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Correlation Between Body Mass Index, Navicular Drop and Q-Angle in Different Position Among College Students - Correlation Study

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ABSTRACT

INTRODUCTION: The Q-Angle is an index of the vector of the combined pull of the knee extensor mechanisms and the patellar tendon. The Navicular Drop Test, is one of the clinical tests most commonly used to study Medial longitudinal arch. It has been found that the different weight of individual may alter the Q-angle.

AIM: To find out the correlation between BMI, Q-Angle and Navicular Drop in different position in college going student.

METHODOLOGY: The participants were taken from Apollo Institute of Physiotherapy and informed written consent was taken from all the participants. Body Mass Index was calculated by standard formula [weight(kg.)/height^2(meter)]. Navicular Drop was measure by using a scale and card method and Q-Angle was measure in standing and supine position by using Standard Goniometer.

RESULT: The study showed a weak correlation of right Q-Angle supine with right Navicular Drop (r= 0.14, p=0.31) and no correlation of right Q-Angle standing with right Navicular Drop (r=0.02, p=0.85). Also, there is no correlation of left Q-Angle supine with left Navicular Drop (r= 0.08, p=0.54) and weak correlation of left Q-Angle standing with left Navicular Drop (r=0.11, p=0.43). There is weak correlation between BMI with Q-Angle (in different positions) and Navicular Drop.

CONCLUSION: Thus, this study concluded that there is weak correlation between BMI, Q-Angle and Navicular Drop. Also suggested that change in the position may alter Q-Angle and Navicular Drop.

Keywords: Body Mass Index, Q-Angle, Navicular Drop, College Students.

INTRODUCTION

Lower extremity alignment has been proposed as a risk factor for acute and chronic lower extremity injuries, including patellofemoral syndrome, [1-2] cruciate ligament injuries, [3-6] medial tibial stress syndrome, stress fractures, and plantar fasciitis.[7] It has been suggested that biomechanical changes resulting from abnormal alignment may influence joint loads, mechanical efficiency of muscles, proprioceptive orientation and feedback from the hip and knee that is resulting in altered neuromuscular function and control of the lower extremities.[3-8]

It has been suggested that Q-angle is composite measure of pelvic position, hip rotation, tibial torsion, patella position and foot position. [9,10] Regarding the clinical significance of Q-angle, it is observed that changes on this angle are associated with chondromalacia patella, lateral dislocation of the patella, erosion of the patellar cartilage and of the lateral condyle, femoral internal rotation, foot pronation and internal tibial torsion.[11] Q-Angle was first defined by Brattström. It is defined as acute angle formed by the vectors for combined pull of

Quadriceps femoris Muscle and patellar tendon which is measured by using landmarks like ASIS, mid-point of patella and tibial tuberosity.[10]

The American Orthopaedic Association defines "excessive" as Q-angles greater than 15◦ Sex-based differences in Q-angle have been reported, with women typically having a larger Q- angle.[12] Navicular Drop is measured using Navicular Drop Test (NDT) which was first described by Brody as means of quantifying the amount of foot position. Navicular drop is a commonly used clinical measure that response that represents a composite measure of foot pronation. In an effort to better understand the potential influence of static posture faults on dynamic knee function, we examined how subjects who were high or low on Navicular Drop and Q-angle may differ in their neuromuscular control strategies under functional, weight bearing conditions. [13]

Stress on bones, tendons and ligaments increases due to additional weight.[14] Locomotor system is additionally loaded due to obesity which leads to functional and structural limitations, thereby raising the stress within connective tissue structures and the risk of musculoskeletal injuries.[15] BMI is one of the anthropometric measurement techniques that can be used to assess Body built.[16]

There is no previous study which shows relation between BMI, Q-angle (in different position) and navicular drop among college students. So, aim of the present study is to find out the correlation between BMI, Q-angle (in different position) and navicular drop among college students.

MATERIALS AND METHODOLOGY

Ethical clearance was taken from institutional ethical committee. An explanation of the procedure and written informed consent were taken from all the subjects. It was cross sectional study with 50 college going students age group between 18-25, both male and female and Subjects who were willing to participate were included in the study. Subject who had Acute trauma or fracture in lower limb or any soft tissue injury or deformity in lower limb were excluded from the study.

Q-Angle were measured in supine and standing using standard goniometer, Navicular Drop measured via Navicular Drop test and Body Mass Index was calculated by standard formula[kg/meter^2].

OUTCOME MEASURES:

Body Mass Index (BMI):[16]

It is most widely used clinical standard to estimate obesity. To determine a person's BMI, body weight in kilograms is divided by the square of body height in meters.

