Meniscal Allograft Transplantation is Chondroprotective and Provides Superior Pain Relief and Function Compared to Arthroscopic Partial Meniscectomy

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INTRODUCTION: Patients with symptomatic meniscal deficiency face long-term risks of osteoarthritis (OA) progression and diminished knee function. While arthroscopic partial meniscectomy (APM) is commonly used, it is associated with cartilage degeneration. Meniscal allograft transplantation (MAT) is proposed as a joint-preserving alternative. This study aims to compare midterm outcomes of MAT versus APM with regard to pain, function, OA progression, and reoperation rates.

METHODS: A prospectively collected database (January 2004 – December 2020) was screened for patients with symptomatic subtotal or total meniscal deficiency. One-hundred-twenty-eight MAT procedures were matched 1:1 to 128 contemporary isolated APM procedures by age (± 5 y), sex, body-mass index (BMI, ± 5 kg/m²) and pre-operative Kellgren–Lawrence (K–L) grade; all absolute standardised differences were < 0.25. MAT was arthroscopic, employing fresh-frozen, MRI-sized grafts fixed with bone plugs, key-hole bone bridge or circumferential soft-tissue sutures; APM removed irreparable fragments, preserving healthy rim. Standardised rehabilitation required partial weight-bearing and motion protection for MAT, but allowed immediate full weight-bearing after APM. Minimum follow-up was 24 months for every patient (mean MAT 84 ± 44, APM 154 ± 51 mo). Outcomes included Knee injury and Osteoarthritis Outcome Score (KOOS) subscales, Lysholm and International Knee Documentation Committee (IKDC) scores, radiographic OA progression (Δ K–L grade), clinical failure (Lysholm < 65), reoperation, complications and Kaplan–Meier survivorship. Non-parametric tests and multivariate logistic or Cox analyses were applied (α = .05).

RESULTS:

Groups were demographically similar (mean age 25 ± 8 y; BMI 27 ± 5 kg/m²; 40 % female; 89 % K–L 0–1). MAT knees had more prior ipsilateral surgery (1.7 ± 1.0 vs 0.2 ± 0.4; p < .001) and more concomitant realignment or ligament reconstruction at the index procedure (67 % vs 39 %; p = .004). Despite this higher complexity, MAT produced larger mean score gains:

KOOS-Pain +45 ± 18 vs +39 ± 21 (p = .01)

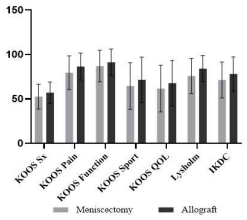
KOOS-Activities of Daily Living +29 ± 17 vs +22 ± 19 (p = .03)

Lysholm +30 ± 17 vs +23 ± 18 (p = .02)

IKDC +27 ± 19 vs +20 ± 20 (p = .04)

Absolute postoperative KOOS-Pain reached 89 ± 13 after MAT versus 83 ± 17 after APM (p = .01); postoperative Lysholm was 82 ± 17 versus 80 ± 18 (p = .04). OA progression was halved following MAT (Δ K–L 0.38 ± 0.72) compared with APM (0.77 ± 1.15; p = .001). Clinical failure occurred in 7 MAT patients (6 %) and 25 APM patients (20 %) (p = .014). Kaplan–Meier survival free of failure was 98 % vs 92 % at 2 y and 90 % vs 78 % at 10 y (log-rank p = .08). Reoperation was more frequent after MAT (29 % vs 9 %; p = .003), but no deep infections, graft collapses or conversions to arthroplasty occurred. Independent risk factors for MAT failure were male sex (odds ratio 0.35; p = .02) and pre-operative K–L grade (OR 1.74; p = .01); only pre-operative K–L predicted APM failure (OR 0.79; p = .04).

DISCUSSION AND CONCLUSION: Meniscal allograft transplantation delivered clinically meaningful and statistically significant advantages over isolated APM in pain reduction, functional restoration and radiographic joint preservation, while maintaining excellent survivorship in a more complex patient cohort. The higher reoperation incidence reflects graft surveillance and adjunctive procedures rather than loss of benefit. Early MAT referral should therefore be considered for young, active patients with symptomatic subtotal or total meniscal deficiency to mitigate OA risk and optimise long-term knee health.



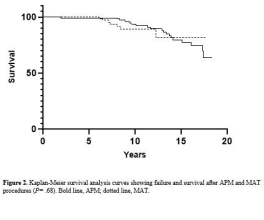


Figure 2. Kaplan-Meier survival analysis curves showing failure and survival after APM and MAT procedures (P= .68). Bold line, APM; dotted line, MAT.

Patient and Procedural Characteristics

Characteristic	APM (n=128)	MAT (n=128)	P
Age at surgery, y	24.85 ± 7.6	25.23 ± 7.6	.69[a]
BMI	27.1 ± 4.8	27.32 ± 5.85	.73[b]
Sex			1[c]
Female	51 (39.8)	51 (39.8)	
Male	77 (60.2)	77 (60.2)	
Follow-up duration, y	12.85 ± 3.7	7.25 ± 3.7	.03[d]
Preoperative Kellgren and Lawrence grade			.55[e]
0	85 (66.4)	70 (54.7)	
1	38 (29.7)	45 (35.2)	
2	5 (3.9)	13 (10.1)	
No. of previous surgeries in ipsilateral knee	.19 ± 0.4	1.67 ± 1.03	.003[d]

Data are presented as mean ± SD unless otherwise indicated. BMI, body mass index.
[a]Independent t test.
[b]Fisher exact test.
[c]Mann-Whitney U test

Clinical Outcomes[a]

	APM (n=128)	MAT (n=128)	P[b]
KOOS			
Symptoms + Stiffness	54.76 ± 13.19	76.80 ± 21.22	**.02**
Pain	82.70 ± 17.2	89.37 ± 13.05	**.01**
Function	88.90 ± 16.13	90.22 ± 14.95	.06
Sport	67.20 ± 26.11	72.60 ± 25.66	.06
QOL	64.70 ± 25.64	66.46 ± 23.29	.15
Lysholm	79.82 ± 17.63	81.52 ± 16.77	**.04**
IKDC	74.64 ± 19.94	80.17 ± 17.49	.07

[a]Data are presented as mean ± SD. KOOS, Knee Injury and Osteoarthritis Outcome Score; IKDC, International Knee Documentation Committee; QOL, Quality of Life; Sport, Sport and Recreation. Bold P values indicate statistical significance.