Rehabilitation Guidelines for Elbow Ulnar Collateral Ligament (UCL) Reconstruction

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The elbow is a complex system of three joints formed from three bones; the humerus (the upper arm bone), the ulna (the larger bone of the forearm, on the small finger side), and the radius (the smaller bone of the forearm on the thumb side). This complex system allows a hinging action (bending and straightening) and a rotation action. The stability of the elbow joint is maintained by the bony congruency, the muscular attachments and the ligaments.

There are several important ligaments in the elbow. Ligaments are soft tissue structures that connect bones to bones. The ligaments around a joint usually combine together to form a joint capsule. A joint capsule is a watertight sac that surrounds a joint and contains lubricating fluid called synovial fluid. In the elbow, two of the most important ligaments are the ulnar collateral ligament (UCL) and the lateral collateral ligament (LCL). The UCL is also known as the medial collateral ligament. The UCL is on the medial (the side of the elbow that's next to the body when your arms are at your side with your palms up or facing out in front of you) side of the elbow and LCL is on the outside of your elbow. The ulnar collateral ligament is a thick band of tissue that forms a triangular shape along the inside of the elbow. It has an anterior bundle, posterior bundle, and a thinner, transverse ligament. These ligaments can be torn when there is an injury or dislocation of the elbow. If the injury to the ligament(s) affects the stability of the joint, it is possible that the function of the elbow will be compromised.

Injury to the UCL in overhead athletes has been widely reported. Normal activities of daily living rarely place enough stress on the UCL to create instability; however throwing sports place high stresses on the elbow supporting structures. Over time, the high repetitive stresses associated with throwing and overhead activity may create overload to the supporting ligamentous support, resulting in a UCL tear. Typically, athletes with UCL injury report a history of repetitive throwing with complaints of pain at the medial (inside) aspect of the elbow during or after their activity. Onset occurs from either one traumatic incident or can develop throughout a long period of time due to repetitive elbow stress. Eventually the athlete loses their velocity and accuracy of throwing. More than 40% of athletes with UCL injury also report symptoms of ulnar nerve irritation from friction or snapping of the nerve during activity.

The overhead thrower often experiences pain with the arm fully cocked (shoulder in full external rotation or the arm rotated all the way back) and as it accelerates through the throw and release of the ball. While throwing, the elbow can straighten at speeds of over 2300 degrees per second and may have a valgus (side) force that exceeds the ultimate strength of the normal uninjured UCL. Therefore, proper mechanics and optimal strength and endurance of the muscles of the upper extremity are needed to assist with injury prevention. Trauma or injury to the UCL results in significant functional limitations including medial elbow pain, loss of velocity and accuracy with throwing, instability, neurologic (nerve) symptoms, and decreased muscular strength.

The consequences of this injury usually leave the athlete who has a torn UCL with two options: 1) rehabilitation with activity modification (i.e. avoidance of pitching and performance throwing) or 2) surgical reconstruction with post-operative rehabilitation prior to return to pitching and performance throwing.

UCL reconstruction surgery is performed through an incision on the medial (inside) side of the elbow joint. The damaged ulnar collateral ligament is replaced with a tendon taken from somewhere else in the body. The tendon graft can come from the patient's own forearm, hamstring, knee or

foot. This is called an autograft. This tendon is weaved through drill holes in the humerus and ulna to re-create the triangular shape of the UCL.

One common technique used to replace the damaged ulnar collateral ligament is called the docking technique. The surgeon drills two holes in the ulna and three in the medial epicondyle of the humerus (the small bump of bone on the inside of the elbow at the bottom of the upper arm). The two holes in the ulna form a tunnel that the tendon graft will be looped through. The three holes in the medial epicondyle form a triangle. The bottom hole will be bigger than the top two holes, so that the surgeon can slide the end of the tendon graft into the bottom hole. The two top holes are used to pull the tendon graft into the tunnel using sutures that are attached to the graft and threaded through the two holes. After the tendon is harvested, sutures are attached to both ends. The tendon is looped through the lower tunnel formed in the ulna, and stretched across the elbow joint. The two sutures attached to the ends of the graft are threaded into the larger bottom tunnel in the medial epicondyle and each is threaded out one of the upper, smaller holes. Using these two sutures, the surgeon pulls the end of the graft farther into the upper tunnel until the amount of tension is correct to hold the joint in position. The surgeon carefully puts the elbow through its full arc of motion and readjusts the tension on the sutures until satisfied that the proper ligamentous tension is restored. The two sutures are tied together to hold the tendon graft in that position.

