Scientific Committee Report

ISAKOS Upper Extremity Committee Consensus Statement on the Need for Diversification of the Rockwood Classification for Acromioclavicular Joint Injuries

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Optimal treatment for the unstable acromioclavicular (AC) joint remains a highly debated topic in the field of orthopaedic medicine. In particular, no consensus exists regarding treatment of grade III injuries, which are classified according to the Rockwood classification by disruption of both the coracoclavicular and AC ligaments. The ISAKOS Upper Extremity Committee has provided a more specific classification of shoulder pathologies to enhance the knowledge on and clinical approach to these injuries. We suggest the addition of grade IIIA and grade IIIB injuries to a modified Rockwood classification. Grade IIIA injuries would be defined by a stable AC joint without overriding of the clavicle on the cross-body adduction view and without significant scapular dysfunction. The unstable grade IIIB injury would be further defined by therapy-resistant scapular dysfunction and an overriding clavicle on the cross-body adduction view.

In the recent literature, injuries to the acromioclavicular (AC) joint have been subject to extensive developments regarding proper clinical diagnosis and treatment. Despite these developments, controversy still exists regarding indications for treatment of the unstable AC joint and, in particular, for grade III injuries classified as AC separations with disruption of both the coracoclavicular (CC) and AC ligaments.[1] Indications for surgical intervention vary based on evaluation of functional impairment and assessment of the patient's concern regarding the cosmetic deformity of the injury. The basis of the surgical indication should ideally rest on a thorough, validated, and precise classification based on a clinical examination and diagnostic imaging. The most widely used classification is that of Rockwood[2] published in 1984. He expanded the classification presented by Tossy et al.[3] in 1963 to a total of 6 injury types by describing 3 additional injuries. The Rockwood classification is a purely radiographic classification system that allows the clinician to further evaluate the patient and to consider treatment options. However, a wide number of factors seem to influence the final result after treatment, including the timing of surgery, degree of dislocation, and ability to restore scapular kinematics after the initial injury.[4]

Treatment of the highly debated type III dislocations based on the current Rockwood classification system is especially problematic for clinicians.[1,4,5] Literature shows that nonoperative treatment is able to restore function even in the elite-level, overhead-throwing contact athlete.[5] There is a lack of information,
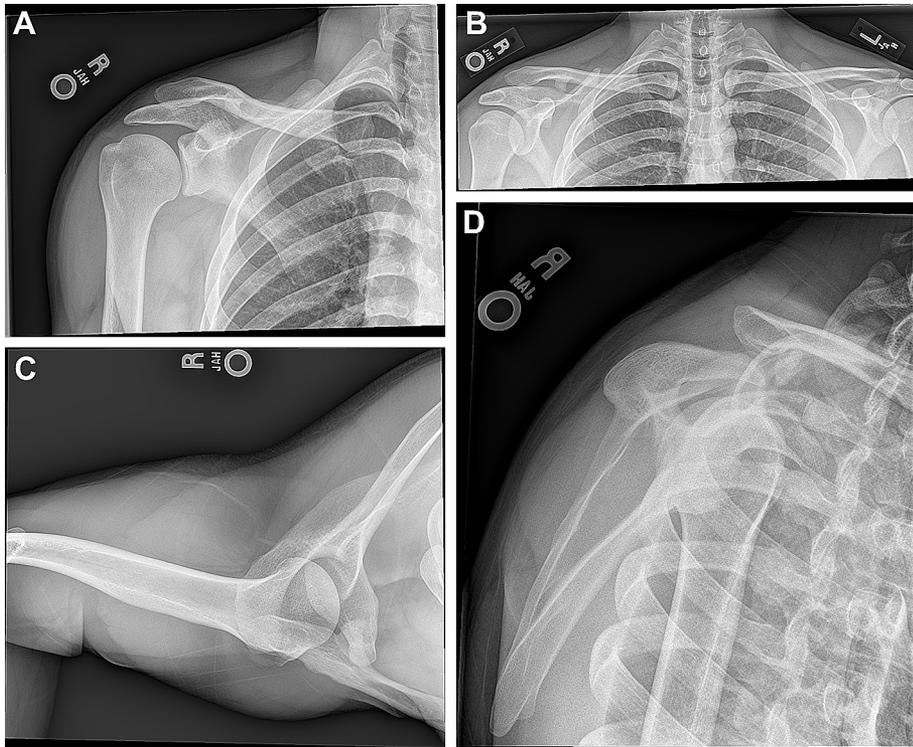
Fig 1. The 4 suggested projections for radiologic imaging of a right shoulder showing a chronic type IIIB instability of the AC joint: (A) true AP projection, (B) Zanca, (C) axillary projection, and (D) cross-body adduction view (Basamania/Alexander).

