii (BB), external oblique (EO), and internal oblique (IO). EMG data were expressed relative to maximum voluntary contraction. Root mean squared EMG were calculated during baseline (BL), defined as 500 ms prior to release; the preparatory phase (PRE), defined as the time between release and impact (mean: 257 ms, SD ± 37 ms); and post-impact (POST), defined as the 200 ms after impact detected using the force plates. One-way repeated measures ANOVA with Bonferroni post-hoc tests were used to test differences in muscle activation between the phases.

Results: There was a significant main effect ($P < .05$) of phase for all muscles. All muscles, with the exception of ANDEL, displayed significant increase in activation from BL to PRE indicating anticipatory activation. The EO and IO had the largest relative increases in activation from BL to PRE. ANDEL and PEC increased in activation PRE to POST while TRI and EO activation did not change. BB and IO decreased significantly PRE to POST. During the PRE and POST phases, IO had the highest overall relative muscle activity.

Discussion: It appears that IO and BB are anticipatory muscles most active during the PRE phase, while ANDEL and PEC are primarily recruited after impact. The TRI and EO appear to play both roles.

Importance: The data describes muscle activation utilized by young women to arrest the body during a FOOSH. Trunk and UE neuromuscular training may be beneficial to include in fall injury prevention program.

Return to Play at 30 Days, Grade 1 Spleen Laceration in a Club Sport Hockey Player

Arduini JB, Pales-Taylor ML, Hicks-Little CA
University of Utah, Salt Lake City, Utah

Background: A 24-year-old male Club Sports Hockey player with no prior medical history collided with an opposing player, and received the butt end of the stick to the ULQ of the abdomen. Examination revealed that the athlete was not able to control his breathing. Chief complaint was of shortness of breath and pain in the ULQ. Palpation of the area revealed that the ribs had diffuse tenderness, ULQ was point tender with rebound pain.

Rationale: Case report.

Methods: The differential diagnosis was rib fracture, intercostal contusion, and spleen laceration. The athlete was immediately transported to the nearest major medical center. Test results confirmed a grade 1 laceration of the spleen as defined by less than 10% of subcapsular hematoma and laceration less than 1 cm in depth. No surgical intervention was indicated. Instructions were given from the physician to be withheld from practice and competition for at least 4 weeks and to complete a follow-up evaluation prior to return to contact. Because no protocol currently exists for grade 1 splenic lacera-
tion return to play, the athlete’s physical exertion was limited until asymptomatic. The athlete was pain free at day 12 and began light physical exertion (biking) at day 16 and non-contact skating at day 23. At 30 days post injury, a diagnostic ultrasound was performed, which revealed splenic recovery. The athlete was allowed to return to full contact practice at that time.

Discussion: This athlete returned to play at 30 days post injury, which is before the typical 3- to 4-month time frame for splenic injuries. Treatment and rehabilitation times of splenic injuries are not well documented; there is uncertainty with regard to how athletes should be treated and returned to play. It is important to recognize the splinting ability of the spleen within the abdominal cavity and provide a false-negative result to the assessing athletic therapist. Therefore, precaution must be taken to return these athletes to play.

Importance: Due to conflicting opinions and lack of research on return to play criteria for varying degrees of splenic injury, this case is a prime example of how a grade 1 splenic laceration can be managed and returned to contact sport successfully and in a timely manner. At present this is the first documented case of a non-surgical grade 1 splenic laceration having been returned to play, as well as the only documented return to play splenic laceration at 30 days post injury of any grade in the literature.

Returning to Play After Concussion: A Phenomenological Study
Da Costa KD, Connolly MC, Frost GF, Sullivan PS
Brock University, St. Catherine’s, Ontario

Introduction: This study examines and describes athletes’ felt sense of readiness returning to play following a concussion. It focused on a particular group of university aged athletes’ decision making in return to play and if/how power and pressure influenced when these athletes were cleared to play.

Rationale: Concussions are a serious issue and need to be understood more clearly. There is limited research in this area, especially relating to athletes’ narrated experiences.

Methods: Phenomenological analyses of the interviews yielded a description of each participant’s experiences with concussions.

