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Scapular dyskinesis following displaced fractures of the middle clavicle

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Purpose: To evaluate the rate of scapular dyskinesis and resulting patient outcomes after treatment of displaced midshaft clavicle fractures.

Methods: Skeletally mature patients with isolated, displaced midshaft clavicle fractures treated with or without surgery over a 16-month period were recruited. The minimum length of follow-up at study examination was 12 months. Patient outcomes were documented using the SICK (scapular malposition, inferomedial border prominence, coracoid pain and malposition, and dyskinesis of scapular movement) Scapula Rating Scale, the Simple Shoulder Test, 3 visual analog scales (VAS) for pain, and shoulder range-of-motion and strength measurements. Of the 32 eligible patients, 24 (75%) were successfully recruited.

Results: The mean participant age was 46 ± 17 years, with a mean length of follow-up at study evaluation of 1.7 ± 1 years. Surgical fixation was performed in 12 patients (50%). Scapular dyskinesis was present in 37.5% of patients (n = 9). Patients with scapular dyskinesis had worse SICK scapula scores (5.8 ± 2.2 vs 3.1 ± 2.4, $P = .01$), worse Simple Shoulder Test scores (10.5 ± 1.6 vs 11.7 ± 0.8, $P = .029$), higher maximum VAS pain scores (4.1 ± 3.1 vs 0.97 ± 1.2, $P = .002$), and worse average VAS pain scores in the week before the examination (2.7 ± 2.5 vs 0.2 ± 0.4, $P < .001$) compared with patients without scapular dyskinesis. Range of motion and abduction strength were similar between the groups. Scapular dyskinesis developed in 1 patient treated with surgery (8% [1 of 12]) compared with 8 patients treated nonoperatively (67% [8 of 12]) ($P = .009$).

Conclusions: Scapular dyskinesis is common after displaced middle-third clavicle fractures, and these patients have more pain and worse functional outcomes compared with patients without scapular dyskinesis. Surgical treatment may reduce a patient's risk of scapular dyskinesis developing and improve short-term outcomes.

Level of evidence: Level III, Retrospective Cohort Design, Treatment Study.

Keywords: Clavicle fracture; scapular dyskinesis; SICK scapula syndrome

Scapular dyskinesis is abnormal scapular positioning at rest and altered kinematics during glenohumeral motion.[14] It is classified based on prominence of the inferomedial scapular border (type I), the entire medial scapular border (type II), or the superomedial border (type III) or no

University institutional review board approval was obtained to evaluate patients by physical examination and history after displaced midshaft clavicle fractures.

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asymmetry/dyskinesis (type IV).[6] Dyskinesis is diagnosed by observing both scapulae with the patient in an upright position and the arms resting at the side. The arms can then be simultaneously elevated in the plane of the scapula while scapular motion is observed[6]; however, observing the scapula in the resting position alone may be adequate.[4] Attributed causes of scapular dyskinesis include bony abnormalities, ligamentous injury, neurologic injury, and muscle weakness or fatigue. Malposition or abnormal scapular motion is associated with increased patient pain and disability regarding daily activities.[6]

A variety of shoulder pathology has been associated with scapular dyskinesis.[5] Warner et al[14] found that 64% of individuals with shoulder instability and 100% of individuals with impingement show evidence of abnormal scapular motion. Whether scapular dyskinesis leads to impingement and instability or vice versa has not been clearly shown in the available literature.[5] Gumina et al[4] reported that scapular dyskinesis develops in 71% of patients with type III acromioclavicular injuries. This may be a result of pain at the acromioclavicular joint or loss of a stable fulcrum that the joint provides with glenohumeral motion. Of the patients with scapular dyskinesis in the previously mentioned study, 58.3% also had SICK (scapular malposition, inferomedial border prominence, coracoid pain and malposition, and dyskinesis of scapular movement) scapular syndrome.[1] The SICK scapula is classified with a rating system to determine severity. This muscle fatigue syndrome was originally recognized in throwing athletes with shoulder pain and weakness and is considered a severe form of scapular dyskinesis.[1]