however, describing which factors are used to identify patients who are more suitable for surgical intervention, in addition to the factors that influence outcomes. The ISAKOS (International Society of Arthroscopy, Knee Surgery & Orthopaedic Sports Medicine) Upper Extremity Committee provided a more specific classification of shoulder pathologies to enhance the knowledge on and clinical approach to these injuries. The purpose of this article is to evaluate the scientific basis of optimal clinical decision making with special emphasis on the highly debated grade III AC dislocation. Furthermore, a modification of the Rockwood classification is suggested.

Radiologic Evaluation of AC Joint injuries (Rockwood Classification and Its Extension)

The Rockwood classification is the most widely used classification for AC joint dislocation but has the disadvantage of being a purely radiographic classification system.[3] This classification is based on the increasing severity of subsequent injury to the stabilizing structures of the AC joint complex and was described by Rockwood[2] in a very detailed anatomic fashion. However, clinical decision making is often a process based solely on 2-dimensional and static anteroposterior (AP) radiographic views without specific guidelines relating to radiographic technique.

Current classification of the Rockwood system is generally described as follows: In a type I injury, there is a sprain of the AC ligament with no radiographic abnormality. In type II injuries, the AC ligaments and joint capsule are disrupted whereas the CC ligaments are sprained but intact in addition to a 50% vertical subluxation of the distal clavicle. In type III injuries, the AC ligaments and joint capsule, as well as the CC ligaments, are disrupted (100% superior displacement of the distal clavicle). In type IV injuries, there is posterior subluxation of the clavicle into the trapezius. Currently, this is thought to be best seen on axillary radiographs. This technique, however, does not safely allow for 3-dimensional and functional evaluation of this lesion. A type V injury is an exaggeration of a type III injury with 100% to 300% superior displacement of the clavicle. In the rare type VI injury, there is subacromial or subcoracoid displacement of the clavicle and a reversed CC interspace.

Radiographic evaluation should include a bilateral Zanca view, which visualizes the ipsilateral and contralateral AC joints on a single x-ray cassette while maintaining the same orientation of the x-ray beam (Fig 1).[6] The view is obtained by tilting the x-ray beam 10° to 15° toward the cephalic direction and using only 50% of the standard shoulder AP penetration strength. By visualizing both AC joints on the same cassette, the CC distance can be compared from side to side, also allowing for future comparison of preoperative and postoperative examination findings. Varying configurations of the AC

joint can be found on AP radiographs. For example, Zanca[6] reported a normal AC joint width of 1 to 3 mm. Stress views are believed to be helpful in distinguishing between type II and III injuries by allowing inspection of the integrity of the CC ligaments. However, the difference in type II and III injuries is rarely significant, and in our opinion, the classical stress views with distal traction typically are not necessary for diagnosis.

An axillary view is particularly helpful in visualizing a type IV AC joint injury that results in an anteromedial displacement of the scapula because radiographic analysis will allow for visualization of a posteriorly displaced distal clavicle in relation to the acromion. However, one has to be careful in diagnosing posterior translation of the distal clavicle based on this view because recent studies have shown the difficulties in identifying a posteriorly translated clavicle on an axillary radiograph.[7] The Stryker notch view is useful for determining a coracoid fracture in a complete AC dislocation with normal CC interspace. Coracoid process fracture should be suspected when radiographs show AC dislocations with a normal CC distance.

