



# Rehabilitation Following UCL Repair with Internal Brace

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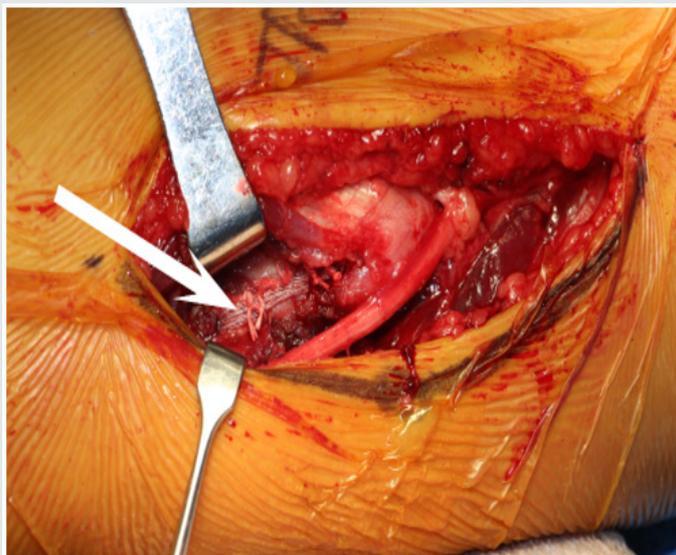
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## Introduction

Elbow injuries in the overhead athlete, particularly baseball pitchers, continue to increase in frequency because of extreme repetitive valgus stress [1-4]. This repetitive stress results in ulnar collateral ligament (UCL) insufficiency which produces elbow pain, medial joint laxity, and an inability to throw. 16 Pitchers are the most injured players in Major League Baseball and elbow injuries account for 22-26% of pitching injuries [1,5,6]. The risk factors related to sustaining a pitching related UCL injury are pitching when fatigued, a high pitch volume, improper mechanics, and repetitive throwing at maximal effort in the youth player and throwing a high number of pitches at peak velocity in the professional athlete [7]. The current preferred surgical treatment for most UCL tears that fail conservative management is a reconstruction using one of several autogenous grafts. [8] Extensive follow-up data on UCL reconstructions with a minimum 2-year follow-up shows that just 83% of the athletes undergoing reconstruction were able to return to the same level of play or higher and that on average return to competition took 11.6 months [9].

However, recent technological advances have sparked renewed interest in repair of the UCL augmented by an internal brace

(Internal Brace; Arthrex Inc) in a search for a surgical option that would allow a faster recovery than what is typical following UCL reconstruction. Repair of the UCL with internal brace is a direct repair of the native ligament with a spanning tape dipped in collagen (Internal Brace) anchored on each end of the UCL [10]. (Figure 1) Two 3.5mm Swive Locks spanned with a 2mm piece of Fiber Tape (Arthrex, Inc. 1370 Creekside Blvd., Naples, FL, 34108) and size 0 nonabsorbable sutures are used to repair the native ligament back to its anatomic origin and insertion ensuring that tension of the Fiber Tape matches that of the native UCL during range of motion (ROM). A UCL repair with internal brace is reserved for use in cases of partial or complete tears at the origin or insertion of the UCL with good ligament tissue and low-grade mid-substance partial UCL tears [10]. In patients with chronic, attritional damage to the UCL and associated loss of elbow joint stability, reconstruction remains the most appropriate surgical intervention [8,9,11,12]. The decision to perform a surgical repair of the UCL, rather than a reconstruction, can only be made intra-operatively from direct visual assessment of the UCL.



**Figure 1:** The UCL repair with the internal brace inserted within the ligament.

### Rehabilitation Guidelines

Rehabilitation after UCL repair with internal brace surgery is accomplished via a sequential and progressive 5 phased approach, designed to return the athlete to their previous level or higher as quickly and safely as possible [13-15] (Table 1). Initially rehabilitation interventions are designed to minimize the effects of immobilization, facilitate early healing of the UCL, re-establishing pain-free ROM, reduce pain and inflammation, and retard muscular atrophy. Early limited passive elbow/forearm ROM exercises and grade I/II joint mobilizations are incorporated in conjunction to neuromodulate pain, promote articular cartilage nutrition and aide

in the synthesis, alignment, and organization of collagen tissue [16-19], [20-25]. Local modalities, including Cryotherapy, electrical stimulation and Class IV deep tissue laser are used to control pain, inflammation, speed healing of the incision and increase nitrous oxide in the healing tissue [26]. Pain free, submaximal isometrics are used to initiate muscle activation and retard atrophy for all planes of elbow, forearm, wrist and shoulder movements. Shoulder external rotation (ER) and internal rotation (IR) isometrics are performed with caution and must be completely pain free. Rhythmic stabilization and neuromuscular control drills for shoulder, elbow and wrist along with seated scapular and postural exercises are also introduced early in the rehabilitation process.

