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A REVIEW ON COMPARISON OF Q-ANGLE IN DIFFERENT ATHLETIC SPORTS

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Abstract: Objective – Seek out research that indicates whether the Q angle aids or hinders particular sports. Methodology- Using an online bibliographical database, we were able to find articles published in journals between 1998 and 2021. All the studies that were used in the meta-analysis were of high quality. Thirty-one studies were suitable in every way. Result - It was determined through statistical analysis that the Q angle might have both positive and negative effects on several sports. Most studies have shown that patellar alignment is affected by both positive and negative variations in Q angle. Conclusion-Statistical analysis suggests that Q angle may have both positive and negative effects on a wide range of sports. Q angle has been shown to influence patellar alignment both positively and negatively.

Index Terms **- Athletes, Injuries, Patellofemoral syndrome, Sports.**

I. INTRODUCTION

Quadriceps angle (Q-angle) is a vector measure used to quantify the strength of the extensor mechanism, which is created by the quadriceps muscle and the patellar tendon (Toby O.Smith et al.,2008). Two axes, one beginning at the q angle and the other at the patellar centre, lead to the tibial tuberosity. The Q-angle characterises how the force vector produced by the quadriceps muscle is oriented with respect to the frontal plane. I looked at what the (Hassan Daneshmandi et al., 2011). It may be helpful in determining patellofemoral dysfunction (Toby O.Smith et al.,2008). In physiotherapy and orthopaedics, the Q angle is a commonly used measurement. Instead of directly measuring the q angle, it is more common to infer it from other data in practise. A positive and linear link between q angle and the quadriceps pull on the patella is observed, however, in a computational model. In the medical field, a two-shanked, handheld goniometer is commonly used to manually measure Q angles. The goniometer is unreliable because of its poor precision and reliance on the operator. Radiographs, which are two-dimensional projections to a frontal plane, are employed for calculating the q-angle or verifying the accuracy of hand-measurements. However, only in three dimensions can you use Q-angle coordinates. Inaccurate visual results may be achieved when using a 3D body model (ANN-KATRIN STENSDOTTER, PER-IVAR ANDERSSON et al,. 2009). Exercise is excellent for both men and women, and its value to human health is well documented. There can be wide ranges in how often, how hard, and how long people exercise depending on factors including gender, age, and the kind of exercise being performed. For the purposes of this definition, we will use the term "sport" to refer to any competitive physical activity that follows a set of defined rules. This finding was reached by a team of academics (Mohamed EE et al., 2012). Q-angle is measured by extending the knee in the frontal plane and observing the resulting angle between the quadriceps muscle and the patellar tendon. There is evidence to show that a high Q-angle (greater than 15-20 degrees) is an anatomic risk factor for knee conditions like chondromalacia, subluxation/dislocation, knee extensor dysfunction, and patellofemoral discomfort. (E.T.A. member Lori A. Livingston) It has been theorised by some that the Q-angle can provide insight into the foot position, knee position, hip rotation, and tibial torsion of an individual. However, there is a lack of studies examining the full scope of anatomical factors that affect q-angle in athletes. This is due to the fact that a change in any of these alignment characteristics could cause a shift in the location of one or more landmarks needed to determine the q-angle and, thus, its magnitude. (Hassan Daneshmandi et al. 2011). The net lateral force applied to the patelafemoral joint during quadriceps contraction can be calculated by observing the q angle. An increase in Q angle increases contact pressure on the lateral side of the patella, while a decrease in Q angle increases pressure on the medial side of the kneecap. The Q-angle is influenced by the strength of the vastus lateralis and vastus medialis muscles; a stronger vastus lateralis decreases the Q-angle, and a stronger vastus medialis increases it. Thus, the Q-angle can be used as a quantitative measure of quadriceps muscle imbalance. (H Daneshmandi et al.,2010). In order to evaluate patellofemoral mechanics, doctors and coaches use the quadriceps angle. Assessing where the quadriceps femoris muscle attaches to the pelvis, thighbone, and lower leg is a clinical assessment. Misalignment in the extensor mechanism has been linked to conditions such as patellofemoral pain syndrome, hypermobile knee joints, and patellar instability.