Results: Descriptions of this phenomenon generated by informants provide a detailed account of the unique issues athletes face when returning to play following a concussion. Participants’ descriptions highlight that to play, an athlete knows that he/she ought to be emotionally and physically ready to play. However, the athletes in this study believe that there is not an actual test that can “prove” this and that they choose to lie and/or cheat the tests to return to play while they are still symptomatic. They realize that they probably shouldn’t return to play but they choose to anyway. All athletes felt pressure to return to play, whether from their coaches and/or teammates, but the evident pressure the athletes felt was internalized. They feel alienated from the team if they aren’t able to play, causing them to want to return to play sooner than they should. These athletes will cheat the system to meet certain deadlines to play. No matter the position on the team, they all believed they could make a difference. Athletes seemed to be experiencing a “hero” complex. They believed whole-heartedly that the team could not win without them. If the team was losing they could have helped them win and if the team was winning they wanted to be a part of the success.

Discussion: Athletes, parents, coaches, and trainers will benefit from learning to be better educated on the severity of concussions, concussion detection, assessment, and the serious physical and mental health consequences that can result from playing with a concussion.

Differences in Symptoms Reported by Parents and Children on the Baseline Measures of the Child SCAT3
Black AM, Schneider KJ, Meeuwisse WH, Emery CA
Sport Injury Prevention Research Centre, Faculty of Kinesiology, University of Calgary, Calgary, Alberta

Introduction: Concussions are a major concern among youth athletes. In 2013, the Sport Concussion Consensus Meeting included the development and publication of a new version of the concussion standardized assessment tool (SCAT3), along with a pediatric version. The Child SCAT3 contains a separate post concussion symptom scale for both the child and parent to complete.

Objective: This study set out to examine the level of agreement of symptom ratings between youth ice hockey players (ages 11-12) and their parents on baseline measures of the symptom checklist on the Child SCAT3.

Methods: This was a cross-sectional study. At baseline (2013/2014 ice hockey season) 389 Pee Wee players (93.77% male) and one of their parents or guardian from 72 teams (Division 1 to 12) in Calgary, Alberta,
ABSTRACTS

Symptoms may persist in approximately 15% of individuals who experienced mTBI (Ontario Neurotrauma Foundation, 2013). Scientific knowledge on the treatment of mTBI is poorly developed, especially when recovery continues beyond the normal expected period of convalescence (1 to 3 months).

Rationale: Exercise is a promising therapeutic avenue because it may have a positive impact on mTBI chronic symptoms, such as depression, headaches, mood, dizziness, impairment of cognitive functions, balance, etc. (Majerske, 2008; Baker, 2012; Leddy, 2011; Griesbach, 2004; Tan, 2014; Archer, 2012). Few clinical studies have been performed on pediatric patients suffering from sport-related mTBI. The aim of this study was to evaluate the effectiveness of the integration of an active rehabilitation intervention to usual care in patients 10 to 17 years old with atypical recovery following mTBI.

Methods: The control group received standard care consisting of rest, general education, school adaptations, and cessation of participation in physical activities until complete resolution of symptoms as proposed by the Zurich Consensus (McCrory, 2013). The experimental group received standard care and active rehabilitation, which comprises low to moderate intensity aerobic training, specific coordination exercise, and therapeutic balance exercises. The following criteria are used to measure the resolution of signs and symptoms of mTBI: (1) Absence of post-concussive symptoms for more than 7 consecutive days (measured by the post-concussion symptoms questionnaire); (2) Cognitive function assessed by a neuropsychologist; (3) Balance measured by: Bruininks-Oseretsky Test of Motor Proficiency 2nd Edition (BOT-2), Modified Balance Error Scoring System (BESS), Tandes Gait, Modified Clinical Test of Sensory Interaction of Balance (m-CTSIB) and Limit of Stability (LOS); and (4) Coordination measured by: Finger-to-nose test (FTN) and BOT-2.

Results: Preliminary results will be available for CATA 49th National Conference 2015.

Discussion: It is urgent to develop feasible and valid interventions that are based on clinical evidence in the pediatric population who sustained mTBI. Exercise may represent a promising therapeutic avenue.

Importance: This project has the potential to influence traumatology practice and may promote sports therapy in mTBI rehabilitation. This project is held in a Canadian collective effort to improve the care of children and adolescents with mTBI through the Canadian Pediatric and Youth MTBI Common Data Study.

Efficiency of an Active Rehabilitation Intervention in a Pediatric Population With Atypical Recovery Following a Mild Traumatic Brain Injury

Imhoff S, Fait P
Département des sciences de l’activité physique, Université du Québec à Trois-Rivières, Québec

Introduction: Mild traumatic brain injury (mTBI) is the most common type of brain injury and represents a major health problem in children and adolescents (Thurman, 2012). Physical, cognitive, and emotional symptoms may persist in approximately 15% of individuals who experienced mTBI as part of the baseline assessment in a larger cohort study.

