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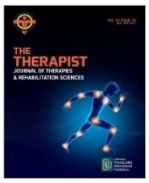

Original Article

Q Angle: Effects of Isometric Quadriceps Contractions and Body Position

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Key Words: Quadriceps angle, patello-femoral pain, anterior knee pain , isometric contractions

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ABSTRACT

Quadriceps angle or Q angle is quadriceps femoris angle and also called extensor muscle angle. It is formed from anterior superior iliac spine to the patellar center and from center of patella to tibial tuberosity. Q angle is linked many knee disorders like patella-femoral pain and varied in male and females. **Objective:** To evaluate the effect of change in anatomic positions like lateral deviation of tibia, tibial tuberosity and hyper-extended knee on the Q angle value **Methods:** Study is cross sectional in nature, randomized control trial adopted to select the healthy subjects without any recent and past knee injury. Ninety patients including 55 females and 35 males were chosen randomly. Q angle were measured goniometrically with contracted and relaxed state of quadriceps in both supine and standing position **Results:** The results shows that females have higher Q angle than male students and while during contracted state as compared to relaxed position. Q angle is greater in supine position than in standing position **Conclusions:** Females have higher Q angle and has more chances of knee injuries as compared to men. Different foot positions also affect the value of Q angle in supine and standing as well.

INTRODUCTION

Quadriceps angle is called as Q angle or extensor muscle angle. It is formed at the anterior lower side of the thigh [1]. It is formed between center of patellar bone to straight in line with anterior-superior iliac spine (ASIS) and from patellar center to tibial tuberosity [2]. While measuring a Q angle an imaginary or temporary line is drawn straight from anterior superior iliac spine (ASIS) to the center of patella and another line from central patella to the tibial tuberosity, thus the angle formed between these is the Q angle. The Q angle is a view of the alignment of the quadriceps muscle relative to the deep skeletal structures of the hip, thighbone and shinbone. The Q angle is of greatest interest for clinicians and researchers and an important diagnostic tool for assessment of patellofemoral mechanics [3-5].

Patellofemoral pain is the most common knee pain and this syndrome is also the cause of anterior knee pain [6]. Patellofemoral syndromes (PFPS) often cause pain and is generally relevant to the front side of the knee [7]. An extremely essential point in joint performance of patella and femur is the Q angle. Malalignment of patella is the extreme vital cause for anterior knee pain [8]. An alignment of patellar bone is often checked by the measuring extensor muscle angle [9,10]. A high Q-angle exaggerates the lateral torsional force on extensor muscle and increases the risk of disorders of patellofemoral joint and study was undervented to guage the link among extensor muscle angle and the anterior knee pain [11].

In sports medicine, the most common pathological conditions of knee involve the joint of patella and femur and PFPS. Among athletes females suffer more probably than males in knee syndrome. PFPS is resulted by variety of reasons, as well as extensor muscle fragility, enhanced Q-angle, decline or no performance of legs loss, increased patellar mobility, ligament elasticity loss, and tightness of lateral flexor fibrous band [12,14]. Bilateral symptoms usually occur and onset is typically deceptive. Some specific activities, like sitting for very long time, stair decency and squats typically worsen pain. One of the reasons for this abnormal tracking is also the delay of onset activity of the vastus medialis oblique (VMO)

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compared to the vastus lateralis (VL) [15-17]. Additionally, resistive activities, abnormal patello-femoral tracking also results femur to rotate medially below the patella, instead moving laterally on the thighbone [18]. The reliable Q-angle are often measured, and it gives an appropriate estimate of the angle of pull on the patella within the frontal plane of the quadriceps femoris muscles. Q angles commonly fluctuate from fifteen to twenty degrees [19]. The quadriceps inserted in patella is through a common tendon, rectus femoris muscle (RF), vastus medialis (VM) and lateralis muscle (VL) in the middle layer, and vastus intermedius (VI).The medial patellofemoral ligament (MPFL) is more common than the lateral femoral patella ligament (LPFL), contr ibuting its portion as the patella's passive medial stabilizer.The extensor muscles play a crucial part in patella and femur joint function, investigating the clinical applications of its incredibly varied anatomy is of clinical significance with regad to joint pathologies and Total Knee Arthoplasty failures [20]. The objective is to investigate Q angle values differences in supine and upright standing in both contracted and relaxed quadriceps in order to determine incidence of knee pain and injuries and the effect of isometric contractions on q angle in both positions to analyze differences in young, healthy adults.

METHODS

It is a cross-sectional type of survey. Duration of study was almost 4to 6 months. The sample size was 90. The Non-probability of convenient sampling is used. Inclusion criteria includes Healthy male and female students, 14-28 years of age, voluntarily participated, participants with no past history of hip and knee. Exclusion criteria includes: Surgery of ankle, hip, knee and spine, Knee dislocation, Edema, Patellar instability, Leg length discrepancy, Osteoarthritis, Tendinopathy, Muscle or joints injuries. Ninety-five students were selected including 55 females and 35 male students of age 15 to 28 years. Goniometer is used to measure Q angles in four positions. In standing with quadriceps relax and contracted state and In supine with quadriceps relaxed and contracted state.