Available data suggest that the Q-angle is a crucial characteristic for diagnosing and classifying lower-limb injuries incurred in sports. (Ali Fatahi et al., 2017). It is widely believed that biological variations between the sexes are the fundamental cause of the observed trend that females typically have larger Q angles than males. This belief is widely held due to the stereotype that women have a more narrow gynecoid pelvis. Among female athletes, a higher QA is associated with a higher incidence of knee injuries. Females have an average QA of 15.8 (+/-4.5) degrees, whereas males have an average QA of 11.2 (+/- 3.0) degrees, per Horton and Hall. It is possible that if QA is increased, contact pressure on the patellofemoral joint will rise. (Mohamed EE et al., 2012). As the quadriceps tighten, the space between the spina iliaca anterior superior and the tibial tubercle shrinks. The Q-angle is less when the quadriceps contract because the patella is contained within the tendon of the musculus quadriceps femoris. The Q-angle of an athlete is associated with knee pain and, possibly, the need for knee surgery. Overuse can cause the quadriceps to tighten and cause pain because they can increase the force with which they pull on the kneecap (patella).(Hahn T et al,. 1997). The evidence supporting the efficacy of exposing students to the arts and sports is substantial. Some have speculated that the impact of clothing colours on individuals could lead to noticeable changes in how they see things. White, for instance, is commonly linked with purity, serenity, and fortitude. The Q angles used by football players and wrestlers may have a positive effect on their beauty without putting them at risk of injury. An abnormally large Q-angle causes the quadriceps femoris muscle to apply an abnormally large lateral stress to the patella, which can aggravate preexisting disorders such patellofemoral pain syndrome. (Murat sen, Cuma Ece et al,. 2019)

Patellar subluxation and patellofemoral joint dysfunction are common knee problems among athletes who participate in contact sports like football, basketball, and volleyball. These kinds of injuries are frequently caused by Q-angles. A bigger Q-angle causes the quadriceps femoris muscle to put more lateral strain on the patella, which can lead to patella-femoral disorders. The Q-angle can be used as a diagnostic tool to reveal an uneven effort from the quadriceps. (Uduonu, E.M, Ezeukwu, A. O et al,. 2018). Surgery to medialize the patella is commonly used to treat people with knee pain or arthrosis caused by a high Q-angle. Among these are adjusting the patellar tendon's tibial connection, strengthening or weakening the quadriceps, and stretching the lateral retinaculum. Although these methods are used to treat aberrant patellar tracking caused by a high Q-angle, nothing is known about how the Q-angle affects knee kinematics. Studies have revealed that too much medialization of the patella might increase the pressure exerted on the kneecap by the thighbone (patellofemoral contact). (Yasayuki Mizuno, Masaru Kumagai et al,. 2000).

METHEDOLOGY

There were 31 studies gathered, of which 12 were included in the analysis. All twelve studies have a good level of methodology. The weight of the evidence was determined by evaluating the quality of studies using a cohort or case-control design. To locate publications on A study of the comparison of Q angle in various athletic activities, the following keywords were used to search the Medline database: Q-angle, Sports, Injuries, Male and female athletes, Q-effect angle's on athletes. More publications have been located using PubMed, Google Scholar, and government websites. The publications were selected based on their abstracts and reference links for articles that fit our inclusion criteria, and a small number of them were included into our research. The selected articles utilised at least one intervention and comprised systematic reviews and cross-sectional research. All relevant works published between 2000 and 2020 are included in the study.

Analysis of the article reviewed

CHARACTERISTICS OF THE INCLUDE STUDIES-

AUTHOR	OBJECTIVE	PROCEDURE	DISCUSSION	RESULTS
1. 1. Mohamed EE,2. Useh U²,3. Mtshali BF	Three anatomical features—the quaternary angle (Q), pelvic width (PW), and Intercondylar notch (IC) width—were shown to be significant predictors of knee injury in female South African soccer players.	Twenty-four South African women's U-23 soccer players were hand-picked to take part in this research. Two groups of participants were formed: Those with knee injuries were in group -1, While group -2 consisted of those who had avoided injury.	In female athletes from South Africa, ages 23 and under, there was no association between QA, PW, or INW with the probability of a knee injury.	Q-angles ranged from 14 degrees to 18 degrees for both the injured and the unharmed. In this study, we ruled out the anatomical factors of QA, PW, and INW as contributors to knee injuries.

