Comparing Postoperative Outcomes of Isolated Anterior Cruciate Ligament Reconstruction and the ''Terrible Triad'' Anterior Cruciate Ligament Reconstruction With Medial Meniscus Ramp and Lateral Meniscus Root Repairs

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Background: A new ''terrible triad'' has been reported to be an anterior cruciate ligament (ACL) tear with a concomitant medial meniscus ramp tear and lateral meniscus root tear. Patient-reported outcomes (PROs) for isolated ACL reconstruction (ACLR) versus an ACLR with concomitant medial meniscus ramp and lateral meniscus root repairs are not well known.

Purpose: To compare postoperative outcomes between isolated ACLR and ACLR with concomitant medial meniscus ramp and lateral meniscus root repairs.

Study Design: Cohort study; Level of evidence, 3.

Methods: An initial cohort of 1228 patients with ACLRs were retrospectively identified between April 2016 and November 2021. A total of 41 patients with isolated ACLR (isolated cohort) were age and sex matched to 41 patients who had an ACLR with concomitant medial meniscus ramp and lateral meniscus root repairs (triad cohort). Patients in the triad cohort were identified consecutively by date of surgery. Preoperative and $\geq$2-year postoperative PROs were evaluated to compare the isolated cohort with the triad cohort. Statistical analysis was performed with unpaired *t* tests and chi-square tests.

Results: Both the isolated cohort and triad cohort demonstrated significant differences between preoperative and postoperative PROs in all questionnaire categories assessed. Postoperative scores for the International Knee Documentation Committee (isolated, 88.8; triad, 86.2; $P = .392$), Cincinnati (isolated, 91.1; triad, 88.1; $P = .295$), and Lysholm (isolated, 92.1; triad, 90.1; $P = .472$) PROs demonstrated no significant differences between the cohorts. No significant difference was found between the isolated and triad cohorts for all preoperative questionnaire categories. Additionally, no significant difference was found in revision or reoperation rates between isolated and triad patients ($P = .733$).

Conclusion: No significant differences in PROs were found at minimum follow-up of 2 years postoperatively between the patients who underwent isolated ACLR (isolated cohort) and those who underwent ACLR with concomitant medial meniscus ramp and lateral meniscus root repairs (triad cohort). Inferior outcomes were not observed in the triad cohort when revision rates, reoperation rates, and postoperative PROs were compared. Given the optimistic short-term outcomes for isolated versus triad ACLR patients and the known biomechanical consequences of these untreated meniscal injuries, medial meniscus ramp and lateral meniscus root repairs should be performed when encountered concurrently with an ACL tear when possible.

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Keywords: knee, general; ACL; knee, meniscus; medial meniscus ramp tear; lateral meniscus root tear; terrible triad; patient-reported outcomes

Concomitant injury to the menisci with an anterior cruciate ligament (ACL) tear is common.[9,25] Tears of the ACL can be successfully treated via reconstructive surgery; however, irreparable or unrepaired meniscal tears can have detrimental long-term effects on overall knee health and ACL graft healing, with the potential progression of osteoarthritis.[2,3,28] The combination of a medial meniscus ramp tear and a lateral meniscus root tear (LMRT) concurrent with an ACL tear has been recently reported to be the new "terrible triad."[18] Rotatory instability, increased anterior tibial translation, and increased technical difficulty in performing this surgery characterize the "terrible" nature of this pathology.[18] Various studies have described the outcomes of meniscal repair with ACL reconstructions (ACLRs), but limited information is available regarding this specific ACL and meniscal tear combination due to the difficult nature of identification both during physical examination and on magnetic resonance imaging (MRI).[6,8,20]

