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Multidirectional Instability in the Female Athlete

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Multidirectional instability of the shoulder (MDI) is the least common form of shoulder instability. It is characterized by a global laxity of the joint capsule that leads to symptomatic inferior instability in addition to anterior or posterior instability or both. Patients with MDI are atypical in that they often have no history of trauma and may present with only vague complaints. They tend to have a loose, patulous inferior capsule in addition to altered glenohumeral and scapulothoracic mechanics, which contribute to instability. Female athletes may be particularly susceptible to MDI because of an increased predisposition to joint hyperlaxity. In addition, female athletes tend to favor sports that both reward and demand flexibility such as gymnastics, ice skating, diving, yoga, and cheerleading, which may cause MDI to become more symptomatic. The goals of treatment include pain relief, functional rehabilitation, and return to sport. Most patients respond well to a rehabilitation protocol involving strengthening of the rotator cuff, scapular stabilization exercises, and proprioceptive training exercises. For patients who fail to respond to conservative treatment, open or arthroscopic capsular shift may be performed, with the technique tailored to the patient's individual pathology. Postoperative rehabilitation aims to restore range of motion, flexibility, and strength while protecting the integrity of the surgical repair. With close adherence to a well-designed rehabilitation protocol, patients may achieve predictably good outcomes, with a low recurrence rate of instability and a high rate of return to sports. Patients should be advised that surgery may decrease their range of motion, and that they may not be able to return to the same level of athletic competition.

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Introduction

The shoulder is the most mobile joint in the body. However, this attribute also renders it particularly susceptible to pathologic instability, especially in athletes who routinely place undue stress on the shoulder. The unstable shoulder in the athlete can be a difficult entity to treat given the multiple etiologies and pathologies involved. This difficulty is most pronounced in the case of multidirectional shoulder instability (MDI). In contrast to straightforward anterior or posterior instability, MDI is characterized by a global laxity of the joint capsule, causing instability in more than one direction. It is most commonly defined as symptomatic laxity of the shoulder with the ability to dislocate or sublux the shoulder inferiorly as well as in at least one other direction.[1]

In 1980, Neer and Foster[2] first identified MDI as a unique entity warranting individual evaluation and treatment. Patients with MDI constitute less than 10% of patients with shoulder instability.[3,4] Among studies of patients with MDI, roughly half are women and most have no history of trauma.[5-9] In some series, about half of the patients also have findings of generalized ligamentous laxity.[8,10] However, generalized ligamentous laxity does not necessarily correlate with shoulder laxity.[10] And while shoulder hyperlaxity may predispose to MDI, the lax shoulder must also be symptomatic so as to qualify a diagnosis of MDI.

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Perhaps as a result of the more chronic nature of multidirectional instability, Largacha et al found that patients with multidirectional instability were more likely to have deficits in range of motion and strength than patients with traumatic anterior instability were. In addition, women had more deficits in physical function and comfort than men did with the same diagnosis.[11] These findings highlight the importance of careful attention to history, examination, and the patient's treatment goals. This article reviews the relevant anatomy and biomechanics, aspects of history and physical examination, imaging studies, and conservative and surgical treatment options for the female athlete with MDI.

Anatomy and Biomechanics

The static stabilizers of the shoulder include the capsule, glenohumeral ligaments, and the labrum; the dynamic stabilizers consist of the rotator cuff, deltoid, and long head of the biceps. Although deficiencies in any of these structures can contribute to instability, capsular and labral deficiencies are viewed as the essential lesions in MDI. In the absence of trauma, repeated minor injuries (microtrauma) or repetitive athletic use can stretch out the capsule and its surrounding ligamentous structures, leading to acquired joint hyperlaxity and predisposing to instability.