2.1 .T puckree, 2, A Govender, 3 P Naidoo ; 2007	A study of Indian distance runners' quadriceps angles and knee injuries	A total of one hundred (100) male Indian runners (ages 25-65) from five (5) Durban athletic organisations participated. Q was measured with a goniometer to get an accurate value. The information was gathered with the help of a questionnaire.	South Africans need to have reference values for Q-angles established, along with the prevalence and root causes of anomalous Q-angles among the general population.	Data from 88 runners was used. Approximately 51% of runners had some sort of knee problem. Five-eighths of the people in the study exhibited abnormal Q-angles.
3.1 YILMAZ ALi kerim, 2 ,KABADAYI Menderes,3, MAYDA M.Hakan	Examining the Q angles of female athletes across disciplines	The study included 42 female students from Ondokuz Mayis University's YasarDogu college of sports sciences. Many of these pupils were accomplished athletes with diverse skill sets, including those in badminton, rugby, volleyball, basketball, and futsal. Each participant had their Q angle, pelvic width, and femur length measured.	Q Angle is affected by a number of an athlete's physical attributes, including her athletic age, the length of her femur, and the breadth of her pelvis.	Analyzing the data, it was obvious that volleyball and basketball players averaged taller statures and had a steeper Q angle than athletes in other sports (p0.01).
4.Murat Sen, 2 Semra Cetin, 3 cuma Ece; 2019	Analyzing the Quadriceps Q-Angle of Professional Soccer Players and Wrestlers	Scientists looked specifically at football and wrestling players. The ages of the volunteers went from 17 to 26. There are 97 females and 181 males altogether.	For athletes like football players and wrestlers, the Q angles were perfectly normal. The dominant foot also plays a role in the quadriceps Q angle alongside pelvic breadth, tibia and femur length, and sex.	Strange facts emerged during this investigation. It was discovered that football players' Q angles differ greatly from those of wrestlers (p0.001).
5.Ami letafkar, 2 Shahrzad zandi , 3 Majid khodayi ; 2013	Wrestlers frequently experience knee soreness, Q angle abnormalities, and flat feet.	Twenty experienced Iranian national wrestlers (average age 19.110.86, weight 70.518.4kg, height 173.29.1 cm) were chosen for this study. The patient's level of pain from flat feet, Q angles, and knees were measured using a goniometer and a pain score.	Using the kinetic chain theory, we discovered that those with flat feet may have more patella lateral rotation and Q angle, both of which can aggravate previous knee pain.	Wrestlers with flat feet were more likely to experience knee pain, and there was a strong association between the two (r=0.686). Flat foot deformity has been linked to an increased Q angle in the dominant leg (r= 0.278).
6.1 Ali Fatahi, 2 , Heydar Sadeghi, 3 , Mitra Ameli; 2017	Pro volleyball players' risk of knee injury is correlated with their Q angle.	Seventy professional volleyball players who were free of known musculoskeletal problems affecting the Q angle took part in the study.	The goal of this study was to identify bilateral Q angle variability and investigate significant variations in knee injuries among volleyball players.	The Q angle between the right and left legs of males and females was shown to be significantly different using the independent t-test but not using the pair t-test.