Recent literature has reported on the prevalence of specific meniscal injuries concurrent with an ACL tear. Medial meniscus ramp tears have been reported to be present in 9% to 41.4%[4,7,8,17,23,24,26] of patients with an ACL tear, and LMRTs have been reported to be present in 6.6% to 15%[10,21] of patients with an ACL tear. Several previous studies have also reported on the prevalence of an ACL tear with concomitant medial meniscus ramp tears and LMRTs, with this "triad" occurring in 4% to 8% of patients.[8,13,18] Furthermore, other factors like contact-induced ACL tears and revision ACLR are known to be associated with an increased prevalence of medial meniscus ramp tear and LMRT compared with patients who have both noncontact and primary ACL tears.[10,18,27]

Biomechanical studies have reported that a medial meniscus ramp tear in an ACL-deficient knee significantly increases translation on the pivot-shift test, internal rotation, and anterior tibial translation.[1,7] As well, it has been reported that LMRTs decrease mean contact area and increase mean contact pressure in the lateral compartment.[12] Additionally, LMRTs caused increased anterior tibial translation with the pivot-shift examination and increased internal rotation in an ACL-deficient knee.[11] A biomechanical study by Geeslin et al[12] reported that LMRT repair and ACLR restored mean contact pressure and area in the lateral compartment to the intact state.

Although the biomechanical parameters of the meniscus have been thoroughly studied, the effect of medial meniscus ramp tears and LMRTs in combination with patient-reported outcomes (PROs) after ACLR is not well understood. The primary purpose of this study was to compare short-term ($\geq$2 years postoperatively) PROs between patients undergoing isolated ACLR (isolated cohort) and patients undergoing ACLR with concomitant medial meniscus ramp and lateral meniscus root repairs (triad cohort). Secondarily, our objective was to compare revision and reoperation rates. We hypothesized that there would be no significant differences in PROs or revision and reoperation between isolated and triad ACLR cohorts at short-term follow-up.

METHODS

Patient Selection

We used an electronic medical record to search for all patients between April 2016 and November 2021 who underwent an isolated ACLR (isolated cohort) or an ACLR with concomitant medial ramp and lateral root repairs—the "terrible triad" (triad cohort)—from 4 sports medicine fellowship–trained orthopaedic surgeons (B.P.B., C.M.L., C.A.W., and R.F.L). Institutional review board approval was obtained for this study. We identified an initial cohort of 1228 patients with ACLRs who were treated and followed at private ambulatory surgery centers. Of these, 41 patients had an ACLR with concomitant medial meniscus ramp and lateral meniscus root repairs. Identification of triad pathology was preoperatively observed diagnostically (via MRI) and was confirmed arthroscopically by direct visualization and probing intraoperatively. A total of 41 patients with an isolated ACLR were matched based on age and sex to the triad cohort and served as the control. Patients with concomitant

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injuries who did not match the triad pathology or had an ACL tear in isolation were excluded.

Patient Demographics

Demographic and patient characteristics included age, sex, prior surgical procedures, additional pathologies, concomitant procedures, follow-up, and any complications. The laterality, graft type, and meniscal repair technique, were also recorded. Compiled information was derived from operative notes, patient electronic medical records, and first-hand communication.

