Abnormal trochlear length on sagittal magnetic resonance imaging relates to trochlear dysplasia in knees with patellar instability

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Disclosures

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Background

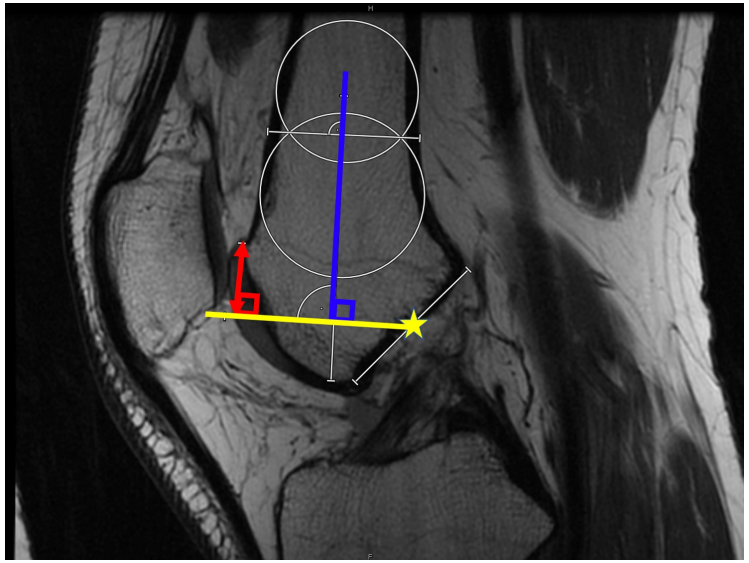
- Trochlear dysplasia is a primary risk factor for patellar instability (1-5)
- Trochlear dysplasia leads to loss of the osteochondral constraint of the patella (6)
- Trochleoplasty techniques include the Peterson grooveplasty which alters the length of the trochlea, however a radiographic measurement of trochlear length to support this has not been described. (7,8)

Objective

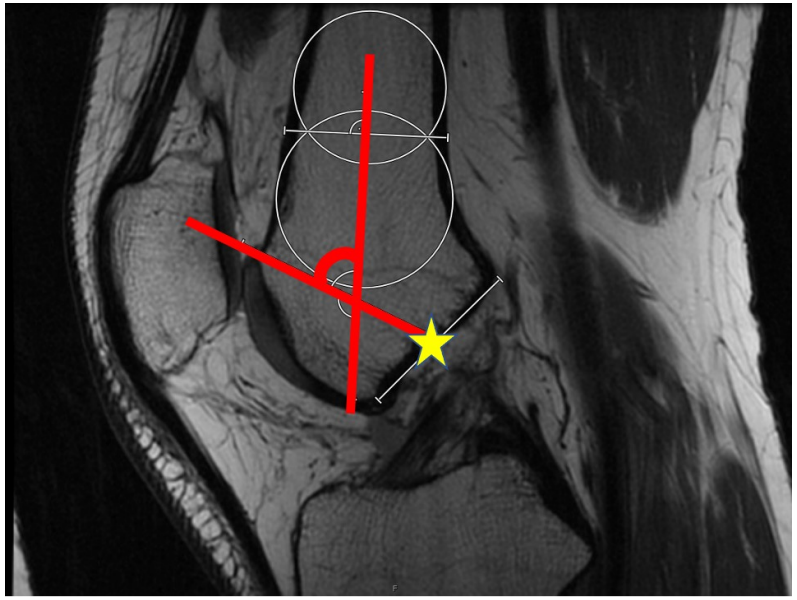
- The aim of this study was to describe measurements to quantify trochlear length on sagittal MRI in patients with and without patellar instability, and to correlate trochlear length with measurements of trochlear dysplasia

Methods

- On sagittal MRI, measurements were performed on 3 sagittal images including the center of the knee, center of the medial condyle, and center of the lateral condyle



The **trochlear extension length** measurement describes the distance between the plane through the midpoint (yellow line) of Blumensaat line (yellow star) to the proximal extent of the trochlea (red line), measured parallel to the axis of the femoral shaft (blue line) and described in millimeters