7. . H.Daneshmandi, 2 F. Saki; 2010	Female football players' hypermobility and Q angle are analysed.	After being told of the research's purpose, 31 female football players agreed to participate. After receiving participants' informed consent, we documented their ages, heights, levels of physical activity, and injury histories.	When evaluating knee discomfort and hypermobility, measuring the Q angle may provide useful information. As a result, it appears that assessing Q angle in hypermobile adults may be helpful for anticipating the onset of knee problems in this population.	The results demonstrated that the average Q angles of hypermobile athletes were higher than those of their less mobile counterparts.
8. 1.T.J .ELLapen, 2 H.J.Van Heerden, 3 R.Taylor ; 2016	Students who play rugby at school face a significant risk of suffering knee injuries.	Over the course of two years, 115 high school rugby players gave their consenting, personal information. In order to better understand the causes and preventative measures for acute rugby knee injuries, players filled out a self-report musculoskeletal injury and activity history questionnaire.	Quadriceps angle deviation was a leading cause of knee injury among players.	A total of twenty-four people had severe knee injuries (p0.001). Tackling (52.1%), diving/falling (43.47%), and high-velocity rotation (4.34%) all contributed to the majority of the musculoskeletal trauma seen in the emergency room (p0.05).
9. 1 Hassan Daneshmani , 2 Farzaneh saki , 3 Sareh Shahheidari; 2011	In female athletes, there is a direct correlation between Q angle and limb alignment issues.	Measurements of navicular drop, Q angle, genu recurvatum, femoral anteversion, tibia-femur angle, tibiofemoral angle, dorsiflexion, hip internal and external rotation, and total joint laxity were taken from the thighs of over 130 female athletes.	Q angle increases due to three factors: tibiofemoral angle, hip internal rotation, and femoral anteversion, with the last having the most effect.	Conclusions Tibiofemoral angle, femoral anteversion, and hip internal rotation all strongly predicted a greater Q angle (p0.05).
10.1 TJ ELLapen, 2 S satyendra , 3 j Morris; 2013	Muscle and bone injuries typical of recreational half marathon runners in KwaZulu-Natal	The information was gathered from two hundred runners who competed in half-marathon road races between February and June of 2012. Runners were given a questionnaire a year before to recruiting to self-report any musculoskeletal injuries they may have sustained while running.	In our sample of casual runners, the knee, tibia, and fibula, as well as the lower back and hip, were the most frequently injured areas.	Ninety percent (180 out of 240) of the runners surveyed reported having musculoskeletal problems (p0.001). The most common sites of injury were the knee (26%), the tibia/fibula (22%), and the low back/hip (16%). (p0.001).
11. Orhan Ahmet Sener,2.Mehmet Durmaz; 2019	Teenage males and females' Q angles are affected by their training and education in various sports.	Using a goniometer, the Q angles of 240 female and 600 male individuals were assessed in both the prone and upright positions. T-tests were used for statistical analysis.	Q angle was shown to be impacted by both the frequency and intensity of physical exercise, suggesting that sport education may operate as a moderator of this relationship.	According to the findings, women had a supine Q angle of 15.71 degrees, while males had a supine Q angle of 13.02 degrees on average. The average Q angles of men and females were not the same, and this difference was statistically significant (p0.001).
12.1 MITCHELL J.RAUH 2.THOMAS D.KOESPELL	Injury Propensity and Quadriceps Angle in	Our research included measuring the Q-angles of 393 male and female high school cross-country runners (ages	To determine the Q-angles of 393 male and female high school cross-country	Injury risk may be higher for high school cross country runners

3.FREDERICK P.RIVARA 4.STEPHEN G.RICE 5.ANTHONY J.MARGHERITA ; 2007	Adolescent Cross-Country Athletes	13-19) as they stood still with their quadriceps at rest using goniometry.	runners (ages 13-19) at rest, we employed goniometry.	with big or asymmetric Q-angles.
13.1 JEHOON LEE, 2 HWANGJAE LEE, et al,.2014	Q-angle and Muscle Activity Onset during Weight-Bearing Therapeutic Exercise How common is patellofemoral pain in elite athletes? A randomised controlled trial.	More than thirty-four of the world's finest athletes converged on Seoul's T Center to compete. Therapy sessions occurred thrice weekly for a total of eight weeks. The VAS hamstring length, as well as the static and dynamic Q angles, were used to evaluate the workouts' efficacy.	Improvements in pain, dynamic Q-angle, and VL and VMO onset time differences were noted by those with PFPS who engaged in an 8-week weight-bearing therapeutic exercise programme.	When comparing the decline in dynamic Q-angle between CG and EBG, the latter shows a significantly larger decrease.

RESULTS

This analysis drew from a total of 31 articles. There were 12 studies that were considered to be useful. There were 1,718 total athletes, with 674 being female.Q-angle values were found to differ significantly (p0.001) between football players and wrestlers in a comparison conducted by (Murat sen, semra cen et al., 2019). While male wrestlers averaged 13.86 degrees, men soccer players had a standing right Q angle of 15.35 degrees. The Q angles were standard for athletes such as football players and wrestlers. The Q angle while standing is greater than when the person is resting supine.

This article reports on a study of 88 Indian distance runners that examined the relationship between quadriceps angle and knee damage (T Puckree, A. Govender, et al., 2007). Roughly half of all runners experienced knee pain at some point. One-half of the sample had Q-angles that were much larger than average. As many as 67% of runners who had abnormal Q-angles wound up having knee problems. The injury rates of runners were independent of their mileage and frequency of runs.

