

Effects of Remnant Preservation in ACL Reconstruction on Postoperative Rotational Knee Instability and Clinical Outcomes

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INTRODUCTION: Remnant preservation during anterior cruciate ligament (ACL) reconstruction has been reported to be beneficial for improving revascularization. However, it remains unclear whether remnant preservation affects the postoperative knee instability and clinical outcomes. This study aimed to investigate the effects of remnant preservation on the postoperative knee instability and clinical outcomes during ACL reconstruction and second-look arthroscopy.

METHODS: A total of 138 patients (51 male, 87 female; average age 26.3 years) who underwent primary double-bundle ACL reconstruction using hamstring autograft tendon from June 2016 and June 2023 and had second-look arthroscopy were analyzed retrospectively. Patients were divided into two groups with remnant status at the end of ACL reconstruction: 82 patients were the remnant-preserved group (Group P), 56 patients the non-preserved group (Group N) (Figure 1). There was a significant difference in preoperative anterior tibial translation (ATT), preoperative pivot shift grade, the presence of meniscal injury, so we adjusted for patient background using propensity score matching. We evaluated side to side differences (SSD) in ATT, residual pivot shift rate, quantitative measurement (side-to-side ratio (SSR) in acceleration (m/s²) and external rotational angular velocity (ERAV) (deg/s) of pivot shift using inertial sensor, the incidence of the cyclops lesion and the cyclops syndrome, and graft quality during second-look arthroscopy. Graft quality was evaluated by the scores for graft laceration and synovial coverage based on the previous report¹. Cyclops lesions were divided into 3 subgroups based on the locations: femoral side (type 1), midsubstance (type 2), and tibial side (type 3) of the ACL graft. Cyclops syndrome (symptomatic cyclops lesion) was defined as a cyclops lesion accompanied by extension limitation. For statistical analysis of the comparison between groups, Mann–Whitney *U* test and Fisher’s exact test were used. Statistical significance was defined as *P* < .05.

RESULTS: After performing propensity score matching, 27 cases were included in each group, with no differences in patient characteristics. Regarding the postoperative knee instability, Group P demonstrated significantly better ERAV values than Group N. [ERAV (SSR: 1.5 (0.9-2.0) in Group P; 1.9 (1.3-2.6) in Group N, *P* =.022)] No significant differences were observed in ATT, residual pivot-shift rate, or acceleration (Table 1). At the time of second-look arthroscopy, no significant differences were observed between the two groups in the incidence of cyclops lesion or cyclops syndrome. The graft scores, reflecting graft quality at second-look arthroscopy, were 6.0 (4.0–6.0) points in Group P and 5.0 (3.5–5.0) points in Group N (*P* = .043) (Table 2).

DISCUSSION: In this study, we adjusted for patient background using propensity score matching to more accurately evaluate the effects of remnant preservation. The most important finding was that the remnant-preserved group demonstrated significantly better ERAV values, indicating improved rotational stability compared with the non-preserved group. In addition, graft quality, as assessed by graft scores at second-look arthroscopy, was significantly better in the remnant-preserved group, suggesting that remnant tissue may promote revascularization and remodeling of the graft into ligament-like tissue. On the other hand, no significant differences were observed in the incidence of cyclops lesions and cyclops syndrome. These results indicate that remnant preservation during ACL reconstruction may provide advantages in terms of rotational stability and graft healing without increasing the risk of cyclops-related complications.

SIGNIFICANCE: Remnant preservation during ACL reconstruction improved postoperative rotational knee instability and graft quality, without increasing the incidence of cyclops lesions or cyclops syndrome.

REFERENCES:

1. E. Kondo, et al. Am J Sports Med. 2015.

IMAGES AND TABLES:

Fig.1A

remnant-preserved group (Group P)



Fig.1B

non-preserved group (Group N)



TABLE1
Postoperative Knee Instability Between Groups

	Group P (n=27)	Group N (n=27)	<i>P</i>
ATT, mm (SSD)	1.0 (0.0-2.0)	1.0 (1.0-2.0)	.170
Residual pivot shift rate(%)	33.3	29.6	.766
Acceleration (m/s ²) (SSR)	1.4 (1.1-1.9)	1.4 (1.1-1.9)	.728
ERAV (deg/s) (SSR)	1.5 (0.9-2.0)	1.9 (1.3-2.6)	.022

TABLE2
Second-Look Arthroscopy Evaluation Results Between Groups

	Group P (n=27)	Group N (n=27)	<i>P</i>
Cyclops lesion (%)	4 (14.8)	4 (14.8)	1.000
Type1	2 (7.4)	2 (7.4)	
Type2	1 (3.7)	1 (3.7)	
Type3	1 (3.7)	1 (3.7)	
Cyclops syndrome	0 (0.0)	2 (7.4)	.491
Graft score	6.0 (4.0-6.0)	5.0 (3.5-5.0)	.043