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:**


Presentations:

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.


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

<table>
<thead>
<tr>
<th>Expense Category</th>
<th>Total Budget</th>
<th>Budget - Year 1</th>
<th>Amount Spent in Year 1</th>
<th>Budget - Year 2</th>
<th>Amount Spent in Year 2</th>
<th>Total Spent</th>
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<td>$5436.00</td>
<td>$8855.90</td>
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</tr>
</tbody>
</table>

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