Analysis of the impact of athletic training and formal schooling on young men's and women's Q angles yielded mean ages of 19.16 and 21.120 years, respectively (orhan Ahmet sener, Mehmet Durmaz et al,.2019). Participation is high throughout all ages, but most heavily among those between the ages of 17 and 22. Both young women and men's dominant knee Q angles proved to be within normal parameters. For men, the ideal knee Q angle is greater than 17, while for women, it's greater than 20. The Q angle hypothesis posits that extracurricular school sports programmes reduce the Q angle.

One study from 2013 looked at the musculoskeletal injuries experienced by recreational half-marathon runners in KwaZulu-Natal and found the most common ones to be: (T J ELLAPEN, S Satyendra et al,. 2013). For recreational runners, this study found that injuries to the knee, tibia/fibula, lower back, and hip were the most common. One hundred eighty (180) runners (90%) reported musculoskeletal issues (p0.001). The most frequently injured anatomical locations were the knee (26% of injuries), the tibia/fibula (22% of injuries), and the lower back/hip (16% of injuries) (p0.001). Abnormalities in the quadriceps and hip flexion angles make runners more vulnerable to musculoskeletal problems (P0.05).

The goal of the study (T.J.Ellapen, H.J. Van Heerden et al., 2016) was to gain a better understanding of the prevalence and nature of knee injuries among high school rugby players. During a two-year period, 115 high school rugby players provided information with their parents' approval. One hundred twenty-four athletes suffered from an acute musculoskeletal knee injury (p0.001). Tackles (52.1%), dives and falls (43.47%), and high-velocity turns (4.34%) all contributed to players suffering from acute musculoskeletal injuries (p0.05). A higher rate of knee injury has been observed in rugby players with aberrant quadriceps angles (p0.05). It was determined that the athletes' levels of physical activity did not put them at a higher risk of knee damage (p0.05).

Female athletes from a wide range of sports had their Q angles calculated (YILMAZ Ali kerim, KABADAYI Menderes et al., 2017). Volleyball and basketball players were shown to have a greater average height than athletes from other sports, while volleyball and futsal athletes had a higher average Q angle than athletes from other sports (p0.01). Q angle in female athletes was found to be influenced by a number of physical parameters including sports age, femur length, and pelvic breadth. Strengthening the quadriceps, a muscle that is dynamically employed throughout training and sports, is thought to reduce Q angle and, by extension, injury risk.

Hypermobile athletes exhibited considerably higher mean Q angle values than non-hypermobile athletes, according to a study comparing joint hypermobility and Q angle in female football players (H Daneshmandi and F.saki et al,. 2010). (p0.05). There was a preponderance of injuries to the lower extremities. In hypermobile people, measuring the q angle may help anticipate the onset of knee issues. Musculoskeletal profiles and regular screenings are so crucial.

When the pelvic breadth and intercondylar notch width were also analysed as potential predictors of knee injuries in female South African soccer players, it was revealed that the Q-angle was within the range of 14° to 18° for both the damaged and uninjured groups (Mohammed EE, Useh U et al., 2012). In a study of female South African athletes under the age of 23, researchers found no correlation between the structural variables of quadriceps area (QA) and hamstring length (INW) with the likelihood of knee injury.

Q Angle was found to be connected with the number of times professional volleyball players experienced knee problems (Ali fatahi, Heydar Sadeghi et al, 2017). While men had a higher incidence of knee injuries (12.52%) than women (11.89%), the distribution of injured knees (11.53%) and severely injured knees (12.25%) was similar between the sexes. Q angle for the right leg was measured between 12.34 and 2.36 degrees, with a mean of 12.34 degrees and a standard deviation of 12.48 degrees. When analysing the Q angles from the right and left sides, the pair t test found no significant differences between the sexes. Nonetheless, the independent t test showed that there are substantial differences between the right and left legs regardless of gender. The chi-square test indicates a statistically significant relationship between the Q angle and the incidence of injuries.

