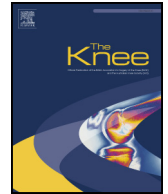




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The Knee



CT-based morphological analysis of the posterior femoral condyle in patients with trochlear dysplasia

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ABSTRACT

Background: The anterior part of the distal femur in trochlear dysplasia has been well investigated; however, to date, posterior morphological characteristics have not been well studied. This study aimed to evaluate whether the posterior femoral condyle in patients with trochlear dysplasia differs from those without trochlear dysplasia.

Methods: Computed tomography scans of 75 knees with trochlear dysplasia and 55 knees with normal anatomy of the patellofemoral joint were analyzed retrospectively. Three observers assessed the width, length, and height of the posterior condyle between the two groups. The intra-class correlation coefficient was used to evaluate inter-observer reliability. The independent Student's *t*-test was used to assess the statistical significance of the qualitative variables. **Results:** There was excellent inter-observer reliability (intra-class correlation coefficient 0.91–0.99) for all of the quantitative measurements. There were significant differences between trochlear dysplastic and normal knees. The trochlear dysplasia group had a larger medial posterior condyle and smaller lateral posterior condyle than the control group. Furthermore, proportion of the posterior condyle in the distal femur markedly differed between the two groups: in the trochlear dysplasia group, the medial posterior condyle accounted for a bigger proportion, while the lateral posterior condyle accounted for a smaller proportion.

Conclusion: Patients with trochlear dysplasia have different posterior femoral condyles compared with those without trochlear dysplasia. Patients with this condition have bigger medial posterior condyles and smaller lateral posterior condyles. A greater amount of attention needs to be paid to this abnormality.

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1. Introduction

Trochlear dysplasia is one of the major predisposing factors associated with patellofemoral instability. Patellofemoral instability is a common medical problem in orthopedic practice, especially in children and adolescents [1–3]. A previous study showed that 96% of patients with a history of true patellar dislocation had evidence of trochlear dysplasia [4]. Measurements and evaluation of this dysplasia are prevalent because of its close relationship to patellofemoral instability. Most research in this area has focused on the morphological geometry of the anterior part of the distal femur such as the sulcus angle, lateral condyle tilt, and the depth of the groove [5–9]. These parameters are considered to be signs of diagnosis and evaluation of trochlear dysplasia. However, the posterior part of the distal femur has not been well investigated. It is still unknown whether the posterior femoral condyle in patients with trochlear dysplasia differs from that in those without trochlear dysplasia.

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Table 1

Demographic characteristics of the trochlear dysplasia and control groups.

	Study (n = 49)	Control (n = 43)	χ^2	P
Gender				
Male	21 (42.86)	18 (41.86)	0.01	0.923
Female	28 (57.14)	25 (58.14)		
Age	19.73 $\pm$ 5.66	19.95 $\pm$ 5.56	–0.19*	0.852
Side				
Right	34 (47.22)	32 (59.26)	1.79	0.181
Left	38 (52.78)	22 (40.74)		

* t-test.

In clinical practice of total knee arthroplasty, valgus knees are always concomitant with patellofemoral instability and the lateral femoral condyle usually does not develop normally, especially distally and posteriorly. Patients who have patellofemoral problems might have differences in the posterior part of the distal femur. Gillespie et al. found that multi-planar hypoplasia of the lateral femoral condyle, which resulted in a valgus knee, was a risk factor for patellar instability in young patients [10]. Therefore, patients who have valgus knees are relatively likely to have a hypoplastic lateral femoral condyle. In addition, abnormal femoral torsion can result in instability of the patellofemoral joint [11–14]. Femoral torsion is defined as the angle that is formed between the axis of the femoral neck and the line passing through the posterior border of the femoral condyle. Therefore, the morphology of the posterior femoral condyle may be related to patellofemoral instability because of its influence on femoral torsion.

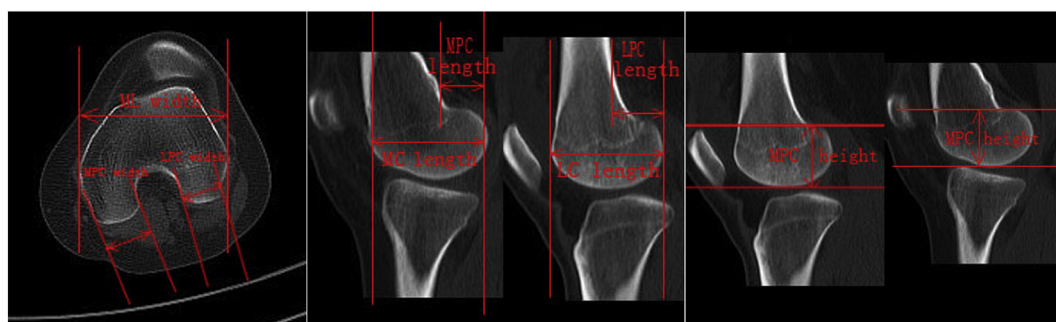
This study aimed to compare the morphology of the posterior femoral condyle in patients with trochlear dysplasia with that of age- and sex-matched control patients without trochlear dysplasia. It was hypothesized that in patients with trochlea dysplasia, the posterior femoral condyle develops hypoplasia or hyperplasia.

2. Material and methods

Computed tomography scans (CT) scans of 75 knees in 49 patients with trochlear dysplasia (TD) were performed between 2014 and 2015; they were analyzed retrospectively. All of the patients had a history of patellofemoral instability and were diagnosed by a senior orthopedic surgeon. None of these patients had prior surgery of the lower extremity. Multi-ligament injured knee, post-traumatic instabilities or arthritis were also excluded.

In the control group, CT scans were performed in 55 knees of 43 patients with normal anatomy of the patellofemoral joint during the same time period. The controls were matched with the trochlear dysplasia (TD) group according to age and sex (Table 1). Patients in the control group consulted the orthopedic surgeon for a complaint unrelated to the patellofemoral joint, such as a slight soft tissue injury or avulsion fracture.

The same technician performed the CT scans, under standard conditions, of all of the patients. All of the patients were placed in the supine position, with the knee in full extension. The feet were in 15° of external rotation to ensure that the patella was strictly anterior. Slices of 5 mm thickness were taken from the superior part of the patella to the tibial tuberosity. The maximal width of the posterior condyle was measured on horizontal images, while the maximal length and height of the posterior condyle were measured on sagittal

**Figure 1.** Measurement of the posterior condyle in three directions.

ML width: the medial-lateral width of epicondyle

MPC width: the medial posterior condyle width

LPC width: the lateral posterior condyle width

MC length: the medial condyle length

MPC length: the medial posterior condyle length

LC length: the lateral condyle length

LPC length: the lateral posterior condyle length

MPC height: the medial posterior condyle height

LPC height: the lateral posterior condyle height

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