Evaluating Performance Testing Measures using Limb Symmetry Index: Return to Sport Outcomes Following Medial Patellofemoral Ligament Reconstruction

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INTRODUCTION: Recurrent patellar instability commonly occurs in young athletes. Medial patellofemoral ligament (MPFL) reconstruction is the definitive treatment, often performed in conjunction with bony procedures addressing anatomical risk factors. However, return-to-sport (RTS) testing after MPFLR is currently adapted from anterior cruciate ligament (ACL) protocols, despite important anatomical and rehabilitative differences. There is a need for RTS criteria tailored specifically to patellar instability. While limb symmetry index (LSI) values can guide rehabilitation, few studies have evaluated these in MPFLR patients. This study aimed to assess performance testing with LSI in relation to RTS and clinical outcomes in athletes undergoing primary MPFLR.

METHODS: All patients who underwent primary MPFLR between 2007 and 2022 were identified using an institutional database. Inclusion criteria were sports participation and completion of LSI-based performance testing during rehabilitation. Patients with contralateral patellar instability or additional procedures such as osteotomy, osteochondral fixation, or meniscus repair were excluded. We collected demographic, radiographic, and operative data, including cartilage status and graft type. Postoperative RTS outcomes and performance test results (isokinetic strength, Y-balance, and hop tests) were recorded. Isokinetic testing was performed at slow (60-90°/sec) and fast (180-300°/sec) speeds. Patients were contacted at a minimum 2-year follow-up for patient reported outcomes including International Knee Documentation Committee (IKDC), Kujala, and Lysholm scores.

RESULTS:

Sixty-six knees in 66 patients (mean age: 15.6 years, BMI: 24.6 kg/m^2, 59% female) were included. The mean age of index dislocation was 14.4 years. Most were high school athletes (77%), and 63% played multiple sports. Eighty percent had sport-related dislocations, averaging 3.3 instability events before surgery. Radiographically, Dejour types were: 32% type A, 8% type B, 39% type C, and 21% type D, with a mean Caton-Deschamps index of 1.5. Patellar chondromalacia was present in 67% (with 70% of these being ICRS grade 1–2), and trochlear chondromalacia in 8%. Concomitant procedures included chondroplasty (24%), hemiepiphysiodesis (6%), and partial meniscectomy (3%). MPFLR grafts used were gracilis (82%) and semitendinosus (18%), with 67% allografts and 33% autografts.

At final assessment, the isokinetic quadriceps LSI averaged 87% at slow speeds and 94% at fast speeds. For the hamstrings, LSI values were 99% at slow speeds and 103% at fast speeds. Y-balance LSI scores were 97% in the anterior direction and 101% in both the posteromedial and posterolateral directions. Hop test LSI scores were 97% for both single and triple hops (**Table 1**). There were no significant differences in LSI values between the 6-month and final assessments. Notably, patients who received allografts demonstrated significantly higher isokinetic LSI scores for slow quadriceps (90% vs. 80%, p=0.030) and slow hamstrings (99% vs. 86%, p=0.014) compared to those who received autografts (**Figure 1**).

Sixty-two patients (94%) returned to sport at an average of 6.1 months postoperative. On follow-up exam, 2 patients (3%) had a positive apprehension sign. At a follow-up of 6.6 years, 6 patients (9%) experienced subsequent instability, and 2 patients (3%) underwent revision surgery. One patient underwent revision MPFLR with tibial tubercle osteotomy at 2.9 years postoperative and the other patient underwent revision MFPLR at 13.8 years postoperative. At final follow-up, mean outcome scores were: Lysholm 87.5, IKDC score 85.4, Kujala 93.9, and VAS pain scores of 0.6 at rest and 1.8 with use (out of 10). Seventy-eight percent reported their knee was much better than before surgery, with an average satisfaction score of 9.1 out of 10. Both rest and activity-related pain were significantly improved postoperatively (p<0.01).

DISCUSSION AND CONCLUSION: Young athletes with recurrent patellar instability undergoing primary MPFL reconstruction achieved a 94% return-to-sport rate at 6.1 months postoperatively, with low rates of recurrent instability. Successful RTS was achieved despite a median 13% LSI deficit in isokinetic quadriceps strength—with 45% of patients below 85% LSI—while hamstring strength and functional tests showed <5% LSI deficits at time of return to sport. Allograft use was associated with higher isokinetic LSI scores than autograft. At 6.6-year follow-up, excellent patient-reported outcomes were maintained. These findings suggest that acceptable strength deficits for return to sport after MPFLR may differ from those following ACL reconstruction, underscoring the need for ongoing work to redefine safe return-to-sport threshold values in this population.

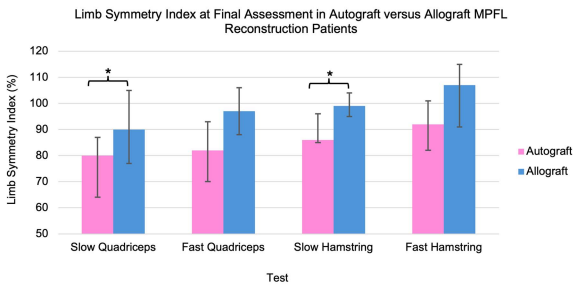

Figure 1. Limb Symmetry Index at Final Assessment Following MPFL Reconstruction: Autograft versus Allograft. *Indicates statistically significant difference ($p<0.05$).

Table 1. Limb Symmetry Index (LSI %) at Final Assessment for MPFL Reconstruction Patients

Test	Median [Q1, Q3] (n=66)	
Isokinetic Lower Extremity Strength Torque		
Slow Quadriceps [60-90°/sec]	**87**	[74 - 99]
Fast Quadriceps [180-300°/sec]	**94**	[82 - 105]
Slow Hamstring [60-90°/sec]	**99**	[90 - 103]
Fast Hamstring [180-300°/sec]	**103**	[87 - 114]
Y-Balance		
Anterior	**97**	[94 - 100]
Posteromedial	**101**	[98 - 102]
Posterolateral	**101**	[98 - 103]
Hop Testing		
Single Hop	**97**	[93 - 101]
Triple Hop	**97**	[93 - 100]