

COMPARISON OF BONE-PATELLA TENDON-BONE (BTB) AND QUADRICEPS AUTOGRAFT FOR ACL RECONSTRUCTION IN PATIENTS UNDER 18 YEARS OF AGE

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Background: Graft choice for ACL reconstruction in patients under 18 years old remains controversial. BTB autograft has long been considered for young athletes who are at or near skeletal maturity. Quadriceps autograft has emerged as an alternative graft choice in the young patient population. However, there remains a paucity of comparative outcomes.

Hypothesis/Purpose: Our purpose is to compare subjective outcomes and complications of ACL reconstruction in patients under 18 years old using either BTB or quadriceps autograft. Our hypothesis is that there will be no difference in subjective outcome or complication between groups.

Methods: Following IRB approval, retrospective review of prospectively collected data identified consecutive cohorts of patients under 18 years old undergoing ACL reconstruction with either BTB or quadriceps autograft. Surgery was performed by a single sports fellowship trained surgeon between 2011-2019. Patients undergoing concomitant osteotomies, cartilage restoration, and other ligament reconstruction procedures were excluded. Pre- and post-surgical patient reported outcomes (PROs) including IKDC, KOOS, PROMIS, SANE, Tegner, and Marx were compared between groups. Complications requiring re-operation (i.e., infection, stiffness, reconstruction failure) were recorded. Results were analyzed statistically.

Results: 71 patients met inclusion criteria. There were 41 BTB and 30 quadriceps autografts. Mean age was 16.5 years in the BTB group and 14.5 in the quadriceps group ($p=0.0000006$). 27 of 41 (66%) BTB and 13 of 30 (43%) quadriceps were female. There were no significant differences in PROs between groups. At minimum 6-month follow-up (range 6-25.7 months), patients in both quadriceps and BTB autograft cohorts reported statistically significant improvements in IKDC scores (31.10%, $p=0.0009$; 34.25%, $p=0.00000008$), all KOOS domains, SANE (41.80%, $p=0.0000006$; 42.42%, $p=0.000000002$), and Tegner scores (2.99%, $p=0.0002$; 3.35%, $p=0.000004$). Post-operative PROs were not significantly different between groups ($p>0.05$). Complications were low and not significant between groups. Both quadriceps and BTB autograft cohorts required 3 post-operative re-operations (10% and 7%, $p=0.7$), each group including 2 revision reconstructions (7% and 5%, $p=0.8$) and 1 procedure for stiffness (3% and 2%, $p=0.8$).

Conclusion: For ACL reconstruction in patients under 18 years old, both BTB and quadriceps autografts demonstrated significant subjective improvements and low rates of complications requiring re-operation. Quadriceps autograft appears to be a safe and effective alternative to BTB autograft in this challenging patient population.

Table 1. Pre-Operative PROs

KOOS

Sub-scale	Graft	Pre-op				N	P-value
		Mean	SD	95% CI			
				Lower Bound	Upper Bound		
ADL	Quadriceps	75.13	16.13	72.43	77.83	17	0.425
	BTB	79.16	15.77	77.00	81.32	25	
Pain	Quadriceps	66.99	19.50	63.73	70.26	17	0.065
	BTB	77.20	14.99	75.11	79.30	24	
Sport	Quadriceps	38.82	23.29	34.93	42.72	17	0.806
	BTB	40.60	22.47	37.52	43.68	25	
Symptoms	Quadriceps	63.43	19.91	60.10	66.76	17	0.713
	BTB	65.53	16.65	63.25	67.81	25	
QOL	Quadriceps	28.69	20.50	25.26	32.13	17	0.229
	BTB	36.02	18.07	33.54	38.49	25	

