Paper 3

Meniscal Allograft Transplantation Reoperation Rates, Operative Findings, And Survival Analysis: A Review Of 200 Consecutive Transplants At Minimum Two-year Follow-up

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Objectives: Reoperation rates for meniscal allograft surgery (MAT) are high with a 70% survival rate at 10 years. The indications and findings for secondary surgery are not well characterized. The purpose of this study is to quantify the percentage of transplants requiring a re-operation, to characterize the operative findings, perform a survival analysis, and perform a case-control analysis if an early return to surgery is predictive of failure.

Methods: A retrospective review of prospectively collected data from a single-surgeon was performed. Inclusion period was 2003-2011.. The number of patients returning to the OR and the findings at surgery were recorded. A meniscal transplant survival curve, the duration between transplantation and return to OR, and an odds-ratio of risk for failure for those requiring a re-operation in the perioperative period were calculated.

Results: Two hundred patients underwent a MAT during the study period. 38% were isolated; 62% had concomitant procedures. Sixty-four (32%) patients returned to the operating room, of which 38 (59%) were for a meniscal? debridement. The mean duration to secondary surgery was 21 months, with 73% within 2 years. One hundred seventy-two (86%) patients were evaluated at a mean 59 months (Range 24-118 months). Eight went on to require a revision MAT or total knee replacement (4.7%). Patients requiring secondary surgery within two years had an 8.4 odds-ratio for future failure (95% CI 1.6-43.4 p.007).

Conclusion: In the largest consecutive series reported in the literature, meniscal allograft transplantation (MAT) has a 95% success rate a mean of approximately five years. There is a 32% reoperation rate, with meniscal debridement the most common secondary surgical treatment.

Paper 5

Pediatric Acl - Socioeconomic Factors That Contribute To A Delay In Presentation, And The Increase In Pathology That Correlates With Delayed Reconstruction.

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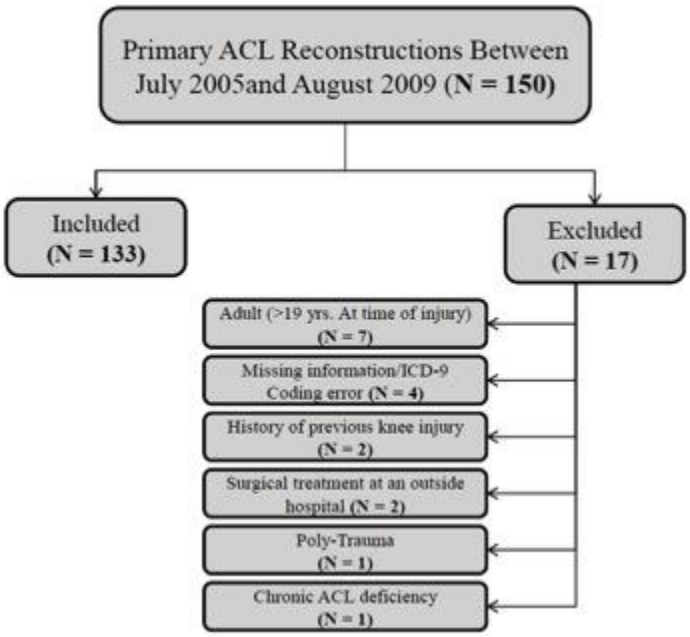
Objectives: The pediatric anterior cruciate ligament (ACL) injury is being recognized as an increasingly important area of research interest. This study further investigates and augments the recently published data describing a delay in pediatric ACL reconstruction and concomitant pathology, which is limited in numbers and scope. Furthermore, this study is the first to investigate the socioeconomic factors that correlate with a delay to surgery.
Methods: All subjects that underwent primary anterior cruciate ligament reconstruction surgery at a single tertiary pediatric hospital between July 2005 and August 2009 were included. Demographic, clinical and socioeconomic variables were retrospectively collected from all patients less than nineteen years of age at the time of surgery.
The operative reports of all eligible subjects were reviewed. The treatment, location and severity of all chondral and meniscal injuries were recorded. The demographics and clinical characteristics of all subjects were summarized using descriptive statistics. Univariable logistic regression analyses were used to identify factors related to chondral and/or mensical injuries that required additional operative treatment. Meniscal and chondral injuries were analyzed with Kaplan-Meier time to event models to compare time to surgery based on the severity of injury.
Results: A total of 133 subjects were included. (Figure 1) The average age at injury was 15 years old (range, 7.83 to 18.56) The median time to surgery among all subjects was 2.29 months [interquartile range 1.31 to 4.30]. A total of 26 subjects (19.55%) underwent ACL surgery greater than five months post injury.
A total of 59 chondral and 119 meniscal injuries were identified. The prevalence of chondral and/or meniscal injuries requiring operative treatment was 57.14% [95% CI: 48.73 to 65.55%].
A delay in surgery of greater than 5 months [p = 0.0001] and a return to activity prior to surgery [p = 0.0007] were significantly related to increased severity of concomitant pathology. The odds of a subject presenting with a chondral and/or meniscal injury that required additional operative treatment were 7.81 [95% CI: 2.21 to 27.58] times greater for a subject that underwent surgery greater than five months after their initial injury.
Demographic factors that were not significantly related include: gender [p = 0.1601], laterality [p =0.3940], BMI percentage [p =0.2969], ethnicity [p = 0.5233], bracing prior to surgery [p = 0.6848] and the subjective report of knee instability prior to surgery [p = 0.3940].
Age at injury [p= 0.0004], household income based on median income associated with zip code [p=0.0150] and type of insurance (private vs. none/government assisted) [p = 0.0491] were significantly related to the timing of ACL surgery.
After controlling for household income, the rate at which surgery occurred was 1.19 times [95% CI: 1.09 to 1.30] greater for every one year increase in age at the time of injury. After controlling for age at