It was shown that high school cross-country runners with a Q-angle of more than 20 degrees had a 1.7 times higher risk of injury than those with a Q-angle of 10 degrees to 15 degrees (MITCHELL J.RAUH, THOMAS D. KOEPSELL et al,. 2007).
An increased risk of injury for high school cross country runners with a large or asymmetric Q-angle.A larger tibiofemoral angle, femoral anteversion, and hip internal rotation (all p0.05) were significant predictors of a larger Q angle in another study evaluating lower extremity malalignment and its linear connection with Q angle in female athletes (Daneshmandi, Hassan;saki, et al,. 2011). Tibiofemoral angle, hip internal rotation, and femoral anteversion all contribute to a larger Q angle, but femoral anteversion has the greatest impact. This is why it's crucial to zero in on the pressures and potential harm associated with poor posture and how they affect Q angle.
We investigated the link between flat foot deformity and knee discomfort in wrestlers and confirmed the findings of previous research (Amir Letafatkar, shahrzad Zandi et al,. 2013) that established a correlation between the two. A high Q angle in the dominant leg is significantly associated with knee pain (r=0.949). Additionally, a high Q angle in the dominant leg is significantly associated (r=0.278) with a flat foot malformation. Fortunately, the increased patella lateral rotation and Q angle brought on by the flat foot deformity led to the development of knee pain.

Discussion

The goal of the research was to examine the relationship between Q-angle and performance in various sports. Many different types of athletes participated in the study. According to a survey of the relevant literature, women have a sharper Q angle than men do. As a general rule, men have lower Q-angles than women since they are taller. However, contrary to popular belief, women do not have a more lateralized anterior superior iliac spine than men. In a study of female athletes, researchers discovered that sports age, femur length, and pelvic breadth all had direct or indirect effects on Q angle. When wrestling, as when playing soccer, the dominant foot remains forward, indicating the greater importance of the feet. Regular exercise has been postulated as a means of lowering a high Q angle. The findings suggest that exercise has a positive effect on Q angle. It might be argued that a higher Q angle is desirable during childhood and physical exertion. **(Murat Sen et al.,** 2019). Certain studies have linked disorders of the patellofemoral joint to Q angles greater than 15 degrees in men and 20 degrees in women. The likelihood of lateral dislocation of the patella is increased during quadriceps contractions because of the stress vector imparted to the patella from the side. It is hypothesised that as Q angle grows, so does the amplitude of this lateral force vector and the inclination for patellar translation to the side. The increased Q angle during quadriceps activity has been connected to increased pressure between the patella and the underlying lateral femoral condyle, suggesting that this may be a strong predictor of knee injury, especially in sports that include a lot of jumping and landing. Researchers led by Ali Fatahi uncovered this (2017b). Q angles were found to be related to biomechanical characteristics including femur and pelvic length, and to be less likely to shift in athletes who underwent more strenuous training programmes. Mehmet Durmaz et al. (2019). According to the research, men runners who have abnormal Q angles are more likely to experience musculoskeletal knee injury.(T J **Ellapen et al .,2013**). Injured rugby players had much more obtuse Q angles than healthy players, and this was especially true for those who had suffered musculoskeletal knee injuries. T.J. Ellapen et al. (2016) draw this inference from their research. 16 percent of males and 20 percent of females with abnormally high QA did not present with knee injuries, suggesting that higher QA may not be the exclusive cause of knee injuries, as found by Emami et al. According to the findings of the study (Mohamed EE et al., 2012),. Also, the wounded limb was not necessarily the one with the greater Q angle. Using a large Q-angle as a risk factor may be problematic if the measured leg is normal because of the greater probability of misdiagnosing a runner's injury risk when just one lower limb is analysed. Here's only one case in point: (MITCHELL J.RAUH et al., 2007). According to the study's findings, those with higher Beighton scores also had greater Q angle values. Ligament laxity is a common cause of abnormally loose joints. It follows that highly mobile people have larger Q angles.(**H.Daneshmandi et al,. 2010).** Lower limb kinematics were found to be influenced by the Q angle. Changing the Q angle places an abnormal stress on the patella cartilage, which can aggravate or possibly cause a variety of knee issues. The Q-angle can be altered if the quadriceps aren't uniformly distributed on the patella. Other scientists' research supports this idea (T Puckree et al., 2007). Our data suggests that patellar lateral rotation and the Q angle are both increased in those with flat feet, and that this leads to the development of knee soreness. Several researchers agreed on this finding in 2013. (among them Amir Letafatkar). The purpose of this research was to compare open- and closed-kinetic-chain exercises for their efficacy in treating patellar chondromalacia. Our research suggests that CKC semi-squat workouts are superior to OKC SLR programmes. The semi-squat population saw a reduction in Q angle, suggesting an effect. According to research by Doucette and Child, CKC training improves VM muscle activation and functional capacity compared to the vastus lateralis. The Q angle can be reduced and patellar malalignment toward the medial side can be corrected by increasing the activity of the VM muscle. The patellar kinematics were found to be solely affected by a lateral tilt of the patella when the Q-angle was dropped in 2007 (A H Bakhtiary, E Fatemi, et al.). This was likely due to the patella tracking along the medial trochlear ridge. When the Q-angle is tiny, the resulting lateral tilt is also little, while when the Q-angle is great, the resulting medial tilt is large. Tibial varus orientation and external rotation may account for the observed lack of medial displacement and lateral rotation. The results reveal that the medial patellofemoral contact pressure increases less with a lower Q-angle than with a larger one. We contend that the translation-tilt relationship is founded on the dimensions and geometry of the trochlear ridge. A hypoplastic lateral trochlear ridge increases translation and decreases concomitant tilt when the Q-angle is altered by the same amount. In accordance with (Yasayuki Mizuno, Masaru Kumagai et al., 2000).

