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**Dr. Gnanaprakash Palaniappan**  
Assistant Professor, Department  
of Orthopaedics, PSGIMSR,  
Coimbatore, Tamil Nadu, India

**Dr. Chetan John Rasquinha**  
Assistant Professor, Department  
of Orthopaedics, PSGIMSR,  
Coimbatore, Tamil Nadu, India

**Dr. Major K Kamlanathan**  
Professor, Department of  
Orthopaedics, PSGIMSR,  
Coimbatore, Tamil Nadu, India

**Dr. Dinakar Rai**  
Professor, Department of  
Orthopaedics, PSGIMSR,  
Coimbatore, Tamil Nadu, India

**Corresponding Author:**  
**Dr. Gnanaprakash Palaniappan**  
Assistant Professor, Department  
of Orthopaedics, PSGIMSR,  
Coimbatore, Tamil Nadu, India

## A study of valgus cutting angle in knees of South Indian population

**Dr. Gnanaprakash Palaniappan, Dr. Chetan John Rasquinha, Dr. Major K Kamlanathan and Dr. Dinakar Rai**

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### Abstract

**Aim:** We undertook this study to determine the average valgus cutting angle of distal femur in South Indian population since most of the studies are on western population and very few studies in Indian population and particularly South Indian population.

**Methods:** We did a study femoral valgus angle of 174 knees in 87 patients with full length CT scannograms in our radiology department.

**Results:** The average Femoral valgus angle was found to be of  $6.51 \pm 0.76$  and there was no statistically significant difference between male and females or between both the sides. There was a strong correlation between the two sides(0.971) and weak correlation with regards to age(.003).

**Keywords:** Valgus cutting angle, mechanical axis, anatomical axis, ct scannograms

### Introduction

As the longevity of South Indian population is increasing, the number of total knee replacements is also increasing due to age related degenerative changes. Proper valgus cutting angle or femoral valgus angle, which is the angle between the mechanical axis and anatomical axis of the femur, is an important parameter which greatly influences the outcome of the surgery [1, 11]. This valgus cutting angle varies from country to country and in different ethnic groups [6]. But the standard valgus cutting angle is based on Western countries population [12]. Very few studies have been made in Asian population, and even fewer studies on the Indian population, particularly South Indian population –and there is many morphometric differences between the two [1, 3]. We did a radiological study of the valgus cutting angle from full length CT scannograms done as part of arterial angiographic study in patients who had vascular diseases.

### Materials and Methods

South Indian patients for whom CT scannogram have been done as part of arterial angiography for vascular disease and which include full length of the hip and knee, in the Department of Radiology, PSG IMSR was included in this study. Scannograms with normal limbs alignment and limbs in neutral rotation were included. Patients with deformities due to conditions like fractures, and bowed femurs, were excluded. Paediatric age group were excluded.

The mechanical axis and the anatomical axis of femur are drawn and the angle between, which is the valgus cutting angle is measured. (Fig 1). This was done by two orthopaedic surgeons independently to avoid inter-observer variation and the average of the two was taken as the value.

### Technique for angle calculation

Center of femoral head-is the center of a best fit geometrical sphere which replicates the femoral head (Fig 1).

Center of knee-is the center of a line connecting the medial and lateral joint line Mechanical axis-is the line connecting the center of the femoral head and the center of the knee.

Anatomical axis –is the line connecting the center of the knee and the center of the femoral shaft Valgus cutting angle –is the angle between the above two lines. (Normal-5 to 7 degrees)



**Statistical Analysis**

The results obtained will be subjected to students t test and Pearson correlation coefficient to evaluate the statistical correlation between the genders, between ages, and between

the sides’ value less than .05 will be considered statically significant.

**Results**

In this cross sectional study 87 participants were enrolled and in total 174 knees were studied. The men age was 55.83 ± 11.56 years (Range = 24 – 82 years). 46 (52.9%) participants were male. This has been depicted in table 1.

**Table 1:** Baseline Characteristics of Study Population (n=87)

	Category	Number (%)
Age	Less than 40 years	04 (4.6%)
	40-49 years	24 (27.6%)
	50-59 years	27 (31.0%)
	60 – 69 years	19 (21.9%)
	70 years and above	13 (14.9%)
Gender	Male	46 (52.9%)
	Female	41 (47.1%)

The valgus cutting angle in the study population was found to have a mean of 6.51 ± 0.76. The averages for right and left side were 6.51 ± 0.77 and 6.50 ± 0.75 respectively. This difference was not statistically significant by t test (p= 0.912). The valgus cutting angle average among males and females were 6.56 ± 0.78 and 6.44 ± 0.72 respectively (p= 0.304). Hence the valgus cutting angle remains the same across gender.

**Table 2:** Gender-wise and Dexterity-wise values of Valgus cutting angle in study population (n=87)

	Category	Valgus cutting angle Mean ± SD	Valgus cutting angle Range
Total (n=87)		6.51 ± 0.76	4.9 – 8.2
Gender (n=87)	Male (n=46)	6.56 ± 0.78	5.1 – 7.9
	Female (n=41)	6.44 ± 0.72	5.1 – 7.9
Dexterity (n=87)	Right	6.51 ± 0.77	4.9 – 8.2
	Left	6.50 ± 0.75	5.1 – 7.9
Male (n=46)	Right	6.56 ± 0.82	5.1 – 7.9
	Left	6.56 ± 0.76	5.2 – 7.6
Female (n=41)	Right	6.46 ± 0.72	4.9 – 8.2
	Left	6.43 ± 0.73	5.1 – 7.9

The correlation coefficient between the valgus cutting angle of Right and Left side is 0.971 – Strong correlation. (p< 0.001). Fig 1

The correlation coefficient between the valgus cutting angle and age was 0.003 and 0.036 for Left and Right Knee respectively (p=0.97 and P= 0.74). Fig 2 a & b. Thus showing that the valgus cutting angle remains the same across age.