RESULTS:

Descriptive statistics shows that among the total population the SD±3.920 and their minimum and maximum were 15 and 28 respectively and their sum of ages were 1796. Among the participants 35(38.9) were male and 55(61.1) were females and SD±490. The mean height from 4.6 to 6.0 ft is 5.447 and SD±3356. The mean weight from 45 to 90Kgs, ages of all individuals was 56.14 and SD±10.98 years. In supine with relax quardriceps the frequency of 19(21.1%),6(6.7%)13(14.4%),4(4.4%),4(4.4%),7(7.8%),19(21.1%),8(8.9%)1(1.1%) (Table 1). The SD±2.77 and their minimum and maximum were 10 and 20 respectively. In supine with contract quardriceps, The SD is 2.740 and their minimum and maximum of total population 90 is 8 and 20 respectively. Of total population 2 of them was(2.2),3(3.3),16(17.8),10(11.1),12(13.3),8(8.9),14(15.6),1(1.1). The SD of total population of 90 in standing with quadriceps relaxed in standing is± 2.90 and their minimum and maximum is 6 and 20 (Table 2). The frequency 1 is (1.1%),2(2.2%),12(13.3%),6(6.7%),11(12.2%),5(5.6),4(4.4),5(5.6%). The SD of total population of 90 in standing position with quadriceps contracted is± 2.567 and their minimum and maximum is 6 and 18 respectively (Table 2).

Supine with Quadriceps in relax position

N	90
SD	2.778
Minimum	10
Maximum	20
Mean	13.63

N	Frequency	Percent
15	19	21.1
.16	6	6.7
17	13	14.4
18	4	4.4
19	7	7.8
20	19	21.1
16	8	8.9
17	4	4.4
18	7	7.8

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19	2	2.2
20	1	1.1
Total	90	100.0

Table 1: The SD±2.77 and their minimum and maximum were 10 and 20 respectively. In supine with relax quardriceps the frequency of 19(21.1%),6(6.7%)13(14.4%),4(4.4%),4(4.4%),7(7.8%),19(21.1%),8(8.9%)1(1.1%)

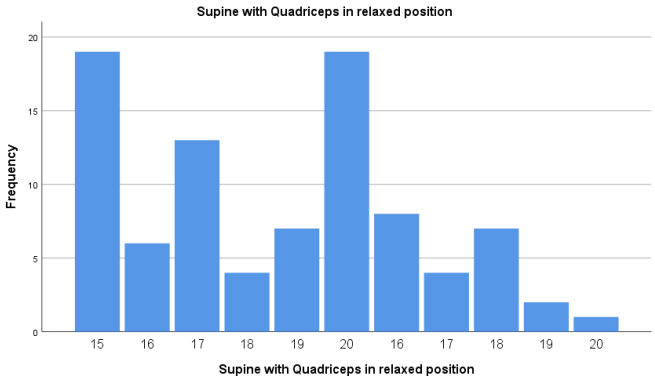

Figure 1: The SD±2.77 and their minimum and maximum were 10 and 20 respectively

Supine with Quadriceps in contracted position

N	90
SD	2.740
Minimum	8
Maximum	20
Mean	12,98

N	Frequency	Percent
13	2	2.2
14	3	3.3
15	16	17.8
16	10	11.1
17	12	13.3
18	10	11.1
19	8	8.9
20	14	15.6
16	8	8.9
17	1	1.1
18	3	3.3
20	3	3.3
Total	90	100.0

Table 2: The SD is 2.740 and their minimum and maximum of total population 90 is 8 and 20 respectively. Of total population 2 of them was (2.2),3(3.3),16(17.8),10(11.1),12(13.3),8(8.9),14(15.6),1(1.1)

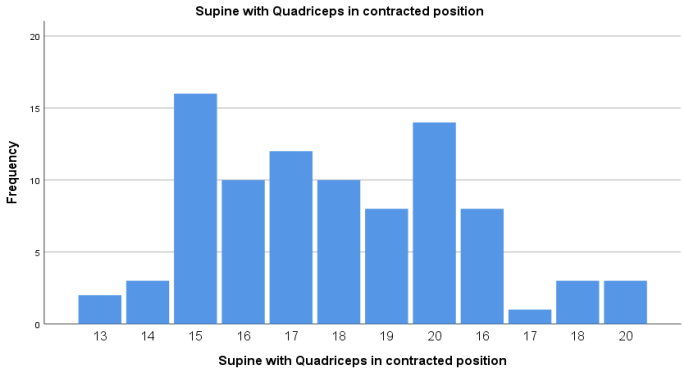

Figure 2: The SD is 2.740 and their minimum and maximum of total population 90 is 8 and 20 respectively

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Standing with Quadriceps in relax position