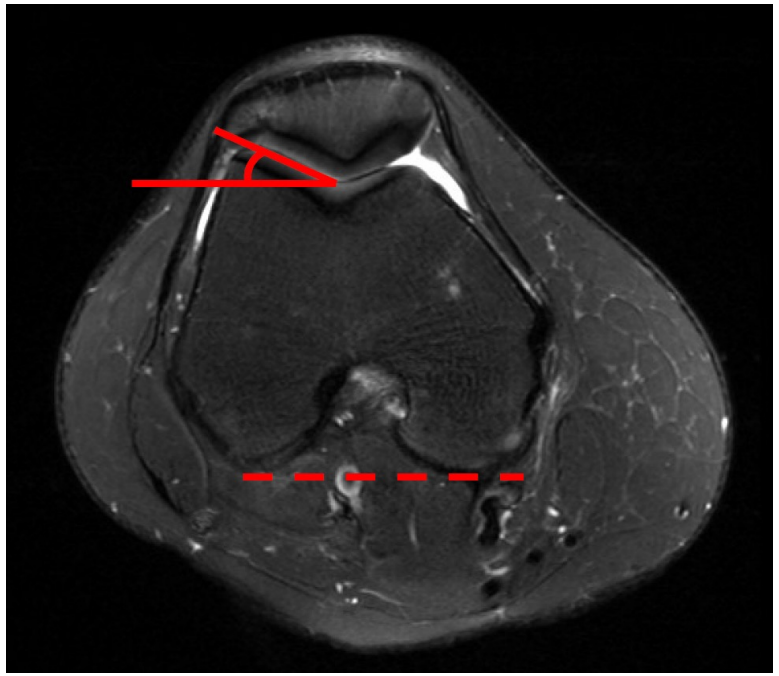


The trochlear alpha angle (TAA) was defined as the angle (red lines) on the sagittal image between the femoral axis and a line from the intercondylar midpoint (yellow star) through the most proximal extent of the trochlea

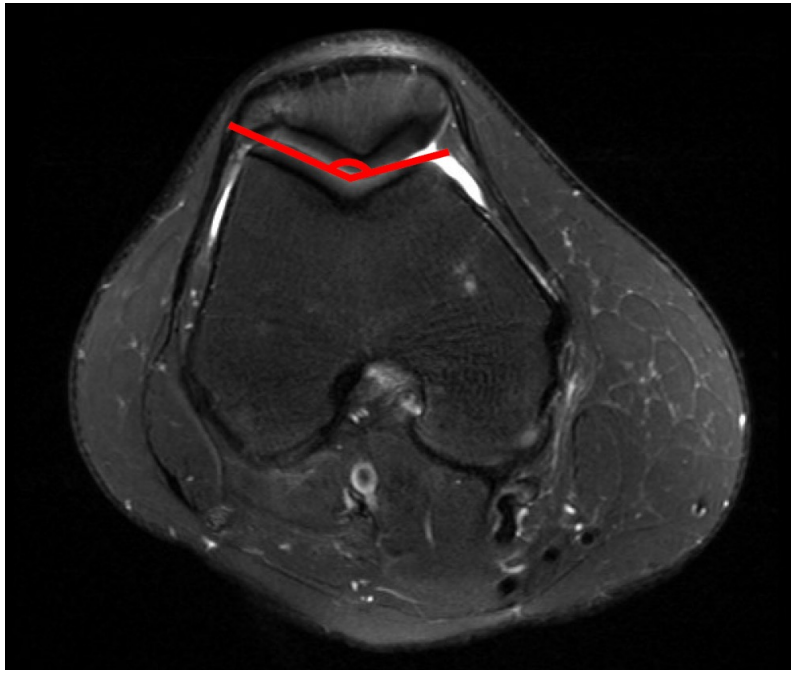
Methods

- Measurements were compared between symptomatic and control groups
- Receiver operating characteristic (ROC) cPurve analysis was performed and area under the curve (AUC) was calculated to describe the accuracy of each measurement to distinguish between knees with and without patellar instability
- Linear and multivariate regression analyses were performed to assess the relationship between sagittal measurements and axial measurements of trochlear dysplasia:
  - Lateral trochlear inclination [LTI]
  - Sulcus angle [SA]
  - Trochlear depth [TD]
  - Patient size based on epicondylar distance

