INTRAOPERATIVE KNEE ANTHROPOMETRICS: CORRELATION WITH CARTILAGE WEAR

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INTRODUCTION

The success of Total Knee Arthroplasty (TKA) relies upon the correct sizing and positioning of the prosthetic implant components. Incorrect sizing can cause prosthesis loosening, incorrect soft tissue balancing and uneven stress distribution at the tibio-femoral articulation (Vaidya, S.V. et al, 2000). It is important to quantify the key dimensions of the knee so that an accurate anatomic data is available for designing the prosthesis and the associated the surgical technique.

Previous studies of knee anthropometrics (Vaidya, S.V. et al, 2000 and Mensch, J.S., Amstutz, H.C., 1975) have used small sample sizes, typically 30. This study uses data collected from 196 TKA patients, dramatically increasing the statistical certainty of our results.

MATERIALS AND METHODS

Patient data (height, weight, age, sex) and anthropometric data for the femur, tibia and patella were collected from 196 Caucasian patients undergoing TKA (128 female and 68 male). All parameters were measured intraoperatively by the same person using a precision vernier gauge.

Four femoral, three tibial and three patellar linear parameters were measured. Femoral parameters were: condylar width (Femcwd), epicondylar width (Femewd), medial condylar anterio-posterior (AP) depth (FemmedAP) and lateral condylar AP (FemlatAP) depth. Tibial parameters were: mediolateral (ML) width (TibMLwd), medial AP depth (TibmedAP) and lateral AP depth (TiblatAP). Patellar parameters were: height (PatSIht), width (PatMLwd) and thickness (PatAPt).

Visual assessment of the patella was carried out in order to quantify the level of cartilage wear of the patellofemoral articular surface: 70 patients had no cartilage present.

Summary statistical analysis was carried out using DataDesk (v.6.1; Data Description Inc., Ithica, NY). Pearson correlation coefficients between parameters were also determined.

RESULTS

Average values and standard deviations for all parameters are shown in Table 1. All values were significantly larger for males (P< 0.01). Average male and female knee dimensions for the 70 patients with extensive patellar cartilage wear were smaller than their respective averages for the unworn male and female groups (P< 0.01). Dimensions for males show significantly higher correlation coefficients than for female. Patellar dimensions showed the poorest correlation for both males and females.

Correlation coefficient results demonstrate that knees with significant cartilage wear have poorer correlation overall than those with cartilage present. For patient height and epicondylar width, r = 0.61 (worn, n = 70) compared to r = 0.76 (unworn, n = 126). Significance tests were carried out and all coefficients were found to be significantly positive. For males, n = 68, r > 0.275, $\alpha = 0.05$ and for females, n = 128, r > 0.17, $\alpha = 0.05$.

Table 1 Average Antiropometric Dimensions			
Parameter:	Overall	Female	Male
Height (cm)	160.8 (10.2)	155.4 (6.5)	170.9 (8.1)
Weight (kg)	77.7 (14.4)	73.6 (13.0)	85.5 (13.8)
Femcwd (mm)	72.9 (6.2)	69.6 (4.1)	79.2 (4.2)
Femewd (mm)	85.8 (7.7)	81.8 (5.3)	93.6 (5.2)
FemmedAP (mm)	65.8 (5.2)	63.3 (4.0)	70.5 (4.1)
FemlatAP (mm)	66.3 (5.6)	63.5 (4.3)	71.6 (3.9)
TibMLwd (mm)	74.4 (6.2)	71.0 (3.3)	80.7 (5.3)
TibmedAP (mm)	50.3 (5.6)	47.7 (4.1)	55.5 (4.3)
TiblatAP (mm)	46.5 (4.6)	44.4 (3.3)	50.5 (4.0)
PatSIht (mm)	35.2 (3.0)	34.6 (3.0)	36.4 (2.6)
PatMLwd (mm)	44.4 (4.7)	42.0 (3.1)	48.9 (3.8)
PatAPt (mm)	22.4 (2.8)	21.0 (2.0)	24.9 (2.1)

Table 1 Average Anthropometric Dimensions

DISCUSSION AND CONCLUSIONS

The results agree with previous studies. Correlation coefficients were quite high at 0.7 or 0.8 and supported the clinical relevance of key linear parameters. For example, the femoral ML sizing for TKA is frequently based upon the ML width of the proximal tibia. A coefficient for these two dimensions of 0.85 supports such a sizing procedure.

The values found for patellar thickness have implications for the practice of patellar resection. For 22 of the 128 females, a routine removal of 5 mm of bone from the patellar thickness during patellar resection would leave less than the minimum 14 mm recommended to avoid risk of post-operative fracture The average values for many knee dimensions were smaller for the 70 patients without patellar cartilage, despite similar height and weight. One might expect the patellar thickness and femoral AP dimensions to be reduced in the absence of cartilage. However, femoral epicondylar width was also significantly smaller (P<0.01) for this subgroup. This suggests that the incidence of cartilage degeneration may be predetermined by virtue of narrower ML width of the knee and hence higher articular surface contact pressures. Clinically, this observation may provide a means of identifying those patients most at risk of more rapidly progressing osteoarthritic change and therefore warranting earlier TKA.

REFERENCES

Vaidya, S.V. et al (2000). J Arthroplasty **15** 1: 79-85 Mensch, J.S., Amstutz, H.C. (1975). Clin Orthop **112**: 231-241