Surgical Technique

The surgical technique for each patient varied depending on the graft used and the extent of the injury. The graft of choice for the ACLR was a bone–patellar tendon–bone autograft, with hamstring tendon and quadriceps tendon being used secondarily to that. Autografts were used preferentially over allografts. The ACLR was performed via standard arthroscopic fashion and single transtibial and femoral tunnels. The insertion trajectory of the ACL tibial tunnel should be 7.1 mm anteromedial to the insertion of the anterior horn of the lateral meniscus. For the femoral ACL tunnel, the attachment center should insert 6.1 mm posterior to the lateral intercondylar ridge and 1.7 mm proximal to the bifurcate ridge.[5] Assessments of articular cartilage and intra-articular structures were made concurrently. Fixation of the ACL grafts was performed with an interference screw or buttons for the femur and a screw, button, or staple for the tibia. For the triad cohort, the medial meniscus ramp tear was repaired using an all-inside or inside-out technique depending on the size of the tear, with larger tears requiring an inside-out repair. For inside-out repairs, a posteromedial approach was made. Then, a spoon was placed to serve as a retractor in the medial interval on the posteromedial aspect of the capsule to catch the suture needles and protect the neurovascular structures. A self-delivery gun fitted with a cannula was used to pass double-loaded nonabsorbable sutures in a vertical mattress suture technique at the superior and inferior portions of the meniscus and capsule along the length of the tear. Sutures were securely tied over the exterior of the capsule. For all-inside meniscal repairs, a double-loaded all-inside suture device was used to deploy 2 anchor-based sutures with slipknots in a similar vertical mattress suture fashion as the inside-out repair. Anchors were deployed on the exterior portion of the capsule, and knots were fixed on the interior of the intra-articular meniscal surface. For lateral meniscus root repairs, the tears were repaired with a transtibial tunnel for type 2 root tears and all-inside or inside-out suture repairs for type 4 root tears (large radial flap tears at root attachment).[15] For transtibial root repairs, the lateral meniscus root insertion was decorticated with a curette, and 2 tunnels were drilled from the anterior tibial cortex posterior into the decorticated attachment of the lateral meniscus root. Sutures were then passed through the detached portion of the root. A suture passer was used to pull the sutures down the tunnels and return the meniscus root to its anatomic attachment. The sutures were tied over a cortical button.

Postoperative Rehabilitation

Patient postoperative rehabilitation was dependent on the type of surgery performed. In the isolated ACLR cohort, the patients were allowed full range of motion and were weightbearing as tolerated after surgery. Patients weaned off crutches once they could ambulate without a limp, usually at weeks 2 and 3.

Patients in the triad cohort were nonweightbearing for the first 6 weeks to protect their lateral meniscus root repair. Flexion was limited to 0° to 90° for the first 2 weeks and then progressed as tolerated after that. At 6 weeks, triad patients initiated a progressive weightbearing protocol, increasing weightbearing at 25% bodyweight per week until they were full weightbearing and could ambulate without a limp. For the first 4 months, the status of the root repair dictated most of the postoperative therapy regimen, with avoidance of squatting and sitting cross-legged for triad patients. Overall, for both cohorts, physical therapy initially focused on edema control, quadriceps activation, and regaining knee range of motion beginning day 1 postoperatively. Mobility, strengthening, stabilization, and neuro-reeducation were prioritized as the patient progressed throughout the protocol.

Outcome Evaluation

All patients included in this study were sent surveys from OBERD via email at milestone timepoints (preoperatively, 3 months, 6 months, 1 year, 2 years, and yearly) that included the International Knee Documentation Committee (IKDC), Cincinnati, Lysholm, Tegner, and Knee injury and Osteoarthritis Outcome Score (KOOS) Daily, Pain, Quality of Life (QoL), and Sports and Recreation (Sport) questionnaire forms. Any patients $\geq$2 years postoperatively without these PROs were contacted by telephone or email. Electronic medical records were reviewed to assess revision and reoperation rates. Reoperation was classified as any pertinent surgical intervention that occurred postoperatively to address persistent symptoms associated with initial injury mechanism or reconstructive surgery.

Statistical Analysis

Preoperative and postoperative PRO scores on the IKDC, Cincinnati, Lysholm, Tegner, and KOOS questionnaires between each cohort and within each cohort were analyzed using 2-tailed t tests assuming equal variance. The Shapiro-Wilk test for normality was used to confirm normality in preoperative PROs ($P > .05$). Revision and reoperation rates between the isolated and triad cohorts were analyzed using a chi-square goodness-of-fit test. Statistical

TABLE 1
Patient Demographics[a]