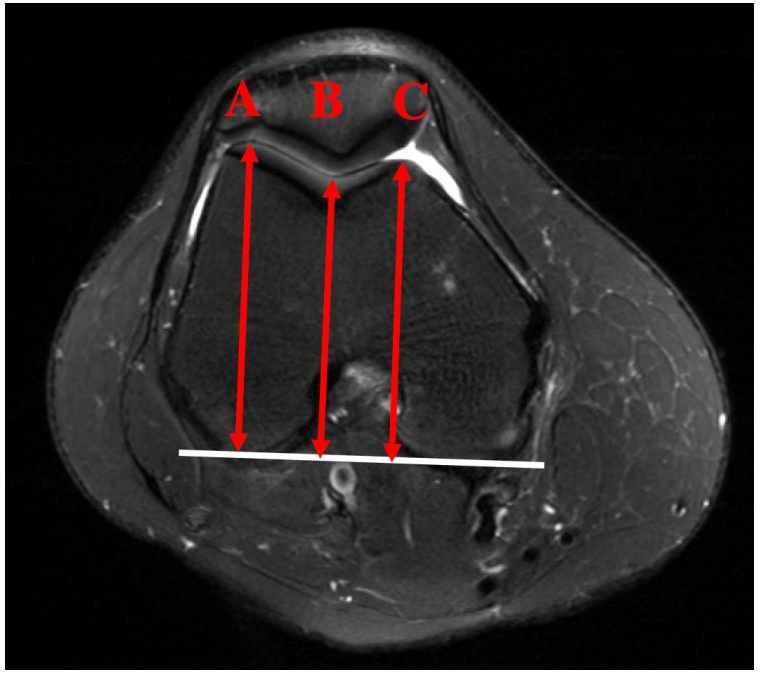
Methods



Lateral trochlear inclination was measured as the angle formed by a line from the deepest portion of the cartilaginous trochlear groove to the most anterior point on the cartilaginous lateral femoral condyle, with a line along the posterior condylar axis (dashed line)



Sulcus angle was measured as the angle formed between the deepest portion of the cartilaginous trochlear groove with the two anterior-most points on the cartilaginous trochlea



Trochlear depth was calculated by subtracting the distance between the posterior condylar axis to the deepest point of the trochlear groove from the mean AP distance of the medial and lateral femoral condyles, (A+C)/2-B

Results

- 66 age- and sex-matched knees (36 female and 30 male, age 18.6+/-7.7 years) were included in this study
- 33 knees were symptomatic
- In symptomatic knees, the central trochlea extended more proximally than in control knees
  - TEL (14.0+/-3.0mm vs 11.5+/-2.3mm, $p<0.001$)
  - TAA (68.4+/-3.8º vs 70.5+/-3.4º, $p=0.006$).

Results

- AUC calculations showed that trochlear extension >=11mm at the central trochlea was predictive of patellar instability in both males and females (AUC 0.77 and 0.83)
- TAA<67º was predictive of patellar instability in females (AUC 0.72)
- An independent association between central TEL and sulcus angle was found
- Central TEL showed a weak correlation with patient size as measured by epicondylar distance, while TAA did not

Results

Summary of trochlear extension length and trochlear angle measurements

		Total			Females			Males		
		Symptomatic	Control	Significance	Symptomatic	Control	Significance	Symptomatic	Control	Significance
Trochlear Extension Length	Central	14.0+/-3.0	11.5+/-2.3	p<0.001	13.4+/-3.7	10.6+/-2.0	p=0.007	14.7+/-1.7	12.6+/-2.2	p=0.005
	Lateral	14.0+/-4.0	12.7+/-3.2	p=0.163	12.1+/-3.8	11.4+/-2.3	p=0.522	16.2+/-3.2	14.2+/-3.5	p=0.121
	Medial	-8.3+/-7.7	-6.3+/-7.5	p=0.275	-3.9+/-5.3	-3.1+/-5.5	p=0.651	-13.6+/-6.9	-10.1+/-8.1	p=0.202
Trochlear Alpha Angle	Central	68.4+/-3.8	70.5+/-3.4	p=0.017	68.1+/-4.4	71.0+/-3.4	p=0.036	68.6+/-3.0	70.0+/-3.3	p=0.261
	Lateral	69.2+/-5.6	71.3+/-4.3	p=0.080	70.5+/-6.2	71.8+/-4.1	p=0.465	67.5+/-4.5	70.8+/-4.6	p=0.057
	Medial	107.5+/-15.4	102.4+/-14.8	p=0.178	99.3+/-11.9	96.4+/-11.3	p=0.462	117.3+/-13.4	109.6+/-15.6	p=0.158

Conclusions

- In knees with symptomatic patellar instability, the central trochlea was found to extend 2.5mm more proximally than in control knees, and this increase in length correlated with measurements of trochlear dysplasia
- As grooveplasty procedures and radiographic assessments of the trochlea are often based on the proximal extent of the cartilaginous trochlea, further studies are needed to identify the role of trochlear length in the assessment and treatment of trochlear dysplasia in the setting of patellar instability

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Thank you

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