

Variation of Q angle with reference to age and sex - A study in central Rajasthan

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Abstract

An understanding of the normal anatomical and biomechanical features of the patellofemoral joint is essential to any evaluation of knee function. One important concept in patellofemoral joint function is the quadriceps femoris muscle angle, better known as the "Q angle".

Keywords: Q angle, Variation, Age, Sex

Introduction

Quadriceps femoris can be divided into four parts, each named individually i.e. rectus femoris, vastuslateralis, vastusmedialis, and vastusintermedius. Rectus femoris arises from the ilium and travels straight down the middle of the thigh. The other three arise from the shaft of the femur and surround it (apart from the linea aspera) from the trochanters to the condyles: vastuslateralis is lateral to the femur, vastusmedialis is medial to it, and vastusintermedius lies in front of the femur. Rectus femoris crosses both hip and knee joints, while the three vasti only cross the knee joint. Cruveilhier in 1840 observed that a contracting quadriceps femoris muscle will seek the shortest route between origin and insertion and stated that "the tendon of the triceps femoris is directed slightly downward and inward and the ligamentum patellae downward and slightly outward, so that the tendon and the ligamentum patellae form an obtuse angle which open laterally." This has subsequently

been referred to as the quadriceps angle (Q) angle and is the angle formed when the line connecting the anterior superior iliac spine (ASIS) and the midpoint of the patella intersects with the line connecting the tibial tubercle to the midpoint of the patella (Paulos et al, 1980).

Aims and objectives

Q angle can be measured reliably and it provides a reasonable estimate of the angle of the quadriceps muscles' pull on the patella in the frontal plane. The Q angle creates a lateral force vector on the patella and predisposes the patella to lateral displacement during activation of the quadriceps. The magnitude of this lateral force vector and the tendency for lateral displacement of the patella are believed to increase as the Q angle increase. An increase in the Q angle also causes an increase in pressure between the patella and the underlying lateral femoral condyle during activation of the quadriceps.

The observations shall be helpful for sports therapist in understanding evaluation of Q angle in athletes as prognostic value for probable knee pathologies that may appear in the future. The observations shall also be useful to physiotherapist and orthopedic surgeon in understanding and dealing with replacement arthroplasty and patellofemoral disorders.

Materials and methods

This study was conducted on 175 adult healthy volunteers. The age range of the participants in the study is from 18-30 years. The participants must have a palpable anterior superior iliac spine, patella and tibial tuberosity to be used as landmarks in the investigation.

All subjects were measured using the same goniometer (transparent, flexible, plastic, full circle goniometer, with two arms (one stationary and lengthened and the other movable arm) and 1° increments).

The following bony landmarks were marked with a marker pen: anterior superior iliac spine (ASIS), centre of patella (CP) and centre of the tibial tuberosity (TT).

Results

175 cases were studied of different age groups from 16 to 30 years.

Discussion

In the present study 175 cases of different age group and of both gender were taken into consideration irrespective of caste, creed and relation of urbanization and rural population.

Out of 175 cases the maximum frequency of age in the present study was observed to be of 24 years with 36 subjects belonged to the study and then is of 19 years with 35 subjects and minimum of 18 years and 27 years as shown in table 1.

Table 2 shows that distribution of frequency of gender in the present study. 102 Males (22%) were observed and 75 females i.e. 41.7%.

Table 1: The distribution frequency of cases according to the age groups.

Sr. No	Age of the subjects (Years)	No. of subjects
1	16	6
2	17	12
3	18	1
4	19	35
5	20	16
6	21	9
7	22	10
8	23	12
9	24	36
10	25	5
11	26	13
12	27	1
13	28	10
14	29	6
15	30	3

Table 2: Shows the distribution of cases according to sex.

Sr. No.	Sex	No. of subjects	% of frequency
1	MALE	102	52.2
2	FEMALE	73	41.7

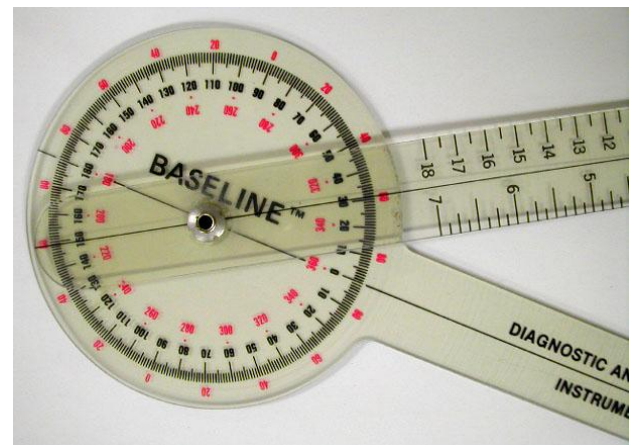


Fig. 1: Goniometer

Summary and conclusion

The present study documents variations in the Q angle in young healthy adult population in Rajasthan. All measurements were made by a single examiner. From the foregoing, we conclude that Q angles are higher in females than males and right and left Q angles are not equal in the same individual.

Previous study had shown that Q angle decreases adjusting for age, weight, pelvic width and gender ($p=0.05$), however the analysis was done only for supine position on right side. Though the mean age, height and weight for both male and female subjects included in that study were higher, we found no correlation between Q angle and gender which was consistent with the study.

On the basis of generalized ligament laxity, more lateralized ASIS (wider pelvis) and relatively shorter femur length (shorter lever arm), the Q angle was accepted to be higher in females, but not proven yet. However, this study showed that the difference in Q angle between male and female was statistically significant ($p < 0.05$). ASIS being so far from patella relative to tibial tuberosity, seemingly important medio-lateral translations have only little effect.

Although women have a wider pelvis in the traditional sense, their ASIS is no more lateralized than in men. It might clearly be different if the most lateral aspect of the iliac wings was used instead. If a woman's ASIS were more lateralized, they would have a higher incidence of patellar instability after knee replacement surgery than men because of more lateral quadriceps pull, which is not the case. Moreover, the surgeon sets the same angle on his femoral intramedullary jig for both men and women, during knee replacement, further suggesting that men and women exhibit similar femoro-tibial valgus. An elevated Q angle equally influence the choice of surgical procedure in a male or female both who requires patellar re-alignment.

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