	Isolated	Triad	*P*
Patients, n	41	41	≥.999
Male, n	23	23	
Female, n	18	18	
Age, y, mean (range)	24.3 (14-55)	24.6 (14-64)	.906
Patient residence, n			.778
Rural	8	9	
Urban	33	32	
BMI, kg/m^2, mean (range)	25.35 (20.09-41.09)	25.9 (20.34-37.11)	.540
Follow-up obtained, n (%)	38 (92.7)	34 (82.9)	.181
Time to follow-up, mo, mean	50.4	43.9	.149
Graft, n (%)			
BPTB	39 (95.1)	36 (87.8)	.241
Quadriceps tendon	0 (0)	1 (2.4)	.320
Hamstring tendon autograft	1 (2.4)	4 (9.8)	.170
Hamstring tendon allograft	1 (2.4)	0 (0)	.320
Ramp repair type, n (%)			
All-inside	NA	34 (82.9)	NA
Inside-out	NA	6 (14.6)	NA
Both	NA	1 (2.4)	NA
Root repair type, n (%)			
Tunnel	NA	22 (53.7)	NA
No tunnel	NA	19 (46.3)	NA

[a]BMI, body mass index; BPTB, bone-patellar tendon-bone; NA, not applicable.

analysis was performed using Microsoft Excel (Version 16.85; Microsoft Corp) and Statistical Package for the Social Sciences (Version 29.0.2.0; IBM Corp). The alpha level for significance was set at $P \leq .05$.

RESULTS

Postoperative outcome measures were obtained from 38 of 41 patients (92.7% follow-up) in the isolated cohort and 34 of 41 patients (82.9% follow-up) in the triad cohort. Minimum follow-up for both cohorts was 2 years postoperatively. Mean follow-up time was 50.4 months for the isolated cohort and 43.9 months for the triad cohort. Patients in the isolated cohort and triad cohort had a mean age of 24.3 years (range, 14-55 years) and 24.6 years (range, 14-64 years), respectively, at the date of surgery. Over the time of this study, the yearly reported incidence of ACL tears with concomitant medial meniscus ramp tears and LMRTs increased from 2.15% in 2017 to 8.33% in 2021. No significant difference was found between the cohorts for age, body mass index, follow-up, or graft type used. Patient demographic and surgical technique data are listed in Table 1.

The preoperative PROs for patients in the isolated versus triad ACLR cohorts demonstrated no significant differences for all questionnaire categories analyzed (Figure 1). The isolated and triad cohorts both reported significant improvements between all pre- and postoperative PRO questionnaire forms (Figures 2 and 3, respectively). For the postoperative PROs between cohorts, the patients in the isolated and triad cohorts demonstrated no significant differences for the IKDC (P = .392), Cincinnati (P = .295), Lysholm (P = .472), Tegner (P = .726), and KOOS (Daily, P = .670; Pain, P = .309; QoL, P = .212; Sport, P = .227) scores (Figure 4). The isolated ACLR and triad ACLR cohorts reported significant improvements in mean scores between all 8 pre- and postoperative PRO questionnaire forms.

The isolated (n = 41) and triad cohorts (n = 41) each had 1 revision ACLR case (2.4% for triad, 2.4% for isolated). The need for revisions in both cases resulted from ACL graft failure and recurrent meniscal tears, both occurring in competition. There was no significant difference in revision or reoperation rates between the isolated and triad cohorts (P = .733) (Figure 5). Analysis of the meniscal repair reoperation revealed that the case for the isolated cohort was due to a new meniscal tear after the initial ACLR. For the triad cohort, 2 cases were for a new meniscal tear and 1 case was for a revision medial meniscus ramp repair.