According to our recommendations, additional radiographs should be taken to allow for differentiation between clinically relevant stable and unstable AC joint injuries. Because these findings are more associated with functional problems, the diagnostic imaging should take these into account and try to objectively evaluate the function of the AC joint. Although there are no published studies, Barnes et al.[8] have reported on a cross-body adduction radiograph (so-called Basamania view) to differentiate between a stable and unstable AC joint. In this imaging technique, a cross-body adduction AP view of the AC joint is used to assess the degree to which the clavicle overlaps the acromion because of the anteromedial translation of the scapula. In 1949 Alexander[9] described a similar radiographic imaging technique for AC joint instability. If the clavicle overrides the acromion on the cross-body adduction view, it indicates instability of the CC ligaments in addition to the AC joint disruption.

Clinical Evaluation of AC Joint Injuries

AC joint dislocations are injuries to a complex osseous ligamentous structure requiring thorough clinical evaluation for correct diagnosis and determination of optimal treatment. Whenever possible, patients should be examined standing or sitting so that the weight of the arm pulling downward stresses the AC joint and will make any deformity more apparent (Table 1). Traumatic pathology of the AC joint is identified by pain, swelling, and point tenderness at the AC joint. If a patient has more pain than expected for a simple AC joint injury, a coracoid fracture or a type IV injury with displacement of the clavicle through the trapezial fascia should be suspected. It has also been shown that in high

Table 1. Important Steps in Clinical Evaluation of Injured AC Joint

Joint	Clinical Testing*
AC joint	• Examine patient while standing or sitting (weight of arm pulling downward) • Check for direct pain, swelling, and point tenderness of AC joint • Check for AP and superoinferior translation • Perform cross-arm adduction test • Perform active compression test (O'Brien) • Perform resisted extension test • Check for combined injuries to glenohumeral joint • Check for neural, vascular, or additional injuries to adjoining joints
Scapulothoracic joint	• Assess patient in resting scapular position (from behind with arms at side) • Assess scapular motion in upward/downward flexion • Assess scapula position after manual reduction of AC joint • Perform scapular assistance test • Perform scapular retraction test

*Note the importance of combined clinical testing to improve the tests' specificity.

degrees of dislocation of the AC joint, associated injuries of the glenohumeral joint are very common and should be searched for.[10]

In type III injuries, both the AC and CC ligaments are torn, with no significant disruption of the deltoid or trapezial fascia. The upper extremity is held in an adducted position with the acromion depressed. The clavicle appears "high riding"; however, in reality the acromion and upper extremity are displaced inferior to the horizontal plane of the lateral clavicle. This is the "third translation," or an extra gliding motion of the scapula. Severe pain persists with motions even 1 to 3 weeks after injury. Patients should be evaluated 3 to 6 weeks after injury to allow for a thorough examination, which is not possible in the acute phase because of the patient's significant pain. Therefore the patient should be referred to a physiotherapist to improve range of motion and re-establish scapular kinematics after initial examination.

An examination for neural, vascular, or additional injuries of the adjoining joints should always be completed. Point tenderness at the joint will be increased with the cross-arm adduction test (arm elevated to 90° and then adducted across the chest with the elbow bent at 90°). Injection of anesthetic agent may relieve the pain, which implicates the AC joint as the source of pain. The examination should be performed before and after injection to determine whether changes in symptoms occurred.

Several physical tests have been described as clinical tools to detect lesions of the AC joint. Previous studies reported a sensitivity of 77% for the cross-body abduction test, 72% for the AC resistance test, and

Fig 2. Patient showing scapular dyskinesis of left shoulder after type V AC joint dislocation (note the prominence of the medial scapula border).

