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RELATIONSHIP OF THE FEMORAL BICONDYLAR DIAMETER AND INTERCONDYLAR NOTCH DIMENSIONS IN NIGERIANS: A RADIOGRAPHIC STUDY

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ABSTRACT

The aim of this study was to determine the relation of the femoral bicondylar diameter to intercondylar notch dimensions (width and depth). Antero-posterior normal knee radiographs of 200 subjects were evaluated to determine the femoral bicondylar diameter (FBD), intercondylar depth (IND) and intercondylar width (INW). The mean value for FBD, INW and IND were 8.84cm, 1.50cm and 1.02cm for males and 7.81cm, 1.26cm and 0.92cm for females on the right side respectively. For the left side, the FBD, INW and IND were 8.93cm, 1.54cm and 1.09cm for males and 7.90cm, 1.30cm and 0.98cm for females respectively. There was weak significant correlation ($p<0.05$) between FBD and INW for males and FBD and IND for females on the right side. For the left side it was between FBD and IND. Our findings suggest a poor correlation between the FBD and intercondylar dimensions which may be a poor guide or reference point for knee realignment surgery or total alignment arthroplasty.

INTRODUCTION

The femoral condyles and intercondylar notch are prominent anatomical features of the femur[1]. The condyles are the expanded bony protrusions on the medial and lateral aspect of the distal end of the femur while the gap that lies between them called the intercondylar notch. It is more visible posteriorly. It is important to note that the femoral condyles articulate with the tibia condyles to form the knee joint. Thus, the morphometric and geometric configuration of these structures are important factors in evaluating lower extremity malignment considered as the main cause of cartilage degeneration and osteoarthritis of the knee. [2-4] Studies of the relation the femoral condyles or intercondylar notch with other anatomical features of the distal end of the femur and proximal end of the tibia focused more on knee pathology. [5-7] Findings of some of these studies suggest a correlation between intercondylar notch stenosis and anterior cruciate ligament injuries. [8-9] There are also reports of correlation of intercondylar notch dimensions and bicondylar width with sex and height. At present, literature on the relation of the femoral condyles and intercondylar notch of normal knees are not readily available. In particular, studies on the relation of the femoral condyles and intercondylar notch are very limited in Nigerians. Therefore, the aim of this study was to determine if a correlation exist between the femoral bicondylar diameter and intercondylar notch dimensions (width and depth) in adult Nigerians

MATERIALS AND METHODS

200 (80 males and 120 females) antero-posterior radiographs of the knee were utilized for this study. The radiographs were selected randomly from the archive of the Radiology Department of the University of Port Harcourt Teaching Hospital, Port Harcourt, Braithwaite Memorial Specialist Hospital, Port Harcourt, and Federal Medical Center, Owerri. The radiographs were those of indigenous adult Nigerians and were all reported to be normal by the Radiologist and confirmed by us.

The femoral bicondylar diameter (FBD) was measured on the radiograph as the maximum distance

across the femoral condyles in the transverse plane indicated by line A-B in Figure 1. The intercondylar notch depth (IND) is the vertical distance (line C-D) from the apex to line G-H, which is tangent to the inferior points of the femoral condyles (Figure 2). The intercondylar width (INW) is the horizontal distance (line E-F) between the lateral surface of the medial condyle and medial surface of the lateral condyle measured at the midpoint of line C-D (Figure 2). All the measurements were taken under good illumination from a view box with a standard rule and pencil.

RESULT

Tables 1 and 2 show the descriptive statistics for FBD, INW and IND based on gender for left and right sides respectively. The mean value for FBD, INW and IND were 8.84cm, 1.50cm and 1.02cm for males and 7.81cm, 1.26cm and 0.92cm for females on the right side respectively. For the left side, the FBD, INW and IND were 8.93cm, 1.54cm and 1.09cm for males and 7.90cm, 1.30cm and 0.98cm for females respectively.

The result for correlation test is shown in tables 4 and 5. There was significant correlation ($p<0.05$) between FBD and INW for males and FBD and IND for females on the right side. For the left side it was between FBD and IND and respectively.