DISCUSSION

The most important finding from this study was that there were no significant differences in postoperative PROs between patients undergoing isolated ACLR (isolated cohort) and patients undergoing ACLR with concomitant medial meniscus ramp and lateral meniscus root repairs (triad cohort). We found that the added complexity of performing concurrent medial ramp and lateral root repairs at

Isolated vs. Triad Preop PROs				
Isolated		Triad		
(N=30)	Average (sd)	(N=29)	Average (sd)	P-Value
Preop IKDC (N=21)	44.9 (19.3)	**Preop IKDC (N=28)**	39.7 (20.8)	0.376
Preop Cincinnati (N=22)	49.4 (23.5)	**Preop Cincinnati (N=26)**	40.4 (21.9)	0.176
Preop Lysholm (N=15)	61.0 (28.4)	**Preop Lysholm (N=19)**	52.3 (25.8)	0.361
Preop Tegner (N=7)	4.4 (3.0)	**Preop Tegner (N=14)**	2.9 (2.5)	0.219
Preop KOOS Daily (N=15)	78.2 (18.2)	**Preop KOOS Daily (N=19)**	80.0 (17.8)	0.784
Preop KOOS Pain (N=15)	73.1 (17.4)	**Preop KOOS Pain (N=19)**	72.8 (17.7)	0.956
Preop KOOS QOL (N=15)	28.3 (22.6)	**Preop KOOS QOL (N=19)**	31.8 (24.4)	0.670
Preop KOOS Sports & Rec (N=15)	40.7 (31.0)	**Preop KOOS Sports & Rec (N=19)**	31.9 (28.0)	0.393

Figure 1. Comparison of preoperative PROs between isolated ACLR (isolated) and ACLR with medial meniscus ramp and lateral meniscus root repairs (triad). ACLR, anterior cruciate ligament reconstruction; IKDC, International Knee Documentation Committee; KOOS, Knee injury and Osteoarthritis Outcome Score; Preop, preoperative; PROs, patient-reported outcomes; QOL, Quality of Life; Sports & Rec, Sports and Recreation.

Isolated ONLY Pre- vs. Postop PROs				
(N=30)	Average (sd)	(N=38)	Average (sd)	P-Value
Preop IKDC (N=21)	44.9 (19.3)	**Postop IKDC (N=35)**	88.8 (13.5)	<0.001
Preop Cincinnati (N=22)	49.4 (23.5)	**Postop Cincinnati (N=35)**	91.1 (13.3)	<0.001
Preop Lysholm (N=15)	61.0 (28.4)	**Postop Lysholm (N=35)**	92.1 (12.4)	<0.001
Preop Tegner (N=7)	4.4 (3.0)	**Postop Tegner (N=34)**	7.7 (2.1)	<0.001
Preop KOOS Daily (N=15)	78.2 (18.2)	**Postop KOOS Daily (N=38)**	97.2 (7.9)	<0.001
Preop KOOS Pain (N=15)	73.1 (17.4)	**Postop KOOS Pain (N=38)**	94.2 (10.4)	<0.001
Preop KOOS QOL (N=15)	28.3 (22.6)	**Postop KOOS QOL (N=38)**	82.2 (21.3)	<0.001
Preop KOOS Sports & Rec (N=15)	40.7 (31.0)	**Postop KOOS Sports & Rec (N=38)**	88.9 (20.4)	<0.001

Figure 2. Comparison of PROs between preoperative and postoperative measures in the isolated ACLR cohort. ACLR, anterior cruciate ligament reconstruction; IKDC, International Knee Documentation Committee; KOOS, Knee injury and Osteoarthritis Outcome Score; Postop, postoperative; Preop, preoperative; PROs, patient-reported outcomes; QOL, Quality of Life; Sports & Rec, Sports and Recreation.