N	90
Std.deviation	2.904
Minimum	6
Maximum	20
Mean	13.71

N	Frequency	Percent
11	1	1.1
13	2	2.2
14	2	2.2
15	12	13.3
16	2	2.2
17	12	13.3
18	6	6.7
19	11	12.2
20	26	28.9
16	5	5.6
17	2	2.2
18	4	4.4
20	5	5.6
Total	90	100.0

Table 3: The SD of total population of 90 in standing with quadriceps relaxed in standing is± 2.90 and their minimum and maximum is 6 and 20. The frequency 1 is (1.1%),2(2.2%),12(13.3%),6(6.7%),11(12.2%),5(5.6),4(4.4),5(5.6%)

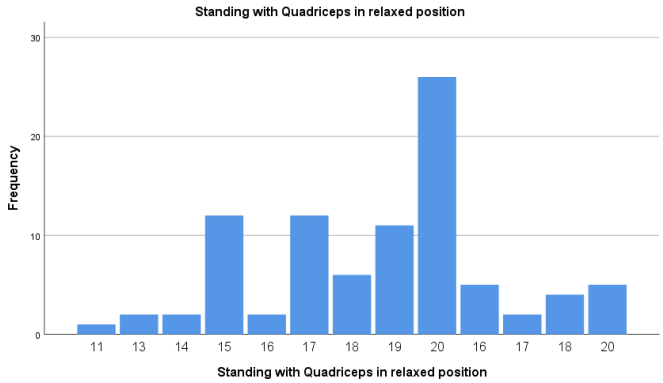

Figure 3: The SD of total population of 90 in standing with quadriceps relaxed is± 2.90 and their minimum and maximum is 6 and 20

Standing with Quadriceps in contracted position

N	90
SD	2.567
Minimum	6
Maximum	18
Mean	12.17

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N	Frequency	Percent
11	1	1.1
13	1	1.1
14	4	4.4
15	26	28.9
16	13	14.4
17	10	11.1
18	11	12.2
19	2	2.2
20	10	11.1
16	4	4.4
17	7	7.8
18	1	1.1
Total	90	100.0

Table 4: The SD of total population of 90 in standing position with quadriceps contracted is±2.567 and their minimum and maximum is 6 and 18 respectively

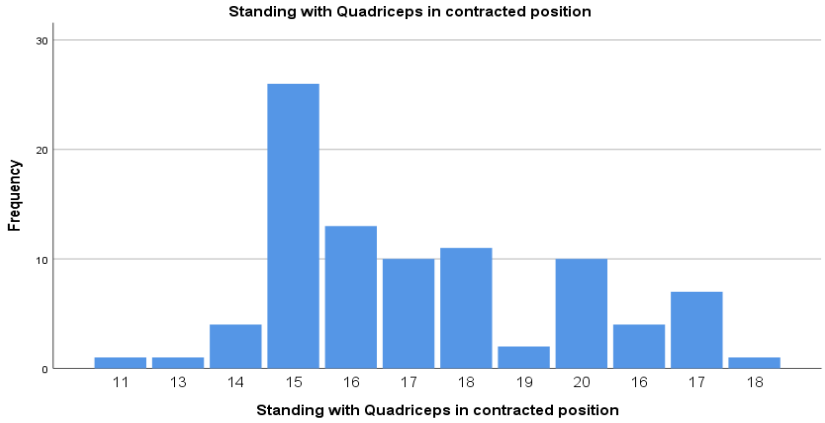

Figure 4: The SD of total population of 90 in standing position with quadriceps contracted is±2.567 and their minimum and maximum is 6 and 18 respectively.

Q Angles values in relaxed and contracted state of standing and supine position of both men and women

Q Angles	Mean	SD	Range
SuRQ	13.63	2.778	10-20
SuCQ	12.98	2.740	8-20
StRQ	13.71	2.904	6-20
StCQ	12.17	2.767	6-18

Table 5: Descriptive statistics during four test conditions of supine and standing with quadriceps relaxed and contracted state for both men and women. SuRQ (In supine with relaxed quadriceps) SuCQ (In supine with contracted quadriceps), StRQ (In standing with relaxed quadriceps),StCQ (In standing with contracted quadriceps) (Table 5).

DISCUSSION

The main outcomes of this study are that women have higher Q angle than men because females have greater pelvic width. During isometric contractions Q angle decreases when compared to relaxed state of quardriceps muscle. Different body positions like standing and supine changes Q angle values significantly and other conditions like medial or lateral rotation of foot, pronation, supination, hyper-extended knee also has greater impact on Q angle values. The subjects with high Q angle were mostly females and have greater incidence of knee pain and injuries. Medial and lateral rotation of tibia during measurement also has an effect on Q angle values. The results support other reports that females have higher Q angle than man and also the difference of Q angle in isometrically relaxed and contracted state are not related to gender but depends upon on the position of patella, pes planus, hyperextended knee, medial and lateral rotation of foot.

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CONCLUSION

Q angle values are different in male and females, as females have higher Q angle and greater pelvic width. During contraction the position of patella changes and Q angle decreases regardless of gender. Q angle measurement procedure should be standardized so that accurate results can be find as q angle differs during relaxed and contracted state of supine and standing.

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