International Journal of Physiotherapy and Research,
Int J Physiother Res 2016, Vol 4(3):1518-23. ISSN 2321-1822
DOI: http://dx.doi.org/10.16965/ijpr.2016.123

Original Research Article

ASSOCIATION OF PAIN, FUNCTION, BMI AND RADIOGRAPHIC EVIDENCE OF OSTEOARTHRITIS WITH CLINICAL ASSESSMENT OF OSTEOARTHRITIS OF THE KNEE JOINT

Santosh Metgud [1], Supriya Kondal *[2], Anand Heggannavar [3].

[1] Associate Professor, Head of Department-Department of Orthopaedic Manual Therapy, KLE University Institute of Physiotherapy, Belagavi, Karnataka, India.

*[2] Post Graduate student-Department of Orthopaedic Manual Therapy, KLE University Institute of Physiotherapy, Belagavi, Karnataka, India.

[3] Assistant Professor, Department of Orthopaedic Manual Therapy, KLE University Institute of Physiotherapy, Belagavi, Karnataka, India.

ABSTRACT

Background: Osteoarthritis (OA) of the knee joint is a highly prevalent musculoskeletal disorder that presents with varying signs and symptoms. Radiological and clinical assessment is routinely used to diagnose and treat osteoarthritis. Establishing a relationship between the signs and symptoms with its assessment needs to be done in order to find the efficacy to relate to patient's symptoms.

Materials and Methods: 60 individuals suffering from osteoarthritis of the knee were screened for BMI, pain score, Q-angle, radiographic features and functional disability.

Results: The correlation coefficient between BMI and Q-angle was -0.03 and 0.19 for right and left respectively whereas that between Pain and Q-angle was 0.14 and 0.15. Correlation between Objective and Functional scores on the Knee Society Score for right and left knees and Q-angle were -0.11, 0.17, -0.3, -0.09 respectively. There was no association found between radiographic evidence and clinical assessment of osteoarthritis of knee joint.

Discussion: The quadriceps muscle is an extra-articular structure that may be a negligible source of pain in osteoarthritis. Therefore the measurement of angle of pull of the muscle may not correlate with pain intensity. Compensatory changes occurring in the initial stages of obesity may not have a direct impact on the Q-angle. Continuation of functional activities in spite of pain may reduce correlation between function and Q-angle assessment. Variability in presenting features and radiographic evidence in our study has been supported by many studies.

Conclusion: Our study concludes that clinical signs and symptoms are highly variable and have a poor correlation with radiological and clinical assessment.

Clinical Implication: Measurement of Q-angle may not be a reliable tool in the assessment of OA knee and therefore a reliable and diagnostic tool should be made with respect to patient's signs and symptoms.

KEY WORDS: Knee Osteoarthritis, BMI, Knee Pain, Radiographs, Q-angle.

Address for correspondence: Dr. Supriya Kondal, PT., Post Graduate student-Department of Orthopaedic Manual Therapy, KLE University Institute of Physiotherapy, Belagavi, Karnataka.
E-Mail: supriyakondal111@gmail.com

Access this Article online

Quick Response code

DOI: 10.16965/ijpr.2016.123

International Journal of Physiotherapy and Research
ISSN 2321- 1822
www.ijmhr.org/ijpr.html

Received: 31-03-2016	Accepted: 22-04-2016
Peer Review: 31-03-2016	Published (O): 11-06-2016
Revised: None	Published (P): 11-06-2016

INTRODUCTION

Osteoarthritis (OA) is highly prevalent disorder of the musculoskeletal system reported to be in the range of 17 to 60.6% in India. When seen in the global scenario, OA is the eighth leading cause of functional disability with the joint most frequently associated with disability being the knee. India is expected to be the chronic disease capital, with 60 million people with arthritis, by 2025 [1].

Age, body weight, gender, any previous history of trauma, etc are the factors associated with increased incidence and prevalence of osteoarthritis of the knee joint. The patient may present with symptoms and signs that may vary in amount and intensity. The most important factors that can vary from patient to patient are the Body Mass Index (BMI) of the patient, intensity of pain, level of functional disability caused due to pain and restriction of range. This variability can reduce the direct association of presenting symptoms and the clinical assessment done routinely [2].

Pain is the major clinical symptom in osteoarthritis of the knee and a key determinant for seeking medical care. Typical mechanical OA pain is often described as deep and dull ache, localized to one or a few joints. It not only contributes to functional limitations and reduced quality of life but is also the leading cause of impairment of mobility in the elderly population [3]. Therefore its assessment is an important outcome measure.

