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ORIGINAL ARTICLE

Shoulder activity level in patients with idiopathic adhesive capsulitis

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Background: Idiopathic adhesive capsulitis is a common condition resulting in painful multidirectional restriction of motion. Adhesive capsulitis may inhibit shoulder activity level, but this relationship has not been previously studied. This study tested the hypothesis that patients with idiopathic adhesive capsulitis have lower shoulder activity than sex- and age-matched controls.

Methods: Seventy-two eligible patients (37 men and 35 women) with idiopathic adhesive capsulitis completed a validated shoulder activity scale that was compared with sex- and age-matched norms from a healthy population with no history of shoulder disorders. The association of shoulder activity level with patient age, sex, and American Shoulder and Elbow Surgeons and Simple Shoulder Test (SST) scores was evaluated.

Results: Overall, 58% of patients actually had higher shoulder activity scores than sex- and age-matched controls. Among patients aged 51 to 70 years, 68% of patients (73% of men and 63% of women) demonstrated higher Shoulder Activity Scale scores compared with controls. The activity level was higher among all patients aged 51 to 70 years compared with controls (10.3 ± 1.48 vs. 8 ± 0.52 , $P = .0067$). The difference was significant for men in this age group (12.2 ± 1.7 vs. 9 ± 0.75 , $P = .0042$). There was a statistically significant positive correlation of the Shoulder Activity Scale score with the SST score ($r = 0.31$, $P = .009$).

Conclusion: Patients with idiopathic adhesive capsulitis do not have a lower shoulder activity level than sex- and age-matched controls, and older men may actually have a higher level of shoulder activity than controls. Shoulder activity level is correlated with the SST score in patients with idiopathic adhesive capsulitis.

Level of evidence: Level III; Cross Sectional Design; Epidemiology Study

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Keywords: Shoulder; activity level; adhesive capsulitis; idiopathic adhesive capsulitis; shoulder activity scale; frozen shoulder

Idiopathic adhesive capsulitis, also called frozen shoulder, is a common idiopathic condition. Thickening and contracture of the rotator interval and capsule result in shoulder pain and restriction of glenohumeral motion.^{14,19,24} The overall incidence is 3%, with a peak incidence between the

ages of 40 and 70 and a slight female predominance.^{1,8,25} The condition is most frequently treated nonoperatively with a combination of anti-inflammatory medications, home exercises, physical therapy,^{7,9,17,19,22} and glenohumeral intra-articular corticosteroids.^{15,16,20,23} Operative treatment, consisting of manipulation under anesthesia, with or without arthroscopic capsular release, may be considered if patients fail to improve with nonoperative measures.¹⁰

Activity level has been identified as a potential prognostic and outcome variable in orthopedic surgery.⁶ As opposed to what tasks a patient is able to perform, activity level

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measures how often a patient engages in specific tasks. A validated shoulder activity score² has been studied in patients with rotator cuff disease,^{3,21} shoulder instability,^{4,5} osteoarthritis,⁵ and in a normative population.¹¹ Although shoulder activity has been shown to be associated with age and sex^{5,11} and to vary by shoulder diagnosis,⁵ shoulder activity level in patients with adhesive capsulitis has not been previously studied. The initial premise was that patients presenting with adhesive capsulitis, which causes pain and globally decreased shoulder range of motion, were likely to have decreased shoulder activity.

The primary purpose of this study was to evaluate baseline shoulder activity using the Shoulder Activity Scale (SAS) in patients with idiopathic adhesive capsulitis. We tested the hypothesis that shoulder activity is lower in patients with idiopathic adhesive capsulitis than in age- and sex-matched healthy controls, while also assessing whether shoulder activity is associated with patient age, sex, and American Shoulder and Elbow Surgeons (ASES) and Simple Shoulder Test (SST) scores. We anticipated that patients with idiopathic adhesive capsulitis would have lower shoulder activity than age- and sex-matched controls and that SAS scores would correlate with ASES and SST scores.

