

Impact of Medial Meniscus Pathology and Treatment on Tibiofemoral Laxity Before and After Anterior Cruciate Ligament Reconstruction

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INTRODUCTION:

Anterior cruciate ligament (ACL) rupture is among the most common knee injuries. The ACL is the primary stabilizer against anterior tibial translation. As a secondary stabilizer, the posterior horn of the medial meniscus is at increased risk for injury in the ACL deficient knee. However, the relationship between medial meniscal pathology and clinical outcomes following ACL reconstruction (ACLR) remains incompletely understood. The purpose of this study was to evaluate the role of the medial meniscus as a secondary stabilizer using clinical outcomes data. We examined the influence of medial meniscal pathology and treatment, in the setting of primary ACLR with autograft, on pre- and postoperative laxity and outcomes. Specifically, we examined the associations of reparable and irreparable medial meniscal injuries with injury-to-surgery duration, pre- and postoperative tibiofemoral laxity and return-to-OR.

METHODS:

We designed a single-center retrospective review using prospectively collected data from patients who underwent arthroscopically assisted ACLR between 2010 and 2015. This study included all patients older than 18 years old with no prior knee surgery who underwent primary ACLR with hamstring or patellar tendon autograft using interference screw fixation. Patients were excluded if their ACLR also included collateral ligament or posterior cruciate ligament repair/reconstruction. Eligible patients were then grouped according to procedure: isolated ACLR (iACLR), ACLR with partial medial meniscectomy (ACLR+MMX), and ACLR with medial meniscus repair (ACLR+MMR). Variables included in analysis were age, BMI, history of diabetes, nicotine use, injury chronicity, preoperative manual-maximum difference (MMD) arthrometry data, subsequent ipsilateral knee surgeries, and postoperative MMD. We dichotomized postoperative MMD data to represent the restoration of native side-to-side laxity using a MMD threshold of 2.5mm as previous validation studies have established a threshold of 3mm or greater as diagnostic of a complete ACL tear.

RESULTS:

A total of 396 patients met inclusion criteria with 290 receiving hamstring autograft and 106 receiving patellar tendon autograft for their primary ACLR. There were 242 patients in the iACLR group, 82 ACLR+MMR, and 72 ACLR+MMX. In comparison to the iACLR group, the ACLR+MMX group was older (mean 30.4 years old vs. 27.4 years old, $p = 0.0107$), had a lower percentage of females (mean 16.7% vs. 28.9%, $p = 0.0376$), higher mean BMI (mean 28.9 vs. 26.3, $p = 0.0002$), and higher injury chronicity (mean 563 days vs. 274 days, $p = 0.0152$). Relative to the ACLR+MMX group, the ACL+MMR group was younger (mean 26.7 years old vs. 30.4 years old, $p = 0.0034$), had a higher percentage of females (mean 32.9% vs. 16.7%, $p = 0.0206$), and had lower injury chronicity (mean 246 days vs. 563 days, $p = 0.0056$). Regression analysis showed an association between the presence of medial meniscus pathology and age ($p = 0.01$) and BMI ($p = 0.0002$), but not with time-to-surgery or gender. When comparing iACLR to ACLR+MMX, the ACLR+MMX group had a significantly higher preoperative manual-maximum arthrometry difference (MMD) (mean 6.48 mm vs. 7.46 mm, $p = 0.0009$), postoperative MMD (mean 1.07 mm vs. 1.55 mm, $p = 0.0360$), and percentage of postoperative laxity (MMD > 2.5 mm in 7.00% vs. 15.5%, $p = 0.0271$). In comparison to iACLR, the ACLR+MMR group did not show a significant difference in preoperative MMD, postoperative MMD, percentage of postoperative asymmetric laxity, or rate of return-to-OR. The postoperative MMD in the ACLR+MMR group was significantly lower than that of the ACLR+MMX group (mean 1.01 mm vs. 1.55 mm, $p = 0.0248$); the rate of return-to-OR in the ACLR+MMR group, however, was significantly higher than that of the ACLR+MMX group (mean 23.3% vs. 9.9%, $p = 0.0288$). Linear regression analysis showed the postoperative MMD was associated with preoperative MMD (coefficient 0.092, $p = 0.0055$) and with an irreparable medial meniscus tear (coefficient 0.52, $p = 0.0102$). This implies that for a 1mm increase in preoperative MMD the postoperative MMD would increase by 0.092mm. The regression analysis further implies that the presence of an irreparable medial meniscus tear that undergoes partial medial meniscectomy would lead to a 0.5mm increase in postoperative MMD. Regression analysis did not show an association with injury chronicity, age, or BMI.

DISCUSSION AND CONCLUSION: Irreparable medial meniscal tears are associated with increased pre- and postoperative tibiofemoral laxity. However, repairable medial meniscus tears are not associated with increased laxity after ACLR. Furthermore, our study does not suggest an association between medial meniscus tears in the ACL-deficient knee and the injury chronicity.

Demographics	ACL		MMX		MMR		ACL+MMX		ACL+MMR		MMX+MMR	
	n	st	n	st	n	st	n	st	n	st	n	st
age	27.44618	8.02886	30.40278	8.424661	26.70732	6.418507	0.03074	0.3399	0.008418	0.008418	0.008418	0.008418
Gender (M/F)	26.73%	11.242	35.397%	15.72	32.306%	6.882	0.0792	0.0005	0.0005	0.0005	0.0005	0.0005
time to OR	274 days	743 days	563 days	889 days	246 days	273 days	0.0152	0.0260	0.0096	0.0096	0.0096	0.0096
isotope	10.74%	n=242	13.89%	n=72	8.54%	n=82	0.0008	0.7389	0.4238	0.4238	0.4238	0.4238

	ACL+MMX+MMR				ACL+MMX+ACL				ACL+MMX+MMR			
	n	st	n	st	n	st	n	st	n	st	n	st
ACL+MMX	100	100	100	100	100	100	100	100	100	100	100	100
ACL+MMR	100	100	100	100	100	100	100	100	100	100	100	100
MMX+MMR	100	100	100	100	100	100	100	100	100	100	100	100
ACL+MMX+MMR	100	100	100	100	100	100	100	100	100	100	100	100

Postoperative laxity vs meniscus pathology