injury, the rate at which surgery occurred was 1.13 times [95% CI: 1.04 to 1.21] greater for every $10,000 increase in household income.

Conclusion: This study shows that a delay in surgery greater than five months correlated with increased number and severity of chondral and/or meniscal injuries.

This is the first study of its kind to show that age at injury, insurance type and household income were significant, independent predictors of the rate at which ACL surgeries occurred.

Figure 1. Summary of Enrollment



Paper 6

Long-term Course In Adolescents After Anterior Cruciate Ligament Reconstruction (ACL)

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Objectives: The risk for further intra-articular damage associated with conservative treatment or delayed ACL reconstruction must be considered against the risk for growth disturbance with early reconstruction and trans-physeal drilling. Long-term follow-ups after surgical treatment of ACL injuries in children are rare. The aims of the present study were to evaluate the results 10-20 years after ACL reconstruction in terms of the presence of osteoarthritis, clinical assessments and health-related quality of life in patients who were adolescents at the time of surgery.
Methods: 32 children, aged 12-16 years (11 boys; 21 girls), with symtomatic unilateral ACL rupture, underwent reconstruction using bone-patellar bone-tendon (n=10) or hamstring tendon (n=22) autograft. Twenty-nine patients (91%) underwent clinical, radiographical and health-related quality of life assessments after 10-20 years (mean 175 months).
Results: The reconstructed knee had significantly more osteoarthritic changes compared to the non-involved contra lateral knee. Preoperatively the Tegner activity level was 4 (2-8) and the Lysholm knee score was 75 (50-90) points. At follow-up the corresponding values were 4 (1-7) and 84 (34-100) points, (p=n.s; preop v follow-up). The one-leg-hop test was 84% (0-105) preoperatively and 93% (53-126) at follow-up (p=0.003). At follow-up muscle strength measurements diplayed more than 90 % of the non-involved leg in both extension and flexion. The knee laxity measurement was significantly less at follow-up than preoperatively (p=0.001). The SF-36 revealed scores compareable to healthy controls (fig. 1).The EQ 5D was 0.9. The KOOS values were lower in all dimensions compared to an aged matched healthy controls.
Conclusion: In the long term, patients who were adolescents at the time of ACL reconstruction reveal significantly more radiographically visible osteoarthritic changes in their operated knee than in their non-involved contralateral knee Clinical outcomes and health-related quality of life are comparable to healthy controls.

