The Conservative Treatment of Ulnar Collateral Ligament Injuries

10

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Introduction

The decision for conservative treatment of UCL injuries is often shared between the physician, patient, family, coaches and trainers; thus understanding the distinct expectations of all involved parties is essential. Non-operative management is advocated by many as the initial treatment of choice regardless of the context of UCL injury. However, there are specific injury features and patient characteristics that should be considered prior to initiating non-operative treatment. Patient-related factors that determine treatment recommendations include level of competition, expectations of outcome, seasonal timing and future athletic aspirations. Injury-related features that affect the prognosis of non-operative treatment include the acuity of injury, physiologic healing capacity, quality of the native ligament, and associated elbow pathology. The presence of modifiable risk factors that can be corrected with proper training, such as weak core strength and flawed throwing mechanics, also influence our treatment algorithm. In this section, we aim to elucidate the complexities regarding conservative treatment of UCL injuries to aid the clinician in appropriate management decisions.

Clinical History

Non-operative management of ulnar collateral ligament (UCL) injury begins with a focused history of the patients' elbow pain and dysfunction. Non-throwing athletes and low-demand recreational athletes are generally good candidates for non-operative management. Specific considerations for athletes include the type of sport, intensity and frequency of competition, and the degree to which participation can be modified to avoid repetitive elbow stress. It is critical to determine the acuity of injury by eliciting the timing and onset of symptoms, presence of prodromal symptoms, and history of a specific inciting event. Any history of activity modification and prior conservative treatment should be assessed, specifically focusing on the nature of such treatment and the extent of therapeutic response, to avoid repeating futile interventions.

Physical Exam and Imaging

Global musculoskeletal assessment of the patient must be emphasized as problems in the kinetic chain are intimately connected to upper extremity injury in the performance athlete. Deficiencies in single leg squat strength and hip rotation should

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be assessed for lower extremity/core weakness or imbalance, which are modifiable lower risk factors for elbow injury. In addition, focused examination of the entire ipsilateral extremity is critical to identifying risk factors for UCL injury that may be specifically addressed with non-surgical treatment. The scapula should be assessed for peri-scapular muscle tone and bulk as well as normal scapulothoracic rhythm during physiologic shoulder motion. Scapular dysfunction is commonly found in throwing athletes and should be addressed during rehabilitation [1]. The glenohumeral joint should also be assessed for range of motion and strength. Glenohumeral internal rotation deficit (GIRD) has been identified as a risk factor for subsequent UCL injury in baseball players and is further discussed below. Muscle tone, bulk and strength of the elbow and forearm flexors should be carefully inspected and tested versus the contralateral extremity. Any deficits should be noted as proper training can enhance dynamic stabilization of the elbow joint. Proximal flexor-pronator injuries may mimic or co-exist with UCL injury due to its similar presentation as medial elbow pain [2].

All patients being considered for non-operative treatment should receive standard Anterior-Posterior (AP), lateral and oblique radiographs of the elbow. Radiographs can identify special acute situations such as avulsion fractures of the sublime tubercle in overhead athletes, which may have a poor prognosis for non-operative treatment and can benefit from surgical repair [3, 4]. In contrast, spurring and calcification within the UCL are indicative of chronic injury. In more severe cases, loose bodies and osteophytes around the posterior-medial olecranon tip are indicative of valgus-extension overload, which suggest ligament laxity and may influence treatment [5, 6].

All patients with suggestive history and positive exam findings undergo magnetic resonance imaging (MRI) of the elbow to allow for characterization of the UCL [7]. MR arthrography improves the diagnosis of partial undersurface tears, therefore enhancement with intra-articular gadolinium contrast is our preferred technique [8, 9]. In addition to the presence of partial- and full-thickness tears of the UCL, MRI also reveals concomitant pathology such as loose bodies, flexor-pronator tendinopathy and posteromedial ulnohumeral chondromalacia [10]. MRI has also been shown to aid in predicting the outcome of non-operative treatment. A recent study by Kim et al. demonstrated that low-grade partial tears and tears-in-continuity—specifically those with low/intermediate MR-signal intensity of the UCL on fat suppressed T2-weighted images—were associated with successful non-surgical rehabilitation in a cohort of 39 baseball players [11]. In some situations, ligament attenuation may be associated with laxity and valgus stress view radiographs can be beneficial in the assessment. Medial joint line opening greater than 3 mm has been considered diagnostic of valgus instability [12]. However, mild increases in valgus elbow laxity have been observed in uninjured, asymptomatic dominant elbows of professional baseball pitchers when compared with their non-dominant elbow [13].

Treatment

Education and Injury Prevention

Regardless of the ultimate treatment of choice, we feel strongly that education and injury prevention are imperative aspects of UCL injury treatment. Due to public awareness of the success of UCL reconstruction in the last three decades, it is important to elicit any unrealistic expectations amongst patients and families regarding conservative versus surgical treatment. We recently demonstrated an alarming rate of misperceptions amongst players, coaches and parents regarding UCL reconstruction surgery with respect to risk factors, indications, recovery time and expected outcomes [14]. Notably, almost half of student-athletes in our study believed surgery should be performed in the absence of injury to improve performance, which may explain an individuals' reluctance to pursue appropriate conservative treatment when indicated. In conjunction with conservative treatment of UCL injury, we educate all of our patients and families regarding injury

prevention, focusing on age-specific guidelines for safe activity level and proper pitching mechanics. It is important to elicit opportunities for rest and activity modification when chronic overuse is suspected and emphasize that the strongest correlation to upper extremity injury is the total amount of throwing [15].

