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Original Research Article

Study on Quadriceps Angle (Q Angle) in an Adolescent and Adult Nepali Population with Anterior Knee Pain

Indra Dhakal[1], Shanta Sharma[2]

[1]Consultant Orthopedic Surgeon, Department of Orthopedics, Lumbini Zonal Hospital, Butwal, Rupandehi, Nepal.
[2]Lecturer, Department of Community Medicine, Devdaha Medical College and Research Institute, Kathamandu University, Rupandehi, Nepal.

Corresponding Author: Indra Dhakal

ABSTRACT

Background: Anterior knee pain (patellofemoral pain syndrome) is a very common problem that poses difficult diagnostic and therapeutic problems. It accounts for up to 74% of knee pain experienced by adolescents participating in sports, with prevalence of 15% in females and 12% in males. Although etiology and pathogenesis of patellofemoral pain syndrome are poorly understood, many predisposing factors suggest an underlying genetic, developmental, or familial abnormality. Various clinical tests have been used to diagnose anterior knee pain but data regarding validity are scarce and inconclusive. Q-angle is the most common test done to identify and treat anterior knee pain. The objective of this study is to evaluate quadriceps angle (Q angle) in patients with anterior knee pain in our setup.
Materials and Methods: A descriptive study was undertaken at Tribhuvan University Teaching Hospital (TUTH), Kathmandu. One hundred patients with symptomatic anterior knee pain presenting to Orthopaedics OPD or Sports Clinic of the Department of Orthopaedics, TUTH, who could meet the inclusion criteria were taken up for the study.
Results: Total124 symptomatic knees of 100 patients (55 male and 45 females) were evaluated. Mean Q-angle was 15.57 degrees; Mean Q-angle of symptomatic knees was 16.62 degree (male-14.55, female-19.05) and 13.84 degrees of asymptomatic knee (male-12.65, female-15.39). Mean q-angle in female was 17.71 degree and in male was 13.81degree.
Conclusions: Q-angle was significantly high in females and symptomatic knee with anterior knee pain. The relationship between Q-angle and knees with anterior knee pain was statistically significant (P-0.001).

Keywords: Anterior knee pain, patellofemoral pain syndrome, Q-angle

INTRODUCTION

Anterior knee pain is the most common knee complaint seen in adolescents and young adults. The rate is around 9% in young active adults and as high as a quarter of all knee problems treated at a sports injury clinic. [1] Nejati et al: found the prevalence rate of AKP to be 16.7% in a study performed in a sports medicine clinic. [2] This rate was similar to that shown by Boling et al: in a study that symptomatic participants from the US Naval Academy. Boling et al found a prevalence of 15% in females and 12% in males. They also observed that the annual incidence of AKP was 33 of 1000 people in female patients, but only 15 of 1000 people in male patients. [3] Nonetheless, not all cases are diagnosed and hence the figure is bound to be even higher. Furthermore, it is to be expected that the number of patients with this complaint will increase because of the increasing

popularity of sport practice. On the other hand, a better understanding of this pathology by orthopedic surgeons and general practitioners should lead to this condition being diagnosed more and more frequently. [4] In spite of its high incidence, anterior knee pain syndrome is the most neglected the least known, and the most problematic pathological knee condition. This is why the expression "black hole of orthopedics" that Stanley James used to refer to this condition is extremely apt to describe the current situation [5]

Also, diagnostic errors, which can lead to unnecessary interventions, are relatively frequent in this pathologic condition. As early as 1922, in the German literature, Georg Axhausen stated that chondromalacia could simulate a meniscal lesion resulting in the removal of normal menisci. [6] In this connection, tapper and hoover, in 1969, suspected that over 20% of women who did badly after an open meniscectomy had patellofemoral pathology. [7] Likewise, John Insall, in 1984, stated that patellofemoral pathology was the most common cause of meniscectomy failure in young patients, especially women. Obviously, this failure was a result of an erred diagnosis and, consequently, of a mistakenly indicated surgery. At present, the problem of diagnostic confusion is still the order of the day. The following data reflect this problem. In surgical series 11% of patients underwent unnecessary arthroscopic meniscal surgery, which, far from eradicating the symptoms, had worsened them. An improvement was obtained, however, after realignment surgery of the extensor mechanism. Finally, physicians who had previously been consulted referred 10% of patients in series to a psychiatrist. [8]

