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NORMAL Q ANGLE VALUE AND ITS GENDER BASED VARIABILITY IN A GROUP OF INDIAN POPULATION.

Anatomy

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ABSTRACT

Q angle is used as a clinical measure to assess the lateral line of pull of Quadriceps muscle relative to patella.
Aim: To establish the normal Q angle value and its gender based variability.
Materials and methods: 81 Males and 161 Females of age 25-60, with no lower limb pathology made the study group. The acute angle formed by two intersecting lines 1) from anterior superior iliac spine to centre of patella (CP) 2) from CP to tibial tuberosity was measured with a goniometer.
Results: Mean Q angle value in male and female were 13.13± 2.5 and 13.8 ±2.9 respectively.
In males the mean Q angle on right was 12.9±2.4 and 13.36± 2.6 on left. In females it was 13.8 ±3.0 on right and 13.8± 2.8 on left.
Conclusion: Q angle and Mean Right QA were significantly greater in females

KEYWORDS

Q angle, gender based variability, Goniometer.

INTRODUCTION

The knee joint is one of the major weight bearing joints. It is most commonly injured, contributing to 50% of all musculo-skeletal injuries. Quadriceps femoris muscle angle(QFM) was first described by Brattstrom in 1964 [1]. It is defined as the acute angle formed by the vector for the combined pull of the quadriceps femoris muscle and the Patellar tendon [2,3]. It can also be stated as a composite measure of pelvic position, hip rotation, tibial rotation, patella position and foot position. Anh-Dung says, a change in any one of these alignment could change the position of one or more land marks used to measure the Q-angle [4].

Contraction of QFM pulls the patella laterally. To assess the lateral line of pull of QFM relative to patella, Q- angle is a meaningful clinical measure. It also provides clear information about the alignment of knee joint [5,6]. If Q- angle exceeds the normal, the force of the lateral pull will increase. Insall et al. suggested that an increased Q- angle is indicative of pathological lateral forces on the patella [7]. Thus it is considered as an important index of patello-femoral function and dysfunction [8,9,10]. It is a risk factor for patello-femoral pain, patellar subluxation and dislocation [11,7,12]. Many researchers found that women do have a greater Q- angle than men, may be due to their broader pelvis and shorter femur[13]. Therefore they can be considered to have greater risk for patello-femoral dysfunction (PFD) [6,14].

Conventional methods of finding Q- angle is by measuring the acute angle formed by the intersection of two lines, one drawn from anterior superior iliac spine (ASIS) to centre of patella (CP) and another from CP to tibial tuberosity (TT) [6]. Subject can be in supine or standing position with QFM relaxed [15].

Many studies done worldwide expressed that normal value of Q- angle varies with given population. Establishment of normal Q- angle can be of use to the orthopaedic surgeon and physiotherapist in assessing the success of their treatment [16, 17]. Q- angle assessment plays an important role in sports medicine also.

Its reliability is being questioned by many, but then the reliability and measurement error are properties of any measure [18]. Controversies exist in the establishment of normal Q- angle value. An abnormally high Q- angle (an excess of the normal for a particular population) is considered as indicative of extensor mechanism misalignment.

Some authors state a Q- angle value of 15° to 20 ° is abnormal [19] while some state an angle greater than 18º is abnormal [20] American Orthopaedic association considers 10° as normal Q, while 15°-20° degree as abnormal [21]. Anh-Dung stated that a greater Q- angle may lead to increased retro-patellar pressure which may result in patello-femoral pain syndrome and degeneration of articular cartilage [4]. It can even be a risk factor for anterior cruciate ligament injury [22]. Agleitti et al found a greater Q- angle, 20° or more in males and females with pathologic knees [23]. Insall et al. in their studies on symptomatic knees found a greater Q- angle in patients with patellar pain or instability [7]. So, females with a greater Q- angle can be considered as having a great risk to develop knee joint problems.

Aims and Objectives

To establish the range of Q- angle value in healthy adults and also to evaluate its gender based difference and bilateral variability.

MATERIALS AND METHODS

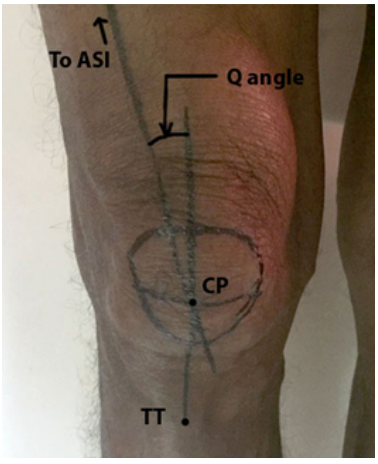
Study group included 242 subjects (81 males, 161 females), without any lower limb pathology or spinal neurological involvement affecting the lower limbs attending the outpatient departments of Amrita Institute of Medical Sciences, Kochi, South India from 2018 to 2019. They were between the age of 25and 60. Clearance was given by the AIMS Ethical Committee.

The procedure was explained to the subjects who then signed the informed consent sought. A single investigator undertook the measurements to obscure observer bias. The measurements were done bilaterally in all subjects with the subject in standing position, big toes touching each other. Using a marker pen ASIS, CP and centre of TT, were marked. Outline of patella was drawn palpating its borders and the CP was marked as the point of intersection of the maximum vertical and transverse diameters of patella. Centre of TT was marked as the point of maximum prominence of tibial tuberosity. Two lines were drawn as below

a) From ASIS to CP and
b) From CP to centre of TT.

