

Angle of Femoral Torsion in Subjects of Udaipur Region, Rajasthan, India.

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Research Article

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ABSTRACT

The femoral neck anteversion has important implications in arthroplasties, evaluation of pathology of hip. Since racial variation is expected to exist because of different needs of different races. The purpose of this study was to estimate the average angle of femoral torsion (FNA) in subjects of Udaipur region. Unpaired 150 dry femora, 63 of females (33 left and 30 right) and 87 of males (47 left and 40 right) devoid of any gross pathology were used to measure femoral torsion from department of anatomy, R.N.T. Medical College, Udaipur in the year 2013. They were evaluated by Kingsley Olmsted method and the data were statistically analyzed. In females the angle ranges from 8-35 degree with the mean of 21.30 degree. The average mean was 20.09 and 22.63 degree on left and right side respectively. In males the angle ranges from 8-25 degree with the mean of 16.67 degree. The average mean was 16.89 and 16.40 on left and right side respectively. The average angle of anteversion was 18.67 with SD of 5 degree. The 'p' value of comparison of angle in male and female was < 0.001 which was highly significant. The difference in angle on the right and left side of both male and female bones was statistically insignificant.

INTRODUCTION

The femoral torsion (FNA) can be defined as the angle formed by the femoral condyles plane (bicondylar plane) and a plane passing through the centre of the femoral neck and head [3] (Figure - 1). If the axis of the neck incline anterior to the transcondylar plane, the angle of torsion is called anteversion, if it is posterior to the transcondylar plane it is called retroversion and if it is in the same plane it is called neutral version (Figure - 2).

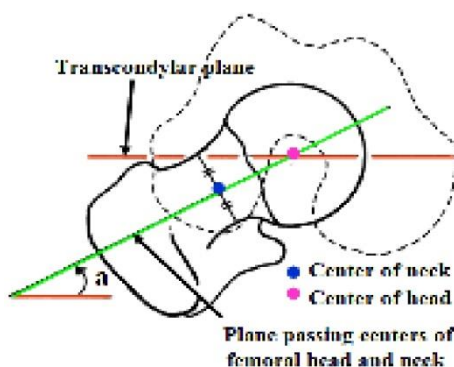


Figure 1 : Shows Angle of Femoral Neck Anteversion

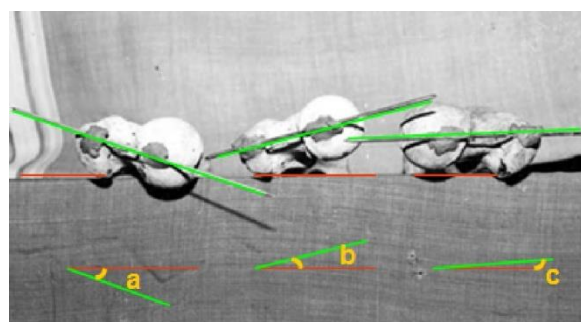


Figure 2 : A - Femoral Retroversion
B - Normal Anteversion
C - Neutral Version

In the past few decades, researchers worldwide have used various methods to measure the angle. They have measured the angle mechanically on cadaveric bones as well as in patients by using roentgenography, ultrasound, computerized tomography and MRI. Earlier studies [2] revealed that the angle varies in population and also according to the method adopted. Thus the data from western countries may not be applicable to Indian population. Hence the anteversion for Indian population was calculated using dry bones.

The present study is an attempt to evaluate the normal anteversion range in adult Indian femora and to compare values of angle in male and female.

MATERIAL AND METHOD

Unpaired 150 dry femurs, 63 of female (33 left and 30 rights) and 87 of males (47 left and 40 rights) devoid of any gross pathology were used to measure the femoral torsion (FNA). The angle of anteversion was measured by Kingsley Olmsted method [4] after placing the specimen at the edge of a glass horizontal surface so that the condyles of the inferior end rest on the surface.

The horizontal limb of Goniometer was fixed at the edge of the experimental table. The vertical limb was held parallel along the axis of the head and neck of femur. The horizontal surface represents the retrocondylar axis and the plane of reference against which the anteversion is measured with the help of the axis of the head and neck of femur. The angle subtended was recorded (figure-3).

All measurements were repeated twice by two independent observers to identify any intra and inter observer variability of these techniques. Data collected was tabulated according to gender and sides and statistically analyzed.

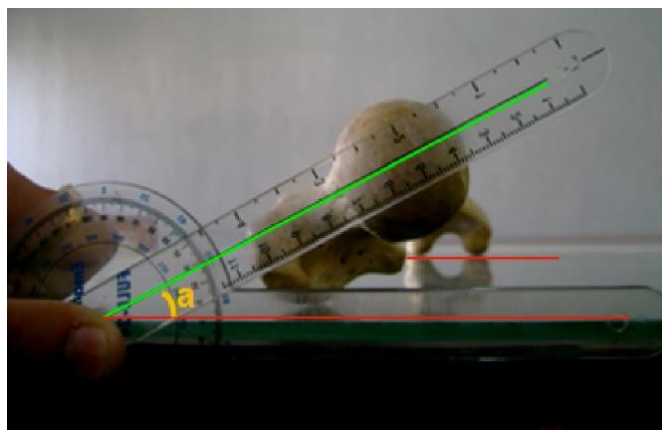


Figure 3: Shows Kingsley Olmsted method of measurement of angle of femoral neck anteversion

RESULTS

Cross sectional study of unpaired 150 dry femora was conducted, out of them 63 were of females and 87 were of males.

Average anteversion in female bones was 20.09 ± 5.30 and 22.63 ± 4.98 on left and right side respectively averaging to about 21.30 ± 5.30 degree. Average anteversion in male bones was 16.89 ± 3.81 and 16.40 ± 3.65 on left and right side respectively averaging to about 16.67 ± 3.73 degree (table-1).