Results: The median numbers of symptoms out of 20 reported by parents and children were 9 (range: 0 to 20) and 5 (range: 0 to 20), respectively. Of a possible total severity score of 60, the median symptom severity scores were 11 (range: 0 to 31) for the parent scale and 5 (range: 0 to 41) for the child scale. The proportion of parents reporting no symptoms was 9.51%, whereas the proportion of children reporting no symptoms was 13.88%. The Bland–Altman 95% Limits of Agreement (LOA) between the number of symptoms reported by parent and child were -10.37 to 16.04, with a mean difference of 2.84 (95% CI: 2.18 to 3.49). Parent and child symptom rating scores were in agreement primarily on the physical symptoms, including double vision (89.20% of the scores agreed), blurry vision (87.40%), and feeling like the room is spinning (86.89%). They tended to agree least on cognitive symptoms, including being easily distracted (31.88%), difficulty concentrating (37.02%), and attention problems (39.60%).

Discussion: On average, parents tend to report more symptoms at baseline than children on the concussion symptom scale. This should be considered when interpreting the scores on follow-up tests.

Importance: This study highlights that reporting of symptoms is normal at baseline and should form an important basis for interpreting post concussion scores. In the majority of cases, the total parent symptom score was not in agreement with the child score. Input from both parent and child should be considered in the management of concussion for children 11 and 12. Parents and children appear to provide a different perspective in reporting symptoms that may occur due to a concussion.
A Survey of Certified Athletic Therapists (Canada): The Perceived Impact of Adding Osteopathy to Their Existing Athletic Therapy Practice

MacLeod HL
British College of Osteopathy, London, United Kingdom

Introduction: Athletic therapists are required to participate in continuing education for advancing competency. Osteopathy is one of the accepted continuing educational units; however, no research exists to determine the perceived impact of adding osteopathy to existing athletic therapy practices in Canada.

Rationale: The purpose of this research using a questionnaire approach was to investigate and identify the perceived impact and recommend future research.

Methods: A cross-sectional study using an electronic questionnaire was used to survey members in good standing of the Canadian Athletic Therapists’ Association who are also osteopathic manual practitioners. Data were gathered on general demographics, education, continuing education, and the perceived impact. A small sample size was reflective for the population. Non-normal distribution (Shapiro–Wilkes test) resulted in the use of the Kruskal–Wallis H test. The $P$ value was set at $< .05$ for significance.

Results and Discussion: Statistical significance was found between gender and the perceived impact of adding osteopathy: increase in patients ($P = .004$); increase billing option ($P = .021$); increase skills to treat head injuries (concussion) ($P = .029$); and becoming a better therapist ($P = .045$). No other statistical significance was found. Subjects reported the following perceived improvements: having the greatest perceived improvement are new skills to be able to treat head injuries (concussion), developing new skills for existing patients, chronic patients, being a better therapist, new skills for non-athlete patients, general pathology, philosophy change, becoming a different therapist, and skills for new patients; having some improvement are increased financial gain, increased revenue, billing options, increased number of patients, and developing new skills for pre/postnatal care; having little impact are new skills for pediatrics and geriatrics; having no impact are new skills for other (not defined by subjects) and infertility treatments.

Importance: This research identified the perceived impact of adding osteopathy to existing athletic therapy practices in Canada. Statistical significance was found between gender and certain perceived impacts. Trends were identified. It is hoped that this work can be used as a beginning to further research.

Initial Development and Content Validation of a Tool for the Diagnosis and Screening of Rotator Cuff Disorders (RCD-DST) in Primary Care

Eubank BHF, Lafave MR, Mohtadi, NG, Wiley JP, Bois AJ
Mount Royal University, University of Calgary, Calgary, Alberta

Introduction: Shoulder pain is the second most frequent musculoskeletal (MSK) complaint presenting to primary care. The majority of patients experiencing shoulder pain likely suffer from rotator cuff disorders (RCD). RCD are the most common cause of shoulder pain seen by physicians. Accurate diagnosis and effective management of RCD can be challenging for clinicians and other healthcare professionals in primary care. Early diagnosis and management of RCD can facilitate timely, appropriate, and cost-effective intervention for patients with shoulder pain and suspected rotator cuff pathology.