Recommendations for future studies

Scientists must calculate the maximum Q angle that poses a risk to male and female athletes. It is important to investigate whether or not Q-angle asymmetry is related to running injuries (MITCHELL J.RAUH et al., 2007). More research is needed, ideally incorporating other sports, to draw a fuller picture. Developing a standardised clinical Q-angle approach necessitates first testing the reliability and validity of this method on a symptom-free control group and a patellofemoral disorder group with matched confounding factors. After that is done, clinicians will have a better idea of whether or not the Q-angle is a helpful clinical criterion for assessing patients with PFPS and patellar instability. After reviewing the data provided by (Toby O. Smith, Nathan J. Hunt et al., 2008).

Conclusion

Women have a larger Q angle than men do because their pelvises are proportionally larger. Males with Q angles more than 15 degrees and females with angles greater than 20 degrees are more likely to experience pathological problems. Age, gender, athletic training, injuries, patellofemoral syndrome, joint hypermobility, and deformity all play a role in the degrees of the Q angle of athletes.

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References

1. Lee, Jehoon, Hwangjae Lee, and Wanhee Lee. "Effect of weight-bearing therapeutic exercise on the q-angle and muscle activity onset times of elite athletes with patellofemoral pain syndrome: a randomized controlled trial." *Journal of physical therapy science* 26.7 (2014): 989-992.
2. Şen, Murat, et al. "Comparison of Quadriceps Q-Angle values of soccer players and wrestlers." *Journal of Education and Training Studies* 7.7 (2019): 95-101.
3. Puckree, T., et al. "The quadriceps angle and the incidence of knee injury in Indian long-distance runners." *South African Journal of Sports Medicine* 19.1 (2007): 9-11.
4. Sener, Orhan Ahmet, and Mehmet Durmaz. "Effect of Sport Training and Education on Q Angle in Young Males and Females." *Journal of Education and Training Studies* 7.7 (2019): 17-21.
5. Ellapen, T. J., et al. "Common running musculoskeletal injuries among recreational half-marathon runners in KwaZulu-Natal." *South African Journal of Sports Medicine* 25.2 (2013): 39-43.
6. Livingston, Lori A. "The quadriceps angle: a review of the literature." *Journal of Orthopaedic & Sports Physical Therapy*28.2 (1998): 105-109.
7. Ellapen, T. J., et al. "Knee Injuries: A Burden of Schoolboy Rugby Players." *Journal of Advances in Medicine and Medical Research* (2016): 1-7.
8. Yilmaz, A., et al. "Analysis of Q angle values of female athletes from different branches." *Sci Mov Heal* 17.2 (2017): 141-146.
9. Daneshmandi, H., and F. Saki. "The study of joint hypermobility and Q angle in female football players." *World Journal of Sport Science* 3.4 (2010): 243-7.
10. Letafatkar, Amir, et al. "Flat foot deformity, Q angle and knee pain are interrelated in wrestlers." *J Nov Physiother* 3.2 (2013): 138.
11. Daneshmandi, Hassan, Farzaneh Saki, and Sareh Shahheidari. "Lower extremity malalignment and linear relation with Q angle in female athletes." *Brazilian Journal of Biomotricity* 5.1 (2011): 45-52.
12. Rauh, Mitchell J., et al. "Quadriceps angle and risk of injury among high school cross-
13. country runners." *journal of orthopaedic & sports physical therapy* 37.12 (2007): 725-733.
14. Fatahi, Ali, Heydar Sadeghi, and Mitra Ameli. "Relationship between Q angle and knee injuries prevalence in elite volleyball players." *Adv Surg Sci* 5.4 (2017): 45-48.