The world health organization proposed a classification system of underweight, overweight and obesity based on BMI values. BMI values have been divided into five categories: underweight, normal weight, overweight, obesity, and extreme obesity.

Classification	BMI (kg/m^2)	Obesity class
Underweight	<18.5	
Normal	18.5-24.5	
Overweight	25.0-29.9	
Obesity	30.0-34.9	I
	35.0-39.9	II
Extreme obesity	≥40	III

Table no.-1 shows classification of BMI

Q-ANGLE: [17]

Q-angle represented the angle formed by a line from anterior superior iliac spine to patella center and a line from the patella center to tibial tuberosity. Q-angle were measured in different position non-weight bearing (Supine) and weight bearing

(Standing) position by using standard goniometer.
reliability and validity of the clinical Q-angle measurements Inter-tester reliability ranged from an ICC of 0.20–0.70. Intra-tester reliability ICC ranged from 0.22 to 0.75.

Figure no. 1 Measurement of Q-Angle

Navicular Drop Test (NDT):[8]
Which is measure of subtalar position, was measured using the method by Brody. Marking the midpoint of navicular tuberosity of the foot with subject in seated position and also mark into the paper Subject then stands up and the mark again in paper Navicular drop is calculated as the difference between the sitting and standing positions.
Navicular Drop Test had excellent reliability, both inter-rater and interrater with ICC ranging from 0.914 to 0.945.

Figure no. 2 Measurement of navicular drop test

STATISTICAL ANALAYSIS

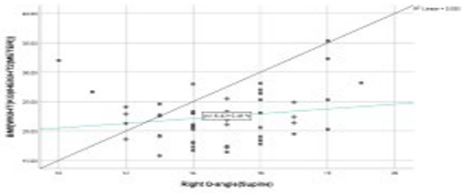
The data analysis was done by using the statistical software SPSS version 26. Normality test was done and the data was not normally distributed spearman's correlation test was used for analysis. Spearman correlation coefficient ranges from -1 to +1, a positive value indicates a positive correlation and a negative value indicates negative correlation. The level of significance was kept at $p<0.05$. Interpretation for correlation coefficient is 0.00-0.10 = negligible correlation,0.10-0.39 = weak correlation,0.40-0.69 = Moderate correlation,0.70-0.89 = Strong correlation, 0.90-1.00= Very strong correlation. [18]

RESULT

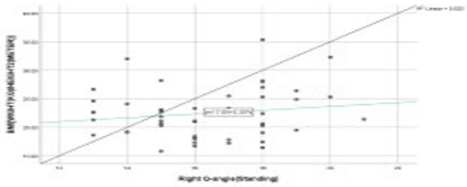
The present study correlates the relationship between Body Mass Index (BMI), Navicular Drop and Q- angle in different position among college students. Table 2 shows descriptive characteristics of subjects with the value of mean and standard deviation of age, height, weight and BMI.Graph 1 to 10 shows the correlation of various factor.

Parameters	Mean ± SD
Age (years)	21.72 ± 2.19
Height (meter)	1.61 ± 0.90
Weight (kg)	57.88 ± 12.18
BMI weight(kg.)/height^2(meter)	4.28

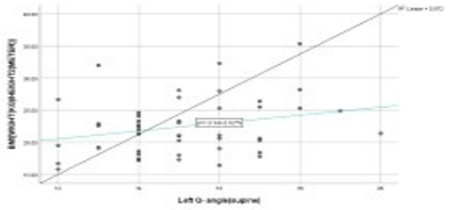
Table 2: Descriptive characteristics of subjects (n=50), value is presented as mean ± standard deviation



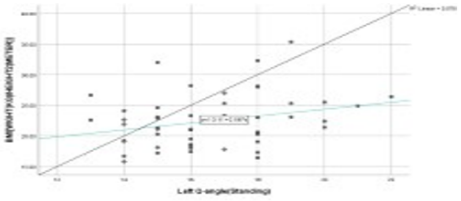
Graph 1 shows that there is positive weak correlationbetweenBMI and right Q-Angle supine.(r=0.16, p=0.2)



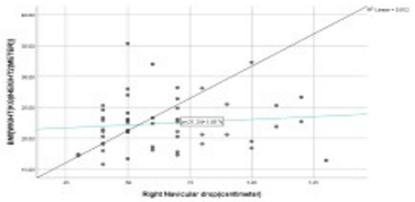
Graph2 shows that there is positive weak correlationbetweenBMI and right Q-Angle standing.(r=0.12, p=0.38)



