



Association and impact of patellofemoral dysplasia on patellofemoral arthropathy and arthroplasty



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ABSTRACT

Background: The association of patellar and trochlear anomalies resulting in isolated patellofemoral osteoarthritis has often been postulated but rarely studied. The purpose of this study was to examine the association of patellofemoral dysplasia, specifically trochlear anomalies, which are a cause for degenerative disease and may result in a worse outcome after arthroplasty for isolated patellofemoral arthritis.

Methods: Eighteen consecutive patients who underwent robotic image-based patellofemoral arthroplasty were compared with an age and sex-matched group of patients who underwent medial unicompartmental arthroplasty using the same image-based navigation system and had no patellofemoral, lateral disease or malalignment.

The compared parameters were the patellofemoral–trochlear angle and Dejour score in the preoperative radiographs and patellofemoral–trochlear angle and internal rotation of the trochlea compared to the intercondylar line in the proximal, middle and distal trochlea.

Results: Significantly higher rates of patella alta ($T = 5$, $P = 0.0001$) and trochlear dysplasia (6% vs. 55%) were found, as manifested by an increase in the trochlear angle and Dejour score. Furthermore, the trochlea was found to have a higher degree of internal rotation in patients with isolated patellofemoral arthritis compared to the control group. **Conclusions:** In conclusion, patellofemoral anomalies such as patella alta and trochlear dysplasia are present in association with isolated patellofemoral arthritis. Isolated patellofemoral arthritis is also associated with higher rates of trochlear internal rotation. Correction of this internal rotation is essential in the success of arthroplasty in patients with patellofemoral disease.

Level of evidence: Level III study, It is a case control study.

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1. Introduction

Isolated patellofemoral knee arthritis is a common condition affecting the middle-aged and the elderly [1]. Association of this disease with patellofemoral instability is known [2–4]. It is postulated that patellofemoral dysplasia caused partly by trochlear dysplasia is responsible for lateral facet overloading and eventual isolated patellofemoral arthritis [4–7]. Furthermore, relatively higher complication rates have been seen with arthroplasty for isolated patellofemoral knee arthritis [8–15]. These complications comprise a high rate of patellofemoral instability and knee stiffness and are seen both in partial and total knee replacement for this condition [16–19].

Trochlear dysplasia is not the only abnormality associated with isolated patellofemoral knee arthritis [4,20–22]. It is also postulated that anterior internal rotational femoral anomaly partly caused by trochlear dysplasia plays a role in complicating arthroplasty following isolated patellofemoral knee arthritis [4,20–22]. Prior to this study, the association

of patellar and trochlear anomalies with isolated patellofemoral osteoarthritis has been postulated but rarely studied [4,20–22].

The purpose of this study was to analyse the presence of trochlear dysplasia and femoral rotational abnormality in patients with isolated patellofemoral knee arthritis using radiographs and computed tomography, which were performed prior to unicompartmental patellofemoral replacement. This data was then compared with identical radiological investigations performed in a comparable control group that did not show any signs of patellofemoral arthritis.

2. Methods: retrospective case–control series

MAKOplasty™ is a robotic image-based navigated unicompartmental knee replacement system that has been used for the insertion of unicompartmental patellofemoral and tibiofemoral knee replacements since 2008 in the authors' unit. Preoperatively all patients underwent computer tomography in a leg holder for image-based navigation. This imaging was then used as an opportunity to access the shape and rotation of the trochlea and distal femur in detail. Pre-operatively performed radiographs were also used to aid in the assessment of trochlear shape.

Seventeen patients (18 knees) who underwent patellofemoral unicompartmental knee replacement in the authors' unit using the MAKOplasty™

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image-assisted navigated robotic knee system (MAKO Corporation, Fort Lauderdale, FL, USA) between 2009 and 2010 were identified and included in the study. Every patient in the study group suffered from primary patellofemoral arthritis and none had post-traumatic arthritis as a causal factor for patellofemoral arthritis. Eighteen controls (17 patients) who were sex, age and BMI matched were randomly chosen from more than 350 unicompartmental medial knee replacements, which were performed over this period for isolated medial compartmental knee arthritis. Patients with pre-operative long leg axis misalignment of more than 5° were not included in the control group. A radiological assessment of trochlear shape as well as the patellar height (as a measure of extra-trochlear anomalies associated with instability) was conducted in both the study and control groups and then compared. These assessments were based on pre-operative CT scans and plain radiographs [7,23].