41% for the active compression test; however, the combination of all 3 tests showed a high specificity of 95%.[11]

Clinical Evaluation of Scapula in AC Joint Injuries

Injury to the AC joint not only affects glenohumeral function but may also have a negative effect on scapulothoracic function and scapulohumeral rhythm. The clavicle is the anterior strut supporting the scapula, and proper function of the AC and CC ligaments greatly contributes to the physiological motion of the scapula.[12-14] Shortening of the clavicle or instability of the AC joint may position the scapula in a protracted and internally rotated position. We know from previous studies that scapular dyskinesis may lead to glenohumeral and lateral shoulder pain as well as motion deficits.[15]

Clinical evaluation of the scapula can determine the presence or absence of alterations in scapular position or motion, collectively called "scapular dyskinesis," and can help guide effective treatment of any functional deficits. A reliable examination can be performed within 10 days after acute injury, when the immediate symptoms have decreased. To assess the resting scapular position with visual access to both scapulae, an evaluation should be performed from behind with both arms at the side. During observation, the clinician should check for asymmetry of the medial scapular border because any prominence indicates excessive scapular internal rotation and/or anterior tilt. This prominence can result when the

scapular strut is lost from injury either to the AC ligaments by themselves (type II) or to both AC and CC ligaments (type III and higher), and it suggests that functional deficits due to scapular dyskinesis may be present and treatment to stabilize the joint is indicated (Fig 2).[15]

In type III and higher injuries, the anterior/posterior drawer test of the AC joint will show positive results, as will the inferior/superior motion test. It is occasionally possible to reduce the AC separation by manually reversing the third translation of the scapula, pushing it laterally and then superiorly. If this can be accomplished, the medial scapular border prominence will often be diminished or eliminated, indicating how important the AC joint is to proper scapular position. If this is restored, rotator cuff strength and arm motion in flexion and abduction will also be improved. More often, the AC joint cannot be completely reduced because of interposed tissue. In these cases scapular corrective maneuvers involved in the scapular assistance and scapular retraction tests can be used to place the scapula in a more anatomic position to improve arm and shoulder function.[16] These manipulations will frequently place the scapula in a position with more posterior tilt and external rotation, thereby improving apparent rotator cuff strength and symptoms of external impingement, as well as enhancing the ability to achieve shoulder abduction and external rotation. These tests, when the findings are positive, indicate the level of contribution that scapular dyskinesis has in shoulder problems, and they give objective evidence to help guide operative or nonoperative treatment decisions. Any AC joint separation that results in scapular dyskinesis will potentially create the physiological and biomechanical deficits that can affect maximal shoulder function. Patients who demonstrate these problems on physical examination should be considered for repair or reconstruction of both the AC and CC ligaments.

Treatment Algorithm Based on Clinical and Radiologic Evaluation

The main goals of treatment, whether surgical or nonsurgical, are to achieve a pain-free shoulder with full range of motion, normal strength, and no limitations in activities. The demands on the shoulder will differ from patient to patient, and these demands should be taken into account during the initial evaluation. Commonly known contraindications for elective surgical procedures (non-tolerable anesthesia risk, increased risk of intraoperative bleeding, increased risk of infection, and so on) may prohibit or delay surgical treatment for all types of AC joint dislocations.