As the shoulder is ranged through internal rotation, external rotation, adduction, and abduction, different segments of the capsuloligamentous system tighten and loosen to prevent excessive translation of the humeral head.[12] When the shoulder is abducted to 90° and externally rotated, the inferior glenohumeral ligament complex (IGHLC) is the primary restraint against anterior translation. It consists of anterior and posterior bands with a hammocklike pouch in between, which enables both the bands to reciprocally tighten as the humeral head rotates.[13] As the arm is adducted from 90°, the middle glenohumeral ligament becomes the main restraint against anterior translation. As the arm returns back to a position of adduction, the superior glenohumeral ligament adds additional stabilization against anterior translation.[14] Posterior translation is mainly prevented by the posterior band of the IGHLC and the anterior superior region of the capsule (the rotator interval capsule) when the shoulder is in 90° of abduction.

The rotator interval capsule is also important in resisting inferior translation, together with the superior glenohumeral ligament, when the shoulder is held in adduction. The role played by the rotator interval capsule has been studied by Harryman et al,[15] who showed that incision of the rotator interval capsule increases inferior translation on the sulcus test by 100%. When the arm is abducted to 45°, the capsuloligamentous structures are the most lax and the shoulder is most susceptible to superior-inferior translation. At this point, the anterior band of the IGHLC becomes the main restraint against inferior translation. As the arm moves to 90°, the posterior band of the IGHLC becomes the main restraint against inferior translation.[16]

Patients with MDI typically have anatomical findings of a large, patulous inferior capsular pouch and an attenuated rotator interval capsule.[17] These static stabilizers maintain stability at extremes of glenohumeral motion; at midrange positions, the dynamic stabilizers of the biceps tendon and the rotator cuff maintain stability by compressing the humeral head into the glenoid concavity. This concavity-compression effect is required to keep the humeral head opposed against the relatively small, shallow glenoid fossa.[18] In patients with MDI, who are most often symptomatic in the midrange positions, it is therefore important to address the dynamic stabilizers in addition to the capsuloligamentous structures.

Negative intra-articular pressure provides an additional means to support glenohumeral opposition. Its effect is most pronounced in the relaxed arm, in the absence of the active compressive forces of the rotator cuff. After a disruption in the capsule, restoration of this negative pressure may be impossible, removing one extra restraint against instability.

Loss of the shoulder's proprioceptive feedback mechanism can further add to instability. Barden et al[19] found that patients with MDI showed significantly greater errors than control subjects in a series of proprioception-based upper limb repositioning tasks. Consequently, in the setting of impaired proprioception, patients with MDI may be predisposed to excessive humeral translation because of the loss of reflexive muscular protection.[16]

Loss of normal scapulothoracic motion is another important contributor to glenohumeral instability. As the shoulder is ranged, the scapula should move conjointly to keep the glenoid appropriately positioned under the humeral head. If there is decreased scapulothoracic movement, glenohumeral mechanics are altered, and the humeral head is more likely to translate on the glenoid as the shoulder approaches extremes of range of motion. Relative to asymptomatic controls, patients with MDI have been shown to have a significant decrease in scapular rotation, leading to an increase in humeral internal rotation as the shoulder is abducted.[20] In addition, if the scapular stabilizers are weak, the scapula droops laterally under the weight of the arm, predisposing to inferior translation of the humeral head.[21] These findings highlight the importance of scapular stabilization exercises during rehabilitation.

History and Physical Examination

The diagnosis of MDI is largely based on history and physical examination. Reported symptoms can be vague and vary widely, but they often include shoulder fatigue or aching, pain at night, feelings of joint looseness or slipping, and transient neurologic—usually sensory—symptoms. In patients reporting neurologic symptoms, cervical radiculopathy and thoracic outlet syndrome must be ruled out.[17,22]

A history of trauma should be recorded, although many patients report none. Repeated microtrauma and athletic overuse are often sufficient to cause symptomatic laxity. Commonly implicated sports include swimming (especially butterfly or backstroke), gymnastics, and overhead throwing sports. In patients who report recurrent subluxations or