Another common technique to reconstruct the UCL is called the figure of eight technique. In this technique, the tendon graft is threaded through two pairs of holes - two drilled in the medial epicondye of the humerus and two in the ulna. The graft is looped through the holes in a figure of eight fashion. The two ends of the tendon are sutured to the tendon itself.

Previously the muscles on the inside of the elbow joint and forearm (the flexor muscles of the wrist) were completely detached from the humerus. Now, the flexor muscles are not detached, but are split and retracted to allow the surgeon to see the areas of the elbow joint required to perform the operation successfully. If there is any concern that the ulnar nerve has been stretched and damaged due to the instability (as mentioned above), it may be re-routed so that it runs in front of the elbow joint rather than through the cubital tunnel in the back of the elbow. The incision is sutured together and the elbow is placed in a large bandage and splint.

Rehabilitation following surgical reconstruction of the UCL begins with range of motion and initial protection of the reconstruction, along with resistive exercises to keep the shoulder and core strong. This is followed by progressions for resistive exercise that attempt to fully restore strength and muscular endurance to allow for a safe return to throwing and overhead functional activities. These guidelines also include aerobic training throughout the rehabilitation process and, for many, a later stage an interval throwing program. This multi-faceted rehabilitation approach often includes biomechanical video analysis to ensure proper throwing mechanics before an athlete returns to their sport.

The early phases of post-operative care for UCL reconstructions involve specific time frames, restrictions and precautions to protect healing tissues and the surgical fixation/reconstruction. The later phases of rehabilitation are presented in a criterion based progression, where advancement to subsequent levels is based on strength and control. Return to competitive throwing will take 8-12 months. Not all athletes will be able to return to competitive throwing. The athlete should ice the elbow for 15-20 minutes after their rehabilitation program to help decrease pain and swelling.

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PHASE I (surgery to 3 weeks after surgery)

Appointments	• Rehabilitation appointments begin 5-7 days after surgery and continue 1 time per week
Rehabilitation Goals	• Protect healing tissues • Decrease pain and inflammation • Prevent muscular atrophy • Initiate elbow range of motion
Precautions	• Week 1 = immobilized at 90° of elbow flexion in hard brace • Week 2 = Functional hinged brace with range of motion from 30°-100° • Week 3 = Functional hinged brace with range of motion from 15°- 110°
Range of Motion (ROM) Exercises (Please do not exceed the ROM specified for each exercise and time period)	• Gentle active and active assistive range of motion for the elbow and wrist • Gentle and gradual overpressure to meet range of motion guidelines • NOTE: Be sure to avoid valgus force or positioning during range of motion exercises
Suggested Therapeutic Exercise	• Begin week 2 with sub-maximal isometrics for shoulder internal rotation, shoulder abduction, biceps, wrist flexors and extensors • Hand gripping • Cervical spine and scapular active range of motion
Cardiovascular Fitness	• Walking, stationary bike - brace on • No treadmill • Avoid running and jumping due to the distractive and compressive forces that can occur at landing

PHASE II (begin after meeting Phase 1 criteria, usually 4-8 weeks after surgery)

Appointments	• Rehabilitation appointments continue 1 time a week
Rehabilitation Goals	• Gradual increase in elbow range of motion to near full range of motion by the 9th – 10th week • Protect reconstruction during continued healing • Improve muscular strength of the arm, shoulder and trunk
Precautions	• Week 4 = Functional hinged brace with range of motion from 10° -120° • Week 5 = Functional hinged brace with range of motion from 5° - 130° • Week 6 = Functional hinged brace with range of motion from 0° – 130° • Discontinue brace at 6-8 weeks except in unsafe environments (this time frame may vary from patient to patient per physician recommendation) • Avoid all valgus positions and minimize valgus stress to the elbow during all rehab exercises

