Rehabilitation of Ulnar Collateral Ligament Injuries and Reconstruction

Rehabilitation versus Surgery

Nonoperative treatment of UCL injuries in throwing athletes.
Rettig, et al, 2010 AJSM

- 31 Overhead Athletes
- Rest x 2-3 months, PT, Throw at 3 months
- Only 13 (42%) returned
- Took Average of 24 week (6 months to return
- Could not determine any history or exam that was predictive of who would succeed.
- Quoted study to do Reconstruction

Treatment of partial UCL tears in the elbow with platelet-rich plasma.
Podesta, et al, 2013 AJSM.

- Used PRP on 34 Overhead Athletes (27 baseball)
- Failed PT x 2 month,
- 88% Returned
- Average return in 12 weeks
- Quoted study to attempt non-surgical and PRP injection
Return-to-Play Outcomes in Professional Baseball Players After Medial Ulnar Collateral Ligament Injuries: Comparison of Operative Versus Nonoperative Treatment Based on Magnetic Resonance Imaging Findings


- 43 UCL injuries (2006-11)
- Graded MRI findings
  - I, intact ligament with or without edema; IIA, partial tear; IIB, chronic healed injury; and III, complete tear.
- 8 Complete (RTSP=63%) and 7 Partial Tears treated with reconstruction (RTSP=86%)
- 28 (18 Pitchers) treated non operatively
  - Pitcher RTSP = 94%  Position RTSP = 90%
- Rehab Procedure
  - Reduce pain/inflam and regain full ROM, strength of RTC and scap back to baseline or better.
  - Throwing was started when asymptomatic with good strength (4-6 weeks)

Figure 1. Study flowchart. MRI grading scale: I = intact ligament with or without edema, IIA = partial tear, IIB = chronic healed injury, III = complete tear. RTP, return to play; RTSP, return to same level of play or higher; UCL, ulnar collateral ligament.
4 Phase Rehab Program
Elbow Ulnar Collateral Ligament Injury: A Guide to Diagnosis and Treatment
By Ellenbecker, Wilk Dines, Altchek, Andrews, ElAttrache, Yocum
Copyright 2012 by Lipincott Williams & Wilkens.

- Immediate Post Op (0-3 weeks)
- Intermediate Phase (3-7 weeks)
- Advanced Strengthening Program (8-12 weeks)
- Return to Activity Phase (14-26 months)
- Start Interval Throwing (4.2 months)
- Mound-as early as 6 months.
- Return to competition (12-18 months?)

Kevin Wilk, DPT
“Father of UCL Rehab”

Immediate Post Op (0-3 weeks)

- Range of Motion-Critical
  - Extension-no stress on Graft
  - Flexion past X increase stress
- Posterior Splint for 7 days
- Adjustable ROM Brace
- Must get ROM during first 6 weeks.
- No Shoulder External Rotation

Figure 1. A low-load, long-duration stretch into elbow extension, performed using light resistance.
Intermediate Phase- 4-8 weeks

- Obtain all Elbow ROM
- Out of Brace by 6 weeks
- Light resistive wrist exercises
- Shoulder and Scap Exercises- Thrower’s 10 initiated at 6 weeks.
- Add Triceps work

Advanced Strengthening

- Initiate eccentric elbow flexion/extension
- Continue isotonic program; forearm and wrist
- Continue shoulder program—Throwers Ten Program
- Manual resistance diagonal patterns
- Emphasize scapular and core exercises
- Initiate plyometrics—2 hand drills only
- May initiate interval hitting program for baseball players
Return to Activity Stage

• Start Interval Throwing Program 4.2 months.
• Mound Work at 6-7 months
• Return to Competition 9-12 months.

Return to Sport

  • 743 athletes (95% baseball, high school, college, pro)
  • 83% Return to same or higher level
  • Systematic Review (7 studies)
  • 405 athletes
  • 83% return to play
  • Systematic Review (20 Studies)
  • 82% Excellent Results
  • 86.2% Return to Play
  • 147 MLB Pitchers
  • 80% RTP at least one game
  • 67% RTP for > 10 games in a season
Performance Metrics

  - 92 MLB pitchers
  - 3 yr before and after TJS
  - Compared to Controls
  - Decline in performance but regressions were similar to control

  - Similar Study to Makhani with controls
  - Decrease in ERA, WHIP compared to controls

  - Minor League pitchers
  - Cohort (Non TJS compared to TJS)
  - Mechanics show no significant differences

Velocity

  - Matched pair cohorts
  - Small but statistically decrease in velocity in UCLr but not statistically significant to control group

  - Found similar results to Jiang.
  - No greater declines than to control group

  - Mean FB velocity from 91.3 to 90.6 mph.
  - Especially in UCLr pitchers over 35 yo
  - Other pitch types did not decrease.
Longevity

• Osbahr, et al. (2014)
  • 10 year follow up study
  • 256 UCLr
  • Career longevity was 3.6 years with a 2.9 years at highest level.
  • 86% retired for other than “elbow” reasons and subsequent shoulder reasons were the most common reason.
  • 93% were satisfied with surgery
  • 98% were still able to throw at least on recreational level