**Table 1:** Postoperative Rehabilitation After Ulnar Collateral Ligament Repair with Internal Brace.

Goals: Protect healing tissue; reduce pain and inflammation; retard muscle atrophy; full wrist (range of motion) ROM
<b>Day of Surgery</b>
Elbow ROM brace locked at 90° for 7 days
Passive ROM (PROM) wrist and hand
Post-op Day 1 and 2: Add (all performed in locked elbow brace)
Shoulder PROM: flexion, ER, and IR to tolerance
Pendulum exercises
Wrist flexor/extensor stretching
Putty/gripping exercises
Post-op Day 3 through 7 (all exercises performed in locked elbow brace)
1. Continue previous exercises, advancing PROM as tolerated
2. Add the following exercises
a. Shoulder isometrics: ER, IR, abduction, flexion, and extension
b. Scapular strengthening (seated neuromuscular control drills with manual resistance)
<b>II Controlled Mobility (Weeks 2-5)</b>
Goals: Gradually restore elbow joint ROM; improve muscular strength and endurance; normalize joint arthrokinematics
<b>Beginning Week 2 (Day 8)</b>
Progress Elbow ROM brace to 30-110°
Begin elbow PROM and AAROM 30-110°

Initiate AROM elbow
Initiate AROM shoulder joint
Scapular strengthening exercises
Progress to light isotonic strengthening at day 10
<b>Beginning Week 3:</b>
Progress Elbow ROM to 10-125°
Initiate Thrower's Ten Exercise Program
<b>III Intermediate Phase (Week 6-8)</b>
Goals: Restore full elbow ROM; progress upper extremity strength, continue with functional progression
<b>Beginning Week 4:</b>
Progress elbow ROM to 0-145°
Progress to Advanced Thrower's Ten Program
Progress elbow and wrist strengthening exercises
Wrist flexion and elbow flexion movements against manual resistance
Beginning Week 6:
Initiate 2 hand plyometrics
Discontinue brace at week 6
Prone planks
Beginning Week 8:
Progress to 1 hand plyometrics
Continue with Advanced Thrower's Ten program
Side planks with ER strengthening
<b>IV Advanced Phase (Weeks 9-14)</b>
Criteria to progress to Advanced Phase:
1. Full nonpainful ROM
2. No pain or tenderness
3. Isokinetic test that fulfills criteria to throw
4. Satisfactory clinical exam
5. Completion of rehab phases without difficulty
Goals: Advanced strengthening exercises; initiate interval throwing program; gradual return to throwing
<b>Beginning Week 9:</b>
Continue all strengthening exercises
Advanced Thrower's Ten program
Plyometrics program (1 and 2 hand program)
<b>Beginning Week 10:</b>
Seated chest press machine
Initiate interval hitting program at (week 10) Seated rowing
Biceps/Triceps strengthening
<b>Beginning Week 11-16:</b>
Initiate Interval Throwing Program Phase 1- Long Toss (week 12)
Continue all exercises as in week 9-10
<b>Beginning week 16-20:</b>
Initiate Interval Throwing Phase 2 (Off the mound) when Phase 1 is complete and athlete is ready
Continue Advanced Thrower's Ten program
Continue Plyometrics
Continue ROM and Stretching Programs
<b>V Return to Play Phase (weeks 14+):</b>
Goals: Gradual return to competitive throwing; continue all exercises and stretches

Week 20+:
Initiate gradual return to competitive throwing
Perform dynamic warm-ups and stretches
Continue thrower's ten program
Return to competition when athlete is ready (physician decision)
Note: ** Each athlete may progress through ITP at different rates/pace Should complete 0-90 ft within 3 weeks of starting ITP and complete 120 ft within 8 weeks