The implications of osteoarthritis towards individual's quality of life (QoL) are different among different individuals and may not be directly proportional to the severity of structural abnormalities of the joints [3,4].

Radiograph of the knee joint is frequently used investigation for diagnosing osteoarthritis but its efficacy to rule out osteoarthritis and its correlation with pain and function is poor as proved by many of the studies done in this regard [5]. The radiographic features seen in osteoarthritis of the knee are presence of osteophytes, joint space narrowing, and sclerosis of bony margins.

Clinical assessment of osteoarthritis consists of measurement of Q-angle which is the angle formed between a line connecting the ASIS to the midpoint of the patella and a line connecting the tibial tuberosity and the midpoint of the patella. It is a cheap and easy to use assessment tool that should be evaluated for finding its efficacy to relate to patient's symptoms.

As there is variability in signs, symptoms and radiographic features from patient to patient, clinical assessment can also vary and therefore there is a need to find out the extent to which the association between patient's signs and symptoms with clinical assessment of osteoarthritis of the knee joint can be established. Therefore the purpose of the study was to find the correlation between pain, BMI, function and clinical assessment of OA knee and association between radiographic evidence and clinical assessment of OA knee.

MATERIALS AND METHODS

The study with a cross sectional study design was conducted on 60 subjects through non-probability sampling design for a period of 6 months.

Males and females more than 40 years of age, Suffering from osteoarthritis of the knee since 6 months, Unilateral or bilateral osteoarthritis of the knee joint and subjects with or without radiographs of the knee joint were included for the study.

Subjects with previous history of fracture of articulating surfaces of femur and tibia and presence of knee instabilities due to ligament and meniscal injuries were excluded from the study.

OUTCOME MEASURES:

Visual analogue scale (VAS): Using a ruler, the score is determined by measuring the distance (mm) on the 10-cm line between the "no pain" anchor and the patient's mark, providing a range of scores from 0–100. A higher score indicates greater pain intensity. The following cut points on the pain VAS have been recommended: no pain (0–4 mm), mild pain (5-44 mm), moderate pain (45–74 mm), and severe pain (75–100 mm) [6].

Knee society score (KSS): it consists of objective

knee score and functional knee score. Highest score is 100 for each. It deals with pain, ROM and stability giving positive points up to 100 and grouping deductions that can take away from the original value [7].

Body Mass Index (BMI): BMI measures the weight of the subject with respect to height. Weight of the patient is measured using a weighing machine and height using tape. BMI is measured using the formula weight in kgs / height in m^2.

Q angle: It is the measurement of the angle between the quadriceps muscles and the patella tendon providing information about the alignment of the knee. It can be measured in supine as well as standing positions.

Knee radiographs: Radiographic evidence of knee osteoarthritis is collected from the patients and graded using kellgran and Lawrence classification of knee osteoarthritis [8].

Procedure: An approval for the study was obtained from the institutional ethical committee. Subjects were screened for inclusion and exclusion criteria and written informed consent was taken.

According to kellgren and Lawrence classification [8] for radiographic assessment and evidence, subjects were graded for stages of Osteoarthritis.

Pain assessment was done through Visual Analogue Scale. BMI was calculated using the formula weight in kgs / height in m^2.

Function and disability was assessed using the knee society score. The score obtained in each component, objective and functional, was totaled for a maximum of 100 points. Deductions were made in the same components.

Clinical assessment of osteoarthritis was done by measuring the Q angle. The subject was in supine position. The midpoint of patella, anterior superior iliac spine and the tibial tuberosity were taken as anatomical landmarks. Two straight lines were marked from the ASIS to the midpoint of patella and from midpoint of patella to the tibial tuberosity. The medial angle formed by the intersection of these two lines was measured and recorded as the Q angle in degrees.

RESULTS

Table 1: Showing the Demographic data.

Variable	Mean	SD
Age	62.16 years	13.08 years
BMI	26.09	3.87

Table 2: Showing the Outcome measures

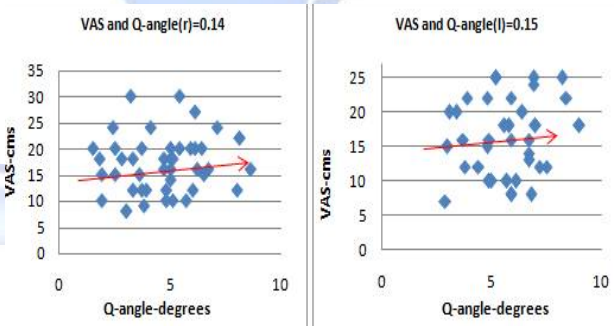
Variable		Mean	SD
VAS	R*	4.74 cms	1.82 cms
	L*	5.53 cms	1.57 cms
KSS-objective score	R	58.63	18.27
	L	54.67	22.1
KSS-subjective score	R	39.39	18.22
	L	36.94	18.95
Q-angle	R	17.04°	5.36°
	L	16.30°	5.58°

*R-right; L-left.

