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Comparison Of Bilateral Quadriceps Angle In Asymptomatic And Symptomatic Males With Unilateral Anterior Knee Pain

A Sra, T Ba, J Oo

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Abstract

Background & Objective: The knee is a complex structure and its evaluation can present a challenge to the clinicians. The quadriceps (Q-) angle assessment is an integral part of such a procedure, as Q-angle influences patella tracking which is necessary for smooth knee joint movement. This study was designed to compare Q-angle in asymptomatic subjects with the corresponding limbs of symptomatic subjects with anterior knee pain (AKP).

Methods: One hundred and forty (140) male subjects, age range 20 and 35 (24.08 □ 2.52) years participated in the study. They were divided into 2 groups; Group (control) A were asymptomatic subjects and group (study) B comprised of subjects with complains of AKP of either the right or left limb. The Q-angle of the subjects was measured in the standing position with the feet positioned in the Romberg stance. The differences in Q-angles within and between the groups were analyzed using the independent t-test (p□0.05).

Results: The results showed a significant difference (p□0.05) in the bilateral Q-angle with the left limb exhibiting higher values compared with the right. The study also showed a statistically significant difference when Q-angle were compared between the control and study groups with greater Q-angle values observed in the study groups (p□0.05).

Conclusion: The study shows that Q-angle is bilaterally asymmetric with left limb having higher value. Findings from this study also show that AKP increased the values of Q-angle. Therefore, it is recommended that Q-angle assessment should be an essential component of the physiotherapy management of knee joint pathology.

INTRODUCTION

Knee pain account for approximately one-third of musculoskeletal problems seen in most primary health care settings.[1,2,3] This complaint is most prevalent in physically active individuals. The knee joint is a complex structure and its evaluation can present a challenge to the clinicians.[2] The importance of a comprehensive assessment of the musculoskeletal system, in particularly that of lower limb during routine medical check-up or pre-treatment assessment can not be over emphasized. The quadriceps (Q-) angle assessment is an integral part of such a procedure, as Q-angle influences patella tracking which is necessary for smooth knee movement.[4,5] Patella tracking is the normal movement of the patella on the femoral groove during active movement of the knee joint.

The Q-angle is an important indicator of biomechanical function in the lower extremity and is intended to provide some indications of the direction of the net lateral force applied to the patellofemoral joint by contraction of the quadriceps muscles. It is also a quantitative measurement of patella position with respect to lower extremity alignment.[3, 5]

The Q-angle is the acute angle formed by the resultant line of force of the quadriceps femoris muscle on the base of the patella, and the line of pull of the patella ligaments on the apex of the patella.[6, 7] It is a reflection of the force of the quadriceps muscles on the apex of the patella.[8] The angle is delineated by drawing an imaginary line from the Anterior Superior Iliac Spine (ASIS) to the centre of the patella and to the midline of the tibia tuberosity (Figure 1).[7, 9]

Overwhelming evidence exists to show that females (range =

15°-20°) have a higher Q-angle (because of wider pelvis) than male (range = 12°-15°).[10]A Q-angle in excess of 20° may lead to knee joint instability and lateral patella tracking.[10]Lateral patella tracking over a long period of time may cause breakdown of the patello-femoral joint surface resulting in petello-femoral pain also called anterior knee pain (AKP), and it is often cited as a risk factor for the occurrence of chondromalacia patellae and patello-femoral subluxation or dislocation.[10, 11]

Anterior knee pain (petello-femoral pain), also called “runner's knee”, is often attributed to malalignment and maltracking of the patella within the patellofemoral joint.[3] Furthermore, AKP is a symptom commonly presented to general practitioners especially by young active individual, though its etiology is said to be multifactorial.[2, 12]It thus represents a significant challenge for patients and clinicians.[2]

Patients may experience AKP at any age, the majority being seen in adolescents before skeletal maturity and in young adults, and could be said to be biomechanical in nature.[2] It tends to occur mostly in very active sports persons who are growing rapidly.[2] Anterior knee pain typically occurs with activity and worsens when descending stairs or hills and can also be triggered by prolonged sitting and it is a limiting factor in the performance of functional activities of daily living.[1, 2]

Deviations from the normal range of values obtained from Q-angle measurement have been implicated in several knee disorders.[7] It can thus be inferred that measuring Q-angle forms an essential part of the assessment of knee joint pathology. AKP could be unilateral (affecting only one limb) or bilateral (affecting both limbs). The unilateral one is commonest in traumatic (acute) condition e.g. sports injury, while the bilateral is mostly found in rheumatic or arthritis (chronic) condition, e.g. osteoarthritis of the knee.[13]

Previous studies have evaluated bilaterally symmetric of Q-angle.[10, 14, 15] Assessment of Q-angle in individuals with AKP is uncommon, there is therefore the need to evaluate Q-angle in asymptomatic subjects and compared with symptomatic subjects with AKP. Therefore this study was designed to evaluate Q-angle in asymptomatic male subjects and compare with the corresponding limbs of symptomatic male subjects with unilateral AKP.