Although the etiology and pathogenesis of patellofemoral pain syndrome are poorly understood, many predisposing factors, including overuse, immobilization, excessive weight, malalignment of the knee-extensor mechanism, congenital anomalies of the patella, a shallow intercondylar sulcus, deficient vastus medialis obliquus, patella alta, chronic patellar subluxation, and so on, suggests an underlying genetic, developmental, or familial abnormality. By excluding anterior knee pain due to intra-articular pathology, peripatellar tendinitis or bursitis, plica syndromes, Sinding Larsen's disease, Osgood Schlatter's disease, neuromas and other rarely occurring pathologies, it is suggested that remaining patients with a clinical presentation of anterior knee pain could be diagnosed with patello-femoral pain syndrome (PFPS). Three major contributing factors of PFPS are: (i) malalignment of the lower extremity and/or the patella; (ii) muscular imbalance of the lower extremity; and (iii) overactivity. [9]

Though there are many clinical tests for diagnosing anterior knee pain, Q-angle is the most commonly used. The Q angle was first defined by Brattstrom. He described the Q angle as an angle with its apex at the patella, and formed between the ligamentum patellae and the extension of the line formed by the quadriceps femoris muscle resultant force. It was later measured using the anterior superior iliac spine (ASIS) as the proximal landmark. The Q angle provides an estimate of the vector force between the quadriceps femoris muscle and the patellar tendon. It is formed by the crossing of two imaginary lines. The first line extends from the ASIS to the centre of the patella (CP). The second line is drawn from the tibial tuberosity (TT) to the CP. The angle formed between these two lines represents the Q angle. The Q angle has come to be accepted as an important factor in assessing knee joint function. An increase in Q angle beyond the normal range is considered as indicative of extensor mechanism misalignment, and has been associated with patellofemoral pain syndrome. [10]

Though it is a common pathology and many factors are thought to be responsible, not many studies have been conducted, so there was a need for study.

This present study has been conducted in an effort to find Q-angle in adolescent and young adults with anterior knee pain and the association between them in the context of Nepal, in Tribhuvan University Teaching Hospital set up.

MATERIALS AND METHODS

This was a descriptive study undertaken at Tribhuvan University Teaching Hospital (TUTH), Kathmandu. Patients with symptomatic anterior knee pain presenting to Orthopaedics OPD or Sports Clinic of the Department of Orthopaedics, TUTH, who could meet the inclusion criteria were taken up for the study. There were one hundred such patients.

Inclusion Criteria:

We studied a non- random consecutive series of all anterior knee pain cases with the following characteristics

(1) Adolescent and young adult (an age between fifteen to thirty years)

(2) A characteristic history and symptoms of patellofemoral pain syndrome in one or both knee

Exclusion Criteria:

1) Post traumatic knee pain

2) Evidence of ligamentous instability or a meniscal tear, on physical examination of the knee

3) Abnormalities indicative of osteoarthritis, osteochondritis dissecans, loose bodies, or other related abnormalities on anteroposterior or lateral weight-bearing radiographs, axial radiograph,

4) Anterior knee pain due to other causes: osteochondritis dissecans, patellar tendinitis, bursitis, Apophysitis (Osgood schlatter's disease, Singig / Johansen / Larsen Syndrome), plica on clinical examination.

5) Systemic illness affecting knee

6) Congenital anomalies of lower extremity

7) Malalignment of lower extremity secondary to trauma

8) Known ankle hip and spine pathology

Procedure:

All patients presenting with non traumatic anterior knee pain aged between fifteen and thirty years were assessed keeping in mind the inclusion and exclusion criteria. Those patients meeting the inclusion criteria were informed about the study and written consent was filled. Then the patients were clinically evaluated and Q-angle was recorded in a Performa. A goniometric method as described by Jha and Raza was adopted. [11] The measurement of the Q angle was performed with the subject supine and keeping the pelvis square. The legs were extended at the knee joint with the quadriceps muscle relaxed. The feet were placed in a position of neutral rotation, such that the toes were pointing directly upwards and the feet were perpendicular to the resting surface. The following bony landmarks were marked with a marker pen: ASIS, CP and centre of the TT. The outline of the patella was drawn with a marker pen, after palpating the borders and making sure that the skin was not stretched in doing so. The CP was defined as the point of intersection of the maximum vertical and transverse diameters of the patella. The point of maximum prominence was defined as the centre of the TT. One line was drawn from the CP towards the ASIS using the straight edge of a measuring tape and represented the longitudinal axis of the femur. Another line joined the centre of the TT and the CP. The second line was extended upwards. The angle formed between the above two lines was defined as the Q angle and measured with a goniometer (Figure 1). [11]

Figure 1: Measurement of the Q-angle. ASIS – anterior superior iliac spine; CP-centre of patella; TT-tibial tuberosity; Q-quadriceps angle.