Fractures of the clavicle may also affect scapular kinematics. Several studies have shown changes in scapular position, shoulder motion, and strength with varying degrees of clavicle shortening.[8,9] In a recent meta-analysis, nonoperative treatment and operative treatment of displaced clavicle fractures were compared. The authors found a 9% symptomatic malunion rate in the nonoperative group compared with 0% in the operative group and variation in associated clinical outcomes.[11]

The factors predicting patient satisfaction and functional outcomes after this injury are not clearly understood. The purpose of this study was to evaluate the rate of scapular dyskinesis and patient outcomes after treatment of displaced midshaft clavicle fractures. The study hypothesis was that there may be an association between midshaft clavicle fractures and the development of scapular dyskinesis resulting in worse patient outcomes.

Methods

Displaced fractures were defined as any middle-third clavicle fracture with a minimum of 2.0 cm of total displacement (sum of vertical displacement and shortening) at the fracture site. Patients with displaced fractures of the middle-third clavicle were identified retrospectively from billing codes by 10 orthopaedic surgeons from April 2009 through August 2010. Patients treated nonoperatively and patients treated with surgical fixation were included. Injury had occurred or surgery had been performed at least 12 months earlier in all patients at the time of study evaluation. Patients were excluded if they were aged younger than 21 years or older than 80 years at the time of injury or had concurrent traumatic injuries, prior fractures on the injured side, injury or surgery on the affected extremity after treatment of the clavicle fracture, neurologic injury (peripheral or spinal cord), frozen shoulder, or shoulder replacement. Patients who were non-ambulatory or not living independently were also excluded from the study group. On the basis of these criteria, 32 patients were eligible for enrollment; of these, 24 were successfully recruited for this study (75% [24 of 32]). Patient-reported outcomes were obtained using the SICK Scapula Rating Scale, Simple Shoulder Test (SST), and 3 visual analog scales (VAS) for pain (ranging from 0 to 10): (1) pain at its maximum, (2) average pain during the week before evaluation, and (3) pain at its minimum.

Scapulothoracic motion was documented in accordance with the SICK Scapula Rating Scale.[1] Shoulder range of motion (ROM), scapular malposition (types I-IV), and shoulder strength were also assessed. Patients were positioned supine for bilateral assessment of shoulder ROM. Goniometric measures of shoulder flexion, abduction, internal rotation, and external rotation were recorded using a standard 10-inch manual goniometer. Shoulder external and internal rotation was recorded at 90° of abduction. Compensatory patterns were controlled for in goniometric ROM measurements per the standards described by Norkin and White[12] to maximize assessment validity and reliability.

Scapular assessment for abnormal kinematics followed the protocol previously described.[1] Limb dominance and the affected side were recorded for each patient. Patients were observed from behind with arms at rest for the assessment of static scapular position, with scapular characteristics (types I-IV) recorded if present.

Scapular motion was assessed with open-chain upper-extremity active ROM by having patients simultaneously elevate both arms in the sagittal and scapular planes as far as possible with each limb for 10 repetitions. Symmetry of motion was assessed in each plane, with asymmetry and pain recorded dichotomously as either present or not present. If no asymmetry or pain was present after this 10-repetition test, the same assessment was repeated with 5-lb dumbbells in each hand for up to 10 repetitions, with recording of asymmetry.

Closed-chain scapular kinematics was assessed with a standard wall pushup test. Patients were asked to stand slightly greater than an arm's length away from a wall. They were then instructed to place their palms on the wall with the hands approximately shoulder width apart. From this position, patients were asked to perform up to 10 wall pushups with full bilateral shoulder protraction and elbow extension. Scapular motion was observed from behind, with dichotomous recording of asymmetry and pain as described earlier. Any scapular winging was recorded as previously described (types I-IV).[1]

The following parameters of static scapular position were then recorded for all patients: (1) superomedial scapular angle height difference (right-left height difference, in centimeters), (2) superomedial angle distance from body midline (right-left