Minimal evidence exists on treatment strategies for AC joint lesions, and treatment for type III lesions
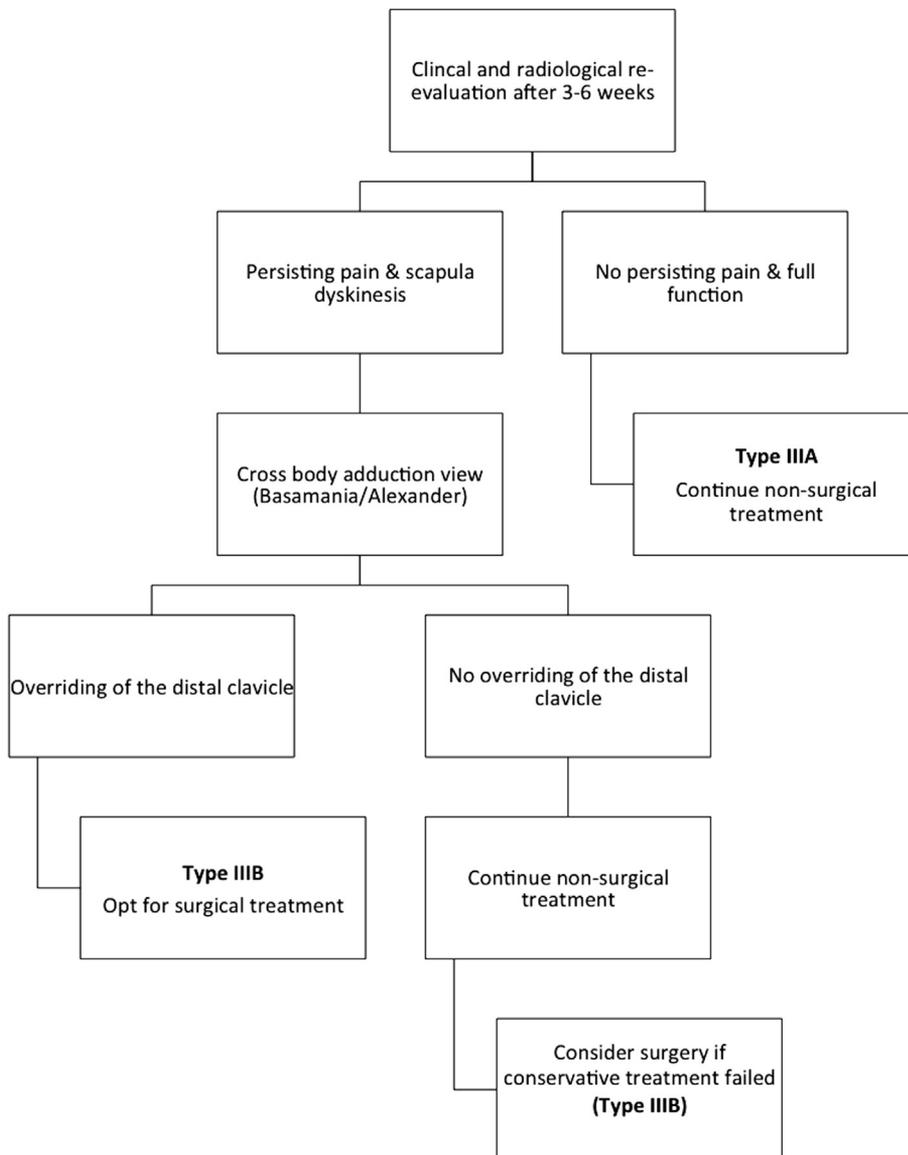
Fig 3. Algorithm showing decision process for early evaluation of AC joint instabilities. The asterisk indicates an individual decision, if the patient does not want to possibly undergo delayed surgery and demands prompt surgical intervention.
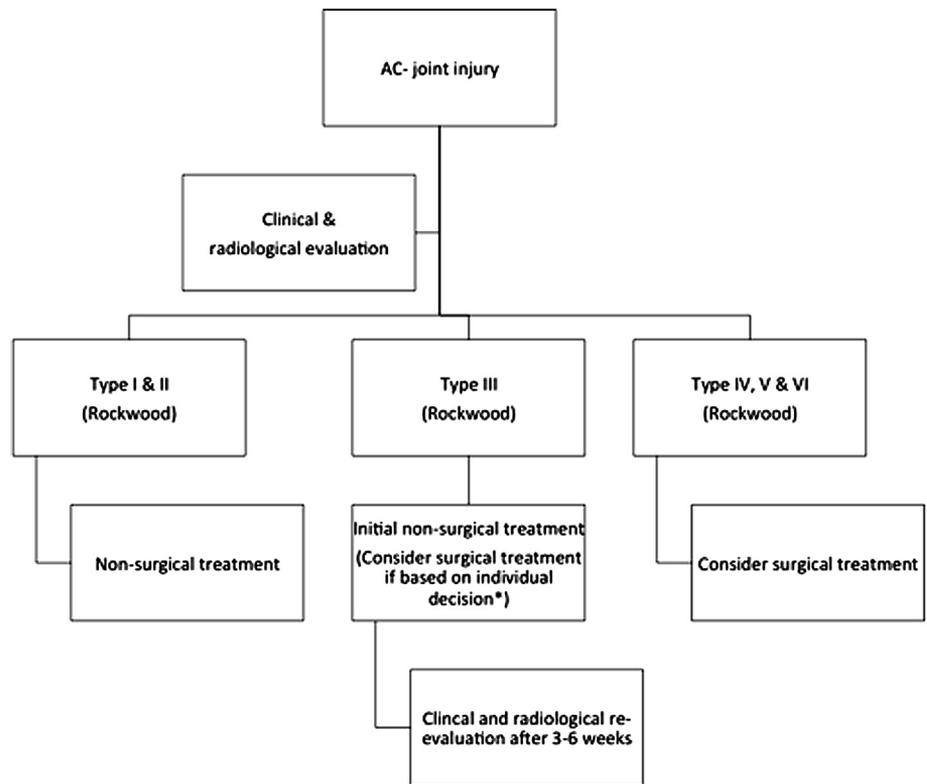
remains especially controversial.[1,4] This may be because these type III injuries present a variety of lesions, ranging from non-symptomatic stable to symptomatic non-stable lesions. Therefore the key for optimal treatment may be seen in a correct diagnosis of the underlying pathology. The findings of the ISAKOS Terminology Project resulted in a new suggestion for the Rockwood classification by further subdividing the type III AC joint injuries into type IIIA (stable) and type IIIB (unstable). The basis for the subclassification is primarily functional rather than anatomic, but special radiographic views (i.e., cross-body stress view) may provide the necessary objective information. Unstable type III lesions (type IIIB) will continue to cause pain (usually on the anterior acromion, rotator cuff, and medial scapular area), weakness during rotator cuff testing, decreased flexion and abduction range of motion, and demonstrable scapular dyskinesis on observation.

