KINEMATIC AND FUNCTIONAL EVALUATION OF DAILY LIVING TASKS IN OLDER ADULTS WITH AND WITHOUT A ROTATOR CUFF TEAR

1,2 Meghan E. Vidt, 1,2 Anthony C. Santiago, 3 Christopher J. Tuohy, 3 Michael T. Freehill, 3 Gary G. Poehling, 4 Michael E. Miller, and 1,2,3 Katherine R. Saul

1 VT-WFU School of Biomedical Engineering and Sciences, Winston-Salem, NC, USA
2 Wake Forest School of Medicine, Department of Biomedical Engineering, Winston-Salem, NC, USA
3 Wake Forest School of Medicine, Department of Orthopaedic Surgery, Winston-Salem, NC, USA
4 Wake Forest School of Medicine, Department of Public Health Sciences, Winston-Salem, NC, USA

email: mvidt@wakehealth.edu, web: www.sbes.vt.edu/kholzbau/MoBL/

INTRODUCTION

Successful completion of daily functional tasks is critical for older adults (age≥60yrs) to maintain their independence. It is estimated that 20-50% of older adults have a rotator cuff tear [1], which is associated with muscle atrophy, decreased strength, and reduced range of motion (ROM). These changes may further exacerbate the functional declines associated with healthy aging. Studies exploring functional performance in older adults are sparse [2], and it is unknown whether rotator cuff injured older adults perform functional tasks differently than their healthy counterparts. In the clinical setting, it is difficult to quantitatively evaluate functional performance, so functional outcome scores are often used. These scores rely on subjective patient self-assessments, and it is unclear whether these scores can successfully classify older adults with a rotator cuff tear. While functional outcome scores are used as a surrogate to evaluate function, it is unknown whether these scores relate to measured kinematics during task performance. Our objective is to obtain functional outcome scores and task kinematics, and assess their relationships for older adults with and without a rotator cuff tear.

METHODS

Six older adults (4M, 2F, mean age 64±2.3yrs) participated; 3 with a degenerative, full-thickness tear of the supraspinatus and 3 age- and gender-matched controls. Subjects performed 7 functional tasks that span the upper limb workspace from a seated position (chair height=0.53m). Tasks included axilla wash, forward reach, functional pull, hair comb, perineal care, upward reach to shoulder height, and upward reach to 115°. Forward and upward reaches were performed with a 2lb dumbbell weight to a distance measuring 80% of the subject’s forearm length; functional pull was against 6lb resistance, from an unloaded weight machine. Three trials of each task were recorded; the second trial was used for analysis. Seven Hawk motion capture cameras (Motion Analysis Corp.) recorded locations of 12 retroreflective markers on anatomical landmarks during tasks. Data was post-processed with Cortex (Motion Analysis Corp.), OpenSim (v.3.0, Stanford Univ.), and Matlab (The Mathworks, Inc.). Maximum and minimum joint angles were calculated for 3 shoulder degrees of freedom (shoulder elevation, elevation plane, shoulder rotation); minimum angle was subtracted from maximum angle to calculate ROM.

Participants completed 4 functional outcome scores: Western Ontario Rotator Cuff Index (WORC), American Shoulder and Elbow Surgeons Shoulder Outcome Score (ASES), Simple Shoulder Test (SST), and the Rand 36-Item Short Form Health Survey (SF-36). Repeated measures ANOVA were used to compare participants with a rotator cuff tear to controls for each functional outcome score and task ROM. Regression analyses were used to assess relationships between ROM and outcome scores for outcomes that were different between groups. Since these are preliminary analyses, we did not correct for type I error and assessed differences at p≤0.1.

RESULTS AND DISCUSSION

All tasks were successfully completed by all
subjects, except the hair comb for a single rotator cuff tear participant; this trial was not included in the analyses. Participants in the rotator cuff tear group had reduced shoulder elevation ROM compared to healthy controls for the hair comb (p=0.0125) and perineal care (p=0.0347) tasks (Fig. 1A). Similarly, elevation plane ROM was reduced for participants with a rotator cuff tear for the axilla wash (p=0.0212) and functional pull (p=0.0707) (Fig. 1B).

Figure 1:

<table>
<thead>
<tr>
<th></th>
<th>Rotator Cuff Tear Group</th>
<th>Control Group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder Elevation ROM</td>
<td>Best (deg)</td>
<td>Worst (deg)</td>
<td>Best (deg)</td>
</tr>
<tr>
<td>Hair comb</td>
<td>120</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Perineal care</td>
<td>120</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Elevation Plane ROM</td>
<td>Best (deg)</td>
<td>Worst (deg)</td>
<td>Best (deg)</td>
</tr>
<tr>
<td>Axilla wash</td>
<td>210</td>
<td>-30</td>
<td>120</td>
</tr>
<tr>
<td>Functional pull</td>
<td>210</td>
<td>-30</td>
<td>120</td>
</tr>
<tr>
<td>WORC</td>
<td>Best (wt)</td>
<td>Worst (wt)</td>
<td>Best (wt)</td>
</tr>
<tr>
<td>SF-36</td>
<td>Best (pts)</td>
<td>Worst (pts)</td>
<td>Best (pts)</td>
</tr>
</tbody>
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Subjects with a rotator cuff tear had worse scores than controls on the functional outcome scores (Fig. 1C). These differences were significant for SST (p=0.045), WORC (p=0.007), and SF-36 (p=0.086), with a trend toward significance for ASES (p=0.167). Using regression analyses, we identified relationships between the functional outcome scores and ROM. For the SF-36, 71% and 88% of the variation in elevation angle ROM was accounted for by changes in SF-36 score for the functional pull (p=0.0341) and axilla wash (p=0.0055), respectively (Fig. 2). Similarly, 64% of the variation in shoulder elevation ROM was accounted for by changes in SF-36 score for perineal care (p=0.0561) (Fig. 2). Sixty eight % of the variation in elevation angle ROM was accounted for by changes in ASES score for the functional pull (p=0.0422), while 57% of the variation in shoulder elevation ROM was accounted for by changes in SST score for the perineal care task (p=0.0848). Our findings indicate that even in this preliminary sample, we are able to identify important relationships between subjective, self-assessments of function and quantitative descriptions of function during specific tasks. This work indicates that the SF-36 and SST scores are able to differentiate between patients with and without a rotator cuff tear and are associated with differences in performance during the axilla wash, functional pull, and perineal care tasks.

CONCLUSIONS

We have measured functional kinematics for a group of older adults with and without a rotator cuff tear and identified differences between these groups for functional outcome scores and ROM. Clinical implications of our findings suggest that a few of the many available functional outcome scores should have a priority when evaluating patients with a suspected rotator cuff tear in the clinic. This work is part of an ongoing study which will further evaluate these relationships in a larger cohort. Identification of tasks that require compensation after injury will allow researchers to focus on the muscles that play a role during those specific tasks.

REFERENCES


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