Statistical Analysis:

The data from the clinical evaluations (Q-angle) were entered in the SPSS software package and were analyzed. We did final analysis of the findings with the help of the statistician; using chi-square tests for analysis of data. Significance was set at $P \leq 0.05$.

Ethical Consideration:

Ethical clearance was taken from the ethical clearance committee of TUTH before the start of the study. Informed consent from all the eligible patients was taken after full explanation about the nature of the study. Consent for publication of the data was also taken from all the participants.

RESULT

We studied one hundred patients with anterior knee pain. Number of patients with bilateral knee pain was 24, so total of 124 symptomatic knees and 76 normal knees was evaluated.

Table 1: Demographic characteristics of the patients;

Characteristics	Percentage (%)
SEX:	
Male	55
Female	45
AGE:(years)	
16-20	30
21-25	38
25-30	32
Side affected:	
right	38
Left	38
both	24
Duration:(months)	
2-6	60
7-12	27
13-18	7
19-24	6
Occupation:	
Student	44
Defense Service holder	12
Player	3
Farmer	7
House wife	24
Doctor	3
Daily wage earner and other	7

Table-1, shows that Right knee were symptomatic in 38 patients while left in 38.Out of total, 55% of subjects were male while 45% were females. Average age of the patient was 23.21 yrs ranging from 16yrs to 30 yrs. Majority of patients were between 21 to 25yrs. Out of 100 patients, 55 were male and 45 female having the ratio of 1.2:1 respectively. Mean duration of pain was 7.16 months, ranging from 2 to 24 months. Majority of patients (60%) presented within 6 months. Forty-four patients were students, 24 patients were house wife, 12 patients belonged to defense service (police, army, guards), 7 were farmer, 3 were players, 3 were doctors and 7 patients were symptomatic in daily wage works.

Figure-2, shows that, Mean Q-angle was 15.57 degrees ranging from 6 to 30 degrees. Peak incidence (70.5%) was present between 11 and 20 degree.

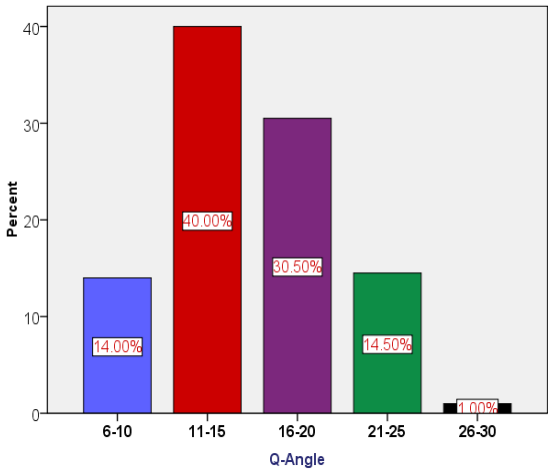

Figure 2: Q-Angle (range)

Table-2, shows that Mean Q-angle of symptomatic knee was 16.62 degree (male-14.55, female- 19.05) and that of asymptomatic knee was 13.84 degree (male-12.65, female-15.39). The relationship between symptomatic and asymptomatic knee was statistically significant (P-0.001).

Table-2: Q-Angle VS Involvement of knee;

	Asymptomatic knee			symptomatic knee		
	Female	Male	Total	Female	Male	Total
Mean	15.39	12.65	13.84	19.05	14.55	16.62
Std. Deviation	3.325	3.176	3.499	4.901	3.925	4.926

Table-3, shows that mean Q-angle in female was 17.71 degree and in male was 13.81 degree. The relationship between Q-angle and sex was statistically significant (P-0.001).

Table-3: Q-angle VS Sex

sex	Mean(degree)	Number	Std. Deviation
Female	17.71	90	4.715
Male	13.81	110	3.753
Total	15.57	200	4.631

DISCUSSION

One hundred patients were evaluated, 38 patients had pain in left knee, 38 patients had pain in right knee and 24 patients had bilateral knee pain. So total, of 124 symptomatic knees were evaluated.