The controlled mobility phase runs for a total of 3 weeks starting at the second week after surgery and focuses on a stepped restoration in elbow ROM (outlined in Table 1), improved muscular strength/endurance, and normalizing joint arthrokinematics. Active-assisted, active, and passive ROM exercises, as well as more aggressive joint mobilizations, are all incorporated for the elbow, forearm and wrist with the primary goal to achieve full elbow extension and minimize the risk of developing an elbow flexion contracture [26-29]. Elbow flexion contractures are the most common postoperative complication following elbow surgery and must be diligently avoided. At any sign of flexion contracture, we

find using a low load–long duration (LLLD) stretch in conjunction with joint mobilization and stretching to be extremely beneficial for regaining full elbow extension. A light resistance exercise band (Theraband CLX Performance Health, 1245 Home Ave, Akron, OH 44310) is applied to the wrist and used to place a LLLD stretch on the anterior elbow structures for 12-15 minutes, for a total of 60 minutes a day. (Figure 2) Strengthening exercises at this point are performed beginning with concentric and progressing to eccentric muscle contractions with the focus placed on a comprehensive strengthening program for the throwing athlete, such as the Thrower's Ten Program [30,31].



**Figure 2:** Low load-long duration stretching to improve elbow extension. A low intensity stretch is applied for 10-12 minutes. Note that the elbow is pronated and the shoulder is internally rotated to lock the humerus and prevent compensation.

The intermediate phase is from postoperative week 6 to 8 and emphasizes the maintenance of joint mobility, improving muscular strength, endurance, neuromuscular control of the elbow complex, and continuing with a functional progression of activity. Stretching, flexibility and mobilizations are used to maintain full motion with a particular focus on elbow extension and forearm pronation flexibility. At 4 weeks the athlete is progressed to the advanced thrower's 10 program to place greater demands on the posterior shoulder and scapular muscles [32]. Neuromuscular control manual resistance exercises are incorporated for both the shoulder and elbow, proprioceptive neuromuscular facilitation, rhythmic stabilizations, and slow reversal hold techniques. 2-handed plyometrics are introduced 6 weeks following surgery progressing to 1-hand exercises 2 weeks later. The fourth phase of UCL repair

rehabilitation is the advanced phase which runs from weeks 9 to 14 and is specifically designed to increase strength, power, endurance, and neuromuscular control to prepare for a return to sports using strengthening activities that emphasize high speed, eccentric contractions, and plyometrics. Elbow flexion exercises here emphasize high speed eccentric control training elbow deceleration. Weight machine exercises are begun 10 weeks after surgery and include, seated chest press, seated rowing, and front latissimus dorsi pull-downs. A hitting program is permitted at week 10 and an interval throwing program 11 weeks after surgery if the athlete meets the objective criteria for throwing. Reinold et al. [33] provides the best description of sports specific interval programs. Pitchers generally are able to advance to throwing off of a mound 8 weeks after they begin a throwing program.

The return to activity phase is the last part of the process and emphasizes a proper dynamic warm-up, continued exercise loads and managing the progression back to unrestricted activity and competitive throwing [34,35]. The general time frame to return to play following a UCL repair with internal brace is approximately 5 months. Functional testing can aide the return to play decision process. We use the prone ball drop test, developed by the senior author (KEW) which utilizes a 1kg (2 pound) plyoball with the

patient prone, shoulder abducted to 90°, and elbow extended. The patient is instructed to perform as many ball drops and catches as possible in a 30 second timeframe, comparing successful cathese bilaterally seeking a goal of 110% for the throwing side (Figure 3). At our center, 350 UCL repairs with internal brace have been performed. Of these, 1-year follow-up data is available for 79 throwers, showing 98% of the 1-year follow ups returned to their pre-injury level of activity.



**Figure 3:** Ball Drop Test: Patient is in prone position on table with 2 LB plyoball in hand performs ball drops & catches for 30 second with the shoulder abducted to 90° and elbow extended.

## Summary

The UCL is a frequently injured in overhead athletes and these injuries continue to climb in number in youth athletes. Surgical repair of the UCL with internal brace is a viable option in athletes who meet specific findings at the time of surgery. The rehabilitation of this unique surgical procedure has been presented based on our experience treating in excess of 350 athletes over the past 3 years. The average time required for an athlete to return to participation in our cohort is 7 months which is approximately 5 months less than average return to play times after UCL reconstruction surgery. Long-term results of this surgery and rehabilitation program are still needed but our initial experience is extremely promising.

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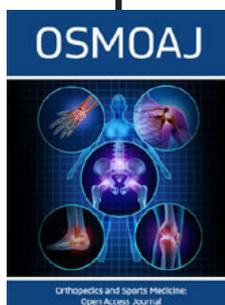
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