SUBACROMIAL INJECTION RESULTS IN FURTHER SCAPULAR DYSKINESIS

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SUMMARY

Patients with subacromial impingement syndrome often experience pain during arm elevation. Subacromial injections of anesthetics are commonly used to help reduce pain for this population. This study examines the influence of subacromial anesthetic injections on deltoid muscle activity and scapular kinematics.

INTRODUCTION

Treatment of subacromial impingement often targets strengthening rotator cuff musculature and reducing pain. However, little is known about the rotator cuff activity in the presence of pain. Work from our laboratory suggests that disabling the rotator cuff (nerve block) results in increased deltoid muscle activity during arm elevation in healthy subjects [1]. Myers et al., suggested that patients with impingement have greater reliance on deltoid activity than healthy controls [2]. Together, these findings suggest that rotator cuff activation may be attenuated by pain inhibition in patients with subacromial impingement.

Patients with impingement have been reported to have greater scapular anterior tilting, which is believed to reduce clearance in the subacromial space [3]. The influence of subacromial pain on scapular tilting is currently unknown. The goal of this study is to examine the influence of pain on deltoid activity. Additionally, we sought to investigate the influence of pain on scapular tilting during arm elevation. We hypothesize that following an anesthetic injection, patients will have a reduction in deltoid activity due to pain dis-inhibition of the rotator cuff. Further we hypothesize that following a subacromial injection, patients will demonstrate scapular kinematics that more closely resemble healthy control participants' kinematics.

METHODS

Twenty patients with a mean age of 57.5 (± 8.1) years diagnosed with stage 2 subacromial impingement syndrome were included in this study. Additionally, to date, 5 healthy age and arm dominance matched control participants, with a mean age of 60 (± 11.2) years have been included. Patients suspected of having rotator cuff tears were excluded. Surface EMG activity was measured from three shoulder muscles (anterior, middle and posterior deltoid) on the affected arm during three arm elevation trials in the scapular plane. Each arm elevation trial was performed at approximately 30 degrees per second. Three dimensional scapular kinematic data were measured using an electromagnetic tracking device (Polhemus Fastrak). Digitization of anatomic landmarks followed the proposed ISB standards [4]. Subjects completed a visual analog scale (VAS) questionnaire depicting their pain immediately following the arm elevation task. All data were collected before and after a subacromial injection of anesthetic (6 cc 0.5% bupivacaine with epinephrine and 3 cc lidocaine with epinephrine) and corticosteroid (1 cc 40mg methylprednisolone acetate) as part of their normal treatment. The procedure was completed by one of our co-authors (M.S) who is an orthopedic surgeon. Normalization of EMG was calculated as percent maximal voluntary isometric contraction (MVIC) of each muscle during a 5 second contraction, where the amplitude of the contraction was determined by the root mean squared (rms) over the middle two seconds of the muscle contraction. Each muscle's MVIC was determined in a unique testing position, with approximately 20 seconds of rest between testing different muscles. No sensors were removed between the pre and post injection tests. EMG data were sampled at 1200 Hz and kinematic motion data were sampled at 40 Hz. All MVIC data (for normalization) were collected post injection.

RESULTS AND DISCUSSION

Following an anesthetic subacromial injection, there was a reduction in pain of approximately 62%; pre injection VAS 6.3/10 ± 2.4, post injection VAS 2.8/10 ± 1.4. Patients tended toward an anteriorly tilted scapula at all levels of humeral elevation and this trend was increased following a subacromial injection. In contrast, our control participants demonstrated posterior tilt at all levels of humeral elevation (Figure 1). Patients had greater deltoid (anterior, middle and posterior) activity at all levels of humeral elevation compared to healthy controls; additionally deltoid activity was augmented following the subacromial injection for our patient population (Figure 2,3,4).

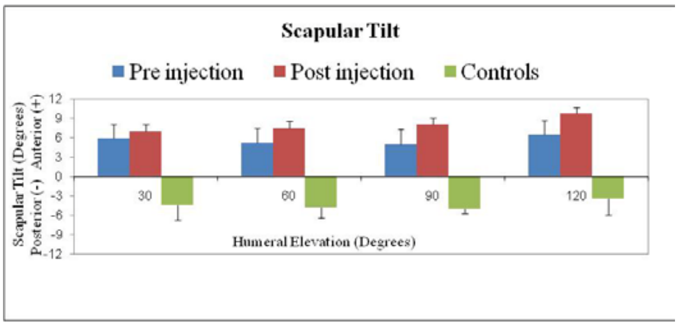

Figure 1: Scapular tilt pre (blue) and post (red) injection in patients with subacromial impingement versus healthy controls (green).