Knee radiographs: 60% of the subjects had radiographs and 40% did not have radiographs.

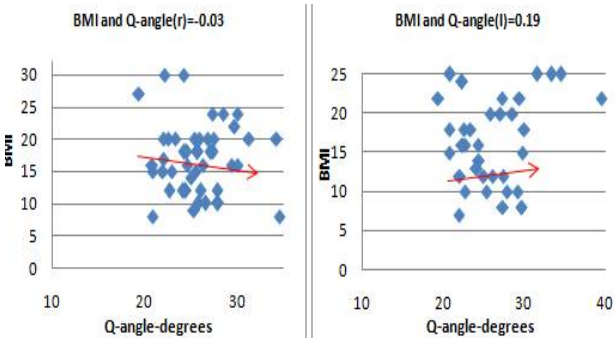
Karl Pearson correlation coefficient:

Graph 1: Correlation between VAS and Q-angle.



Pain and Q-angle: r = 0.14 (R); r = 0.15 (L)

Graph 2: Correlation between BMI and Q-angle.

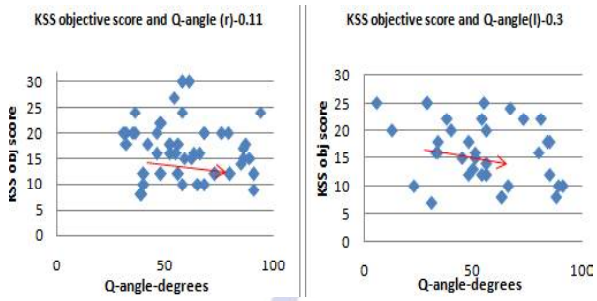


BMI and Q-angle: r = -0.03 (R); r = 0.19 (L)

Chi-square test: H_0 was accepted and no association was found between knee radiographs and Q-angle. P value = 0.5 (R); 0.1 (L).

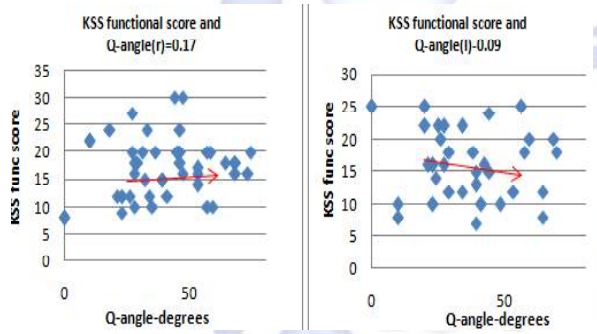
KSS score:

Graph 3: Correlation between KSS Objective score and Q-angle.



Objective score: r = -0.11 (R); r = -0.3 (L)

Graph 4: Correlation between KSS functional score and Q-angle.



Functional score: r = 0.17 (R); r = -0.09 (L)

DISCUSSION

The study was conducted on a sample size of 60 individuals diagnosed with osteoarthritis of the knee joint. Statistical analysis revealed low to poor correlations among the outcome measures.

The Q-angle estimates the lateral pull of the quadriceps muscle on the patella. The rectus femoris and the vastus intermedius are centrally located and their action pulls the patella along the axis of the femur. As the femur deviates laterally from the tibia, they pull proximally and laterally on the patella. The vastus lateralis pulls the patella slightly laterally. However, the patellar ligament pulls in a distal direction. Addition of these forces on the patella yields a force that is directed laterally on the patella. The fiber arrangement of the Vastus Medialis Oblique (VMO) provides a stabilizing force to the patella against the lateral pull [9].

Weakness of the VMO can cause increased lateral pull thereby increasing the Q-angle. This leads to anterior patella-femoral pain which is a general consensus. But according to Masahiko ikeuchi et al.,[10] pain in OA knee originates from extra-articular structures that is synovium, capsule and cartilage with negligible contributions from extra-articular structures. Also central sensitization of pain in long standing cases of OA knee has been thought to cause pain.

Poor correlation in our study between pain score and Q-angle could be due to the above mentioned reason in which extra-articular structure, quadriceps muscle, is not a major source of pain therefore measurement of its angle of pull may not have a direct relationship with the intensity of pain.

