SCAPULAR ELEVATION PREDICTS GLENOHUMERAL STABILITY AND FUNCTION WHEN REACHING BEHIND THE BACK IN PATIENTS WITH ROTATOR CUFF TEARS

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Introduction

Individuals with a rotator cuff tear frequently utilize scapular compensation to complete functional tasks [1], which may lead to uncoordinated glenohumeral motion resulting in altered glenohumeral joint function and stability. Compensation in the form of increased scapular elevation may increase clearance with the lateral torso resulting in decreased glenohumeral internal rotation required to reach behind oneÕs back.

Objectives

Determine if maximum scapular elevation when reaching behind the back measured pre-exercise therapy predicts changes in glenohumeral internal rotation and glenohumeral joint stability following a 12-week structured exercise therapy program.

Methods

- 20 subjects (ages 45-70) recruited after providing IRB-approved written informed consent
  - Symptomatic rotator cuff tear isolated to supraspinatus

Exercise Therapy Protocol

- 12-week structured program
  - Focuses: Range of motion and strengthening of rotator cuff/scapular muscles
  - Subject progression based upon pain, range of motion, and strength

Dynamic Stereoradiography [2] and Vicon Motion Capture

- Subjects performed a behind the back task beginning with hand placed on thigh, reached as far behind back
- Vicon used to track anatomical marker to quantify scapular elevation

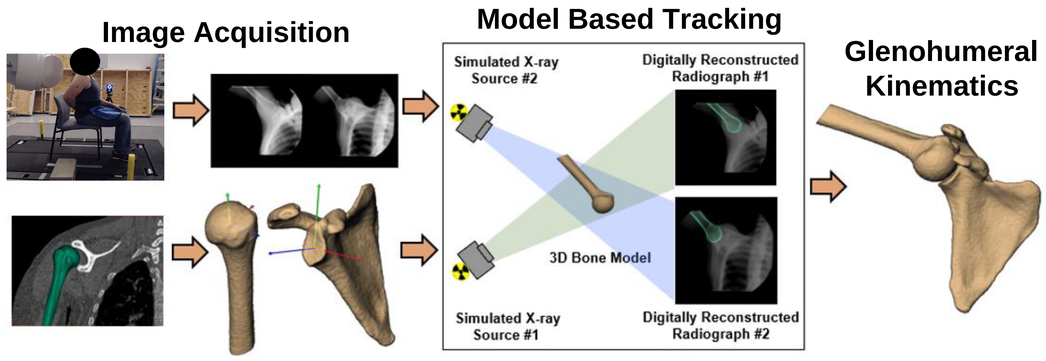

Figure 1: Overview of image acquisition and procedures for kinematic analysis

Pre- vs. Post-Exercise Therapy

- Comparisons made using pre- and post-exercise therapy trials containing the maximum reach in the medial-lateral (ML) direction
- Outcome Parameters
  - Maximum scapular elevation of affected-side quantified using Vicon (marker on acromioclavicular joint, normalized to initial position, mm)
  - Glenohumeral internal rotation (IR) at maximum reach (degrees, Dynamic Stereoradiography)
  - Contact path length throughout task (% glenoid size, Dynamic Stereoradiography)

Statistics

- Paired t-test or Wilcoxon signed rank tests on outcome parameters pre- vs. post-exercise therapy
- Linear regressions to determine ability of maximum scapular elevation to predict changes in glenohumeral internal rotation at maximum reach and changes in contact path length
  - Significance was set at $p < 0.05$

Results

Table 1: Summary of Scapular Elevation Prediction Models

Dependent Variable	*b*	R^2	,
Internal Rotation	-0.48	0.23	<0.05
Contact Path Length	0.51	0.26	<0.05

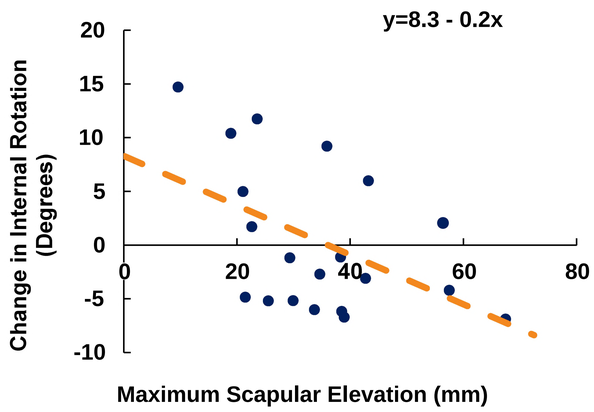

Figure 2: Relationship Between Scapular Elevation and Changes in Internal Rotation

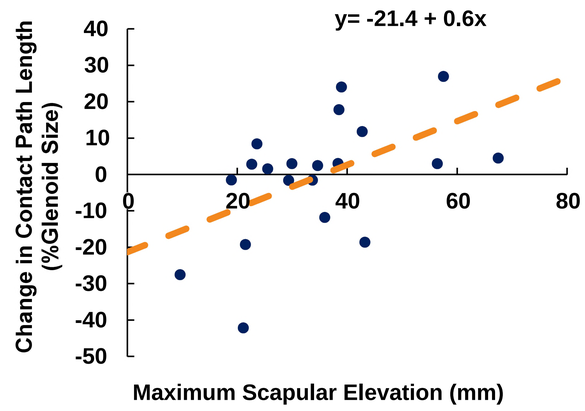

Figure 3: Relationship Between Scapular Elevation and Changes in Contact Path Length

- No changes in contact path length or IR post-exercise therapy ($p>0.05$)
- Increase in maximum scapular elevation of 7.3 Ñ10.9mm post-exercise therapy ($p<0.05$)
  - 75% subjects showed an increase in maximum scapular elevation of 11.8mm (average)

- Maximum scapular elevation predicts changes in IR and contact path length post-exercise therapy (Table 1)
  - 10mm increase maximum scapular elevation IR decreases 2.0Á(Figure 2)
  - 10mm increase maximum scapular elevation contact path length increases 6.0% glenoid size (Figure 3)

Discussion

- Increases of 6.0% glenoid size per 10mm increase in scapular elevation may be clinically significant
  - Previous studies showed differences in contact path length between healthy and asymptomatic subjects of 9.1% glenoid height during frontal-plane abduction [3]
- Increased scapular elevation post-exercise therapy scapular compensation should be more specifically addressed in non-operative treatment when reaching behind back

Future Directions

- Compare healthy subject's kinematics when reaching behind back with symptomatic subjects

Significance

- Identifying tasks that predict function aid in development of rotator cuff index for clinical decision making on initial treatment

Acknowledgements

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References

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