Paper 7

Rates and Determinants of Return to Play After Anterior Cruciate Ligament Reconstruction in Division 1 College Football Athletes: A Study of the ACC, SEC, and PAC-12

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Objectives: In competitive athletes, return to play (RTP) and return to pre-injury levels of performance are the main goals of anterior cruciate ligament (ACL) surgery. RTP has been studied in several athletic populations, such as the National Football League. However, to our knowledge, RTP has not been comprehensively evaluated in Division 1 college football. This study aimed to determine the rate of RTP amongst players in three major Division 1 college football conferences, and to investigate several athlete and surgery related variables that may affect RTP. We hypothesized that rates of RTP would be higher than those previously reported in the National Football League and that graft choice and history of concomitant menisectomy would affect RTP. We also hypothesized that players with more experience, at higher depth chart positions, and/or on scholarship would RTP at higher rates than other players.
Methods: Head team orthopaedists and athletic trainers at institutions in the Atlantic Coast Conference, Southeastern Conference, and Pacific 12 Conference were contacted to request their participation in the study. Following IRB approval participating institutions were sent a standardized data collection spreadsheet that asked for RTP and other athlete- and surgery-specific information on all football players undergoing ACL reconstruction from 2004-2010. RTP was defined as an athlete participating in a full practice or official game after the date of his surgery. Athletes whose eligibility expired while injured were excluded from our analysis. Data from each institution was pooled and Chi-square and Fisher Exact tests were used to test the association between any categorical variables and RTP rates.
Results: Data from a total of 184 athletes was obtained. The overall rate of RTP was 82% amongst all

athletes. 76% of athletes were able to return to a level of play equal or higher than before their injury. Player's depth chart position before injury did have a significant ($p = .0049$) association with RTP, with 73% of players who rarely played, 88% of utilized players, and 95% of starters returning to play after surgery. Athletes on scholarship returned to play at a higher rate (88%), than those not on scholarships (69%) ($p = .014$). Years of experience also had a significant ($p = .047$) effect on RTP, with freshman RTP at 83%, sophomores at 94%, juniors at 89%, seniors at 73%, and fifth year seniors at 75%. The use of autograft vs. allograft and the specific choice of autograft did not have a significant impact on RTP rates. Players who underwent a menisectomy returned to play at a rate (79%) similar to those who did not have a concomitant menisectomy (84%) ($p = .56$).

Conclusion: The overall rate of RTP in our Division 1 college football athlete cohort was higher than that previously reported in professional football players. Athletes at higher positions on the depth chart and those on scholarship returned to play at higher rates. Year in school also had a significant effect on RTP rates, while the type of ACL graft and the performance of menisectomy did not.

Paper 16

Primary Versus Revision Arthroscopic Rotator Cuff Repair - An Analysis In 350 Consecutive Patients

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Objectives: The aim of this study was to evaluate the outcome of revision arthroscopic rotator cuff surgery when compared with primary arthroscopic rotator cuff surgery in a large cohort of patients.
Methods: A consecutive series of 350 (300 primary and 50 revision) arthroscopic rotator cuff repairs performed by a single surgeon with a minimum of two years follow-up were retrospectively reviewed using prospectively collected data. With the 50 revision cases as a reference, three primary repair cases were chosen immediately before and three after each revision case. Standardized, patient-ranked outcomes, examiner determined assessments, and ultrasound determined rotator cuff integrity was assessed pre-operatively at six months and two years after surgery.
Results: The revision group had a significantly larger pre-operative tear size (4.1 cm2 ± 0.5 cm2)(mean ± SEM) compared to the primary group (3.0 cm2 ± 0.2 cm2)($p < 0.05$). The mean age of the revision group (63years, range 43-80) was older compared to the primary group (60years, range 18-88)($p < 0.05$).The re-tear rate for primary rotator cuff repair was 16% at 6 months and 21% at two years; while the re-tear rate for revision repair was 28% at six months and deteriorated to 40% at two years ($p < 0.05$). Two years after surgery the primary group reported less pain at rest ($p < 0.02$), during sleep ($p < 0.03$) and with overhead activity ($p < 0.01$) compared to the revision group. The primary group had better forward flexion (+13 Degrees, $p<0.03$), abduction (+18 Degrees, $p < 0.01$) and internal rotation (+2 vertebral levels, $p < 0.001$) compared to the revision group at two years after surgery. The primary group also had significantly greater strength (+15 N, $p < 0.0004$), lift-off strength (+9.3 N, $p < 0.02$) and adduction strength (+22 N, $p < 0.003$) compared to the revision group at two years.
Conclusion: The short term clinical outcomes of patients undergoing revision rotator cuff repair were similar to primary rotator cuff repair. However, these results did not persist and by two years patients who had revision rotator cuff repair were twice as likely to have re-torn compared to those undergoing primary repair. The increase re-tear rate in the revision group at two years was associated with increased pain and impaired overhead function.