Rationale: The goal of this study is to report on the initial research of an online tool for diagnosis and screening of patients with RCD.

Methods: A literature search was performed to link evidence to items in the online tool. Research was reviewed and assigned a level of evidence to indicate quality of research: Level 1: Randomized controlled trial; Level 2: Prospective comparative study or retrospective prognostic study; Level 3: Case-control study; Level 4: Case series; and Level 5: Expert opinion. The first draft of the online tool was designed based on research evidence and expert opinion ($n = 3$: two orthopedic surgeons, one certified athletic therapist).

Results: The Rotator Cuff Disorder Diagnostic and Screening Tool (RCD-DST) is a combination of 114 items from the following domains: history taking, screening, diagnosis, physical examination, investigation, and treatment. Seventy-four of 114 (65%) items were assigned Level 2 evidence. Thirty-six of 114 (32%) items were assigned Level 3 evidence. Four of 114 (4%) of items were assigned Level 4 evidence.

Discussion: The use of diagnostic and screening tools is an important aspect of clinical practice. Screening tools are important because they identify clinical care pathways or “flag” special needs individuals that require...
alternative pathways. The RCD-DST has undergone the first stage of content-validation by attaching levels of evidence to each item. The next step is to determine the content validity through the eyes of 10-12 experts who will employ the RCD-DST. Then, psychometric properties of the RCD-DST will dictate its practicality and applicability to the primary care setting.

**Importance:** The literature has suggested that the clinical care pathway for patients presenting with shoulder disorders is plagued with patients that do not receive best practice treatment. Additionally, primary care professionals lack clinical confidence and skills in physical examination and basic MSK medicine. A tool that has accurate diagnostic and screening properties would streamline healthcare processes and improve the quality of primary healthcare.

**Initial Content Validity of Athletic Therapy Clinical Presentations**

Lafave MR, Yeo M, Westbrook K, Valdez D, Eubank BHF, McAllister J
Mount Royal University, Calgary, Alberta

**Introduction:** Competency-based education has emerged among the medical profession and allied healthcare professions (Crosbie, 2002). Carraccio et al. (2002) defined competency as “a complex set of behaviors built on the components of knowledge, skills, attitudes and competence.” The rationale to implement such change is plentiful and underscoring this rationale is a movement toward student-centered learning and constructivist learning theory (Barman et al., 2014). The CATA mandates competency delivery within athletic therapy programs. However, it is assumed that the competencies are achieved by students based on practicum hours logged rather than through evaluation.

**Rationale:** The current study applied the first two steps in Carraccio et al.’s (2002) four-step process to create competency-based curricula related to competency: (1) identification; (2) determination of components and performance levels; (3) evaluation; and (4) overall assessment of the process.

**Methods:** The first two steps above coincide with our content validation process: the modified Ebel procedure. Local professors generated a list of clinical presentations (CPs) organized by body region and medical emergencies. The list of CPs was then sent to 12 experts with representation from every CATA accredited program in Canada and an industry expert (minimum of 10 years of field and clinic experience) in that same region. Experts used a 0 to 100 mm visual analogue scale to rate the importance (not important = 0; extremely important = 100) and difficulty (extremely difficult = 0; easy = 100) on 253 CPs.

**Results:** The range of ‘important’ ratings was from 99.3/100 (airway emergency and deadly bleeding) to 54/100 (high altitude cerebral edema). The range of ‘difficulty’ scores was from 5.99/100 (cuboid syndrome) to 89.8/100 (biceps contusion). A composite index (CoI) was calculated taking the average of the importance rating and the difficulty rating. The CoI ranged from 37.9/100 (decompression illness) to 93.4/100 (inversion ankle sprain).

**Discussion:** There is a wide range of CPs that could be delivered within athletic therapy programs. Faculty must prioritize the CPs to teach and or assess considering the limited time to evaluate student competency with all CPs. No CP scored 0/100 on the ‘important’ scale, thus all had some relevance to the professional scope of practice. It may be important for novice athletic therapy graduates to be competent across all 253 CPs, realizing that some CPs are more challenging and not as important as others.

**Importance:** Assessment of student learning should consider importance and difficulty parameters for each CP when creating formative and summative assessment expectations.

Compiled and edited by Jackie Vandertuin, MSc, CAT(C), Sheridan College, Brampton, Ontario, Canada.

The author has no financial or proprietary interest in the materials presented herein.

doi:10.3928/19425864-20150422-03