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A study on variability of Quadriceps angle (Q-Angle) in a group of asymptomatic medical, paramedical and nursing students of Agartala- A cross sectional study

Tithi Mahalanobish, [1] Pranab Debbarma [2], Manirul Islam [3]

ABSTRACT

Background

The knee joint is a synovial joint present in lower limb of the body. One of the ways to define the force vectors acting on the knee joint is the Quadriceps Angle (Q-Angle) which is defined as the angle formed between the ligamentum Patellae and the extension of the line formed by the quadriceps femoris muscle with its apex at the patella. Higher the Q angle, more are the risks of patellar dislocation and other knee injuries. The present study was aimed to record and analyze the values of Q-angle in a group of asymptomatic medical, paramedical and nursing students of Agartala. The gender-related difference, bilateral variations in Q-angle was also established.

Methodology

This study was conducted at Agartala Government Medical College and GBP Hospital in the year 2024 with a sample size of 200 after satisfying inclusion and exclusion criteria. All the students under study were divided into 2 groups, Group A consisted of 100 male students and Group B with 100 female students. Q angle was measured by goniometric method and the collected data was analyzed using Microsoft excel and SPSS 25.0 software.

Results

It was found that male had a mean Q angle of 11.79 ± 1.68˚(SD) and female had 13.79 ± 1.93˚ (SD). The mean value of right Q angle of male students was 12.03±1.73˚ (SD). Whereas, that of female students was 14.06 ± 2.13˚ (SD). The mean value of left Q angle of male students was 11.55 ± 1.66˚(SD) and that of female students was 13.53±1.72˚ (SD). Out of a total of 200 students, 60 % had bilateral variations in Q angle. Among them, 6% had bilateral variation more than 3˚, 12 % had a bilateral variation of 3˚, 11.5 % of all students had bilateral variation of 2˚ and rest 39.5 % had a bilateral variation of 1˚.

Conclusion

The findings of the present study are in accordance with the fact that female have a higher Q angle than male. The findings of the study would be very helpful for orthopedic surgeons and sports medicine specialists practicing in this region in preventing as well as treating knee injuries.

Key-words: Quadriceps Angle, ligumantum Patellae, quadriceps femoris, goniometric method, Standard deviation (SD).

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INTRODUCTION

The articulatio genus or the knee joint is a synovial joint present in lower limb of the body. This complex joint has an immense clinical and applied aspect. The knee joint bears the weight of the body as well as stress during physical activities. The direction and magnitude of force produced by the quadriceps muscle is responsible for the biomechanics of this joint. The line of force exerted by the quadriceps is lateral to the joint line mainly due to the large cross-sectional area and force potential of the vastus lateralis muscle. Excessive lateral traction of the patella is found to have an association with knee joint pathology.

One of the ways to define the force vectors acting on the knee joint is the Quadriceps Angle (Q-Angle) which is defined as the angle formed between the ligumantum Patellae and the extension of the line formed by the quadriceps femoris muscle with its apex at the patella. Q-Angle is calculated between bisection of two lines at the center of patella; one line is drawn between the anterior superior iliac spine and the Centre of Patella, and extended upwards to bisect the second line drawn between the tibial tuberosity and the Centre of Patella (Figure 1).[1] There are various techniques of measuring the Q Angle, the most effective and easy being the Goniometric method which is performed with a universal plastic gonioscope. In this method, the subject lies down in supine position by keeping the knee extended and the quadriceps relaxed. Then, the center of patella is marked and center of the goniometer is placed over it. One arm of the goniometer is aligned with the line connecting the anterior superior iliac spine and the center of patella and the other arm is aligned with the upward extended line connecting the tibial tuberosity and center of patella. The angle formed by both the arms (Q Angle) is measured.

Normal values of the Q angle are 8 - 12° for men and 10 -20° for women. A Q-angle of 20°-22° is supposed to be the predisposing factor to patellar dislocation and other knee injuries [2]. Larger value of Q angle causes an increase in the lateral force on the patella which may increase the compression stress of the lateral patella on the lateral lip of the femoral sulcus. In some individuals, this lateral vector may become large enough to sublux or dislocate patella. Larger Q angle bears a potential risk for developing patellar subluxation, chondromalacia patellae, patella alta, anterior cruciate ligament injury, or patellofemoral stress syndrome (PESS). This study was aimed to record and analyze the values of Q-angle in a group of asymptomatic medical, paramedical and nursing students of Agartala. The gender-related difference, bilateral variations in Q-angle was also established.

