

Abnormal Trochlear Morphology in Pediatric Patients with Fixed Lateral Patellar Dislocation: A Radiographic Study

Emilie Lijesen, Shae K Simpson, Daniel William Green

INTRODUCTION: Fixed lateral patellar dislocation is a rare condition characterized by a fixed laterally dislocated patella that fails to reduce onto the trochlea. We define a fixed lateral patellar dislocation as those cases where the patella remains dislocated in the lateral gutter even with flexion and extension of the knee. Good understanding of the trochlear morphology in this patient group is paramount for surgical planning and successful treatment. Despite the abundant literature on trochlear dysplasia in patients with recurrent patellar dislocations, the characterization of trochlear morphology in patients with fixed lateral patellar dislocations is not well understood. The purpose of this study was to compare trochlear morphologic features on knee magnetic resonance imaging (MRI) in pediatric patients with fixed lateral patellar dislocation to those of a control group. We speculate that a fixed lateral patellar dislocation results in a loss of normal contact between the patella and trochlea, leading to abnormal morphologic changes in these patients during development. Therefore, we postulated that these patients would have dramatic morphologic changes in trochlear morphology as compared to those with normal knee pathology.

METHODS: This was a retrospective case series with a matched case-control design to compare trochlear morphological features between patients with fixed lateral patellar dislocation who underwent medial patellofemoral ligament (MPFL) reconstruction to a control group without patellar instability (PI). Control patients underwent ligamentous knee reconstruction for non-patellar indications and were age- and sex- matched to the dislocation group. Trochlear measurements were made on pre-operative axial MRI including bony sulcus angle (BSA), cartilaginous sulcus angle (CSA), facet symmetry ratio, trochlear depth, patellar lateralization, and tibial tubercle-trochlear groove (TT-TG) distance. Continuous variables were assessed using independent samples *t*-tests or Mann-Whitney U tests, after data normality was assessed with Kolmogorov-Smirnov tests. Statistical analysis was performed using SPSS Statistical Analysis Software, Version 29 (IBM, Armonk, NY, USA), with two-tailed significance threshold set as $p \leq 0.05$.

RESULTS:

A total of 15 knee MRI scans in patients with fixed lateral patellar dislocation were included in this series and matched to 30 patients with control knee MRI scans. The average age at surgery was 13.6 ± 3.6 years in the dislocation group and 13.9 ± 2.7 years in the control group. BSA, CSA, patellar lateralization, and TT-TG were all significantly greater and trochlear depth was significantly smaller in the fixed lateral dislocation group compared to the control group ($p < 0.001$). Facet asymmetry did not differ significantly between groups ($p = 0.32$).

DISCUSSION AND CONCLUSION:

Patients with fixed lateral patellar dislocation have drastically abnormal trochlear morphology. We speculate that the mechanic pressure provided by a located patella in the trochlear groove is essential for the development of normal trochlear morphology during growth and that the abnormal morphology developed by patients with fixed lateral patellar dislocation is therefore due to the prolonged absence of a located patella. To the authors' knowledge, this study is among the first to describe how trochlear measurements in patients with fixed lateral patellar dislocation differ from patients without patellofemoral instability. Ongoing work aims to compare these findings to patients with recurrent patellofemoral instability to further distinguish anatomical differences across patellofemoral instability subtypes.

Figure 1. Fixed Lateral Dislocation on Axial MRI

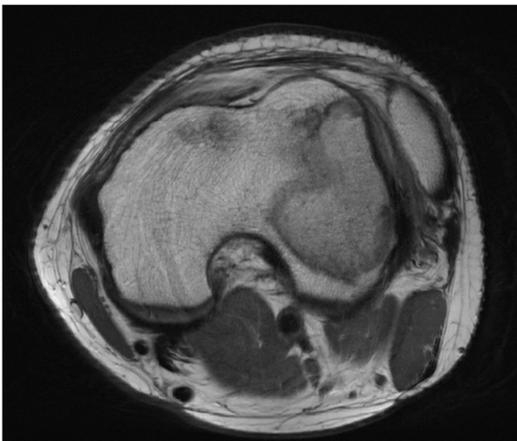


Table 1. Trochlear Measurements in Patients with Fixed Lateral Patella Dislocation vs. Control Group

Variable	Fixed Dislocation (n=15)	Control (n=30)	P-value
BSA (degrees)	166.0 \pm 16.1	138.7 \pm 8.6	<0.001
CSA (degrees)	158.5 \pm 16.2	132.5 \pm 15.9	<0.001
Facet Asymmetry (mm)	64.7 \pm 28.9	73.1 \pm 18.5	0.32
Trochlear Depth (mm)	1.9 \pm 1.8	4.6 \pm 1.3	<0.001
Patellar Lateralization (mm)	37.8 \pm 13.6	-2.2 \pm 3.9	<0.001
TT-TG (mm)	29.4 \pm 9.6	9.2 \pm 4.5	<0.001

BSA: bony sulcus angle, CSA: cartilaginous sulcus angle, TT-TG: tibial tuberosity-trochlear groove