CHANGES IN SCAPULAR KINEMATICS PRE AND POST WORKDAY

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INTRODUCTION

Shoulder impingement syndrome is the most commonly diagnosed musculoskeletal disorder of the shoulder complex [1]. It has been found that of the 3 scapular rotations, upward rotation was the only movement to significantly affect the clearance of the rotator cuff tendons within the subacromial space [2]. Shoulder impingement syndrome has been found to occur frequently in workers requiring repetitive arm motions such as dental hygienists. While working, dental hygienists may require their shoulders to be elevated above 60 to 90 degrees for long periods of time [3]. It is believed that repetitive tasks may alter normal shoulder kinematics and cause compensatory shoulder motions to adjust for deficits caused by fatigue [4]. We hypothesized that workday fatigue would cause increases in scapular upward rotation from normal glenohumeral kinematics [4]. To the best of our knowledge there have been no published studies comparing 3D scapular kinematics between pre and post workdays in any population. Additionally, no studies of this nature have been conducted within the workspace of the desired population.

METHODS

Four healthy female dental hygienists participated in this study (mean age, 35 years). All subjects worked full time (40+ hours per week) and all data were collected before and after a full 8 hour workday at the clinic the hygienist was employed. Kinematic data were collected via the Polhemus Fastrack magnetic tracking system with three receivers: thorax, scapula and humerus (Figure 1). The thoracic receiver was attached using double side adhesive tape to the manubrium inferior to the jugular notch. The scapular receiver was attached using a scapula tracker jig and Velcro strips on the scapular spine and acromion process [2]. The humeral receiver was placed over the deltoid tuberosity using a molded cuff. Bony landmarks were digitized using the stylus during the calibration phase of our experimental protocol. For all trials, data were collected at a rate of 40 Hz.

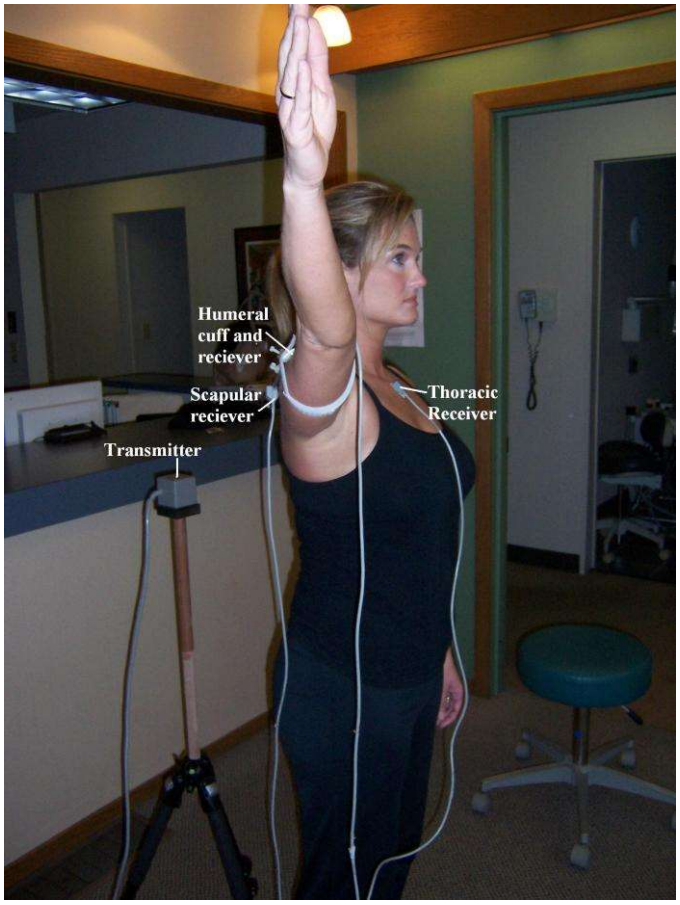

Figure 1: Experimental setup and attachment of sensors.

During calibration and data collection trials, subjects were in a standing position. The arbitrary axis systems defined by the Polhemus were converted to anatomically appropriate axis systems based on the recommendations of the International Society of Biomechanics (ISB) Committee for Standardization and Terminology [5].

Each subject preformed three unconstrained arm elevation movements with their dominant arm.

