

Orthopaedic Section of the APTA
Grant Program
Annual Progress Report Form

Date: 11/28/2014

Name of Investigators: Audrey R.C. Elias, DPT; Ryan L. Mizner, PT, PhD

Name of Grant: A clinical trial to improve motor learning in plyometric training post-ACLr via a novel body-weight support system

Award Period: May 15, 2014 – April 30, 2015

Current Year of Award completed: Year 1, (first half)

1. Summary of accomplishments in the past year:

IRB approval was received in December 2013; approval of amendments pertaining to this funding was received in June 2014. Necessary equipment for training including supplies for constructing custom harnesses was obtained during the summer of 2014, and extensive recruitment efforts to local orthopaedic surgeons and physical therapists were undertaken at this time as well. A treating clinician was hired to manage approximately ½ of the treatment sessions. A treatment fidelity analyst was hired and treatment fidelity protocols developed to ensure consistency in treatment between groups and clinicians. At this time, 23 participants have been recruited and pre-tested. Fifteen participants met biomechanical inclusion criteria for the clinical trial and began training. Of those, 1 dropped out of the study due to time constraints; 8 have finished the 8-week training protocol; and 5 have undergone retention testing. Three participants will finish the training in the next week, and 3 more are scheduled for pre-testing.

2. Provide a one-paragraph summary of results or abstract suitable for posting on the Orthopaedic Section website.

At this time, we have not collected enough data to provide results; the layperson's summary originally submitted will be sufficient at this time, and is included below.

People recovering from anterior cruciate ligament (ACL) reconstruction (ACLr) frequently are unable to accept weight and attenuate load with their surgical knee during high-intensity tasks such as jumping. Their muscular recruitment patterns are also frequently dysfunctional, displaying high co-contraction that may be a protective response, but increases joint compression. Training to increase knee bending and improve the use of the knee during jumping tasks is generally limited in repetition, due to the possibility of joint damage from the large loads inherent to even the lowest intensity plyometric tasks. The Bodyweight Reduction Instrument to Deliver Graded Exercise (BRIDGE) reduces impact forces during jumping tasks and allows investigation into the effect of higher volume jump training on weight acceptance, knee flexion, and neuromuscular patterns during jump landing. For this prospective, randomized, double-blind clinical trial, 40 individuals with ACLr between 6 and 48 months previously

will undergo clinical, electromyographic, and 3-D biomechanical screening for landing faults, defined as 70% side-to-side asymmetry in vertical ground reaction force (VGRF) during double leg landing, or knee joint torque under 2.6 body weights in a single leg land. The International Knee Documentation Committee questionnaire will also document subjective function. An anticipated 16 people will present with landing dysfunction and consent to training. They will be randomly assigned to training at low volumes and high intensity (STANDARD) or high volumes and lowered intensity (BRIDGE). Individual training programs will last 8 weeks twice weekly, and participants will undergo re-testing at 4 weeks (mid-training), 8 weeks (post-training), and 16 weeks (retention). The results of this trial will help elucidate the relative importance of repetition in developing optimal habitual movement patterns following ACLR. Improving the ability of people with ACLR to accept weight and dissipate impact loads through their surgical knee may ameliorate the high rates of early-onset osteoarthritis in this population. This trial is registered at ClinicalTrials.gov, # NCT02148172.

3. Attach a list of your publications published or accepted during the past year, or currently being written. Send reprints when available. List presentations made and abstracts accepted for presentation based on this work. Indicate with an asterisk (*) those publications supported by Orthopaedic Section funding.

Peer-Reviewed Publications

- Elias ARC, Hammill CD, Mizner RL. Adaptation of Quadriceps and Hamstring Co-contraction Following Landing Instruction in Patients with ACL Reconstruction. JOSPT. IN PRESS
- Elias ARC, Hammill CD, Mizner RL. The Effect of body Weight Support on Kinetics and Kinematics of a Repetitive Plyometric Task. J Biomech. SUBMITTED

Presentations Made

- Elias ARC, Hammill CD, Mizner RL. A New Direction in Plyometrics: The Effect of Unweighting in Performance of Dynamic Tasks. Presented at CSM 2014.
- Elias ARC, Mizner RL. Mechanism of Injury Affects Neuromuscular Patterning of Hamstrings and Quadriceps Following Anterior Cruciate Ligament Reconstruction. Presented at ACSM-Northwest Regional Meeting. May 2014.

Abstracts Submitted

- Elias ARC, Mizner RL. Associating Clinical and Biomechanical Measures of Single Leg Performance After Anterior Cruciate Ligament Reconstruction. Accepted CSM 2015.
- *Elias ARC, Mizner RL. High Volume Jump Training Coupled with Body Weight Support in a Patient with Anterior Cruciate Ligament Reconstruction. Accepted CSM 2015

4. Provide a budget, using the original approved budget. Indicate total funds spent to date per major categories. If there was a $\geq 25\%$ deviation (greater or less spent) of use of funds for any of the budget categories, please BRIEFLY indicate the rationale.

Expense Category	Budgeted Period 1	Actual Period 1	Remaining Period 1	Budgeted Period 2	Projected Period 2
Investigator Salary	2072	4143	(2071)	2071	0
Clinical Salary	2576	560	2016	2576	4592
Contract Services	1817	250	1567	1815	3382
Materials & Supplies	1033	1289	(256)	1032	776
Total	7498	6242	1256	7494	8750

- The investigator salary was disbursed in full over the summer of 2014, as originally planned. This was used primarily for recruitment, testing, and training as needed.
- As our recruitment over the summer was lower than anticipated, our training clinician did not see as many subjects as anticipated. Additionally, her availability and that of most of the remaining subjects did not align for needed scheduling. As our recruitment has increased, she is working with more of the subjects, delaying these payments somewhat.
- Contract services included the treatment fidelity analyst. Because of our delayed recruitment, she has just begun completing analysis of the treatments, and as such these payments are delayed.

5. Objectives for the next 6 months:

- Complete pre-testing for remaining 17 subjects, with an anticipated 8 subjects eligible for training. We have had greater than anticipated eligibility and retention, so this should increase our sample somewhat. Complete data collection by April 2015.
- Complete treatment fidelity protocols on first half of subjects by January 2015, adjust treatment to ensure adherence to protocols within and between treating clinicians as necessary. Complete treatment fidelity protocols on all subjects by May 2015.
- Data analysis when subjects complete training and retention testing (May 2015).
- Submit preliminary results for presentation at Combined Sections Meeting 2016.
- Complete manuscript preparation through Summer 2015.

 PROCS . 12/1/14
Signature Date