

# Isolated Medial Meniscus Posterior Root Repair Is Not Sufficient To Prevent Postoperative Meniscus Extrusion and Varus Progression: A Cohort Study With Minimum Three-Year Follow-Up

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## INTRODUCTION:

Posterior medial meniscus root tears (PMMRT) significantly disrupt knee biomechanics and accelerate joint degeneration if untreated. Varus alignment progression after PMMRT repair, is not clear yet. This study aimed to evaluate mid-term clinical and radiological outcomes following transtibial repair for PMMRT and to assess the relationship between meniscal healing, alignment changes, and meniscus extrusion progression.

## METHODS:

Patients who underwent transtibial pull-out repair for PMMRT between 2020 and 2021 at a single institute were included in this retrospective study. The radiographs for hip-knee-ankle angle (HKA), mechanical lateral distal femoral angle (mLDFA), mechanical medial proximal tibial angle (mMPTA), Kellgren-Lawrence (KL) grade, and MRI (3-Tesla) to evaluate meniscal extrusion and healing (complete, partial, non-healed) were reviewed by two orthopaedic surgeons. Visual Analogue Score (VAS) pain, Lysholm, and IKDC subjective scores were also recorded. Statistical comparisons were performed using paired tests and subgroup analysis based on healing status.

## RESULTS:

The study included 45 patients (mean age  $55.4 \pm 7.3$  years; 86.7% female), with a mean follow-up of  $41.7 \pm 4.6$  months. Radiological changes included significant progression of varus alignment (HKA:  $+2.66^\circ$ ,  $p < 0.001$ ), tibial-driven alignment shift (mMPTA:  $-0.99$ ,  $p < 0.001$ ), and increased meniscal extrusion ( $+1.42$  mm,  $p < 0.001$ ). Despite these structural changes, patients demonstrated substantial clinical improvement, with VAS decreasing from  $8.1 \pm 1.2$  to  $3.8 \pm 2.0$  ( $p < 0.001$ ), Lysholm score increasing from  $33.5 \pm 13.5$  to  $68.1 \pm 15.5$  ( $p < 0.001$ ), and IKDC score improving from  $26.4 \pm 10.1$  to  $56.7 \pm 14.7$  ( $p < 0.001$ ). Meniscal healing on MRI was complete in 44.4% of patients, partial in 40.0%, and absent in 15.6%. Notably, healing status was not significantly influenced by changes in alignment; postoperative mMPTA and HKA values did not differ significantly between healing groups ( $p > 0.05$ ) (Table-1). In addition, correlation analyses showed no meaningful association between the degree of varus progression and changes in clinical outcome scores, with all Spearman's rho values  $< 0.3$  ( $p > 0.05$ ). However, meniscal healing status was significantly associated with VAS improvement, with better pain outcomes observed in patients with complete healing ( $p < 0.05$ ). Post hoc power analysis confirmed excellent statistical power (0.99).

## DISCUSSION AND CONCLUSION:

As a result of this study, although PMMRT repair provides satisfactory clinical results, it is understood that it is insufficient to prevent varus progression and meniscus extrusion. The results of this study may help surgeons for concomitant osteotomies that can be added to MMPRT repair.

|           |                  | Preoperative      | Postoperative     | Difference        | P                |
|-----------|------------------|-------------------|-------------------|-------------------|------------------|
| X-Ray     | KL               | $1.11 \pm 0.71$   | $2.13 \pm 0.81$   | $1.02 \pm 0.58$   | <b>&lt;0.001</b> |
|           | 0                | 9 (20.00)         | -                 |                   |                  |
|           | 1                | 22 (48.89)        | 11 (24.44)        |                   | <b>&lt;0.001</b> |
|           | 2                | 14 (31.11)        | 18 (40.00)        |                   |                  |
|           | 3                | -                 | 15 (33.33)        |                   |                  |
|           | 4                | -                 | 1 (2.22)          |                   |                  |
|           | mLDFA (°)        | $88.51 \pm 1.03$  | $88.59 \pm 1.16$  | $0.08 \pm 1.16$   | 0.6545           |
| mMPTA (°) | $87.03 \pm 1.40$ | $86.04 \pm 1.97$  | $-0.99 \pm 1.64$  | <b>&lt;0.001</b>  |                  |
| HKA (°)   | $4.32 \pm 2.23$  | $6.98 \pm 3.87$   | $2.66 \pm 2.44$   | <b>&lt;0.001</b>  |                  |
| MRI       | Extrusion (mm)   | $4.14 \pm 1.19$   | $5.55 \pm 1.52$   | $1.42 \pm 0.97$   | <b>&lt;0.001</b> |
| Clinical  | VAS              | $8.11 \pm 1.21$   | $3.78 \pm 1.98$   | $-4.33 \pm 1.92$  | <b>&lt;0.001</b> |
|           | Lysholm          | $33.49 \pm 13.51$ | $68.13 \pm 15.46$ | $34.64 \pm 17.93$ | <b>&lt;0.001</b> |
|           | IKDC             | $26.43 \pm 10.07$ | $56.69 \pm 14.65$ | $30.26 \pm 17.03$ | <b>&lt;0.001</b> |

**Table 1:** Comparison of preoperative and postoperative radiological and clinical parameters. Values are presented as mean  $\pm$  standard deviation or number (%). Bold p-values indicate statistical significance.

KL, Kellgren-Lawrence grade; mLDFA, mechanical lateral distal femoral angle; mMPTA, mechanical medial proximal tibial angle; HKA, hip-knee angle; MRI, magnetic resonance imaging; VAS, Visual Analog Scale; IKDC, International Knee Documentation Committee.