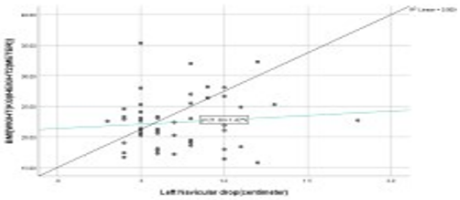
Graph3 shows that there is positive weak correlationbetweenBMI and left Q-Angle supine.(r=0.25, p=0.08)



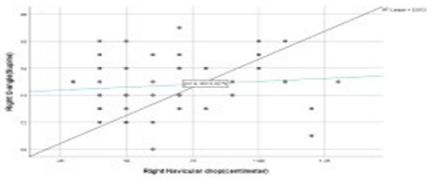
Graph4 shows that there is positive weak correlationbetweenBMI and left Q-Angle standing.(r=0.26, p=0.06)



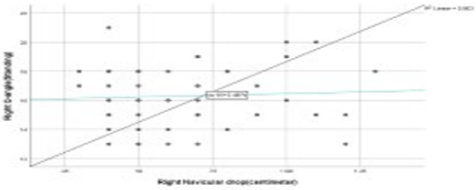
Graph 5 shows that there is positive weak correlation between BMI and right NavicularDrop.(r=0.16, p=0.25)



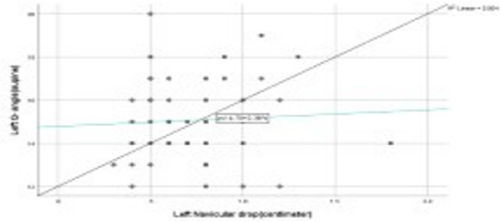
Graph6 shows that there is No correlation between BMI and left Navicular Drop(r=0.07, p=0.59)



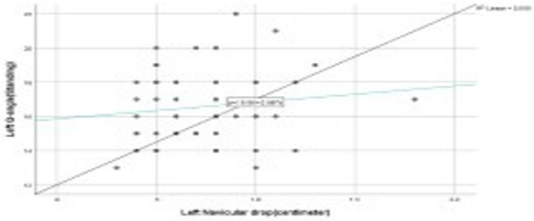
Graph7 shows that there is Weak correlation between right Q-Angle supine and right NavicularDrop(r=0.14, p=0.31)



Graph 8 shows that there is No correlation between right Q-Angle standing and right Navicular Drop.(r= 0.02, p=0.085)



Graph 9 shows that there is no correlation between left Q-Angle supine and left Navicular Drop.(R=0.08, p=0.54)



Graph 10 shows that there is Weak correlation between left Q-Angle standing and left Navicular Drop.(r=0.11, p=0.43)

DISCUSSION

The purpose of the study was to find out the correlation between Body Mass Index, Navicular Drop and Q-Angle in different position in college students. The result showed positive weak correlation between Body Mass Index, Navicular Drop and Q-Angle. As the BMI increases there is increase in waist and hip ratio which alters Q-Angle.[2] Difference in position is also affects the Q-Angle. It varies from non-weight bearing supine position to weight bearing position like standing which may also alters the position of navicular bone.[19]

Based on other previous studies, a high Q-angle value will Cause an abnormally high valgus angle. This abnormally High valgus angle will affect the biomechanics of the Patellofemoral joint through increased lateral traction of the Quadriceps muscle on the patella. This problem was causing Mal-tracking and overpressure on the patellofemoral joint and ultimately resulting in anterior knee pain.[20] Nguyen et al. investigated the relationship between the Q-angle, increased tibiofemoral angle, and increased femoral anteversion and discovered no significant relationships between the Q-angle and other parameters (pelvic angle, genu recurvatum, tibial torsion, navicular drop, and femur to tibia length ratio) [21]

Our system functions together as a kinetic chain for example in gait assessment as there is foot pronation cause tibial internal rotation which cause knee valgus and hip internal rotation.[3] Q-Angle and Navicular Drop are associated through kinetic chain as there is alteration in Q-Angel it also changes Navicular Drop and vice a versa.

Limitation And Future Recommendation

Study was done on small sample size.

Future study can be done on other population like individuals with flat foot, plantar fasciitis and calcaneus spur etc.

CONCLUSION

From the present study we concluded that there is a weak correlation between Body Mass Index, Navicular Drop and Q-Angle among college students. Also suggested that changes in position may alter Q-Angle and Navicular Drop.

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Ethical Approval: Approved

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