All-Soft Tissue Quadriceps Autograft in the Pediatric Athlete: A Retrospective Cohort Study of 540 Cases

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INTRODUCTION:

More children and adolescents participate in high-level athletics, with increasing incidences of anterior cruciate ligament (ACL) ruptures outpacing that of adults. The all-soft tissue quadriceps tendon (QT) autograft poses many advantages as a graft choice for the pediatric patient, but the literature has yet to report outcomes representative of this population. This study aimed to report re-injury rates and functional objective and subjective outcomes in the intermediate postoperative period for pediatric patients undergoing primary ACL reconstruction using an all soft tissue QT autograft.

METHODS:

In this retrospective analysis, consecutive pediatric patients (<18 years) that underwent primary ACL reconstruction using all soft tissue QT autograft by a single surgeon between 2011-2021 were analyzed. Demographic and injury specific data, pre- and postoperative IKDC scores, isometric quadriceps strength at 6- and 12 months, and KT1000 measurements at 12 weeks and 6 months, were recorded. Descriptive statistics were performed to evaluate re-injury rates and progressions in measured outcomes. Statistical significance was set at $p<0.05$ with a power of 0.8.

RESULTS:

Of 593 patients, 540 (female: 50%, age: 15.9 standard deviation (SD): 1.7, body mass index (BMI): 23.18, SD: 3.96) met inclusion criteria. Most common injuries were sustained during soccer (28.1%), football (24.6%), and basketball (22%). Average follow up was 20.55 months (range: 14-25 months). Most common complications (n=95, 17.66%) included graft failure (n=46, 8.5%; plus meniscus injury [n=17, 3.1%]), isolated medial meniscus injury (n=15, 2.7%), cyclops lesion (n=34, 6.3%), and arthrofibrosis (n=33, 6.1%). The most common contralateral injury (n=21, 3.9%) was ACL rupture (n=18, 3.3%). IKDC scores improved to 89.40 ± 11.84 on last follow up (mean difference to baseline: 31.58 ± 17.75, $p<0.001$). Isometric quadriceps strength improved from 40.07% (60˚) and 42.2% (180˚) strength deficit to an average of only 10.82% (60˚) and 9.97% (180 ˚) remaining deficit at 12 months ($p<0.001$). Anterior tibial translation with KT1000 was within acceptable range in 95% of patients at 6 months.

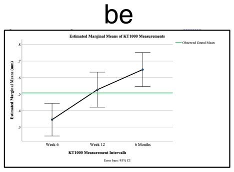
DISCUSSION AND CONCLUSION:

The all-soft tissue QT autograft is a reliable graft choice for the pediatric athlete. This study demonstrates low graft failure and re-injury rates comparable to, or lower than other autograft options in pediatric patients, and serves to affirm that this graft can be used safely with reproducible results.

Table 2: Adverse Outcomes

	Total, n=540	Transphyseal, n=510	Physeal-Sparing, n=30
Re-Injury total	**95 (17.6%)**	**86 (16.9%)**	**9 (30%)**
Ipsilateral Injuries	**70 (13%)**	**65 (12.7%)**	**5 (16.7%)**
QT Graft Failure	46 (8.5%)	45 (8.8%)	1 (3.3%)
+ *Meniscus Injury*	17 (3.1%)	16 (3.1%)	1 (3.3%)
+ *Chondral Defect*	1 (0.2%)	1 (0.2%)	0 (0)
Medial Meniscus (Isolated)	15 (2.7%)	12 (2.4%)	3
Lateral Meniscus (isolated)	5 (1%)	5 (1%)	0
Cyclops Lesion	34 (6.3%)	34 (6.7%)	0 (0)
Arthrofibrosis	33 (6.1%)	33 (6.3%)	0 (0)
Graft Site Hematoma	10 (1.9%)	10 (2.0%)	0 (0)
Infection	4 (0.7%)	4 (0.8%)	0 (0)
+ *Deep*	1 (0.2%)	1 (0.2%)	0 (0)
+ *Superficial*	3 (0.6%)	3 (0.6%)	0 (0)
Contralateral Injuries	**21 (3.9%)**	**17 (3.3%)**	**4 (13.3%)**
ACL Rupture	18 (3.3%)	15 (2.9%)	3 (10%)
Meniscus Injury	10 (1.9%)	9 (1.8%)	1 (3.3%)

*Percentages are referenced from *Total*, *Transphyseal*, and *Physeal-Sparing* groups



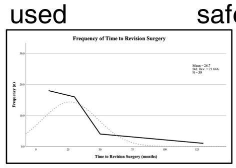


Table 3: IKDC Score - Baseline versus Last Follow-up (Paired)

Baseline, mean (SD)	Last Follow Up, mean (SD)	Mean difference	P-value
57.82 (15.47)	89.40 (11.84)	31.58 (17.75)	<0.001

IKDC Score: Baseline versus Last Follow-up (Unpaired)

Baseline, mean (SD)	Last Follow Up, mean (SD)	Mean difference	P-value
57.37 (16.08)	88.33 (12.63)	30.96 (14.38)	<0.001

* Completed IKDC: n= 257 (47.6%)

† Mean time to IKDC completion: 15.55 ± 7.18 months

Table 4: Isokinetic Quad Strength Progression Compared to Contralateral Side: 6 months vs. 12 months, n=397

	Deficit at 6 Months, %	*Deficit at 12 Months, %*	*Absolute Improvement, %*
60 Degrees	40.07	10.82	29.25
180 Degrees	42.2	9.97	32.24