

Morphological and Morphometric Study of the Human Distal End of Femur

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Abstract

Introduction: The distal end of human femur is widely expanded, consisting of two condyles - medial and lateral condyle. The transverse distance of bicondyles as well as anteroposterior distance is important parameters for the design of total knee prostheses.

Aim: The study aimed at determining the mean values of different morphometric measurements from the right and left distal end of femur.

Materials and Methods: The present study was carried out on 100 distal end of femur which consisted of 50 right and 50 left distal end of femur at Government Medical College, Amritsar. All the parameters were taken using standard digital Vernier caliper.

Results and Conclusion: Total mean AP distance of bicondyles when compared between two sides was more on the right side than left side. On the other hand, when total mean TS distance compared between two sides, the distance was more on left side. The TS distance of bicondyles is considered an important parameter for the design of total knee prosthesis.

Key words: AP distance of bicondyles, TS distance of bicondyles, Total Knee Replacement

INTRODUCTION

The Femur is the largest, longest, and strongest bone of the body. It transmits the body weight and gives stability to human. The distal end of the femur is widely expanded, consisting of two condyles: medial and lateral condyle. The condyles are partly articular and articulate inferiorly with corresponding condyles of the tibia and anteriorly with the patella. The transverse distance of bicondyles as well as anteroposterior distance of medial and lateral condyles of femur are important parameters for the design of total knee prostheses.^[1] The transverse distance of condyles of femur also determines adequate coverage of resected bone surfaces, which allows even stress distribution, tension-free wound closure, and smooth tracking of the patellar component in the trochlear groove during flexion.^[2] The anteroposterior

distance of femoral condyles is important in maintaining flexion extension spacing. The distal end of femur plays an important role in knee joint locomotion. The shape of distal femur is a clear marker for the achievement of bipedal posture. Accurate morphometric anatomical data of distal end of femur are very important to make a design of total knee joint replacement (TKR). Manufacturing of prosthesis for TKR requires measurements of distal femoral condyles. Hence, the aim of this study is to measure the dimensions of bicondyles, which can serve as guidelines for designing a suitable femoral component of total knee prostheses of Indian population.

MATERIALS AND METHODS

The study was carried out on 50 human distal end of femora of unknown age and either sex made available from the department of Anatomy, Government Medical College, Amritsar. Each femur was marked from 1 to 50 with suffix "R" or "L" indicating right or left side respectively. Data were collected by Vernier caliper.

Following parameters were recorded in a pro forma

1. Maximum anteroposterior distance of bicondyles [Figure 1]
2. Maximum transverse distance of bicondyles [Figure 2].

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Table 1: Mean, range and P value of all parameters of right, left and total femur

Parameters	Mean±SD			Range			P-value
	Right	Left	Total	Right	Left	Total	
AP distance of Bicondyles	48.09±4.22	45.48±4.84	46.79±4.68	38.5–56.2	34.1–55	34.1–56.2	0.725
TS distance of Bicondyles	74.52±4	76.16±5.74	75.34±4.97	65.3–80.6	65–87	65–87	0.412

Table 2: Comparison of anteroposterior and transverse distance of bicondyles with previous studies (mm)

Early studies with year			Anteroposterior distance of bicondyles	Transverse distance of bicondyles
Study	Year	Population range	Mean±SD	Mean±SD
Mistri ^[3]	2015	Kolkata (India)	53.04±0.47	74.43±0.61
Jha and Chauhan ^[4]	2017	Delhi (India)	57.84±5.07	73.11±6.14
Biswas and Bhattacharya ^[5]	2017	Calcutta (India)	-	71.71±4.50
Rashid <i>et al.</i> ^[6]	2018	Jammu (India)	-	74.98±5.91
Chavda <i>et al.</i> ^[7]	2019	Gujarat (India)	-	69.60±5.04

**Figure 1: Anteroposterior distance of bicondyles****Figure 2: Transverse distance of bicondyles.**

RESULTS

On comparing the anteroposterior and transverse distances [Figures 1 and 2], it was seen that the transverse distance was more than anteroposterior distance on both sides.

When compared between two sides, the distance was more on the right side than left side. The distance was more on right side than left side [Table 1].

DISCUSSION

Various studies have been carried out on morphometry of bicondyles of femur. Following tables [Table 2] present the comparison of means of the various previous studies with that of present study.

It is evident from the above table that the findings of (AP distance of bicondyles) present study were in consonance with the findings of Mistri^[3] and Jha and Chauhan.^[4]

It is evident from the above table that the findings of (TS distance of bicondyles) present study were in consonance with the findings of Mistri^[3] and Jha and Chauhan,^[4] Biswas and Bhattacharya,^[5] Rashid *et al.*,^[6] and Chavda *et al.*^[7]

CONCLUSION

In the present study, key parameters of the distal end of femur such as medial condyle, lateral condyle, intercondylar fossa, and bicondyles have been measured on dry bones. These morphometric parameters have been measured and tabulated separately for the right and left sides. The findings of present study corroborated the results of many previous authors, but a racial variation is also observed in various dimensions. Several parameters are observed to be higher on the right side than the left side. A thorough understanding of the anatomical aspects of distal end of femur is very imperative for the radiologists and orthopedicians, as knee replacement requires implant placement with highest degree of accuracy. Hence, the average values of the parameters measured in this study would be of significant value in the manufacture of femoral component of knee prostheses in the north Indian population.

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