PROMIS

Sub-scale	Graft	Pre-op				N	P-value
		Mean	SD	95% CI			
				Lower Bound	Upper Bound		
Physical Health	Quadriceps	49.15	6.53	48.05	50.24	17	0.332
	BTB	51.24	6.05	50.26	52.22	18	
Mental Health	Quadriceps	57.59	7.54	56.33	58.85	17	0.418
	BTB	59.54	6.51	58.48	60.60	18	
Physical Function	Quadriceps	39.52	5.73	38.56	40.48	17	0.183
	BTB	42.60	7.49	41.38	43.81	18	
Pain Interference	Quadriceps	57.93	6.33	56.87	58.99	17	0.892
	BTB	58.27	8.29	56.92	59.62	18	
Mobility T-Score	Quadriceps	40.91	6.52	39.46	42.36	10	0.372
	BTB	43.69	7.87	42.23	45.14	14	

Other

Variable	Graft	Pre-op				N	P-value
		Mean	SD	95% CI			
				Lower Bound	Upper Bound		
Marx	Quadriceps	14.18	4.14	13.48	14.87	17	0.964
	BTB	14.20	3.24	13.76	14.64	25	
SANE	Quadriceps	45.65	26.51	41.21	50.08	17	0.968
	BTB	46.00	24.84	41.84	50.16	17	
Tegner	Quadriceps	2.47	1.42	2.23	2.71	17	0.158
	BTB	3.21	1.74	2.96	3.45	24	
IKDC	Quadriceps	44.83	15.07	41.92	47.74	13	0.313
	BTB	50.63	16.37	48.12	53.15	20	

Table 2. Post-Operative PROs

KOOS

Sub-scale	Graft	>6 Months Post-op				N	P-value
		Mean	SD	95% CI			
				Lower Bound	Upper Bound		
ADL	Quadriceps	98.88	1.67	98.63	99.13	21	0.326
	BTB	97.86	4.48	97.33	98.40	33	
Pain	Quadriceps	94.57	6.71	93.57	95.58	21	0.637
	BTB	93.43	9.64	92.29	94.57	33	
Sport	Quadriceps	92.20	9.87	90.73	93.68	21	0.108
	BTB	83.64	22.61	80.95	86.32	33	
Symptoms	Quadriceps	91.43	8.93	90.09	92.77	21	0.563
	BTB	89.59	12.59	88.10	91.09	33	
QOL	Quadriceps	70.54	19.68	67.59	73.49	21	0.251
	BTB	77.04	20.46	74.64	79.43	34	

PROMIS

Sub-scale	Graft	>6 Months Post-op				N	P-value
		Mean	SD	95% CI			
				Lower Bound	Upper Bound		
Physical Health	Quadriceps	58.30	7.98	57.07	59.53	20	0.651
	BTB	59.24	6.52	58.42	60.05	30	
Mental Health	Quadriceps	58.24	8.33	56.92	59.55	19	0.131
	BTB	61.83	7.74	60.87	62.80	30	
Physical Function	Quadriceps	51.79	7.99	50.57	53.02	20	0.205
	BTB	55.32	10.49	54.04	56.61	31	
Pain Interference	Quadriceps	47.16	7.04	46.10	48.21	21	0.589
	BTB	46.00	7.81	45.04	46.96	31	
Mobility T-Score	Quadriceps	53.98	7.55	52.58	55.38	14	0.456
	BTB	55.72	6.34	54.81	56.63	23	

Other

Variable	Graft	>6 Months Post-op				N	P-value
		Mean	SD	95% CI			
				Lower Bound	Upper Bound		
Marx	Quadriceps	11.17	5.02	10.16	12.18	12	0.572
	BTB	12.22	5.24	11.47	12.97	23	
SANE	Quadriceps	87.44	10.60	85.72	89.17	18	0.805
	BTB	88.42	14.58	86.63	90.21	31	
Tegner	Quadriceps	5.46	2.40	5.00	5.92	13	0.221
	BTB	6.56	2.66	6.20	6.92	25	
IKDC	Quadriceps	75.93	26.33	71.38	80.47	16	0.219
	BTB	84.88	16.38	82.37	87.40	20	

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