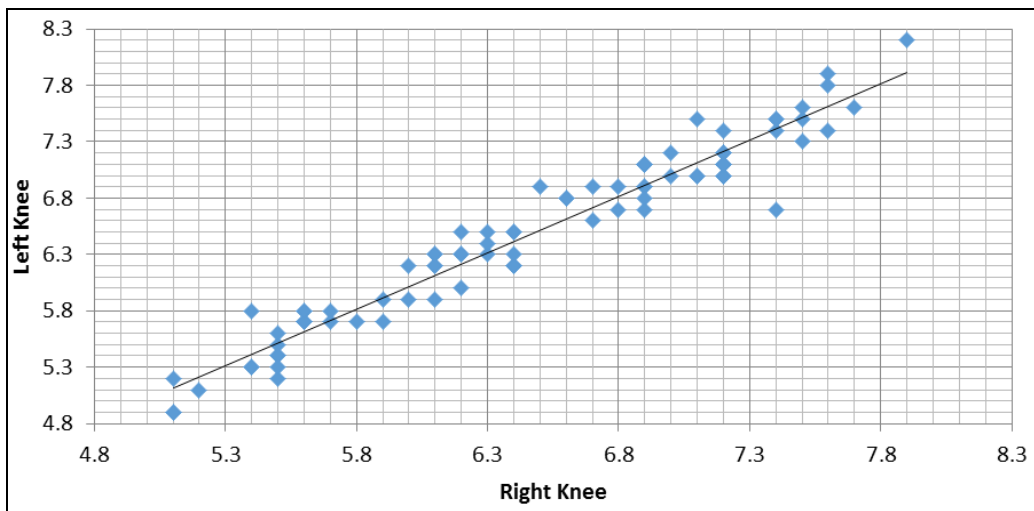


Fig 1: Depicting the correlation between values of right and left knee Valgus cutting Angle (n=87)

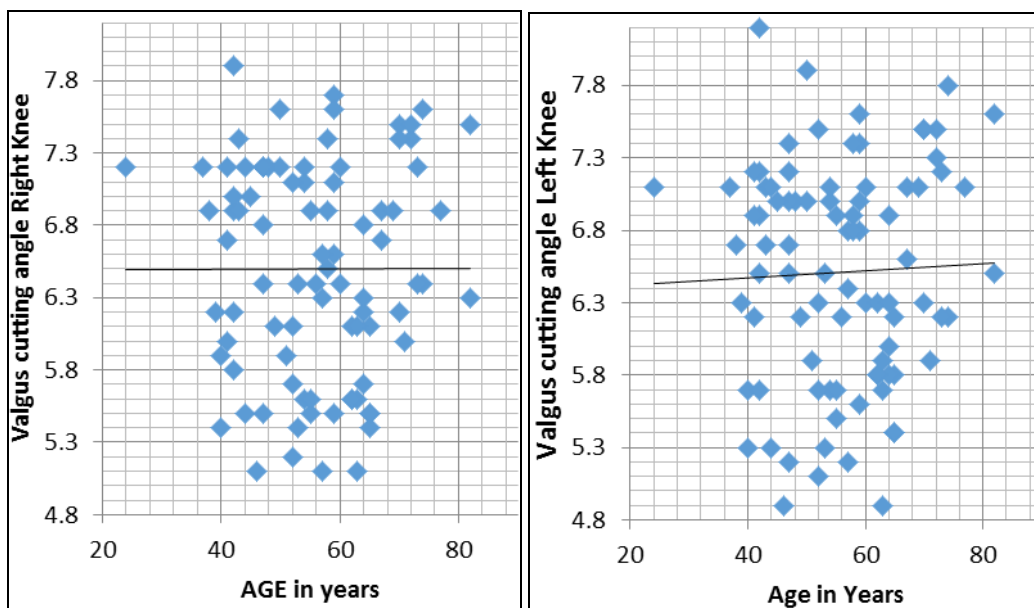


Fig 2: Correlation between values of right (a) and left (b) knee Valgus cutting Angle and Age (n=87)

**Discussion**

Proper alignment is an important aspect for a successful outcome of a total knee replacement [11]. The distal valgus cutting angle is one of the key factors for this [4]. There are wide variations in angle between countries and races and even within a country depending upon their morphometry [6]. In our study of South Indian population who are considerably shorter when compared their Western counterpart or even their North Indian counterparts, showed that the mean valgus cutting angle was  $6.5 \pm 0.76$ . There was strong correlation between the two sides but no correlation with respect to age. Genderwise there was no statistically significant difference between the two sexes. Western literature suggests a valgus cutting angle range as 5- 7 degrees [12] An Indian study found the average valgus cutting angle to be 5.8 degrees [3]. In our study the average cutting angle is found to be 6.5, which is in the higher side of the range. This may be due to the shorter stature of South Indians when compared to their Northern counterparts within the country and from the Western population. Western literature shows statistically significant difference between the valgus cutting angle between males and females [12] whereas Indian studies<sup>3</sup> showed no statistically significant difference between the two genders. Our study was similar to the Indian study and showed no

statistically significant difference between the two sides. This may be again explained by the shorter stature of the population under study.

**Conclusion**

The average valgus cutting angle in South Indian population is considerably at the higher side of the normal range (5-7 degrees) that is 6.5 degrees. This can be explained by the shorter stature of South Indians when compared to their Northern counterparts and the western population. So, a valgus cut of 6.5 degrees will be appropriate in most cases of total knee arthroplasty done in this population.

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