Paper 21

Return To Play After Nonsurgical Treatment Of Elbow Ulnar Collateral Ligament Injuries In Professional Baseball Players.

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Objectives: Injury to the elbow ulnar collateral ligament (UCL) is relatively common in pitchers. In the 70's reconstructive surgery was developed as a viable option to a potentially career ending injury. Multiple studies have demonstrated return to play (RTP) rates of 74-83% after reconstruction. Studies of RTP after nonoperative treatment in throwing athletes are limited, reporting 42%. There are no studies reporting RTP rates with nonoperative treatment of professional baseball players. The purpose of this study was to identify professional baseball players' ability to return to play after UCL injuries based on nonoperative vs. operative treatment, MRI grade, and player position.
Methods: A retrospective review of a single professional baseball organization (6 minor league teams and 1 Major league team) between 2006 & 2011 revealed 72 medial elbow injuries. MRI was performed on all players. UCL injuries were diagnosed in 45 players by physical exam & MRI. Players were treated with rehabilitation, surgery or both. Success was RTP for >1 season. Rates of RTP and return to the same level of play or higher (RTSP) were calculated and correlated with MRI grade, location, and player position. MRI grading used was: 1 intact ligament +/- edema, 2 partial tearing, 3 complete tear, and 4 chronic healed injury.
Results: Overall 91% of 45 players had RTP, and 87% had RTSP. Fifteen were treated surgically and 30 nonoperatively with rehab. Of players treated surgically, 73% had RTSP, whereas 93% of nonoperatively treated players had RTSP (p-value 0.07). All players with grade III tears had surgery. Of surgically treated players, none had grade I injuries, 13% had grade II injuries, 53% had grade III injuries, and 33% had grade IV injuries. Of nonoperatively treated players, 13% had grade I injuries, 23% had grade II injuries, none had grade III injuries, and 60% had grade IV injuries. Of all grade II and grade IV injuries, 78% were treated nonoperatively and all but 1 player in each group (treated nonoperatively) had successful RTSP. Of the players treated for grade III tears, 50% had RTSP, whereas 92% of players treated for incomplete (grades I, II and IV) injuries had RTSP (p-value 0.01), regardless of treatment. When considering RTP rather than RTSP for complete vs. incomplete injuries, the rates improved to 75% and 95% (p-value 0.13) respectively. All grade I injuries, 86% of grade II injuries and 91% of grade IV injuries had RTSP. Of the 45 players with UCL injuries, 33 were pitchers. Among pitchers treated surgically RTP was 86% and RTSP was 71%. Nonoperatively treated pitcher’s RTP and RTSP was the same, 95%. Among the pitchers, 24% had grade III injuries whereas none of the positional players had grade III injuries. Ten of 11 positional players treated nonoperatively had RTSP. One positional player was treated operatively and had RTSP.
Conclusion: Professional baseball players treated nonoperatively for UCL injuries have a much higher RTP rate than previously published among throwing athletes. Pitchers are more likely to develop UCL

injuries than positional players and are more likely to have complete tears leading to surgical treatment. Incomplete UCL injuries are more likely to lead to nonoperative treatment and a higher RTSP than complete tears. RTP and RTSP occurs at a higher rates for non-pitchers than pitchers. MRI grade of UCL injuries can help predict the potential for RTP and need for surgery.