2.1. Trochlear dysplasia

Trochlear dysplasia was assessed using the Dejour classification. Lateral radiograph and CT scans were used to classify the degree of trochlear dysplasia. The Dejour classification is a categorical system involving direct vision and a lateral radiograph of the knee based on the description of the trochlear shape [24,25] (Fig. 1). The inter and intra-observer variability were assessed based on the original Dejour classification. However for the purpose of this study trochlear dysplasia was divided into significant dysplasia (Dejour grades B, C & D), mild dysplasia (Dejour grade A) and normal trochlear appearance.

2.2. Patellofemoral–trochlear angle

The patellofemoral–trochlear angle was measured in the following imaging sequences (Fig. 2):

- Merchant's sunrise view at 50° knee flexion [26].
- CT scan cut in the bottom of the trochlea just above the roof of the notch.

- CT scan cut in the middle of the trochlea at the same level as the medial and lateral epicondyles.
- CT scan cut at the top of the trochlea.

2.3. Distal femoral rotation

For the assessment of distal femoral rotation, a CT scan was used to assess the degree of anterior femoral rotation compared to the transepicondylar axis at three levels within the trochlea (Fig. 3).

- CT scan cut in the bottom of the trochlea just above the roof of the notch.
- CT scan cut in the middle of the trochlea at the same level as the medial and lateral epicondyles.
- CT scan cut at the top of the trochlea.

For the first and third measurements, the transepicondylar axis was identified in the CT scan cut containing the epicondyles and was then transposed on the respective cuts in order to achieve accurate rotational assessment in each cut against the same fixed anatomical landmark.

The patellar height was also measured preoperatively on the lateral knee radiograph with 30° knee flexion using the Insall–Salvati ratio (B/A) (Fig. 4) [3,27].

Computed tomography and radiographs were taken in a standardised format in the same radiology department and measured and calibrated using the Phillips iSite PACS system (Philips Healthcare, Andover, MA, USA).

All measurements were analysed and the two different assessments of trochlear dysplasia, anterior femoral rotation and patellar height were then compared between the patients with patellofemoral knee arthritis who had undergone patellofemoral unicompartmental knee replacement and the control group.

2.4. Statistics

Even though this was a retrospective study, a power analysis was performed prior to the data analysis based on measurements of the

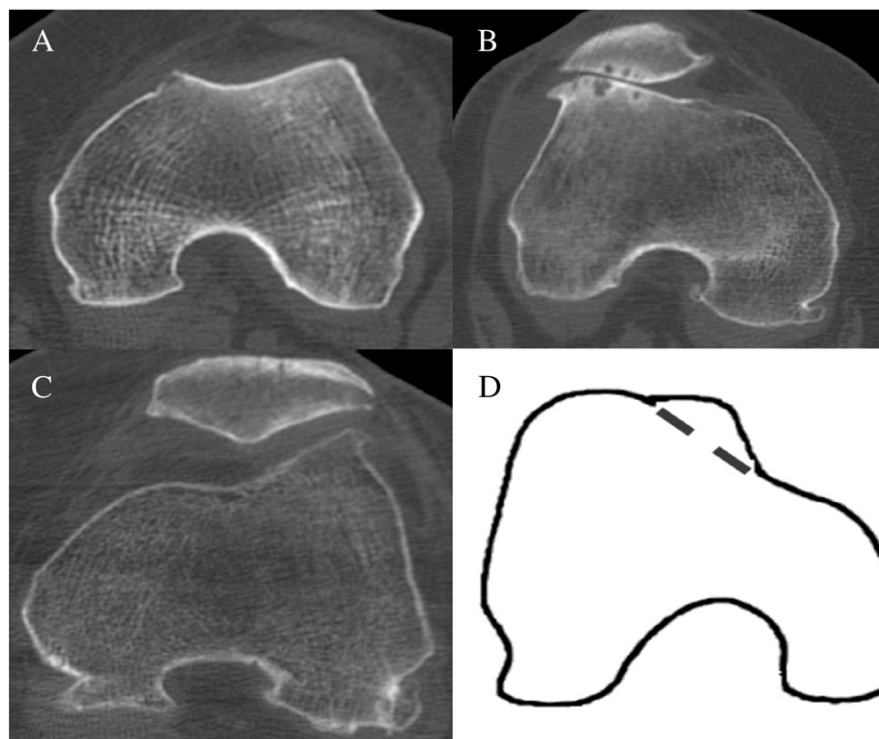


Fig. 1. Dejour classification of trochlear dysplasia.

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