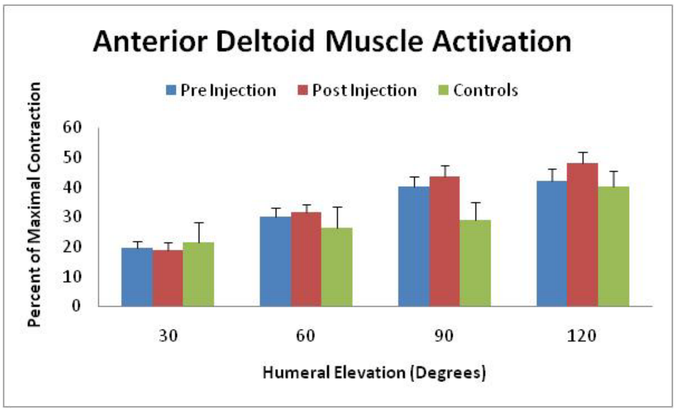

Figure 2: Anterior deltoid activity pre (blue) and post (red) injection in patients with subacromial impingement versus healthy controls (green).

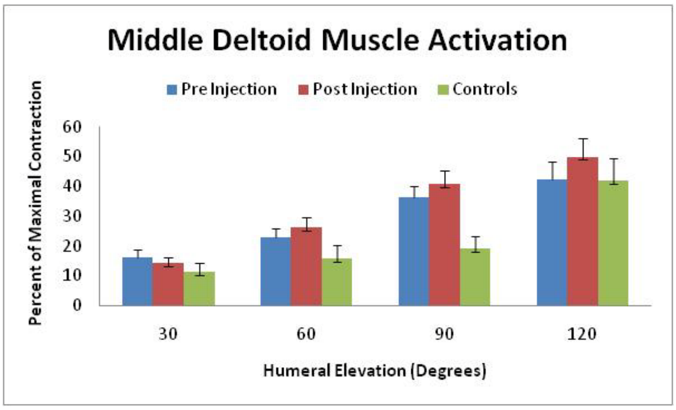

Figure 3: Middle deltoid activity pre (blue) and post (red) injection in patients with subacromial impingement versus healthy controls (green).

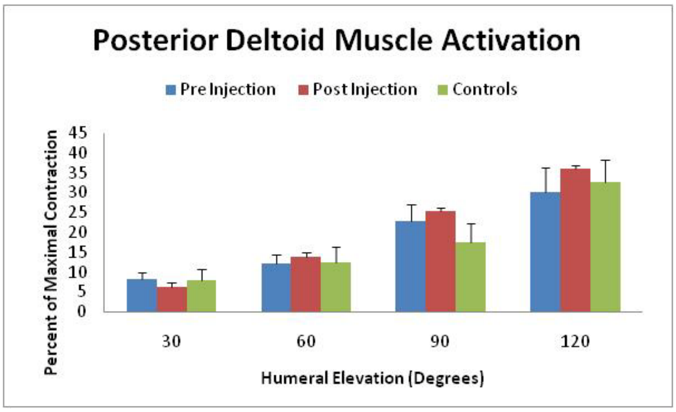

Figure 4: Posterior deltoid activity pre (blue) and post (red) injection in patients with subacromial impingement versus healthy controls (green).

The subacromial distance can be influenced by scapular anteior tilting and superior humeral migration. Our results indicate that patients with impingement have greater scapular anteior tilting than control subjects. Further scapular tilting increased following the subacromial injection. Thus our hypothesis was not supported. This finding suggests that pain may be inhibiting scapular tilt to some degree. However, it is likely that the changes measured are transitory and represent the immediate adaptation in scapular neuro-mechanics adopted by this population.

Also contrary to our hypothesis, patients with impingement had greater deltoid activity after injection. However, our hypothesis was supported when comparing the patients with impingement with healthy controls. This finding suggests that patients with impingement may have greater superior humeral head migration than healthy controls, but humeral migration may be exacerbated by a subacromial injection. The greater activation of deltoid muscles in the impinged group may be due to reduced rotator cuff activity [1]. These findings suggest that a reduction of pain may further reduce rotator cuff activity and result in greater superior humeral displacement during arm elevation. However, these results may be due to a transitory or "foreign sensation" adaptation due to the short lived anesthetics.

CONCLUSIONS

Patients with impingement demonstrate scapular kinematics that were consistent with narrowing of the subacromial space. Additionally, scapular dyskinesia was worsened by an anesthetic injection. Patients also demonstrated increased deltoid activity during arm elevation following an injection which suggests a reduction of rotator cuff involvement and potential narrowing of the subacromial space. Pain may have an important role in maintaining scapular and humeral kinematics in patients with subacromial impingement.

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