Graft Selection in Skeletally Immature ACL Reconstruction: Quadriceps Tendon Reduces Retear Risk Compared to Semitendinosus

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INTRODUCTION:
Anterior cruciate ligament (ACL) reconstruction in skeletally immature patients presents unique challenges, including elevated retear risk due to open physis and high athletic demand. Although semitendinosus tendon (ST) grafts are frequently used, quadriceps tendon (QT) grafts have gained attention for their superior cross-sectional area, graft stiffness, and graft maturation properties.
We hypothesized that QT grafts would result in a significantly lower retear rate compared to ST grafts, while maintaining comparable clinical outcomes in skeletally immature patients undergoing ACL reconstruction.
METHODS:
This retrospective comparative cohort study included 40 skeletally immature patients who underwent primary ACL reconstruction between 2018 and 2023. Patients were assigned to two groups based on graft type: QT (n=20, mean age 14.5±1.6 years) and ST (n=20, mean age 14.9±1.1 years). All procedures were performed by single orthopedic surgeons. Retear and graft failure was confirmed through clinical assessment and MRI. Secondary outcomes included KT-1000 side-to-side difference, negative rate of pivot shift test, and KOOS subscales (symptoms, pain, ADL, sports, QOL). The minimum observation period is 12 months. For statistical analysis, the chi-square test and t-test were used, with a significance level set at $p < 0.05$.
RESULTS:
The QT group experienced 0 retears and graft failure (0/20; 0%), while the ST group had 4 retears and graft failures (4/20; 20%)(p=0.035), all occurring within 12 months postoperatively in patients returning to pivoting sports. KT-1000 difference(QT: 0.8mm, ST: 0.9mm) and negative rate of pivot shift test (QT: 5%, ST: 10%)showed no statistical differences. Both groups demonstrated comparable mean KOOS scores in symptom(QT: 96.1, ST: 96.4), pain (QT: 97.5, ST: 99.0), ADL (QT: 99.7, ST: 99.9), sports (QT: 98.2, ST: 98.2) and QOL(QT: 95.5, ST: 93.8).
DISCUSSION AND CONCLUSION:
Quadriceps tendon grafts resulted in a substantially lower retear rate compared to semitendinosus grafts in skeletally immature ACL reconstruction, Although there was no difference in clinical outcomes. These findings support the use of QT as a more durable graft option in pediatric patients. Further prospective studies with larger cohorts are warranted to validate these results and refine graft selection in high-risk, growing athletes.

	QT group	ST group	p value
Number of patients	20	20	
Mean age (years)	14.5 ± 1.6	14.9 ± 1.1	0.29
Re-tear (cases)	0	4	*0.035*
KT-1000 side to side difference(mm)	0.8 ± 0.9	0.9 ± 0.9	0.76
Negative rate of pivot shift test (%)	5	10	0.66
KOOS symptom	96.1 ± 36.9	96.4 ± 20.3	0.88
KOOS pain	97.5 ± 11.5	99.9 ± 3.6	0.21
KOOS ADL	99.7 ± 0.37	99.9 ± 0.2	0.56
KOOS sports	98.2 ± 11.4	98.2 ± 16.4	1
KOOS QOL	95.5 ± 71.0	93.8 ± 46.8	0.61