The angle formed by the intersection of these 2 lines was measured with a goniometer. [Figure 1].

Figure 1: Photograph showing Q angle.



Statistical analysis

Statistical analysis was performed using IBM SPSS version 20.0 software. Continuous variables were expressed using mean and standard deviation. To test the statistical significance of the difference in the mean values of Q- angle between male and female Student's t -test was used. To test the statistical significance of the difference in the mean values of Q- angle between right and left knee within male and female Paired t -test was used.

Results

Mean Q- angle value of all 484 limbs was 13.57 ± 2.85. Mean Q- angle values for males and females were noted separately. The difference in the mean Q- angle values between the male and female is found to be significant (Table-1).

Table 1: Correlation between mean Q- angle values of male and female

Q angle	Gender	Mean	SD	p-value
	Male (n=81)	13.13	2.5	0.015
	Female(n=161)	13.8	2.9	

Right quadriceps angle (RQA) and left quadriceps angle (LQA) for male and female were noted separately (Table-1). Females were having a significantly greater RQA compared to males (p-value – 0.024),while difference in LQA between male and female was insignificant (p-value – 0.246). In males significant bilateral difference was noted (p-value – 0.009). In females there was no significant bilateral difference (p-value – 0.957).

Table 2: Correlation between RQA and LQA in male and female subjects

		Male	Female	p-value
RQA	Mean	12.9	13.8	0.024
	SD	2.4	3.0	
LQA	Mean	13.36	13.8	0.246
	SD	2.6	2.8	
p-value		0.009	0.957	

DISCUSSION

Studies conducted worldwide expressed that the mean Q- angle value differs with population. Normal value of Q- angle showed a variation from 8° to 22.8° (24,15) in different populations. These can be considered as variations due to races or to differences in methods of measurement, the degree of contraction of quadriceps muscle etc.

Mean Q- angle value in Indian population in the present study is greater than that established by Veeramani et al [25]

Our study shows that females are having a significantly greater Q-angle value when compared with males[Table 1]. Many of the studies done so far also corroborate this findings [Table 3].The greater Q-angle in female may be due to the changes in the positions of ASIS, CP, or TT. Veeramani et al attributed this greater value in females to a greater laterality of TT (26).

Table 3: Q- angle value in different studies

Authors	Year	Number of limbs studied		Mean value of Q angle	
		Male	Female	Male	Female
Aglietti et al (23)	1983	75	75	14± 3°	17 ± 3 °
Woodland and francis(27)	1992	538	514	12.70º	15.80º
Jha and Raza(24)	2000	280	220	12.36°	13.96°
Grelsamer et al.(28)	2005	90	48	13.30º± 4.5	15.70º± 4.5
Omololu et al(15)	2009	708	246	10.6º	21º
Veeramani Raveendranath et al(25)	2009	100	100	10.98º± 1.75	14.48º± 2.02
Islam tarawneh(29)	2016	219	200	14.4	18.42
Present study	2019	162	322	13.13 ± 2.56	13.79 ± 2.96

The present study shows the mean RQA is significantly greater in females compared to males (p value-0.024) while no such significant difference is noted in LQA. (Table-2). Aprajitha Raizada et al. states significant difference of LQA between the two genders while no significant difference in RQA (30).

Many of the previous studies show a significantly greater RQA and LQA in females compared to males (Table-4). A small difference in the placement of CT & TT may make a great difference in Q- angle [31]. Variability can be due to difference in the methods of measurements [6]. Roush et al described methods for validating better accuracy of results [32].

Assessment of Q- angle may help to analyse the possibility for patello-femoral dysfunction and pain. It may also be of use in evaluation of treatment of such patients. It is important in sports medicine also as it can be used to screen the patellar stability in sportspersons.

Table 4: Comparison of RQA and LQA in males and females in different studies

Author	Q angle			
	Male		Female	
	RQA	LQA	RQA	LQA
Livingston and Mandigo et al(1997)(33)	9.5 ±4.6	10.4 ±5.7	10.5± 4.2	12.2± 5.2
Jaiyesimi ,A. O and Jegede, O. O(2009)(34)	12.2 ±3.96	10.38 ±3.49	17.09 ±3.64	14.84 ±3.47
Veeramani Raveendranath et al.(2009)(26)	11.24±1.67	10.24±2.29	14.48± 1.76	14.48 ±3.03
Aprajitha Raizada et al(2019)(30)	8.6±2.20;	8.1±1.83	8.9±2.52	8.8±2.33
Present study	12.9± 2.4	13.36 ±2.6	13.8 ±3.0	13.8 ±2.8

CONCLUSION

Present study states the mean Q- angle for healthy male adults is 13.13 ± 2.5 and for females- 13.8 ± 2.9. The mean RQA was 12.9±2.4 and LQA13.36±2.6 in males and in females the RQA was 13.8 ± 3.0 and LQA was 13.8 ± 2.8. Significant difference was noted in the RQA between the two genders. In males mean LQA was significantly greater than RQA. A normal range of Q- angle for the population, as well as for men and women separately, will help the clinicians in predicting the possibility for developing PFD and in its treatment too. It may help in screening of the athletes. For establishing the cause further studies are to be carried out.

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