

Orthopaedic Section of the APTA Grant Program Final Report Form

Date: July 27, 2017

Name of Investigators: Gretchen B. Salsich, PT, PhD (Principal Investigator); Linda R. Van Dillen, PT, PhD (Consultant); Catherine E. Lang, PT, PhD (Consultant)

Name of Grant: Task-specific Movement Pattern Training for Treatment of Patellofemoral Pain
(Supplement to project funded by Washington University Institute of Clinical and Translational Sciences)

Award Period: 6/1/14 to 5/31/17 (Initial award date is the date that the award was made to your institution)

The final report is due no later than 60 days after the end of the award date.

1. Briefly summarize major accomplishments of this project (2-4 pages)

In this project we tested a physical therapy intervention focused solely on training people to move correctly (i.e. avoid dynamic knee valgus) while performing daily activities. The aims of this preliminary study were to determine whether the intervention 1) was feasible, and 2) could lead to improvements in lower limb movement patterns, pain, function, and activity participation in females with PFP.

General Project Tasks and Accomplishments

This project was completed as proposed in 3 years (2 year award period + 1-year extension). The major administrative tasks that were accomplished leading to the successful completion of our aims include:

- IRB protocol developed and approved
- Hiring and training of study personnel
- Set up of electronic database (RedCap) and data collection instruments
- Data collection, processing and analysis
- Manuscript/abstract dissemination

Summary of Specific Aim 1. To determine if it is feasible to conduct a task-specific movement pattern training rehabilitation program.

- **Approach:** Female subjects between the ages of 18-40 who have chronic PFP were recruited for participation in a 6-week rehabilitation program focused solely on movement pattern training during functional tasks (task-specific movement pattern training). Subjects participated in 45 minute sessions 2x/week during which they were trained in common daily tasks and tasks that had subject-specific relevance (e.g. sport- or job-related tasks). Subjects were educated in key concepts of optimal movement and practiced performing tasks while adhering to the key concepts. Observational assessment of movement pattern correction without increased pain was used to determine task progression.
 - **Hypothesis 1a:** 25 subjects will be enrolled and 85% will be retained over the study period.
 - **Findings:** Twenty-five subjects were recruited and 23 were retained (92% retention) over the study period. All 23 subjects completed all 12 treatment visits.
 - **Hypothesis 1b:** Subjects will demonstrate 75% adherence (self-report) to the corrected movement pattern during daily activities
 - **Findings:** Self-reported average daily adherence was 79% and subjects were able to perform their prescribed home program correctly (reduced hip and knee frontal plane angles) by the second intervention visit. Subjects also gave the intervention high credibility/expectancy ratings (credibility: 25 out of 27, and expectancy: 22 out of 27).

Summary of Specific Aim 2. To characterize the effect of task-specific movement pattern training on kinematics, pain, function, and activity participation.

- **Approach:** Using a prospective, non-randomized, within-group, double baseline study design, subjects were evaluated at multiple time points on measures related to kinematics, pain, function, and activity participation. Assessments were made at baseline 1, baseline 2, post-intervention, and 4 weeks post-intervention
 - **Hypothesis 2a:** Kinematics (hip adduction, hip internal rotation, knee external rotation) during daily tasks will improve between pre- and post-intervention assessments. Kinematics will remain improved 4 weeks post-intervention. Tasks include single limb squat, sit to/from stand, ascend/descend stairs.
 - **Primary Findings:** For all 3-D kinematic outcomes, changes during the treatment phase (baseline 2 to post-intervention) were greater than changes during the control phase (baseline 1 to baseline 2) ($p < .0001$) during the single limb squat. Following intervention, improvements were detected in hip adduction, hip internal rotation, and knee external rotation. Similar results were noted for other tasks. Improvements were retained 4 weeks post-intervention in all measures for all tasks except hip adduction during the single limb squat.
 - **Additional Findings:** 2-D movement data is still being analyzed. Preliminary results indicate that hip and knee 2-D frontal plane projection angles during the single limb squat and Y-balance task improve after intervention. Other findings indicate that the dynamic valgus movement pattern is consistent across tasks (e.g. greater dynamic valgus during squat is associated with greater dynamic valgus during stair descent, etc.)
 - **Hypothesis 2b:** Subjects will report meaningful changes in pain, function and activity participation between pre- and post-intervention assessments. Measures will remain improved 4 weeks post-intervention.
 - **Primary Findings:** For all pain and self-reported function measures, changes during the treatment phase (baseline 2 to post-intervention) were greater than changes during the control phase (baseline 1 to baseline 2) ($p < .0001$). At Post-intervention, pain and function (self-reported) improved compared to baseline 2. Both measures remain improved at the 4-wk post-intervention assessment ($p > 0.05$).
 - **Additional Findings:** Interestingly, the performance-based functional measures did not improve after intervention, however *pain during* the performance-based measures decreased, and as noted above, movement during the Y-balance task improved following intervention. Activity level (self-reported) did not change across time.

