

**Orthopaedic Section of the APTA
Grant Program
Final Report Form**

Date: July 22, 2014

Name of Investigators: Rogelio A. Coronado, Steven Z. George, Mark D. Bishop, Joel E. Bialosky

Name of Grant: Cervical and Shoulder Manipulative Therapy on Shoulder Pain

Award Period: June 1, 2012 to May 31, 2014

1. Briefly summarize major accomplishments of this project:

At the end of year 1, we reported that we had successfully collected all data from approximately 1/4 (n = 28) of our targeted sample. Over the last year, we completed enrollment and all follow-up sessions for our final sample of 78 individuals with shoulder pain and 25 asymptomatic control individuals (total N = 103) and met our a priori sample size. A manuscript related to the primary aims of our study is in preparation for submission to *J Orthop Sports Phys* and was submitted as a platform presentation to the 2015 Combined Sections Meeting of the American Physical Therapy Association.

2. Provide a one-paragraph summary of results or abstract suitable for posting on the Orthopaedic Section website. (The following abstract was submitted as a platform presentation to the 2015 Combined Sections Meeting of the American Physical Therapy Association):

Laboratory-based studies indicate spinal manipulation (SMT) has an influence on central pain processes, supporting its application for treatment of spinal and extremity conditions. Despite this potential, direct comparison of SMT and extremity-directed interventions on altered pain processing have not been widely examined. We compared the immediate and short-term effects of cervical and shoulder manipulation and exercise on altered pain processing and subsequent clinical outcomes in patients with unilateral shoulder pain. We hypothesized cervical manipulation would yield greater effects on measures of pain processing and clinical outcome compared to shoulder manipulation or exercise. 78 clinical participants with shoulder pain (mean age (SD) = 39.0 (14.5)) were randomized to receive cervical (n = 26) or shoulder (n = 27) thrust manipulation or standard shoulder flexibility and isometric exercises (n = 25). Data from 25 healthy participants (mean age (SD) = 35.2 (11.1)) were used to determine the presence of altered pain processing in the clinical participants. All participants completed baseline questionnaires and underwent pain sensitivity testing including pressure pain threshold (PPT), heat pain

threshold (HPT), and thermal temporal summation protocols. Our primary outcomes for clinical participants were immediate changes in pain sensitivity occurring at 3 sessions over a 2-week period and clinical outcomes for pain intensity and disability measured at 4, 8, and 12 weeks. All outcomes were obtained by a masked assessor. ANOVA models and correlation analyses were conducted for examining comparative effects and the relation between pain sensitivity and clinical outcome. Compared to healthy participants, clinical participants demonstrated enhanced sensitivity at areas local and remote to the shoulder for PPT and at a remote region for HPT suggesting alterations in pain processing. Favorable effects on these indirect measures of sensitization were observed immediately following therapeutic intervention ($p < 0.05$) with no difference between manipulation and exercise groups ($p > 0.05$). Reductions in clinical pain and disability were also observed at all follow-up time points ($p < 0.05$) with no difference between groups ($p > 0.05$). We did not find an association between immediate changes in pain processing over a 2-week period and longer term clinical outcome ($p > 0.05$). These results suggest that cervical manipulation and shoulder-directed intervention (manipulation or exercise) result in similar within-session pain processing and between-session clinical effects, potentially suggesting non-specific mechanisms. Additionally, the lack of association between these pain processing effects and clinical outcome may suggest general pathways for clinical benefit when comparing manual therapy to exercise. Physical therapists can expect similar pain sensitivity and clinical effects following cervical and shoulder manipulation and exercise, which includes isometrics, when managing shoulder pain.

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 support by Orthopaedic Section funding.

Publications:

1. *Coronado RA, Bialosky JE, Bishop MD, Riley JL, Robinson ME, Michener LA, George SZ. The comparative effects of cervical and shoulder thrust manipulation and exercise on pain sensitivity and the relation to clinical outcome: an exploratory trial using a shoulder pain model. Manuscript in preparation.
2. Coronado RA, Simon CB, Valencia C, Parr JJ, Borsa PB, George SZ. Suprathreshold heat pain response predicts activity-related pain, but not rest-related pain, in an exercise-induced injury model. *PLoS One*. In review.
3. Alappattu MJ, Coronado RA, Lee D, Bour B, George SZ. Clinical characteristics of patients with cancer referred to outpatient physical therapy. *Phys Ther*. In review.
4. Valencia C, Coronado RA, Simon CB, Wright TW, Moser M, Farmer K, George SZ. Pre-surgical physical therapy treatment was not predictive of post-operative pain and disability outcomes: a prospective study. *Clin Orthop Relat Res*. In review.