Materials and methods

New patients presenting to the clinic of a single sports medicine and shoulder fellowship-trained orthopedic surgeon (R.H.B.) with a chief complaint of shoulder pain or restricted shoulder range of motion prospectively completed the SAS,² ASES,¹³ and SST.¹² The SAS asks how often patients have participated in 5 specific activities in their healthiest and most active state during the past year. The questionnaire generates a numeric score from 0 (least active) to 20 (most active). In addition, 2 questions assess the level of involvement in overhead and contact sports.

The findings of a complete history, physical examination, and review of pertinent imaging studies were used to establish a diagnosis. Patients diagnosed with idiopathic adhesive capsulitis without a history of prior injury or surgery on the affected shoulder were included in the study. The study excluded patients diagnosed with any other causative shoulder pathology at the time of the initial clinic visit or at any subsequent clinic visit. Age was not an exclusion criterion.

In a previous study, age- and sex-based normative data from individuals aged older than 18 years without shoulder complaints were collected by a marketing research firm that maintains a large database of people matched to the March 2010 Current Population Survey Social and Economic Supplement and the 2009 American Community Survey.¹¹ That study reported the distribution of shoulder activity level in healthy controls in aggregate age groups by sex, including 18 to 30, 31 to 50, 51 to 70, and older than 70 years.¹¹

The current study compared the activity level of each idiopathic adhesive capsulitis patient with the median activity level for a corresponding healthy control from the same sex and age group. The percentage of idiopathic adhesive capsulitis patients with SAS above or below the median for the corresponding age- and sex-matched healthy control was calculated for patients aged 31 to 50 and 51 to 70 because all patients were aged between 30 and 70 years.

The 25th, 50th, and 75th percentile of shoulder activity was calculated for the men and women with idiopathic adhesive capsulitis from both of these age groups.

Paired Student *t* tests were used to compare mean SAS scores between patients with idiopathic adhesive capsulitis and sex- and age-matched controls. The distribution of participation in overhead and contact sports was also calculated and compared with sex- and age-matched controls. The χ^2 test was used to compare this distribution. SAS score was correlated with age, both overall and by sex. Statistical significance was determined at the level of $P < .05$. The SAS score was correlated with the baseline ASES and SST scores. The analysis was conducted using Microsoft Excel 2016 software (Microsoft Corp., Redmond, WA, USA).

Results

SAS score by age and sex

The SAS was completed by 72 patients, 37 men (51.4%) and 35 women (48.6%), diagnosed with idiopathic adhesive capsulitis. The age of included patients ranged from 33 to 68 years. Shoulder activity level did not correlate with patient age for the entire cohort ($r = 0.20$, $P = .089$) or when stratified by sex (men: $r = 0.26$, $P = .12$; women: $r = 0.11$, $P = .53$; Fig. 1).

Overall, 58% of idiopathic adhesive capsulitis patients had a higher activity level than sex- and age-matched controls. Broken down by age, 47% of patients aged 31 to 50 years were more active than matched controls, with 43% of men and 50% of women in this age group demonstrating higher activity than controls. Among patients aged 51 to 70 years, 68% of patients (73% of men and 63% of women) demonstrated a higher activity level compared with controls (Fig. 2). For idiopathic adhesive capsulitis patients aged 51 to 70 years, the median activity level was 11 (mean 10.3 ± 1.48), which was significantly higher than the median activity level for age-matched controls of 8 (mean 8.0 ± 0.52 ; $P = .0072$). Men were significantly more active than controls (12.2 ± 1.74 vs. 9.0 ± 0.7 , $P = .0042$; Fig. 2).

No significant differences were demonstrated between idiopathic adhesive capsulitis patients and sex- and age-matched controls in participation in contact sports or overhead sports (Table I).

SAS compared with other patient-reported scores

For all patients, there was a statistically significant positive correlation of shoulder activity with the SST score ($r = 0.31$, $P = .009$; Fig. 3, A) but not with the ASES score ($r = .067$, $P = .58$; Fig. 3, B).

Discussion

Contrary to our initial hypothesis, patients with idiopathic adhesive capsulitis do not have lower activity scores than asymptomatic sex- and age-matched controls. In fact, men

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