

# Increased Posterior Tibial Slope Correlates with Greater Odds of Reoperation and Failure Following Meniscus Allograft Transplantation

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**INTRODUCTION:** Higher posterior tibial slope (PTS) is associated with a higher rate of failure in meniscal root tears and anterior cruciate ligament reconstruction. The purpose of this study is to analyze the correlation of PTS with patient reported outcomes (PROs), reoperation, and failure rates in meniscal allograft transplantation (MAT).

**METHODS:** A retrospective review of a prospectively maintained database was performed to assess outcomes after MAT in patients between 2003 and 2021 with minimum 2-year follow-up. PTS was measured on lateral knee radiographs, with medial posterior tibial slope (MPTS) and lateral posterior tibial slope (LPTS) measured on magnetic resonance imaging (MRI). PROs were collected preoperatively and at a minimum of 2-years follow-up. MAT failure was defined as revision MAT or conversion to arthroplasty. Multivariable regression was used to correlate PTS with PROs, reoperation, and failure rates. Failure and reoperation were further analyzed separately in medial and lateral MATs for MPTS and LPTS, respectively.

**RESULTS:** One-hundred-seventy-five knees (174 patients) met inclusion criteria with an average age of  $27.4 \pm 9.1$  years and mean follow-up of  $8.3 \pm 3.8$  years. Average PTS was  $8.8^\circ \pm 3.2^\circ$  by radiograph,  $5.1^\circ \pm 2.7^\circ$  (MPTS) and  $5.8^\circ \pm 3.3^\circ$  (LPTS) by MRI. MRI measurements significantly underestimated radiographic measurements by  $3.3^\circ \pm 2.9^\circ$ . Correlation coefficients demonstrated weak to moderate correlations between radiograph and MRI measurements, while intraclass correlation coefficients ranged from 0.920-0.931 for intra-rater reliability and 0.855-0.952 for inter-rater reliability within MRI or radiographic measurements. There was no association between PTS and postoperative PROs. Sixty cases (34.3%) resulted in reoperation at an average of  $2.5 \pm 2.8$  years and 8 cases (4.6%) experienced failure at an average of  $8.9 \pm 2.9$  years. Higher radiographic PTS and MPTS was associated with higher odds of reoperation (OR=1.126,  $p=0.024$  and OR=1.166,  $p=0.013$ ), and failure (OR=1.654,  $p=0.001$  and OR=1.712,  $p<0.001$ ). Higher LPTS was associated with greater odds of failure (OR=1.279,  $p=0.018$ ). In medial MAT, MPTS was associated with higher odds of reoperation and failure.

**DISCUSSION AND CONCLUSION:** Increased PTS correlates with greater odds of reoperation and failure following MAT. With subgroup analysis, increased MPTS is associated with an increased risk of medial MAT reoperation and failure.



Figure 1. Lateral radiographs of knees that were included in the study. Red lines indicate the posterior tibial slope (PTS) measurement. The angle between the posterior tibial slope and the horizontal line is the PTS.

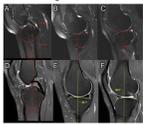


Figure 2. MRI images showing medial posterior tibial slope (MPTS) and lateral posterior tibial slope (LPTS) measurements. Red lines indicate the slope angles.

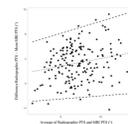


Figure 3. Scatter plot showing the correlation between radiographic PTS and MRI MPTS. The x-axis is Radiographic PTS (Mean ± SD) and the y-axis is MRI MPTS (Mean ± SD).

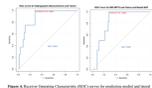


Figure 4. Kaplan-Meier survival curves for reoperation and failure rates based on PTS. The x-axis is Time (years) and the y-axis is Survival probability.

Variable	Mean	SD	Min	Max
Age	27.4	9.1	18	58
Follow-up (years)	8.3	3.8	2	21
PTS (radiograph)	8.8	3.2	4	15
MPTS (MRI)	5.1	2.7	2	10
LPTS (MRI)	5.8	3.3	2	12

Table 1. Descriptive statistics for PTS and follow-up. Mean, standard deviation, minimum, and maximum values are shown.

Variable	OR	95% CI	P-value
PTS (radiograph)	1.126	1.024-1.238	0.024
MPTS (MRI)	1.166	1.054-1.288	0.013
LPTS (MRI)	1.279	1.088-1.491	0.018

Table 2. Multivariable logistic regression for reoperation and failure. Odds ratios (OR) and 95% confidence intervals (CI) are shown for PTS measurements.

Variable	OR	95% CI	P-value
PTS (radiograph)	1.654	1.126-2.431	0.001
MPTS (MRI)	1.712	1.126-2.618	<0.001
LPTS (MRI)	1.279	1.088-1.491	0.018

Table 3. Multivariable logistic regression for reoperation and failure. Odds ratios (OR) and 95% confidence intervals (CI) are shown for PTS measurements.