In type I injuries, the AC ligaments are sprained but the AC and CC ligaments are intact with no palpable displacement of the distal clavicle. Clinically, the patient presents with swelling and joint tenderness, although there is no widening, separation, or deformity at the AC joint seen radiographically. An examination for neural, vascular, or additional injuries to the adjacent joints should always be completed if a lesion of the AC joint is suggested. In type II injuries, the CC ligaments are intact but the AC ligaments are torn. The patient has moderate to severe pain at the AC joint, a slightly superior position, and increased horizontal mobility of the distal clavicle. On radiographic examination, the lateral end of the clavicle may be elevated. Type I and II lesions are generally treated conservatively with a sling, ice, and a brief period of immobilization, typically lasting 3 to 7 days. The patient is encouraged to initiate range-of-motion activities within the first week after injury to reduce pain and inflammation in an effort to decrease associated morbidity.[17] We use the 4-part physical therapy protocol suggested by Gladstone et al.[18]: Phase 1 focuses on the elimination of pain and protection of the AC joint through sling immobilization (3 to 10 days), along with the prevention of muscular atrophy. We prefer to start with closed-chain scapular activities that are easily tolerated early in the post-injury period, allowing the patient to work on scapular strength and motion without provoking undesirable increases in symptoms. These exercises unload the weight of the upper extremity, allowing the patient to focus on isolating scapular motion.[17] Phase 2 consists of range-of-motion exercises to restore full mobility and a gradual progression of strengthening with the addition of isotonic exercise. Phase 3 involves advanced strengthening to enhance the dynamic stability of the AC joint, whereas phase 4 incorporates sport-specific training to prepare for a full return to prior level of activity. Full rehabilitation should be achieved within 6 to 12 weeks.

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│ Clincal and radiological re- │
│ evaluation after 3-6 weeks │
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Persisting pain & scapula dyskinesis

No persisting pain & full function

Cross body adduction view (Basamania/Alexander)

Type IIIA
Continue non-surgical treatment

Overriding of the distal clavicle

No overriding of the distal clavicle

Type IIIB
Opt for surgical treatment

Continue non-surgical treatment

Consider surgery if conservative treatment failed (Type IIIB)

Fig 4. Algorithm showing decision process for second evaluation of type III instabilities. The distinction between type IIIA and type IIIB lesions is based on function, pain, clinical evaluation of scapular motion, and the cross-body adduction view.