Another reason for poor correlation could be that the strength of the quadriceps correlates poorly with pain and disability in OA knee as proved by Narinder Kaur et al. [11]. As isotonic as well as isometric strength of quadriceps depends upon the angle of pull of the muscle, measured through Q-angle, it can be said that measurement of Q-angle cannot be an accurate predictor of pain intensity in patients with OA knee.

Study done by Sheila et al.,[12] suggests that quadriceps strength is independently associated with knee pain and disability which is a contradictory statement with respect to the above mentioned study. Psychosocial factors also play an important role in pain perception and tolerance. Each individual has a varying level of pain tolerance which can be affected by past experiences and expectations.

Increased body weight causes increased shear stresses on the articular cartilage of the knee joint leading to wear and tear of the cartilage. This leads to subchondral bone exposure as well as periosteal tearing and subsequent inflammatory changes and formation of osteophytes and bony sclerotic changes. There was a poor correlation found between BMI and Q-angle in this study. There was no particular trend in the study with respect to BMI and Q-angle as it is in normal individuals. Q-angle varied greatly from varus to valgus angulation.

Every osteoarthritic knee has wide variations in its presenting signs and symptoms. This could have been one reason for a poor correlation mentioned above. When there are alterations

occurring in the intra-articular structures of the knee joint due to increased body weight, compensatory mechanisms set in to maintain alignment particularly of the patella which is prone to lateral displacement. This is acquired through over activity in the quadriceps particularly the VMO.

This can be in contradiction to studies where it is proven that patients with osteoarthritis have weak quadriceps as a consequence of excessive lateral pull from tight lateral structures. But in initial stages of osteoarthritis, the body structures try to compensate which maintains alignment. Chronic cases develop after long standing weakness after compensatory mechanisms have failed causing permanent alterations.

In an individual without knee pathology, the Q-angle and the valgus angle made by the anatomical axis of femur and tibia are almost similar to one another but in case of pathology lateral tibial torsion can increase the Q-angle while the valgus angle remains unchanged.

The knee society score consists of the objective and functional scores. Each of these scores contain sub components that assesses an individual's signs, symptoms as well as level of difficulty faced during activities of daily living and advanced activities in the society. The objective score has components based on stability in the anterior-posterior and medio-lateral directions. Stability is provided by passive structures such as the ligaments. It has been suggested that ligamentous support to the knee joint reduces due to laxity of ligaments along with weakened muscles. This is in support of the reduced objective scores obtained by the subjects in the study.

The overall association of the objective score with the Q-angle was low negative in the right knee whereas it was moderately negative for the left knee. Decreased stability may facilitate malalignment of structures around the knee joint ultimately leading to alterations in the Q-angle. But the objective score is a combination of pain score and x-ray measurement of valgus angle of the knee. Therefore this result cannot be attributed to stability factor alone. The functional score also had a very poor correlation with the clinical assessment of osteoarthritis.

Study done by Narinder kaur et al.,[11] shows that patients with OA had good muscle strength tested both isotonically and isometrically. Correlation between functional status and quadriceps strength revealed positive correlation. They have suggested that good muscle strength improves endurance and functional capacity thereby reducing disability.

In our study, changes in Q-angle did not affect functional status of patients with osteoarthritis. This could be due to good strength of muscles around the knee mentioned in the above study.

The sub components of functional score had certain activities that most patients reported to have never done which may have affected the overall score thus lowering the correlation coefficients.

Psychosocial factors play an important role in this case as patients continue with their daily activities and in some cases sports and other advanced recreational activities despite of severe pain in the knee joint.

There have been many studies done to evaluate the association between radiographic assessment and clinical assessment in patients with osteoarthritis of the knee joint. They have revealed poor to no correlation thereby supporting the results of our study.

Although radiograph is the first line of investigation for diagnosis of osteoarthritis, it does not correlate well with presenting signs and symptoms. Patients presenting with severe pain have normal radiographs at times and individuals with severe radiographic changes have minimal to no symptoms suggesting variability from person to person. But there have also been studies to prove that there exists a strong association between pain and radiographic findings in osteoarthritis of the knee joint.

As signs and symptoms are variable and can vary with the radiographic findings, it can be said that clinical assessment also may not match to the radiographic findings as has been the results in our study. One reason for this could be that the x-ray films were taken in standing weight bearing position whereas Q-angle was measured in supine position. In supine position, alignment of patella and other structures around

the knee is different as compared to standing due to relaxed soft tissues in supine. In standing, there is tendency for an increased valgus angulation as a result of pull from the lateral structures around the knee and femoral anteversion combined with tibial torsion. The primary limitations in this study were Q-angle was measured in non-weight bearing position, popliteal angle was not measured and Strength of muscles around the knee was not assessed. Contribution of Hamstring muscles to signs and symptoms in osteoarthritis can be studied in future studies as well as the development of a valid diagnostic tool for accurate assessment of osteoarthritis.