Out of the one hundred patients, 45% were females and 55% males, with female to male ratio of 1:1.2. The reported female to male ratio in the literature is between 1.4:1 and 2.23:1. [12-14] Study by Boling et al found a prevalence of 15% in females and 12% in males. They also observed that the annual incidence of AKP was 33 of 1000 people in female patients, but only 15 of 1000 people in male patients. [3] Gender is a significant predictor for the development of AKP, with females having an incidence that is 2.23 times higher than that of males. The higher incidence of knee pain in females could possibly be due to anatomic factors such as increased pelvic width resulting in excessive lateral thrust on the patella, postural and sociological factors such as wearing high heels and sitting with legs adducted. [15,16] The high incidence of males in our study can be due to more participation in sports and outdoor professional and recreational activities by them. It could also be due to the difference in sample size, and other demographic variations. [17,18]

The age of the patients ranged from 15 to 30 years with mean age of 23.21 years. Peak incidence was between 21 to 25 years. Patients younger than 15 years were excluded because Q-angle measurement can be altered by incomplete ossification of knee. Patients more than 30 years of age were also excluded to avoid early asymptomatic degenerative changes. Samule R. Ward et al in their study reported similar findings with mean age of 25.1 +/- 3.4 years. [19] Melissa G Horton, Terry L Hall et al reported mean age of 22.6 years in their study. [20] In study by Saheli I et al, involving 260 patients with anterior knee pain, the mean age was 22.8 years. [21] Similarly in study by Paolo Aglietti et al, 90 patients with anterior knee pain were evaluated; with an average age was 21 yrs. [22] These findings are consistent with our study. The reason of more incidence of anterior knee pain in this age group could be because of them being the most active group, more participation in sports and outdoor professional and recreational activities thereby making them more prone to stress, and strains and minor repetitive trauma. [8,23]

Rights knee was involved in 38 patients; left knee was involved in 38 patients and both knees in 24. In study by Andrew P.Davies et al, 103 patients aged between 12 and 30 years were evaluated. Of these, 34 had bilateral symptoms, [24] which is similar to our study.

Average duration of pain was 2 to 24 month with mean duration of 7.16 months. Majority (60 %) of patients presented within 6 months. In study by Pekka A. Kannus et al the mean duration of pain was 16months.In our study majority (44%) of patients were students, followed by house wives (24%) students, have to sit for prolonged periods on chairs with flexed knee, which increase the patellofemoral pressure leading to pain. Along with this, students are the most active age group with more involvement in sports activity which predisposes to repeated microtrauma in anatomically predisposed patients. [17,18]

Study shows that mean Q-angle in female was 17.71 degree and in male was 13.81 degree. The relationship between Q-angle and sex was statistically significant (P-0.001). Mean Q-angle of symptomatic knee was 16.62 degree (male-14.55, female- 19.05) and that of asymptomatic

knee was 13.84 degree (male-12.65, female-15.39). The relationship of Q-angle between symptomatic and asymptomatic knee was statistically significant (P-0.001). Q-angle was abnormal in 40.3% knees and normal in 59.7% knees. In the study by M J Emami et al the case group consisted of 100 outpatients (44men, and 56 women) with anterior knee pain. The control group consisted of 100 outpatients (50 men, and 50 women) with the same age distribution, who presented with different problems in the upper extremities and no knee pain, the Q- angle of each knee was measured in all participants. The mean Q- angle for men, women, and all participants in the case group was 15.2, 20.1and 18.0 degrees, respectively. [16] In the study by Paolo Aglietti et al consisting 90 patients with anterior knee pain, average Q angle was 18degree (male-16 degree and female 19 degree). [22] Similarly in study by Amir Haim et al, 61 infantry soldiers with patellofemoral pain syndrome and 25 control subjects were evaluated. The mean Q-angle in soldiers with knee pain was 16.8(+/-) 7 degrees. [25] The results of above studies are similar to our study.

CONCLUSION

Q-angle is and easy and effective clinical test to diagnose anterior knee pain. Q-angle was significantly high in females and symptomatic knee with anterior knee pain. The relationship between Q-angle and knees with anterior knee pain was statistically significant.

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