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

Chronic patellofemoral joint pain (PFP) is common, persistent, and potentially debilitating. Emerging evidence links a faulty movement pattern (dynamic knee valgus), where the lower limb moves inward during weight bearing, to pain in females with PFP. This study tested the feasibility and potential efficacy of a novel physical therapy intervention focused on training people to move correctly while performing daily activities. Results indicate that the intervention is feasible (recruitment and retention goals have been met, and participants have high adherence to the prescribed program). Additional findings indicate that dynamic knee valgus, pain, and function improve following task-specific movement training, suggesting that this intervention may be an effective rehabilitation strategy for PFP and should be further investigated in a larger randomized trial.

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.
- *Salsich GB, Yemm B, Steger-May K, Lang CE, Van Dillen LR. A feasibility study of a novel, task-specific movement training intervention for women with patellofemoral pain. *Clin Rehabil* 2017, in press.
 - *Scholtes SA, DiStaulo AM, Salsich GB. Consistency of movement patterns across tasks in women with patellofemoral pain. (manuscript in progress)
 - *DiStaulo AM, Scholtes SA, Salsich GB. Individual variability in 3-dimensional contributions to dynamic valgus in women with patellofemoral pain. (manuscript in progress)
 - *Salsich GB, Yemm B, Steger-May K, Lang C, Van Dillen LR. "Preliminary Effects of Task-Specific Movement Training on Lower Extremity Kinematics, Pain, and Activity Limitations in Women with Patellofemoral Pain" (Poster; presented at the Orthopaedic Research Society Midwest Musculoskeletal Workshop, Washington University School of Medicine, St. Louis, MO, July 20, 2017).
 - *Salsich GB, Yemm B, Reitenbach A, Lang CE, Van Dillen LR. "Task-Specific Movement Training: Effect on Lower Extremity Kinematics, Pain, and Activity Participation in Females with Patellofemoral Pain" (Poster: presented at the Combined Sections Meeting of the American Physical Therapy Association, San Antonio, TX, Feb 15-18, 2017).
 - *Arhos EK, Reitenbach A, Yemm B, Salsich, GB. "The Effect of Movement Training on 2D Kinematics during an Untrained Task in Females with Patellofemoral Pain: Relationship to Hip Muscle Strength" (Platform: presented by EK Arhos at the Combined Sections Meeting of the American Physical Therapy Association, San Antonio, TX, Feb 15-18, 2017).

Budget:

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

EXPENSE CATEGORY	Original Budget	Total Expenditures	Amount Remaining in Year 3 budget
Personnel	19,497	19,510.23	
Supplies	470	813.54	
Outpatient care costs	775	707.50	
Other: software, equipment	3170	2800	
TOTAL	\$23,912	\$23,831.27	\$80.73

5. Budget: please send out a final print-out from your institution indicating monies spent per major categories.

Financial report to be sent by the Office of the Vice President for Research. A check in the amount of the unspent funds (\$80.73) will be issued to the Orthopaedic Section.



Your Signature

7/27/17

Date

Return to:

Tara Fredrickson, Executive Associate
Orthopaedic Section, APTA, Inc.
2920 East Avenue South, Suite 200
LaCrosse, WI 54601-7202