15. Mohamed, E. E., U. Useh, and Bhekiwe Francisca Mtshali. "Q-angle, Pelvic width, and Intercondylar notch width as predictors of knee injuries in women soccer players in South Africa." *African health sciences* 12.2 (2012): 174-180.
16. Stensdotter, Ann-Katrin, et al. "Q-angle variations in standing and supine positions and for different measurement methods in women with and without patellofemoral pain." *Advances in Physiotherapy* 11.2 (2009): 88-96.
17. Lathinghouse, Laura H., and Mark H. Trimble. "Effects of isometric quadriceps activation on the Q-angle in women before and after quadriceps exercise." *Journal of Orthopaedic & Sports Physical Therapy* 30.4 (2000): 211-216.
18. Heiderscheit, Bryan C., Joseph Hamill, and Graham E. Caldwell. "Influence of Q-angle on lower-extremity running kinematics." *Journal of Orthopaedic & Sports Physical Therapy* 30.5 (2000): 271-278.
19. Smith, Toby O., Nathan J. Hunt, and Simon T. Donell. "The reliability and validity of the Q-angle: a systematic review." *Knee Surgery, Sports Traumatology, Arthroscopy* 16.12 (2008): 1068-1079.
20. Ramskov, Daniel, et al. "No association between q-angle and foot posture with running-related injuries: a 10 week prospective follow-up study." *International journal of sports physical therapy* 8.4 (2013): 407.
21. de Sousa Fernandes, Marcos Vinicius, et al. "Effects of neuromuscular exercises on q-angle, knee joint stability and ankle mobility of handball athletes." *Manual Therapy, Posturology & Rehabilitation Journal* (2019): 1-7.
22. Bakhtiary, Amir H., and Elham Fatemi. "Open versus closed kinetic chain exercises for patellar chondromalacia." *British journal of sports medicine* 42.2 (2008): 99-102.
23. Mizuno, Yasayuki, et al. "Q-angle influences tibiofemoral and patellofemoral kinematics." *Journal of orthopaedic research*19.5 (2001): 834-840.
24. Mitani, Yasuhiro. "Gender-related differences in lower limb alignment, range of joint motion, and the incidence of sports injuries in Japanese university athletes." *Journal of physical therapy science* 29.1 (2017): 12-15.
25. Satkunskiene, Danguole, et al. "Leg stiffness, valgus knee motion, and Q-angle are associated with hypertrophic soft patella tendon and idiopathic knee pain in adolescent basketball players." *The Journal of sports medicine and physical fitness* 57.7-8 (2017): 1003-1013.

26. Tsakoniti, Aikaterini E., et al. "Effect of Q-angle on patellar positioning and thickness of knee articular cartilages." *Surgical and radiologic anatomy* 33.2 (2011): 97-104.

27. Lopezosa-Reca, Eva, et al. "Does the type of sport practised influence foot posture and knee angle? Differences between footballers and swimmers." *Research in Sports Medicine* 26.3 (2018): 345-353.

28. Uduonu, E. M., et al. "Variation in adiposity indices, fitness index and Q-angle with types of contact sports." *International Journal of Basic, Applied and Innovative Research* 7.4 (2018): 98-106.

29. Guerra, Jeffrey P., Michael J. Arnold, and Richard L. Gajdosik. "Q angle: effects of isometric quadriceps contraction and body position." *Journal of Orthopaedic & Sports Physical Therapy*19.4 (1994): 200-204.

30. Emami, Mohammad-Jafar, et al. "Q-angle: an invaluable parameter for evaluation of anterior knee pain." (2007): 24-26.

31. Sarkar, Aparna, et al. "Effect of isometric quadricep activation on "Q" angle in young females." *Indian J Physiol Pharmacol*53.3 (2009): 275-278.

32. Hahn, Thomas, and Anders Foldspang. "The Q angle and sport." *Scandinavian journal of medicine & science in sports*7.1 (1997): 43-48.