Paper 22

Performance and Return-to-Sport After Tommy John Surgery in Major League Baseball Pitchers

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Objectives: Ulnar collateral ligament reconstruction (UCLR) is a common procedure performed in Major League Baseball (MLB) pitchers with symptomatic UCL deficiencies. The purpose of this study was to determine: 1) the rate of return to pitching in the MLB following UCLR, 2) performance after return to pitching, and 3) the difference in return to pitching and performance between pitchers who underwent UCLR and matched controls who did not.
Methods: MLB pitchers with symptomatic UCL deficiency that underwent UCLR between 1986 and 2012 were evaluated. Players' data was extracted from MLB team websites, injury reports, player profiles/biographies, press releases and cross-referenced with the MLB injury database (MLB411). All player, elbow, and surgical demographic data were analyzed. Age, body mass index (BMI), position, handedness, and MLB experience-matched controls were selected from the MLB during the same years as those undergoing UCLR. An "index year" was designated for controls, analogous to UCLR year in cases. Return to pitching and performance measures in MLB was compared between cases and controls. Student's t-tests were performed for analysis of within-group and between-group variables, respectively.
Results: One hundred forty-eight pitchers (83%) were able to return to pitching in MLB. Length of career in MLB following UCLR was 3.9 +/- 2.84 years. Revision rate was 3.9%. In the year prior to UCLR (or index year in controls), cases were significantly ($p<0.05$) worse than controls with regard to number of innings pitched, games played, wins, and winning percentage and were not significantly different than controls in all remaining parameters. Pitchers undergoing UCLR had significantly ($p<0.05$) fewer losses, a lower losing percentage, and lower earned run average (ERA) following surgery (versus pre-surgery). In addition, cases threw significantly ($p<0.05$) fewer walks and allowed fewer hits, runs, and home runs following surgery. Comparisons between cases and controls for the timeframe following UCLR (cases) or index year (controls) demonstrated that cases had significantly ($p<0.05$) fewer losses per season and a lower losing percentage. In addition, cases had a significantly lower ERA and fewer walks and hits allowed per inning pitched (WHIP) (Table 1).
Conclusion:
There is a high rate of return to pitching in the MLB following UCLR. Performance declined prior to surgery and improved following surgery. When comparing to demographic-matched controls, UCLR had better results in multiple performance measures. Ulnar collateral ligament reconstruction allows for a predictable and successful return to professional-level baseball.

Pre-and post- UCLR outcome data vs. Demographic-matched controls

Before and after UCLR		P Value
ERA	5.7 (pre) vs 4.2 (post)	<.001
WHIP	1.6 (pre) vs 1.4 (post)	<.001
Losses/season	4.4 (pre) vs 3.1 (post)	<.001
Losing percentage	19% (pre) vs 14% (post)	.001
Hits given up/season	77 (pre) vs 58 (post)	.001
Runs given up/season	39 (pre) vs 30 (post)	.002
Home runs given up/season	8.7 (pre) vs 6.7 (post)	.002
Walks thrown/season	30 (pre) vs 22 (post)	<.001
Year one prior to UCLR (or index year)		
Innings pitched	54 (cases) vs 90 (controls);	<.001
Games played	21 (cases) vs 30 (controls);	<.001
Number of wins	2.7 (cases) vs 5.4 (controls);	<.001
Winning percentage	14% (cases) vs 21% (controls)	.003
After UCLR (or index year)		
ERA	4.2 (cases) vs 6.4 (controls);	<.001
WHIP	1.4 (cases) vs 1.7 (controls);	<.001
Losses/season	3.1 (cases) vs 4.3 (controls);	.003
Losing percentage	14% (cases) vs 23% (controls);	<.001
Hits given up/IP	1.01 (cases) vs 1.17 (controls)	<.001