THE GEOMETRY OF THE PATELLOFEMORAL JOINT
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Introduction: The normal relationships of the patellofemoral joint provide a basis for the evaluation of patients with patellofemoral abnormalities. Previous studies have often described the patellofemoral joint using X-rays which are encumbered with projectional inaccuracies.1,2 We have used CT to describe the geometry of the patellofemoral joint and its relationship to the tibiofemoral joint in terms of angles and distances.

Materials and Methods: Knee CT scans of 43 knees of patients above the age of 55 without patellofemoral disease were performed and three dimensional images were reconstructed. The flexion axis of the tibiofemoral joint was found by fitting a sphere to each posterior femoral condyle. The line connecting these centres is defined as the flexion axis of the tibiofemoral joint. These two centres and the centre of the femoral head form a frame of reference for reproducible femoral alignment. The trochlear geometry was defined by fitting circles and spheres to slices and surfaces, then constructing an axis through their centres. The relationship between the trochlea and the reference plane was then explored. Angles between the flexion axis, the transtrochlear axis and the conventionally described axes were measured in coronal and transverse views.

Results: The deepest points on the trochlear groove can be fitted to a circle with radius of 23mm (STDEV 4mm) and rms of 0.3mm. On either end of this line, the articular surface of the trochlea can be fitted to spheres of radius 30mm (STDEV 6mm) laterally and 27mm (STDEV 5mm) and rms of 0.4mm medially. The centres of the circle and the two spheres fall on a line with rns of 1.1mm. The patellofemoral joint is related to the tibiofemoral joint with a mean offset of 18.4mm (STDEV 3mm) anteriorly and 7.9mm (STDEV 2.3 mm) proximally and angulation of 67 degrees.

Angles between epicondylar and flexion axes were on average 1° (STDEV 6.4°) and 0° (STDEV 2°) in coronal and transverse view.

Angles between the posterior condylar axis and the flexion axis were on average 0° (STDEV 2°) in coronal and transverse view.

Discussion: The trochlea may be simply and accurately modelled as the circular intersection of two spherical surfaces. This structure has a relationship with the tibiofemoral joint that is describable using our method with high reliability. The method described allows investigators and surgeons to describe both anatomy and patho-anatomy of the different parts of the knee in detail. It may permit us to understand disease processes and to plan their treatment with greater reliability.

References: 1. Freeman et al., Journal of Arthroplasty, S69-S84. 1989
2. Feinstein et al., Clinical Orthopaedics, PP . 64-73. 1996

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