5. Simon CB, Coronado RA, Wurtzel WA, Riddle DL, George SZ. Content and bibliometric analysis of the *Journal of Manual and Manipulative Therapy*. *J Man Manipulative Ther*. In press.
6. Coronado RA, JE Bialosky, ME Robinson, SZ George. Pain sensitivity subgroups in individuals with spine pain: potential relevance to short-term clinical outcome. *Phys Ther*. In press. PMID: 24764070
7. Sharififar S, Coronado RA, Romero S, Thigpen M. The effects of whole body vibration on mobility and balance in Parkinson's Disease: a systematic review. *Iran J Med Sci*, 2014;39:318-26. PMID: 25031483
8. Coronado RA, Simon CB, Valencia C, George SZ. Experimental pain responses support peripheral and central sensitization in patients with unilateral shoulder pain. *Clin J Pain*, 2014;30:143-51. PMID: 23619203
9. Slaven EJ, Goode A, Coronado RA, Hegedus EJ. The relative effectiveness of segment specific level and nonspecific level spinal joint mobilization on pain and range of motion: results of a systematic review and meta-analysis. *J Man Manipulative Ther*, 2013;21(1):7-17. PMID: 24421608
10. Gay CW, Alappattu MJ, Horn ME, Coronado RA, Bishop MD. The effect of a single session of muscle-biased therapy on pain sensitivity: a systematic review and meta-analysis of randomized controlled trials. *J Pain Res*, 2013;6:7-22. PMID: 23403507.

Presentations:

1. *Coronado RA, Bialosky JE, Bishop MD, Riley JL, Robinson ME, Michener LA, George SZ. The comparative effects of cervical and shoulder manipulation and exercise on pain sensitivity and clinical outcome. Submitted as platform presentation at the American Physical Therapy Association Combined Sections Meeting, 2015.
2. *Coronado RA, Mackie LN, Simon CB, Bialosky JE, Bishop MD, George SZ. Pain sensitivity questionnaire differentiates individuals with shoulder pain who demonstrate widespread sensitivity with quantitative sensory testing. Poster presentation at the American Pain Society Annual Scientific Meeting, Tampa, FL, May 2014.
3. *Coronado RA, Mackie LN, Simon CB, George SZ. Predictive ability of self-report measures to identify widespread sensitivity. Poster presentation at the Annual UF Public Health and Health Professions Research Day, Gainesville, FL, April 2014.
4. *Coronado RA, Bialosky JE, Bishop MD, Robinson ME, Riley JL, George SZ. Cervical manipulation has similar effects on pain sensitivity as shoulder-directed treatment in individuals with shoulder pain. Poster presentation at the Annual UF Neuromuscular Plasticity Symposium, Gainesville, FL, March 2014.
5. Coronado RA, Bialosky JE, George SZ. Experimental pain sensitivity subgroups in individuals with spine pain: potential relevance to short-term clinical outcome. Platform presentation at the American Physical Therapy Association Combined Sections Meeting, Las Vegas, NV, February 2014.

6. *Coronado RA, Simon CB, Mackie LN, Bialosky JE, Bishop MD, George SZ. Immediate pressure and thermal pain response is associated with change in clinical outcome following manual therapy for shoulder pain. Platform presentation at the Annual American Academy of Orthopedic Manual Physical Therapists Conference, Cincinnati, OH, October 2013.
7. *Coronado RA, Simon CB, Bialosky JE, Bishop MD, George SZ. Does treatment location matter: immediate effects on pain processing in patients with unilateral shoulder pain. Poster presentation at the Annual UF Neuromuscular Plasticity Symposium, Gainesville, FL, March 2013.

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	Total Budget	Budget - Year 1	Amount Spent in Year 1	Budget - Year 2	Amount Spent in Year 2	Total Spent
Participant compensation	\$11340.00	\$6804.00	\$4142.61	\$4536.00	\$5616.48	\$9759.09
Materials & Supplies	\$1860.00	\$1860.00	\$1180.90	\$0.00	\$232.48	\$1413.38
Travel	\$1500.00	\$750.00	\$597.80	\$750.00	\$2556.61	\$3154.41
Other Expenses	\$300.00	\$150.00	\$60.00	\$150.00	\$450.33	\$510.33
Total	\$15000.00	\$9564.00	\$5981.31	\$5436.00	\$8855.90	\$14837.21

Budget variation from the initial plan was due to completion of enrollment just prior to projected sample of 108 participants (which accounted for potential drop-out) and re-allocated cost of presentation at a national conference.

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

Budget sent as requested.

Signature: Rogelio Coronado

Date: 7/22/2014