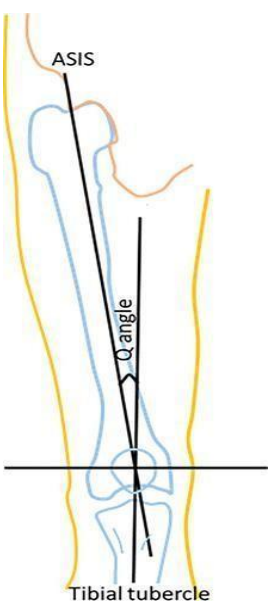

Figure 1. Schematic diagram of Right sided Q Angle. **Axis**: Anterior Superior Iliac Spine **Q Angle**: Quadriceps Angle

MATERIALS AND METHODS

This study was conducted at Agartala Government Medical College and GBP Hospital in the year 2024. Asymptomatic undergraduate students of MBBS, Paramedical and nursing colleges who attended the Department of Anatomy for classes and who provided informed and written consent were selected for the study after considering the inclusion and exclusion criteria. A total of 200 students were studied out of which there were 100 male and 100 female students. All the students of this study were divided into 2 groups. Group A consisted of male students and Group B with female students. Then they were interviewed in a prerecorded performa and data were collected regarding the Right and left Q angle for each group separately. A plastic goniometer (Figure 2) was used to measure the Q Angle of the students in a supine position by keeping the knee extended and the quadriceps relaxed. Then, the center of patella was marked with a delible skin marker and center of the goniometer was placed over it. One arm of the goniometer was aligned with the line connecting the anterior superior iliac spine and the center of patella and the other arm was aligned with the upward extended line connecting the tibial tuberosity and center of patella (Figure 3). The angle formed by both the arms was measured and recorded. The data recorded was then entered in an excel sheet following which statistical analysis was done in Microsoft excel as well as SPSS 25.0 software. The study was conducted after obtaining due ethical approval from the institutional ethics committee.

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RESULTS

In our study, the mean age of male students was 18.6 years with range 18 – 24 and mean age of female students was 18.4 years with range 18-23.

It was found that the mean value of Q angle of all 200 lower limbs in male student group consisting of 100 students was 11.79 ± 1.68°° (mean ± SD) and the same of the female student group of 100 students was 13.79 ± 1.93° (Table 1).

The value of right Q angle of male students was 12.03 ± 1.73° (mean ± SD). Whereas, the value of right Q angle of female students was 14.06 ± 2.13° (Table 1). The value of left Q angle of male students was 11.55 ± 1.66° and that of female students was 13.53 ±1.72° (Table 1). The comparison between the mean values of Q Angles of both limbs (average), right limbs and left limbs in both male and female group was statistically significant with a p-value of 0.006 (Table 2). Out of a total of 200 students, 60 % had bilateral variations in Q angle. Among them, 12 % had bilateral variation of more than 3°, 6 % had a bilateral variation of 3°, 11.5% of all students had bilateral variation of 2°. Rest 39.5 % had a bilateral variation of 1° (Table 3). Comparing values of bilateral variation of Q Angle, irrespective of the groups, it was found that the value of average right Q angle is more than average left Q angle.

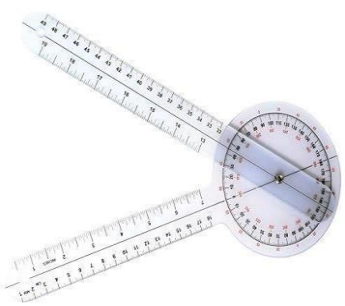

Figure 2. Plastic Goniometer used to measure Q Angle.