The average angle of anteversion obtained was 18.67 degree by Kingsley Olmsted method with SD of 5 degree. The 'p' value of comparison of angle in male and female was < 0.001 which was highly significant.

The frequency of femoral torsion in 150 femurs was – 6% of femurs were showing angle in the range of 1-10 degree. 67.33% of bones were showing angle in the range of 11-20 degree. 25.33% of the bones were showing angle in the range of 21-30 degree and 1.33% were in the range of 31-40 degree. All specimens showed anteversion. No retroversion was found in the study.

DISCUSSION

The development of femoral torsion starts from 4th gestational month onwards. There is gradually increasing torsion of femur throughout prenatal stages of development, beginning with slightly negative values in the earliest stages (2-3 months) and reaching its highest values of 35-40 degree in perinatal period. At birth anteversion angle is about 40 degree. During 1st year of life it decreases by about 8 degree, there after 1 degree per year until in the adult it is at average of 10-15 degree. It is multifactorial as a result of evolution, hereditary, fetal development, intra uterine position and mechanical form.

The knowledge of normal femoral anteversion is of extreme importance in selection of patients for prosthesis and pre operative planning for total hip replacement surgery and anthropological studies. Although newer methods using computed tomography (CT) have been shown to be ± 1 degree accurate. There is no

universal consensus for locating the femoral neck axis and the femoral condylar axis [8]. Hence estimation of anteversion in dry bones is still considered the most accurate method.

There are few studies done in India before this study. Western studies results are not applicable in Indian population because femoral anteversion differs in both population

Table 1: Statistical comparison of Angle of Anteversion in Males and Females [1, 4, 5, 8 10, 11, 12, 13]

Researcher	Mean Angle of Anteversion	SD of Angle of Anteversion	Range
Parson FG et al	M - 13 F - 17	-	
Kingsley PC et al	M - 7.94 F - 8.11	-	
Ankur Zalawadia	M - 10.9 F - 13.6	-	
Maini PS	M - 17.43 F - 14.80	-	
Srimathi	M - 9.78 F - 9.79	-	
Srikant Rokade	M - 18.68 F - 16.34	-	
Jain AK	M - 7.5 F - 10.5	-	
Nagar M et al	M - 16.27 F - 10.94	-	
Present Study	M - 16.67 F - 21.30	3.73 5.30	8-25 8-35

In the present study out of 150 bones, 63 were of female and 87 were of male. The mean FNA in female is 21.30 with SD 5.30 and of male is 16.67 with SD 3.73. The difference is of approximately 5 degree between male and female bones. The angle is more in females. The 'p' value of comparison is < 0.001 which is highly significant.

Table 2: Statistical comparison of average angle of Anteversion [1, 6, 8, 10, 11, 12, 13, 14],

Researcher	Mean angle on right side	Mean angle on left side	Average angle
Merkel	-	-	17.9
Lange	-	-	18.6
Kingsley PC et al	-	-	7.88
Yoshika Y et al	-	-	M-7, F-8
Rigaud	-	-	20.0
Parson et al	15.5	14.5	15.3
Nagar M et al	-	-	13.65
Jain AK	7.3	8.9	8.10
Ankur Zalawadia	9.00	15.4	12.4
Shrikant Rokade	14.70	17.79	17.34
Srimathi	9.49	10.13	9.8
Maini PS	16.01	16.61	17.31
Present Study	19.51	18.49	18.61

As shown in table 2 the average angle of present study is 18.61 degree. The study is found consistent with the study of Lange. The average angle shown by Merkel was also near to the present study. Kingsley PC et al and Yoshika Y et al observed the angle on much lower side that was nearly 8 degree. Rigaud on the other hand observed the average angle on the higher side that was 20 degree. Parson FG et al found the average angle to be 15.3 degree which was much less than the present study.

Among the Indian researchers Srikant Rokade and Maini PS found the average angle very near to the average angle of present study so they were consistent with the present study. Nagar M et al showed less average angle. Ankur Zalawadia showed much less average angle that was 12.4 degree. The difference in mean angles of both sides and the average angle was quite significant. On the other hand Jain AK and Srimathi showed much less angle with the difference of 9-10 degree with the present study.

Because Indians are more apt to participate in floor level activities, in contrast to persons in the west, our hips have to be evolutionary different from theirs. Thus, the same procedure produces a different outcome in our population.

In India with the increasing demand for total hip replacement this anteversion angle becomes more significant. Therefore our study was undertaken to ascertain the average angle of anteversion of femur in Indian subjects.

CONCLUSION

The average anteversion in male bones was 16.89 +/-3.81 and 16.40 +/-3.65 on left and right side respectively averaging to about 16.67+/-3.73 degree.

The average anteversion in female bones 20.09+/- 5.36 and 22.63+/-4.98 on left and right side respectively averaging to about 21.30+/-5.30 degree.

The average angle of anteversion obtained on dry bones was 18.67 degree by the Kingsley Olmsted method. The frequency of femoral torsion in 150 femori was 6% of the femurs were showing angle in the range of 1-10 degree, 67.33% of the bones were showing angle in the range of 11-20 degree, 25.33% of the bones were showing the angle in the range of 21-30 degree and 1.33% were showing angle in the range of 31-40 degree.

All specimens showed anteversion. No retroversion was found in the study.

The difference in angle between the male and female type bones was statistically significant. The male bone shows 5 degree less anteversion than female bones. The 'p, value of comparison is <0.001 which is highly significant.

The difference in angle on the right and left side of both male and female bones was statistically insignificant. The present study thus favors the hypothesis that both limbs are symmetrical

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