Outcomes of pullout repairs for partial medial meniscus posterior root tears – comparison with complete radial tears

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Introduction: Good clinical outcomes after complete medial meniscus posterior root tear (MMPRT) repair have been reported recently, however, the progression of medial meniscus extrusion (MME) occurs during the follow-up after pullout repair, especially in older patients with degenerative menisci. The MMPRT can be roughly divided into two stages: partial tear and complete tear. Previously conservative treatment was mainly performed in partial MMPRTs. Recent studies have shown tibiofemoral joint stress increases even in partial MMPRTs [1], some partial MMPRTs progress to complete tear, and MME progresses in some partial MMPRTs with large MME [2]. We thus assume MMPRT repair for partial MMPRTs could be effective in some cases, and the outcomes of pullout repair of partial MMPRTs are superior to those of complete radial MMPRTs. This study aimed to reveal clinical, arthroscopic, and radiologic outcomes of partial MMPRTs following transtibial pullout repair and compare these outcomes with those of complete radial MMPRTs.

Methods: Partial MMPRTs were diagnosed based on the characteristic ocarina sign [3], and the absence of complete tear signs on MRI. From 2019 to 2021, 101 patients who underwent transtibial pullout repair for MMPRT were enrolled in the study. The patients were divided into two groups: partial radial tear group (15 knees, male/female, 5/10, average age, 64.4 years) and complete radial tear group (86 knees, male/female, 18/68, average age, 66.4 years). All patients underwent second-look arthroscopy on average one year post-operatively, and a semi-quantitative meniscal healing score composed of three criteria (anteroposterior width, stability, and synovial coverage, total 10 points) was evaluated (Fig. 1). Medial meniscus extrusion using magnetic resonance imaging and clinical scores, including the International Knee Documentation Committee Score, were evaluated pre-operatively and at second-look arthroscopy.

Results: All the clinical scores were significantly improved one year post-operatively compared to pre-operative scores in the partial tear group (Fig. 2). The two groups showed no significant short-term difference in post-operative clinical scores (Table 1). However, second-look arthroscopy revealed a significant difference between the groups in repaired meniscal stability (partial tear; 3.3 points, complete tear; 2.3 points, $p<0.001$) and total meniscal healing scores (partial tear; 8.3 points, complete tear; 7.1 points, $p<0.001$) (Table 1). MME progression was significantly different (partial tear; 0.4 mm, complete tear; 1.0 mm, $p<0.001$) (Table 1).

Discussion: The most important finding of this study was that pullout repair for partial MMPRTs effectively improved clinical outcomes and resulted in a better meniscal healing status, especially in stability, and lower MME progression compared to the results for complete tears. One possible reason for the difference was the grade of degeneration of the MMPRT. In complete MMPRT, histologically fibrocartilage metaplasia and calcification are highly recognized at the tear site [4], which might have a negative effect on tissue healing. And, a swollen, degenerated meniscus[5] could be associated with a longer posterior movement during knee flexion by impingement between femur and tibia, which could lead to over-stress of the pullout sutures.

Clinical relevance: Although postoperative clinical scores were similar one year after surgery, transtibial pullout repair for partial MMPRTs demonstrated a better meniscal healing status with higher stability in the prevention of MME progression for complete radial MMPRTs.

References:

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Figures/tables:

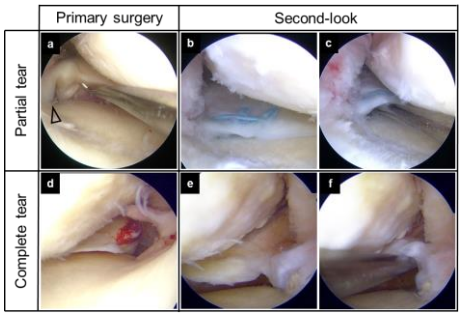

Fig. 1: Arthroscopic findings at primary surgery and second-look arthroscopy. (a) Partial tear with connecting tissue coverage (arrowhead). (b, c) Healed meniscus with good stability. (d) Complete tear (e, f) Healed meniscus with loose stability.

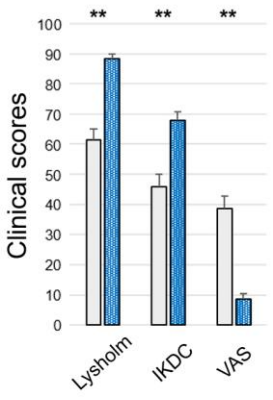

Fig. 2: Pre- and postoperative clinical outcomes in the partial tear group. The white and blue bars denote the pre-operative and post-operative scores, respectively. ** $P < 0.05$.

	Partial tear	Complete tear	P value
Arthroscopic scores			
Meniscal healing score (point)	**8.3 ± 1.2**	**7.1 ± 1.1**	**<0.01***
Width of bridging tissues (point)	4.0 ± 0.0	3.9 ± 0.4	0.42
Stability (point)	**3.3 ± 0.9**	**2.3 ± 0.6**	**<0.01***
Synovial coverage (point)	1.0 ± 0.7	0.9 ± 0.5	0.25
MRI findings			
Pre-operative MME (mm)	3.0 ± 0.7	3.2 ± 0.9]	0.60
1Y Postoperative MME (mm)	**3.4 ± 1.0**	**4.2 ± 1.3**	**0.01***
ΔMME preoperative to 1Y (mm)	**0.4 ± 0.6**	**1.0 ± 1.0**	**0.02***
Postoperative clinical Scores			
Lysholm knee score	88.4 ± 5.7	87.1 ± 6.3	0.63
IKDC score	67.9 ± 11.0	64.0 ± 15.2	0.61
VAS pain score (0 – 100)	8.6 ± 7.1	11.1 ± 15.1	0.43

Table. 1: Comparison of arthroscopic scores, MRI findings, and postoperative clinical scores between groups. Values are presented as mean ± standard deviation. 1 year, 1Y. International Knee Documentation Committee, IKDC. Visual analog scale, VAS. * $p < 0.05$.