Figure 3. Q Angle of a subject being measured

Table 1. Values of Q angle

Group	Limb	Mean ±SD	Range
Male student	Both limb (Average)	11.79 ± 1.68°	9 -18
	Right	12.03±1.73°	
	Left	11.55 ± 1.63°	
Female Student	Both limb (Average)	13.79 ± 1.93°	10-20
	Right	14.06 ± 2.12°	
	Left	13.53±1.72°	

Table 2. Comparison of Q angle (One-way ANOVA test)

Group A	Group B	Limb	p-value	Result
MS	FS	Both limbs (Average)	0.0006	Significant
MS	FS	Right		
MS	FS	Left		

MS: Male Student **FS:** Female Student

Table 3. Degrees of bilateral variation of Q angle

Degree of variation	Male student	Female student	Total
0 degree	46	34	80 (40%)
1 degree	36	43	79 (39.5%)
2 degrees	13	10	23 (11.5%)
3 degrees	4	8	12 (6%)
More than 3 degrees	1	5	6 (3%)
Total	100	100	200

DISCUSSION

This study was conducted in healthy and asymptomatic young students of the 1st academic year of MBBS (medical graduation course), paramedical and nursing courses at Agartala, Tripura. A plastic goniometer was used for measurement and the same method was also used by Ghulyani T et al [3] in their study. The advantages of this method over the others is that it's a very cost effective and non-interventional technique which has no health hazards. Bhat M.A et al [4] in their study conducted at Kashmir, had found that the average Q angle in male was 10.98° and that of in females was 14.48°. But in this study it was found to be 11.79° and 13.79° respectively. The difference is probably due to the age of the study population as the range of age in their study was 20 to 40 years whereas it is 18 to 24 in this study. Another American study conducted by Grelsamer R.P. et al [5] stated that the average Q angle in male was 13.30° and that of in females was 15.70°, the result of which differs from this study and the probable reason being the difference in the ethnicity of the study populations between both the studies.

Veeramani et al [6] in their study conducted at Bangalore, found that 36% of the study participants did not show any bilateral variability and Q angle on the right side was greater than the left side. Whereas in this study it was found that 40% of the participants had no bilateral variability and the Q angle on the right side was greater than the left side. The results of both the studies are nearly in accordance with each other. The following table (4 and 5) compares the findings of few of the previous studies with this study:

Table 4. Q angles in different studies

Author	Year of study	Country	AQA (Male)	AQA (Female)
Grelsamer R.P. et al [5]	2005	USA	13.30°	15.70°
Bhat M.A. et al [4]	2020	India	10.98°	14.48°
Ghulyani T. et al [3]	2021	India	12.48°	14.48°
This Study	2024	India	11.79°	13.79°

AQA: Average Quadriceps angle

Table 5. Bilateral variability comparison with different studies

Author	Year	Result
Livingston et al [7]	1997	L>R

Veeramani et al [6]	2009	R>L
Ghulyani T. et al [3]	2021	L>R
This Study	2024	R>L

CONCLUSION

The findings of this study are in accordance with the fact that females have a higher Q angle than male and the fact is strongly substantiated in this study as all of the subjects belong to the similar age group. The study population included subjects from tribal and non-tribal ethnicity from the state of Tripura, hence there is a further scope of study in comparing the Q angle among different ethnic backgrounds. The findings of the study would be very helpful for orthopedic surgeons and sports medicine specialists practicing in this region in preventing as well as treating knee injuries.

REFERENCES

1. Insall J, Falvo KA, Wise DW. Chondromalacia Patellae. A prospective study. The Journal of Bone and Joint surgery. American Volume. 1976;58(1):1-8.
2. Nandi M, Debb S, Palc JN, Tapadard A, Roye H, Karf C. The "quadriceps angle": Correlation between clinical and radiographic measurements from a study in North Bengal. J Anat Soc India. 2013;62:68-72.
3. Ghulyani T. et al. Study of variability of quadriceps angle (q-angle) in a group of asymptomatic young adults. Int.J.Med.Sci. Educ.2021;8(1):75-82.
4. Bhat M.A. et al. Bilateral Variability of the Quadriceps Angle (Q angle) in an Adult Kashmiri population. JMSCR. 2020;8(4):414- 20.
5. Grelsamer R.P. et al. Men and women have similar Q angles: a clinical and trigonometric evaluation. J Bone Joint Surg Br. 2005;87(11):1498-501.
6. Veeramani R et al.The Quadriceps angle (Q angle) in Indian men and women. Eur J Anat.2009; 13 (3): 105-109.
7.Livingston LA et al. Bilateral Q angle asymmetry and anterior knee pain syndrome. Clin Biomech (Bristol, Avon). 1999;14(1):7-13