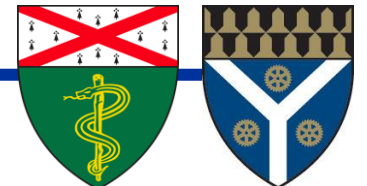# Curvature Analysis Of The Distal Femur As A Tool To Classify Trochlear Dysplasia
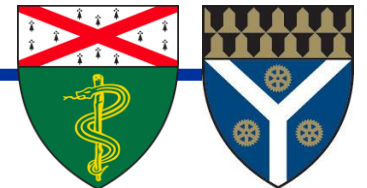
Johannes Sieberer, Nancy Park, Shelby T Desroches, Armita R. Manafzadeh, PhD, Madhusudhan Venkadesan, PhD, John P. Fulkerson, MD

Financial Disclosures

I have nothing to disclose.

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Trochlea dysplasia

- Understanding and classification of trochlea dysplasia is important for clinical decision making in patellofemoral instability (PFI) [1]

- Current classification methods have low interrater reliability and fail to capture the full 3D morphology of the femoral trochlea. [3]

- 3D Curvature Analysis can highlight features such as Trochlea Morphology [1]

Figure 1: In PFI the patellar tracks laterally [2]

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Curvature Analysis

- 3D Curvature analysis allows us to describe the local shape of a surface by classifying the surface type as convex, concave, and flat. (See Figure 2)

- Side note: Curvature consists of two orthogonal values, minimal and maximal curvature. The distal femur is dominated by its cylindrical shape. Therefore, minimal curvature is enough to describe the trochlea groove.
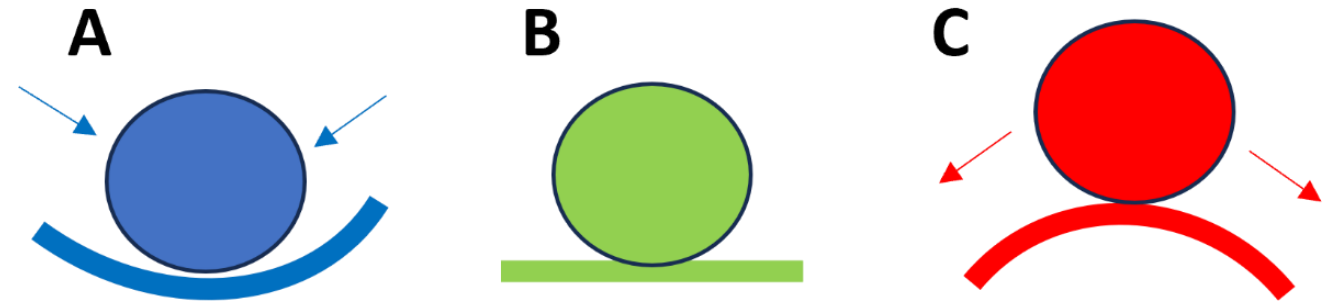

Figure 2: In this simple 2D example, three different curvature types are displayed (A-concave, B-flat, C-convex). Curvature analysis allows us to assign values to the specific curvature. [1]

Classification of Trochlea Dysplasia

- The method highlighted in Figure 2 was applied to the distal femur of PFI patients with recurrent dislocations and healthy controls (See Figure 3).

- The local surface / each surface point was analyzed and categorized as concave, flat, or convex and calorized accordingly.

- Subsequently several raters categorized the proximal trochleae in three groups (See Figure 3).
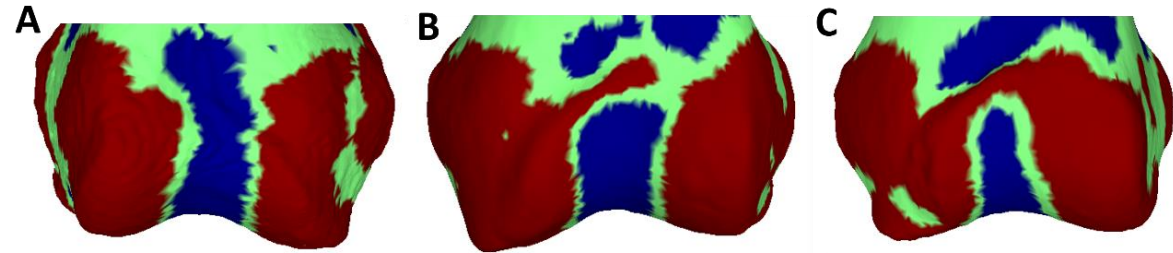

Figure 3: Trochleae of PFI patients (B-C) and a control (A) were overlayed with their local curvature type. Trochleae were classified in three groups. (A) Proximal trochlea is concave (blue), (B) it is flat (green), (C) it is convex (red).

Methods

- 33 patients with PFI, defined as at least 2 dislocations were matched with 36 healthy controls.

- High resolution CT-scans were acquired and femur 3D models created.

- Curvature based visualization was applied

- Two independent blinded raters classified all femora

- Statistical differences in classification were evaluated; Interrater reliability was calculated via intraclass coefficients (ICC).

Results
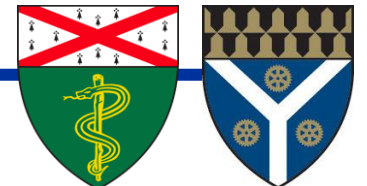
- Controls were significantly more likely to be classified as proximal concave, compared to patients, which were majorly convex.

Class	A	B	C
PFI Patients (n=33)	2 (6%)	13 (39%)	18 (55%)
Controls (n=36)	32 (89%)	4 (11%)	0 (0%)

- The interrater reliability was 0.86 [95% CI: 0.82-0.90], which is interpreted as "Good to Excellent" [4]

Summary and Conclusion
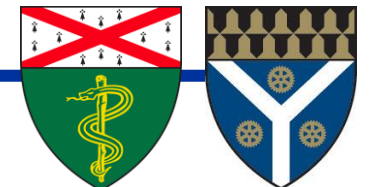
- 3D Curvature analysis can be used to classify and interpret trochlea dysplasia.

- The interrater reliability is higher compared to literature values of the Dejour classification (0.86 vs. 0.21 [3])

- PFI patient's proximal trochleae are mostly flat or convex. [3]

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References
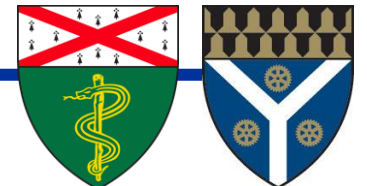
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