MATERIALS AND METHODS

SUBJECTS

One hundred and forty (140) subjects, encompassing both asymptomatic (no AKP) and symptomatic (unilateral AKP, from sports injury) participated in the study. The subjects comprised of 70 asymptomatic and 70 symptomatic (35 each for the left and right knee side AKP) participants. All subjects were males and were between the ages of 20 and 35 (24.08 2.52) years. The subjects were recruited from the students of the College of Medicine University of Lagos, and the sport men from the Medical centre of National Stadium, Lagos Nigeria.

Subjects were medically screened with history and a detailed physical examination before the commencement of experiment. The inclusion and exclusion criteria for asymptomatic subjects were; individuals with no history of AKP, and individuals with normal gait and posture. Criteria for symptomatic subjects were; individuals with unilateral AKP of either of the limbs. Subjects with bilateral AKP and knee deformities such as genu varum, valgum, and recurvatum were excluded. All subjects were right dominant.

The subjects were divided into 2 groups;

Group A: This is the control group of asymptomatic male subjects

Group B: This group consisted of active sportsmen with either right or left sided AKP.

INSTRUMENTATION

Universal goniometer (Lafayette Instrument Co., Inc) graded from 0°- 360°

Water soluble marker (Steadler) and meter rule

Ethanol/methlated spirit and cotton wool

RESEARCH DESIGN

A cross-sectional study design was employed for the study.

PROCEDURE

The local Ethics Committee approved the study protocol and all subjects gave written informed consent. The subjects were briefed on the procedure for the study.

Also, demographic data (age), height and weight were measured respectively.

MEASUREMENT OF THE Q-ANGLE

The Q-angle has the ASIS, mid-point of the patella and the tibia tubercle as standard anatomical landmarks (Figure 1).[7] The measurements were taken in standing positions with the subjects decently exposed to show the landmarks. The anatomical landmarks were located through palpation and were then marked with a water soluble marker. Each subject assumes the Romberg stance anatomical position with the knees extended without voluntary quadriceps contraction. The anatomical landmarks already marked were then joined by the use of a meter rule and a marker.

With the pivot of the goniometer placed on the mid-point of the patella, the stationary arm on the line adjoining the ASIS to the mid-point of the patella, and the moveable arm placed over the line adjoining the tibia tubercle to the mid-point of the patella. The angle thus formed between the two arms of the goniometer was then measured and recorded as the Q-angle. Bilateral measurements of the Q-angle were taken and recorded on each subjects.

STATISTICAL ANALYSIS

Data was analyzed using the descriptive statistics of mean and standard deviation (X SD). Inferential statistics of independent t-test was used to compare for bilateral Q-angle symmetry as well as the Q-angle values between the corresponding limbs of the asymptomatic and symptomatic subjects with unilateral AKP. Level of significance was set at the p<0.05.

RESULTS

Table 1 shows the demographic and anthropometric data of the subjects. Statistical analysis using independent t-test shows there was no significant difference in the demographic and anthropometric data between the two groups (p 0.05).

The comparison of the bilateral Q-angle values for symmetry for the asymptomatic subjects (group A) using independent t-test is shown in table 2. The results showed there was a significant difference in the Q-angle values obtained with the left limb having higher values compared with the right limb.

The comparison of the corresponding limbs of asymptomatic (group A) and symptomatic subjects (group B) with unilateral AKP using independent t-test is shown in table 3. There was a significant difference in the Q-angle obtained in the limbs of the asymptomatic subjects and the corresponding limbs of the symptomatic subjects (p 0.05).

Figure 1

Table 1: Demographic and Anthropometric Data of the Subjects.

Variables	Group A Asymptomatic	Group B Symptomatic	t	P value
Age (yrs)	24.02 ± 2.66	24.14 ± 2.38	0.24	0.81
Weight (kg)	69.64 ± 11.24	74.04 ± 11.79	1.90	0.06
Height (m)	1.85 ± 0.09	1.81 ± 0.09	1.18	0.24

Figure 2

Table 2: Comparison of Bilateral Q-angles for symmetry in the asymptomatic subjects.