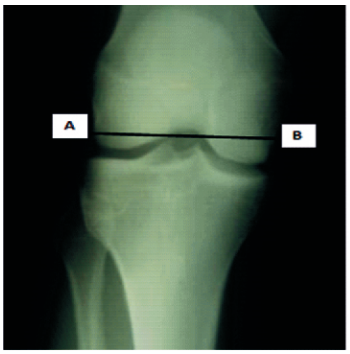

Figure 1: Femoral bicondylar diameter (Line A-B)

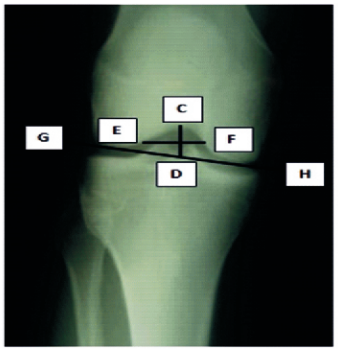

Figure 2: lntercondylar depth (Line C-D, Intercondylar width (Line E-F)

TABLE 1: DESCRIPTIVE STATISTICS BASED ON THE RIGHT SIDE AND GENDER

Parameter	Sex	Sample size	Mean	SEM	SD	Var
FBD	M	46	8.84	0.1	0.7	0.49
	F	67	7.81	0.05	0.41	0.17
INW	M	46	1.5	0.04	0.24	0.06
	F	67	1.26	0.03	0.22	0.05
IND	M	46	1.02	0.04	0.27	0.07
	F	67	0.92	0.03	0.23	0.05

TABLE 2: DESCRIPTIVE STATISTICS BASED ON THE LEFT SIDE AND GENDER

Parameter	Sex	Sample size	Mean	SEM	SD	Var
FBD	M	34	8.93	0.12	0.71	0.5
	F	53	7.9	0.06	0.47	0.22
INW	M	34	1.54	0.06	0.35	0.12
	F	53	1.3	0.04	0.26	0.07
IND	M	34	1.09	0.06	0.33	0.11
	F	53	0.98	0.05	0.35	0.12

Table 2: PEARSON'S CORRELATION (r) AND CORRELATION TEST FOR PARAMETERS (RIGHT SIDE)

Parameter	Sex	Pearson correlation value (r)	Calculated t score for r value	Critical z score at 0.05 level	Inference
FBD Vs INW	Males	0.47	3.50	1.99	Sig (p<0.05)
	Females	0.20	1.67	1.96	NS (p>0.05
FBD VS IND	Males	0.22	1.50	1.99	NS (p>0.05
	Females	0.28	2.36	1.96	sig (p<0.05)

Table 2: PEARSON'S CORRELATION (r) AND CORRELATION TEST FOR PARAMETERS (LEFT SIDE)

Parameter	Sex	Pearson correlation value (r)	Calculated t score for r –value	Critical z score at 0.05 level	Inference
FBD Vs INW	Males	0.28	1.66	1.99	NS (p>0.05)
	Females	0.20	1.44	1.96	NS (p>0.05)
FBD VS IND	Males	0.30	1.81	1.96	NS (p>0.05)
	Females	0.53	4.41	1.96	Sig (p<0.05)

DISCUSSION

In this study, the relations of the FBD to INW and IND have been studied. Understanding the relationship of the femoral condyles to other anatomical components of the knee joint is important for aligning and restoring kinematics in total knee arthroplasty.[10]

The principal findings of this study suggest inconsistency in the relationship of FBD, INW and IND. In males, there was a positive correlation between FBD and INW on the right side. While in females there positive correlation of the FBD and IND on both sides. However, the correlation was very weak on the right side. This knowledge is useful in knee prosthesis were relational quantification are necessary

Although correlation studies of the femoral condyles and intercondylar notch are very limited, there are however studies that correlate these structures to other anatomical components of the knee. Wang *et al.*[7] studied the relationship between femoral tunnels, intercondylar notch and femoral geometry after double–bundle anterior cruciate ligament reconstruction using transportal technique. They concluded that anteromedial femoral tunnel length was correlated with femoral condyle size (medial femoral condyle anteroposterior distance, lateral femoral condyle anteroposterior distance, and medial-to-lateral epicondylar distance) and intercondylar notch size (notch width, notch height, and notch area). Similarly, the relation of the femoral condyles radii in valgus and varus knee showed a strong association respectively. [6] There are mixed reports on the relation of anterior cruciate ligament to intercondylar absolute width, notch width, index, notch area, notch shape, and notch outlet dimensions. Some studies have found a correlation between a narrow notch width - or smaller notch width index and anterior cruciate ligament injury. 8,[11-14] while other studies have failed to reach that conclusion.

Other findings of the study are consistent with earlier work that the FBD is greater in males than females. [15-16]

In conclusion, there is a poor relationship between the FBD and intercondylar dimensions which may be a poor guide or reference point for knee realignment surgery or total alignment arthroplasty.

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