Arm movements were preformed in the scapular plane (30° from frontal plane). The speed of the movement was controlled by having the subject achieve maximal humeral elevation in 4 seconds and returning their arm to their side using the same path in an additional 4 seconds. Data were collected twice, once in the morning before work and once immediately following the work day. An average of the three arm elevations trials was made; from these data, humeral elevation and scapular upward rotation were interpolated in 5 degree increments during the humeral elevation path.

RESULTS AND DISCUSSION

Using the pre and post workday data for each subject, we plotted scapular upward rotation with respect to the thorax to humeral elevation with respect to the thorax (Figure 2). From all subjects, an observable increase in scapular upward rotation was noted after the workday. From both subjects 1 and 2 it appeared that the increase in scapular upward rotation was more profound towards the peak of humeral elevation post workday. Intuitively this makes sense, as increased humeral elevation demand typically requires more scapular involvement. These preliminary findings are consistent with our hypothesis that scapular upward rotation would increase post workday due to a compensatory fatigue mechanism. However, more subjects are needed to confirm these preliminary results.

ACKNOWLEDGEMENTS

Funding for this project was possible through a NIOSH grant 5R01OH008288.

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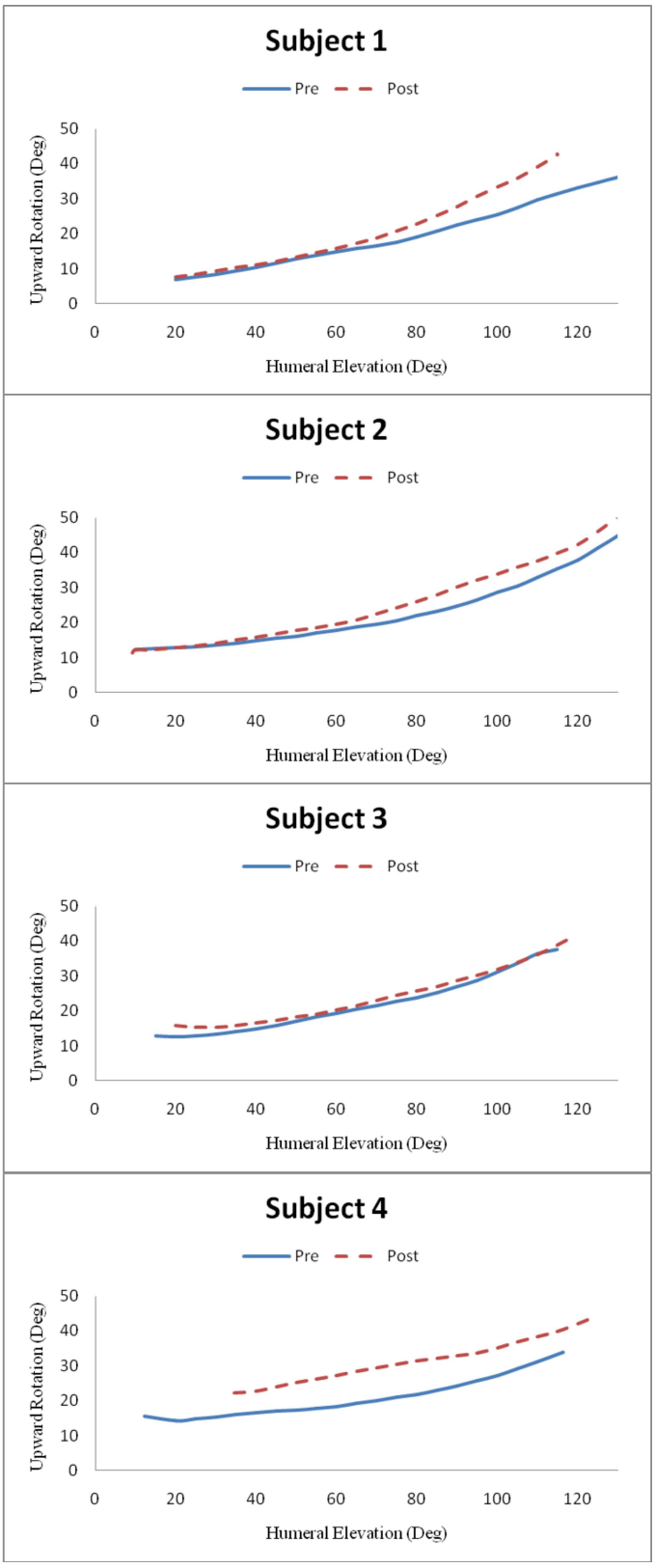

Figure 2: Changes to scapular upward rotation as a result of workday fatigue.

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