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Paper #138

Is There a Relationship Between the Coronal Alignment and the Rotational Geometry of the Distal Femur in the Osteo-Arthritic Knee?

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Summary:
We observed a linear relationship between the coronal alignment and the rotational geometry of the distal femur in the osteo-arthritic knee with statistical significant differences between the different coronal alignment groups.

Abstract:
Introduction:
There is quite a lot of inter-individual variation in the rotational anatomy of the distal femur. This study was set up to define the rotational anatomy of the native distal femur in the osteo-arthritic knee and to investigate its relationship with gender and the overall coronal alignment of the lower leg.

Methods:
We retrospectively collected CT-scans of 231 patients with end stage knee osteo-arthritis prior to TKA surgery. Patients with rheumatoid arthritis or posttraumatic arthritis were excluded. This represents the biggest series published on rational geometry of the distal femur in literature so far. Rotational parameters were measured on the axial plane images of these CT-scans. Coronal alignment was measured on the A/P scout image of the CT scan. External rotation of the first reference axis relative to the second one, was denoted as a positive value.
The patients were subdivided into three categories, based on the mechanical tibiofemoral angle (mTFA) for further analysis. Varus knees: mTFA <= 177; neutrally aligned knees: 177° < mTFA < 183°; valgus knees: mTFA >= 183°. We subdivided each class according to gender in order to evaluate the variability of the femoral rotational anatomy in relation to the gender of the patient.

Results:
The average age of the patients was 68.8 years (range: 38.8 – 87.1). Eighty patients were males, 151 were females. The posterior condylar line (PCL) was on average 1.58° (SD 1.92) internally rotated relative to the surgical transepicondylar axis (sTEA). The perpendicular to trochlear anteroposterior axis (TRAx) was on average 4.76° (SD 3.34°) externally rotated relative to the sTEA. The aTEA was on average 4,71° (SD 0,71°) externally rotated relative to the sTEA.
The posterior condylar angle (PCA) (=PCL vs sTEA) was statistically different in the different coronal alignment groups ($p<0.001$): 0.98° (SD 1.77°) in varus knees, 2.14° (SD 1.84°) in neutral knees and 2.63° (SD 1.83°) in valgus knees (table 1). The same was true for the perpendicular to the TRAx in these 3 groups ($p<0.02$). The relationship between the aTEA and sTEA remained constant.
There was a linear relationship between the overall coronal alignment and the rotational geometry of the distal femur. For every 1° in coronal alignment increment from varus to valgus, there is a 0.12° increment in posterior condylar angle ($p<0.001$) ($R = 0,4$).
Men and women had the same PCA in varus knees. Significant gender differences were found in neutral and valgus knees with women having a significant greater PCA.

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Conclusion:
The mean PCA was found to be 1,58° in the osteo-arthritic knee.
This value is different from previous studies in healthy knees who showed a mean PCA of 3° (Matsuda, 1998; Asano, 2005). It is also somewhat different from the findings in previous smaller series in the osteo-arthritic knee (Nagame, 1998; Matsuda, 1998; Yoshino, 2001)
Our findings are consistent with those of Anglietti and confirm the linear relationship between the coronal alignment and the rotational geometry of the distal femur in a bigger series. Taking this relationship into account could significantly increase the accuracy of axial plane femoral component positioning in TKA.