Principles of Rehabilitation

The initial management of UCL injury consists of rest, icing, anti-inflammatory medications and judicious use of bracing/splinting [16]. While these modalities are aimed at reducing pain and inflammation, the underlying pathoanatomy of chronic UCL injury, which is related to tensile failure and micro-tearing of the ligament, is likely unchanged. Electrical stimulation is advocated by many therapists as an adjunctive treatment modality. While its use has not been specifically validated for elbow ligament injuries, electrical stimulation has demonstrated efficacy and safety in extra-articular knee ligament animal models [17, 18].

Once pain-free active and passive elbow range of motion has been achieved, patients can progress to strength and conditioning. Attention to global mechanics in throwing athletes is of particular importance as it has been shown that sequential muscle activation during the throwing motion relies on coordinated force generation from trunk and shoulder girdle muscles to minimize the work of smaller distal segments [19–21]. As such, it is important to emphasize the concept of the "kinetic chain" that begins with lower extremity and pelvic core strength optimization [1, 19]. Optimized and reproducible efficiency of motor patterns and force transfer from the lower extremity and core can be achieved through proper training and may serve a protective role in injury [22].

The general principles of upper extremity rehabilitation for UCL injury includes early focus on stretching and flexibility with progressive strengthening as tolerated [23]. Biomechanical data provides further insight as to the protective role of the glenohumeral stabilizers in protecting the elbow from excessive valgus load [20]. Dynamic contribution of the peri-scapular stabilizers and rotator cuff muscles maximizes efficient force transfer to the distal segments of the limb and should be a concurrent focus of UCL rehabilitation. The forearm flexor-pronator muscles, notably the FCU, have been shown to provide direct dynamic valgus stabilization of the UCL [24]. Electromyographic data suggest an association of decreased activation of the pronator teres (PT) and flexor carpi ulnaris (FCU) with UCL insufficiency [25]. Conditioning of forearm flexors is thus an important aspect of both prevention and treatment of injury to the UCL.

Glenohumeral Internal Rotation Deficit

Shoulder internal rotation provides the largest contribution to the varus counter-torque to valgus load at the elbow during the late cocking phase of throwing [19, 26]. GIRD has been identified as a significant risk factor associated with UCL injury [27]. Garrison et al. suggested that total range of motion, rather than specifically internal rotation, was more closely associated with UCL injury [28]. Thus treatment of GIRD focuses on posterior capsular stretching modalities as well as restoration of total shoulder motion [29]. Any deficits in shoulder rotation should be corrected through rehabilitation and reassessed in conjunction with conservative treatment of UCL injury.

Injections

We do not favour the use of corticosteroid injections for symptomatic treatment of UCL-related elbow pain due to concerns regarding its detrimental effect on tissue integrity seen in other clinical applications and lack of intermediate-term efficacy in chronic elbow tendinopathies [30–33]. As the use of platelet-rich plasma (PRP) injections in non-operative management of ligament and tendon injuries continues to grow, its application to UCL injuries has recently gained in interest. Dines et al. reported on a series of 27 baseball players with partial UCL tears treat-

ed with serial injections of PRP. At a mean of fourteen weeks of follow-up, 59% of players had an excellent outcome with return to their previous level of competition or higher. While the level of evidence supporting the use of PRP in UCL injuries is currently confined to level-IV retrospective case series, the initial literature suggests good treatment efficacy with low morbidity.

Progressive Throwing Program

The initial phase of non-operative treatment requires approximately 6 weeks of rest from throwing and progressive rehabilitation as discussed previously. When symptoms of elbow discomfort have resolved, the elbow physical exam is normal, *and* kinetic chain abnormalities are corrected, the patient may begin a progressive throwing program. This typically requires six additional weeks of supervised throwing with emphasis on proper warm-up, throwing mechanics and maintenance of strength and flexibility. An alternative non-operative treatment option, which is often available to younger athletes, is to change to a less demanding throwing position or change sports altogether. For example, for competitive baseball players at risk for elbow injury, changing position to first or second base entails less throwing demands and may allow continuation of playing without symptoms.

Outcomes

The published literature of non-operative management of UCL injuries suggests that acute, traumatic injuries are more amenable to successful non-operative treatment than chronic, attritional injuries due to repetitive throwing. A retrospective review of ten professional National Football League (NFL) quarterbacks with acute UCL injury reported a 90% success rate of non-operative rehabilitation with successful return to play at mean 27.4 days [34]. Another retrospective study of acute elbow injuries in the National Football League reported a successful return to sport in five players (two centres, one running back, one quarterback) without surgical reconstruction [35]. Both of these studies underscore the importance of accurate diagnosis of UCL dysfunction and prompt initiation of non-surgical treatment to prevent further injury and maximize the likelihood of success in non-throwing athletes.

Throwing athletes, however, have a much poorer prognosis for non-surgical management of UCL injury. Barnes et al. reported a 50% rate of return to play with non-surgical treatment of UCL injuries in 100 baseball players [36]. Rettig et al. reviewed the outcomes of non-surgical management of 31 throwing athletes and reported a 42% rate of return to sport at or above their pre-injury level following an average of 24.5 weeks of rehabilitation [37]. Thus, in the context of high-demand throwing activities, the prognosis for non-surgical management of UCL injury remains guarded. Longitudinal reassessment and proper counselling are necessary to determine the indication for surgical treatment in throwing athletes who are not responding favourably to appropriate conservative treatment of UCL injury.

While there are no published reports that delineate specific injury features optimal for non-operative treatment, theoretical favourable conditions include ligament injury at the proximal insertion as opposed to intra-substance rupture at the distal attachment. In addition, if other modifiable risk factors are identified such as poor pitching mechanics, GIRD, lower extremity or core muscle weakness, imbalance and poor flexibility, these can be corrected concomitantly and may improve results of non-operative treatment. Patient expectations and overuse issues can also be modified with proper counseling and may offer improved treatment results.

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