CONCLUSION

Findings of this study conclude that Q-angle correlates poorly with the patient's signs and symptoms. 73.3% of the subjects were overweight and obese. 70% of the females (n=30) were overweight and obese. 76.6% of the males (n=30) were overweight and obese. 56.6% of the subjects had a pain score greater than 5 cms on the visual analogue scale. 20% of the females had genu valgum while 16.6% had genu varum. 6.6% of the males had genu valgum while

ABBREVIATIONS

OA - Osteoarthritis
BMI - Body Mass Index
KSS - Knee Society Score
VAS - Visual Analogue Scale
VMO - Vastus Medialis Oblique
QoL - Quality of Life

ACKNOWLEDGEMENTS

I would sincerely like to thank the following people for making substantial contributions to our study. I would like to thank my parents for always supporting me in every possible way. Secondly, my statistician, Mr. Sudeep Kondal for analyzing the data appropriately. Lastly I would also like to acknowledge my friends, colleagues and teachers for their unconditional support towards the completion of this study.

Conflicts of interest: None

REFERENCES

[1]. M.S. Radha and M.R. Gangadhar. Prevalence of knee osteoarthritis patients in Mysore city, Karnataka. International Journal of Recent Scientific Research. 2015 April;6(4): 3316-20.
[2]. Anna Litwic, Mark Edwards, Elaine Dennison, Cyrus Cooper. Epidemiology and Burden of Osteoarthritis. Br Med Bull. 2013;105:185–199.
[3]. Keith K.W. Chan and Ricky W.K. Wu. Symptoms, Signs and Quality of Life (QoL) in Osteoarthritis (OA). Principles of Osteoarthritis – Its Definition, Character, Derivation and Modality-Related Recognition. 2012.
[4]. Ajediran I. Bello*, Jeffrey A.Danso, Emmanuel Bonney, Oppong-Yeboah Bertha. The Influence of Body Mass Index, Q-angle and Tibiofemoral Alignment on the Clinical Deficits of Osteoarthritis of the Knee. J Physical Rehab Med. 2015;1(1):005.
[5]. Be´laSzebenyi, Anthony P. Hollander, Paul Dieppe, Brian Quilty, John Duddy, Shane Clarke, and John R. Kirwan. Obj. Associations between Pain, Function, and Radiographic Features in Osteoarthritis of the Knee. Arthritis & Rheumatism. 2006 Jan;54(1):230–35.
[6]. Venus Pagare. Visual analogue scale [internet]. Available from: "http://www.physio-pedia.com/Visual_Analogue_Scale".
[7]. Ana Luiza Cabrera Martimbianco, Fernanda Rizzo Calabrese, Luiz Alberto Nakao Iha, Marcelo Petrilli, Ozório Lira Neto, and Mário Carneiro Filho. Reliability of the "American Knee Society Score" (AKSS). Acta Ortop Bras. 2012;20(1):34–38.
[8]. Dr Henry Knipe and Dr Vivek Pai et al. Kellgren and Lawrence system for classification of osteoarthritis of knee [internet]. Available from: http://www.Radiopedia.org
[9]. Carol A. Oatis. Kinesiology-The mechanics and pathomechanics of Human Movement. Second Edition. Lippincott Williams and Wilkins. 2009;772-774.
[10]. Masahiko Ikeuchi, Masashi Izumi, Koji Aso, Natsuki Sugimura and Toshikazu Tani. Clinical characteristics of pain originating from intra-articular structures of the knee joint in patients with medial knee osteoarthritis. Springer Plus 2013;2:628.
[11]. Narinder Kaul and S.K. Verma. Quadriceps Strength of Patients of Osteoarthritis Knee: Relationships to Pain and Disability. Journal of Exercise Science and Physiotherapy 2005; 1(1,2):38-45.
[12]. Sheila C O'Reilly, Adrian Jones, Ken R Muir, Michael Doherty. Quadriceps weakness in knee osteoarthritis: the effect on pain and disability. Ann Rheum Dis 1998;57:588-594.

How to cite this article: Santosh Metgud, Supriya Kondal, Anand Heggannavar. ASSOCIATION OF PAIN, FUNCTION, BMI AND RADIOGRAPHIC EVIDENCE OF OSTEOARTHRITIS WITH CLINICAL ASSESSMENT OF OSTEOARTHRITIS OF THE KNEE JOINT. Int J Physiother Res 2016;4(3):1518-1523. **DOI:** 10.16965/ijpr.2016.123