Range of Motion (ROM) Exercises (Please do not exceed the ROM specified for each exercise and time period)	• Gentle active and active assistive range of motion for elbow and wrist • Passive range of motion should be initiated if needed in a very controlled and gentle fashion
Suggested Therapeutic Exercise	• Isotonics with light resistance for shoulder internal rotation/external rotation, shoulder abduction, elbow flexion/extension, pronation/supination, wrist flexion/extension (all in a protected elbow position – hand staying on the medial side of the elbow for all shoulder rotation exercises) • Scapular strengthening and stabilization • Hip, lower extremity and core strengthening • Cervical spine active range of motion/stretching
Cardiovascular Fitness	• Walking, stationary bike - brace on • No treadmill • Avoid running and jumping due to the distractive and compressive forces that can occur at landing

PHASE III (begin after meeting Phase II criteria, usually 9–12 weeks after surgery)

Appointments	• Rehabilitation appointments are once every 1-2 weeks
Rehabilitation Goals	• Increase overall strength and endurance • Achieve and maintain full elbow range of motion • Transition to entry level plyometrics
Precautions	• There should be no pain while doing the strengthening exercises • Post-exercise soreness, should be less than 4/10 and return to baseline within 24-36 hours
Range of Motion (ROM) Exercises (Please do not exceed the ROM specified for each exercise and time period)	• Range of motion should be full at post-operative week 10, and if not, please consult with the physician well in advance of week 12 appointment
Suggested Therapeutic Exercise	• Progressive isotonics for shoulder and elbow strengthening with the arm < 45 degrees abduction positions, controlling speed of the movement and valgus force at the elbow • Initiate eccentric elbow flexion strengthening • Assess shoulder mobility and address any imbalances (such as posterior capsular tightness) which may prevent optimal throwing biomechanics in the next phase • Manual resistance diagonal patterns • Hip, lower extremity and core strengthening • Scapular strengthening and stabilization

Cardiovascular Fitness	• Walking, stationary bike - brace off • Continue to avoid running and jumping

PHASE IV (begin after meeting Phase III criteria, usually 13-20 weeks after surgery)

Appointments	• Rehabilitation appointments are once every 1-2 weeks
Rehabilitation Goals	• Maximize rotator cuff and scapular strength in throwing positions and postures • Initiate education on throwing mechanics • Transition to higher level plyometrics
Precautions	• There should be no pain while doing the strengthening exercises • Post-exercise soreness, should be less than 4/10 and return to baseline within 24-36 hours
Range of Motion (ROM) Exercises (Please do not exceed the ROM specified for each exercise and time period)	• Range of motion should be full at this point, and if not, please consult with the physician
Suggested Therapeutic Exercise	• Shoulder and elbow strengthening with the arm in > 45 degrees abducted positions, controlling speed of the movement and valgus force at the elbow • Initiate rhythmic stabilization drills for the elbow and shoulder in protected positions (at athlete's side) • Initiate plyometics – 2 hand drills only • Begin throwing mechanics education – including slow motion "air throws", posture and position check points • Hip, lower extremity and core strengthening • Scapular strengthening and stabilization
Cardiovascular Fitness	• At week 16 athletes may be running and sprinting at 75% speed, monitoring the environment to minimize the risk of falls

PHASE V (begin after meeting Phase IV criteria, usually 21-36 weeks after surgery)

Appointments	• Rehabilitation appointments are once every 2-3 weeks
Rehabilitation Goals	• Maximize dynamic neuromuscular control with shoulder and elbow stabilization • Develop biomechanically sound throwing mechanics • Maximize muscular endurance and strength of the muscles involved in throwing – including core, upper and lower extremity

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Precautions	• There should be no pain while throwing or doing sport specific drills • Post-throwing soreness, or post-sport specific drill soreness, should be less than 4/10 and return to baseline within 24-36 hours
Range of Motion (ROM) Exercises (Please do not exceed the ROM specified for each exercise and time period)	• Range of motion should be full at this point, and if not please consult with the physician
Suggested Therapeutic Exercise	• Multi-joint, multi-planar strengthening program • Shoulder and elbow stabilization and proprioceptive drills • Plyometric progressions (over several weeks) – transition from 2 arms in the sagittal plane, progressing to 1 arm sagittal plane, to 2 arm rotational movements, to 1 arm rotational movements • Initiate interval throwing program, progressing to a position specific throwing program around week 28 if the athlete has had no pain or problems with the baseline throwing program • Initiate sport specific return program for golf, tennis, basketball or volleyball • Hip, lower extremity and core strengthening
Cardiovascular Fitness	• Training should be targeted toward sport specific energy systems

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