Limb	X ± S.D	t	p value
Left	15.70 ± 1.72	-9.249	<0.001*
Right	12.88 ± 1.30		

*** Indicates significant difference at P < 0.05 level**

Figure 3

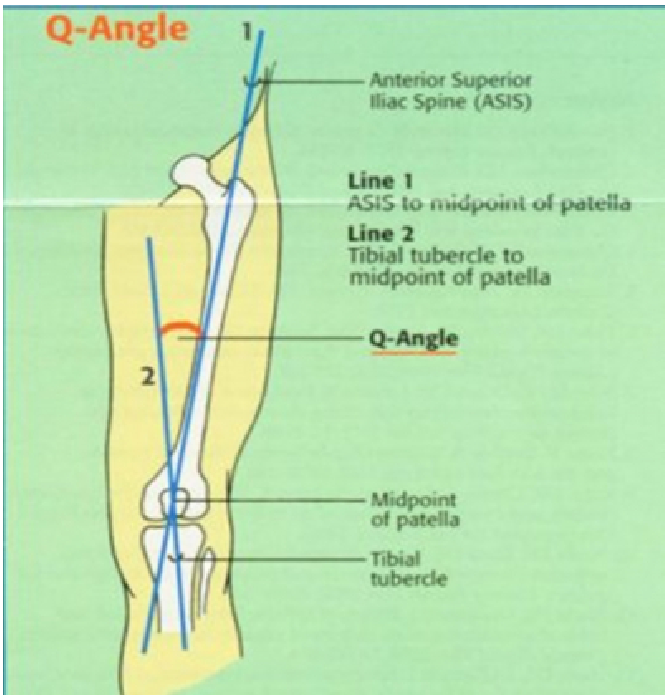
Table 3: Comparison of the corresponding limbs of asymptomatic and symptomatic subjects with unilateral anterior knee pain.

	Asymptomatic	Symptomatic		
Limb	X ± S.D	X ± S.D	t	p value
Left	15.70 ± 1.72	21.15 ± 1.96	-12.650	<0.001*
Right	12.88 ± 1.30	21.22 ± 2.09	-20.830	<0.001*

*** Indicates significant difference at P < 0.05 level**

Figure 4

Figure 1: Q-angle Representation (Horton & Hall, 1989).



DISCUSSION

The results showed that there was no significant difference between the ages, weights and heights of the study and control groups. The differences thus observed between the groups were not likely to be due to differences in the physical characteristics.

It was hypothesised that there will be no significant difference in the Q-angle values obtained bilaterally in the asymptomatic subjects. It was also hypothesised that there will be no significant difference in the Q-angle obtained on comparison with the corresponding limbs of asymptomatic and symptomatic male subjects with unilateral AKP.

While some studies[10, 14, 15] reported bilateral symmetry of Q-angle, others[13, 16]claimed bilateral asymmetry. This study corroborated the bilateral asymmetry of Q-angle with the left side exhibiting higher values compared with the right limb. The reason adduced for this finding is that quadriceps training tends to lower the magnitude of Q-angle, since the right limb is often the dominant limb in most people and its frequently more in use e.g. ball kicking compared with the left.[13, 14] This observation was also reported by Livingston and Mandigo[10], who reported that Q-angle is not bilaterally symmetric, with the magnitude and direction of the observed asymmetry varying according to whether an individual is asymptomatic, unilaterally symptomatic or bilaterally symptomatic with AKP.

It was also observed from the study that Q-angle is significantly increased in the presence of AKP, irrespective of the limb affected. This finding was also supported by previous studies.[3, 10]However, Cowan,[17] also agreed with this finding, but stated that Q-angles above 20° is commonly viewed as anatomic risk factor in the aetiology of overuse injuries of the knee, of which AKP is often a presenting symptom.

It was also observed in this study that the mean Q-angles of the symptomatic subjects in the right limb was higher (21.22 2.09) than that observed in the left symptomatic subjects (21.15 1.96). This is quite opposed to what was obtained in the asymptomatic subjects. There is however little evidence in literature regarding this observation. It may be postulated that the probability is high that the right limb of symptomatic subjects may have suffered greater trauma in addition to other intrinsic factors compared with the left since the right limb is dominant in all the subjects. However, it may be difficult to conclude thus, hence study may be done to further investigate this observation.

CONCLUSION

The result of this study shows that Q-angle is bilaterally asymmetric with left limb having higher value compared with the right. Findings from this study also show that AKP increased the values of Q-angle. Therefore, it is recommended that Q-angle assessment should be an essential component of the physiotherapy management of knee joint pathology. Furthermore, the measurements should always be bilateral, irrespective of whether it is unilateral or bilateral knee involvement.

In conclusion, correlation between pain intensity in subjects with anterior knee pain and Q-angle may further be evaluated, and the effect of anthropometric parameters such as weight, height, BMI, and gender on Q-angle may be evaluated in further study. Also all subjects in this study were right dominant, further study may be conducted on the left dominant subjects.

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Author Information

Akinbo Sra, PhD
Department of Physiotherapy, College of Medicine University of Lagos

Tella Ba, M.Sc.
Department of Physiotherapy, College of Medicine University of Lagos

Jimo Oo, B. Pt
Department of Physiotherapy, College of Medicine University of Lagos