Recovering full range of motion in the absence of pain and comprehensive functionality with the ability of self-protection enable a return to competitive sports. If full function is achieved and only pain remains, a local anesthetic injection could be considered to allow a return to professional sports.

Initial nonsurgical treatment is presently favored in type III dislocations in most cases.[1] The new classification of type IIIA and type IIIB lesions helps to differentiate and better identify patients who would benefit from surgical intervention. In light of the controversy and clear lack of evidence supporting acute surgical management of grade III AC separations, we recommend that all patients presenting with type III instability initially undergo treatment with 3 to 4 weeks of nonsurgical management.[1,4,5] Some of these conservatively treated patients will have persistent

pain and an inability to return to their sport or job. Subsequent surgical stabilization, albeit delayed, will still allow eventual return to sport or work in such cases.

In type IV injuries, the AC ligaments, the CC ligaments, and the deltoid fascia are ruptured. The distal clavicle is displaced posteriorly into the trapezius muscle and may tent the posterior skin, which is usually associated with increased pain. Type V injuries represent a greater degree of soft-tissue damage: both the AC and CC ligaments are ruptured, and the delto-trapezial fascia is stripped off the acromion and the clavicle. A plethora of surgical procedures for the treatment of lesions greater than type IV exist. None has proved to be the gold standard, and it would be beyond the scope of this article to define 1 surgical procedure to be superior to any others. However, we

believe that specific criteria should be used when treating AC joint dislocations surgically: (1) Biologic augmentation (e.g., tendon graft) should be used in the chronic situation (>3 weeks after injury), and (2) anatomic techniques for surgical reconstruction should be favored.[4]

Discussion

There is increasing evidence that AC joint lesions might be incorrectly diagnosed, resulting in poor clinical decisions regarding diagnosis and treatment outcomes. The new subdivision of grade III injuries suggested by the ISAKOS Terminology Project may improve our options for distinguishing stable and unstable AC joints. At present, this distinction is not possible in the acute setting in which patients are in pain and provocative tests are inconclusive. On the basis of these assumptions and our experience, we suggest the following algorithm for clinical and radiologic evaluation of dislocated AC joints.

During the first clinical evaluation, the surgeon should complete a detailed physical examination including all tests for AC stability (e.g., pain, translation, and cross-body test) and evaluate the scapula motion (Fig 3). A thorough evaluation for additional lesions within the glenohumeral joint should be performed to exclude additional injuries.[10] Skin lesions as a consequence of clavicle dislocation or direct trauma should be ruled out. Self-evidently, neurologic insufficiencies and injuries to blood vessels must be excluded. Radiographic evaluation should include AP, lateral, and axillary views of the shoulder. A bilateral Zanca view might be added to better judge the increase in CC distance. Clinical evaluation at this stage might be difficult based on the degree of the patient's pain in the AC joint. After clinical evaluation, patients should be seen as early as possible by a physiotherapist to regain as much movement and scapular control as possible. This is especially important for those presenting with type III lesions.

We suggest a second evaluation for type III lesions at 3 to 6 weeks after the injury (Fig 4). This second evaluation should always be completed within 3 months. It has been reported that, at this time, around 80% of patients have regained full function. Patients presenting with persisting pain and loss of function interfering with return to previous activity (or sports) performance level are thoroughly re-evaluated clinically and radiographically. If the patient presents with continued abnormal scapular movement and radiographic images in the Basamania (Alexander) view show an overriding clavicle on the acromion, we suggest operative treatment. We therefore recommend that grade IIIA and grade IIIB injuries be added as a modification to the Rockwood classification to distinguish between stable type III injuries, defined as those without overriding of the clavicle on the

acromion on the Basamania (Alexander) view and without significant scapular dysfunction, and unstable grade III injuries, with therapy-resistant scapular dysfunction and overriding of the clavicle on the Basamania (Alexander) view.

In the future, clinical studies will need to evaluate the type IIIA and type IIIB modification of type III injuries and the effect of nonoperative treatment addressing scapular dysfunction over regular nonoperative treatment. In particular, we need to improve our knowledge of conservative treatment outcomes for type III injuries in overhead athletes.

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