Triad ONLY Pre- vs. Postop PROs				
(N=29)	Average (sd)	(N=34)	Average (sd)	P-Value
Preop IKDC (N=28)	39.7 (20.8)	**Postop IKDC (N=33)**	86.2 (11.0)	<0.001
Preop Cincinnati (N=26)	40.4 (21.9)	**Postop Cincinnati (N=34)**	88.1 (10.2)	<0.001
Preop Lysholm (N=19)	52.3 (25.8)	**Postop Lysholm (N=34)**	90.1 (10.4)	<0.001
Preop Tegner (N=14)	2.9 (2.5)	**Postop Tegner (N=32)**	7.5 (1.9)	<0.001
Preop KOOS Daily (N=19)	80.0 (17.8)	**Postop KOOS Daily (N=33)**	96.3 (9.3)	<0.001
Preop KOOS Pain (N=19)	72.8 (17.7)	**Postop KOOS Pain (N=33)**	91.7 (10.6)	<0.001
Preop KOOS QOL (N=19)	31.8 (24.4)	**Postop KOOS QOL (N=33)**	75.9 (20.6)	<0.001
Preop KOOS Sports & Rec (N=19)	31.9 (28.0)	**Postop KOOS Sports & Rec (N=33)**	83.3 (18.1)	<0.001

Figure 3. Comparison of PROs between preoperative and postoperative measures in ACLR with medial meniscus ramp and lateral meniscus root repairs (triad). ACLR, anterior cruciate ligament reconstruction; IKDC, International Knee Documentation Committee; KOOS, Knee injury and Osteoarthritis Outcome Score; Postop, postoperative; Preop, preoperative; PROs, patient-reported outcomes; QOL, Quality of Life; Sports & Rec, Sports and Recreation.

Isolated vs. Triad Postop PROs				
Isolated		Triad		
(N=38)	Average (sd)	(N=34)	Average (sd)	P-Value
Postop IKDC (N=35)	88.8 (13.5)	**Postop IKDC (N=33)**	86.2 (11.0)	0.392
Postop Cincinnati (N=35)	91.1 (13.3)	**Postop Cincinnati (N=34)**	88.1 (10.2)	0.295
Postop Lysholm (N=35)	92.1 (12.4)	**Postop Lysholm (N=34)**	90.1 (10.4)	0.472
Postop Tegner (N=34)	7.7 (2.1)	**Postop Tegner (N=32)**	7.5 (1.9)	0.726
Postop KOOS Daily (N=38)	97.2 (7.9)	**Postop KOOS Daily (N=33)**	96.3 (9.3)	0.670
Postop KOOS Pain (N=38)	94.2 (10.4)	**Postop KOOS Pain (N=33)**	91.7 (10.6)	0.309
Postop KOOS QOL (N=38)	82.2 (21.3)	**Postop KOOS QOL (N=33)**	75.9 (20.6)	0.212
Postop KOOS Sports & Rec (N=38)	88.9 (20.4)	**Postop KOOS Sports & Rec (N=33)**	83.3 (18.1)	0.227

Figure 4. Comparison of PROs between isolated ACLR (isolated) and ACLR with medial meniscus ramp and lateral meniscus root repairs (triad). ACLR, anterior cruciate ligament reconstruction; IKDC, International Knee Documentation Committee; KOOS, Knee injury and Osteoarthritis Outcome Score; Postop, postoperative; PROs, patient-reported outcomes; QOL, Quality of Life; Sports & Rec, Sports and Recreation.

Revision and Reoperation Rates		Isolated	Triad
Revision		1 (2.4%)	1 (2.4%)
Reoperation		8 (19.5%)	11 (26.8%)
Type of Reoperation	*Arthrofibrosis*	6	9
	Cyclops	4	7
	Synovectomy	1	2
	Meniscus Repair	1	3
	Chondroplasty	1	5
	Notchplasty	1	1
No Revision or Reoperation		32 (78.0%)	29 (70.7%)
Total		41	41
Chi-Squared Test	**P-Value: 0.773**		

Figure 5. Revision and reoperation rates between isolated anterior cruciate ligament reconstruction (ACLR) (isolated) and ACLR with medial meniscus ramp and lateral meniscus root tears (triad) demonstrated no significant differences (chi-square goodness-of-fit test).

the time of ACLR did not affect the ultimate PROs or reoperation/revision rates, and we recommend their concurrent treatment at the time of ACLR.

