

Femoral Antetorsion is Related to the Morphology of the Femoral Trochlea

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Summary:

Many of the trochlea indices showed significant correlation with femoral antetorsion in that an increased antetorsion is associated with a flatter, more dysplastic trochlea.

Abstract:

OBJECTIVES

In the field of patellofemoral disorders the limb-alignment in the transverse plane is regularly issued. There is consensus in that abnormal femoral antetorsion (AT) causes patellofemoral disorders. However, we are not aware of articles that specifically investigated for a relationship between femoral AT and trochlea morphology. Therefore, we hypothesized that there exist significant correlations between femoral AT and parameters of trochlea morphology.

METHODS

We identified 560 lower-limb CT scans in our hospitals PACS. Excluded were limbs with previous a) fractures or b) osteotomies of the femur, limbs with c) total or partial hip or knee arthroplasties. 40 cases were randomly picked and with a standardized measurement technique the following parameters were determined: Regarding femoral antetorsion recent research introduced a method, which provides additional information with regard to whether the antetorsion is located rather proximally or distally on the femur. Accordingly, the following 4 lines were determined from the CT scans: One through the center of femoral head and neck. One through the top of the trochanter minor and the center of the femoral shaft. One as a tangent to the dorsal part of the distal femur - just above the gastrocnemius insertion. And one as a tangent to the posterior condyles. Between the respective lines it is possible to measure the following parameters of femoral torsion: a) total AT, b) proximal AT, c) diaphyseal AT and d) distal AT.

Similar to previous research trochlea parameters were all determined from 2 different axial CT-slices, the proximal one, when the trochlea is initially completely covered with cartilage and a distal one 5 mm further distally. The following well-established trochlea parameters were determined as described by previous research: trochlea height (medial, central, lateral), transverse trochlea shift, trochlea depth, sulcus angle, lateral trochlea slope and Dejour trochlea type. To falsify the above mentioned hypothesis a correlation analysis was performed with Pearson correlation coefficients between the variables of AT and trochlear morphology. Alpha was defined as 0.05.

RESULTS

The descriptive statistics of the femoral torsion parameters were: 25.9° ±9.4° (total AT), 55.1° ±13.8° (proximal AT), -37.9° ±14.8° (diaphyseal AT), 8.5° ±3.8° (distal AT).

The inferential statistics (correlation analysis) confirmed our hypothesis. The 'total AT' was significantly correlated with the trochlea parameters trochlea depth ($r = -0.340$, $p = 0.032$), sulcus angle ($r = 0.312$, $p = 0.05$) and lateral

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trochlea slope ($r = -0.494$, $p = 0.001$). The 'diaphyseal AT' was significantly correlated with the 'sulcus angle' ($r = 408$, $p = 0.009$). The 'distal AT' showed significant correlations with medial, central and lateral trochlea height ($0.340 < r < 0.434$, $0.005 < p < 0.032$) and with the Dejour trochlea type ($r = 0.321$, $p = 0.043$).

CONCLUSION

Based on our findings it is concluded that the morphology of the trochlea is significantly related to femoral antetorsion. Increased antetorsion is associated with a flatter, more dysplastic trochlea what confirms our observations from clinical practice. The findings of the study are regarded as important because that issue was so far not investigated in previous research.