With such good results, why
Revision Studies

**Outcomes in Revision Tommy John Surgery in Major League Baseball Pitchers (JSES-2016)**

Joseph Liu, M.D.; Grant H Garcia, MD; Stan Conte, DPT, ATC; Neal ElAttrache, MD; David W Altchek, MD; Joshua S DiNeu, MD

- Since 1999, 235 MLB pitchers underwent TJS.
- 31 pitchers (13.2%) underwent revision surgery
- 37% underwent revision within 3 years of their index year of primary TJS
- 26 revisions had more than 2-year follow up
- 17/26 (65.4%) pitched at least one MLB game
- Only 11/26 (42.3%) pitched more than 10 games
- Compared to controls: shorter career after revision surgery (4.9 vs 2.6 seasons, P = .002), pitched fewer innings, and had fewer total pitches per season. (Workload)
- Average return to MLB = 20.76 months
- Revision Rate = 13.2%

**Pitching performance and longevity after revision ulnar collateral ligament reconstruction in Major League Baseball pitchers. (AJSM-2015)**

Marshall, NE, Keller, RA, Rey, M, Moutzourous, V

- 33 MLB pitchers who underwent revision and compared with 33 age- and position-matched control
- 65.5% of UCL-R pitchers returned to the MLB level
- UCL-R pitchers played 0.8 years less in the majors (P<.01) than did the control pitchers.
- Returning pitchers similar stats compared to control groups (ERA and WHIP)
- Declines in IP, Walks, Wins.
- Also non significant declines in WAR and Runs above replacement.
Revisions Update - MLB Players 1996-2016

Return to Play (1996-2014) = 65% (26/40)

Revision Rate increased from 1-3% to 13.2%

Revision Surgeries Per Year

# of UCL Revisions per Year, 2010-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>MLB</th>
<th>Minor</th>
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<tbody>
<tr>
<td>2010</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
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<td>3</td>
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<tr>
<td>2017</td>
<td>15</td>
<td>3</td>
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</table>
Theories on Why an Increase in Revisions

- Change in the technique of the surgery?
  - Modified Figure 8, Docking Procedures

- Change in the surgeons?
  - 11/15 surgeons on Revisions under 3 years were MLB Surgeons

- Return to previous mechanical issues?
  - Fleisig study shows Pitchers with TJ surgery have similar mechanics as non-TJ.

- Over usage when they return?
  - Pitch counts have been in place for the past 20 years
  - Reliever’s appearances (?)

- Improvement in velocity
  - Not according to velocity studies

- Change in the rehab?
  - Most MLB Teams have followed similar time frames in early and intermediate rehab.

MLB Average Throwing Program Progression

<table>
<thead>
<tr>
<th>Step</th>
<th>Average Post-Surgery</th>
<th>Average Time Between Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 mos.</td>
<td>4.8 months</td>
<td>2.7 months (11.7 weeks)</td>
</tr>
<tr>
<td>5 mos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 mos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 mos.</td>
<td>Flat-Ground Pitching</td>
<td>7.5 months</td>
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<tr>
<td>8 mos.</td>
<td>Mound Pitching</td>
<td>8.4 months</td>
</tr>
<tr>
<td>9 mos.</td>
<td>Change-ups</td>
<td>8.9 months</td>
</tr>
<tr>
<td>10 mos.</td>
<td>Breaking Pitches</td>
<td>9.9 months</td>
</tr>
<tr>
<td>11 mos.</td>
<td>Live to Batters</td>
<td>10.6 months</td>
</tr>
<tr>
<td>12 mos.</td>
<td>Rehab Games</td>
<td>11.5 months</td>
</tr>
</tbody>
</table>
Throwing Velocity and the UCL

- Mechanics and Velocity have a direct relationship with varus torques forces on the medial elbow.
- Both of these can be problems in the progression of the rehab process
- Nothing puts more stress on the UCL than velocity.
- The graft strength and maturation is unknown during the rehab process but one can assume that it is weakest at the early rehab and stronger later.
- A common theory of UCL injury is repeated microtrauma and damage to the UCL fibers.
- Early loading of the young UCL could cause micro tearing of the ligament.
- However, the healing graft responds positively to gradual submaximal stress.

My Theory on Going Slower

- The problem is not the immediate post op or intermediate phases.
- The decision of when and how hard to throw is the biggest potential problem
- Throwing programs are generally not controlled.
- Perceived Exertion is an inaccurate method to measure velocity. (Fleisig study)
- Why do we start at 4 months?
  - How strong is the graft?
  - You can’t teach sheep to throw!
- Radar guns or better technology is required.
My Recommendations

• Throwing should not start until 6 months.
• All velocities or valgus stress should measured on every throw.
• Mound work may be safer than long toss as long as velocity is controlled.
• Goal should be return to competitive level at minimum 14 months.

Thank You

Conte Injury Analytics
conteinjuryanalytics.com