When comparing the isolated ACLR cohort and the triad cohort, we found no significant difference in preoperative outcomes, no significant difference in postoperative outcomes, and significant positive improvements between preoperative and postoperative outcomes for both cohorts. These findings are important because they reveal that the cohorts had comparable outcome measures at both preoperative and postoperative evaluations and both cohorts reported improvements in overall outcomes due to surgery.

Previous studies have reported on patient outcomes after ACLR with medial meniscus ramp repairs and LMRT repairs individually, but not with this triad presentation. DePhillipo et al[8] reported similar PROs, knee stability, return-to-sports rates, and similar failure and complication rates at final follow-up between patients with an ACLR with a medial meniscus ramp repair and matched patients with an isolated ACLR. Zheng et al[29] reported improved IKDC and Lysholm outcome scores and a 93.6% healing rate on second-look arthroscopy for patients with ACLR and lateral meniscus root repairs. Although the triad injury presentation is more complex,

we found that repairs of medial meniscus ramp tears and LMRTs with an ACLR did not negatively affect PROs or reoperation/revision rates.

In this study, we observed an increase in the prevalence of patients per year with this specific triad injury over a 5-year period, from 2.15% in 2017 to 8.33% in 2021. Previous positive surgical outcomes may contribute in part to this increase in observed cases along with an increased overall awareness of the triad pathology, Similarly, other studies have reported on the increased prevalence of ACL tears with these concomitant meniscal injuries. Within the existing literature on concomitant ACL and meniscal injuries, the triad combination prevalence has ranged from 4% to 8%, and recognition is only increasing as awareness of their detection increases.[8,13,18] One of the difficulties with diagnosing and detecting these specific meniscal injuries is secondary to the challenges some clinicians and radiologists have had accurately visualizing ramp and root tears on MRI. DePhillipo et al[7] and Krych et al[14] reported sensitivities of 48% and 33% for diagnosing medial meniscus ramp lesions and LMRTs, respectively. Another study reported a sensitivity of 60% for LMRTs using a 3.0-T MRI, indicating that sensitivity may be higher with stronger MRI machines.[16] These results emphasize the importance of having a high index of suspicion for these injuries in patients with an increase in anterior tibial translation, Lachman test, or explosive pivot-shift test and should be validated with thorough arthroscopic probing and direct assessment of any meniscal pathology.[8,11,19,22] Our study supports prior literature with regard to increasing recognition and diagnosis of the triad injury presentation in patients with ACL tears.

Limitations

This study is not without limitations. One limitation was the inability to match all relevant demographic variables including body mass index, injury mechanism, sports, and other contributing factors to recovery. Furthermore, we did not have a cohort of patients with ACLR and unrepaired medial meniscus ramp and LMRTs, which would have allowed direct comparison between performing and not performing the meniscal repairs. The retrospective nature of this study further limited the reliability of preoperative assessment data characterizing rotary instability, laxity, and increased translation. The addition of consistent physical assessments would allow for intercohort pre- and postoperative comparison of the biomechanical effects of this injury combination. This, in combination with postoperative imaging, can assess whether degenerative consequences exist. Furthermore, our conclusions on increasing triad prevalence are limited by the nonepidemiological nature of the study. The future direction of this study would optimally obtain larger patient cohorts and report over a longer time frame to improve the support of definitive inferences.

CONCLUSION

No significant differences in PROs were seen at a minimum of 2 years postoperatively between patients undergoing isolated ACLR (isolated cohort) and patients undergoing ACLR with concomitant medial meniscus ramp and lateral meniscus root repairs (triad cohort). Inferior outcomes were not observed in the triad cohort when revision rates, reoperation rates, and postoperative PROs were compared. Given the promising short-term outcomes comparing isolated versus triad ACLR patients and the known biomechanical consequences of these meniscal injuries, medial meniscus ramp and lateral meniscus root repairs should be performed when encountered concurrently with an ACL tear when possible.

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