CORRELATION STUDY BETWEEN CLINICAL AND RADIOLOGICAL FINDINGS IN KNEE OSTEOARTHRITIS

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ABSTRACT: Osteoarthritis (OA) of the knee is the most common form of arthritis and leads to more activity limitations (e.g., disability in walking and stair climbing) than any other disease, especially in the elderly. Recently, impaired proprioceptive accuracy of the knee has been proposed as a local factor in the onset and progression of radiographic knee OA (ROA).

PURPOSE: to compare between the clinical and radiological findings in healthy with that of knee OA. Also, to determine if there is a correlation between the clinical and radiological findings in patients with knee OA.**Subjects:** fifty one patients diagnosed as unilateral or bilateral knee OA with age ranged between 35-70 years, from both gender without any previous history of knee trauma or surgery, and twenty one normal subjects with age ranged from 35 - 68 years

.**METHODS:** peak torque/body weight (PT/BW) was recorded from knee extensors at isokinetic isometric mode at angle of 45 degree.Also the Absolute Angular Error was recorded at 45^{O} and 30^{O} to measure joint position sense (JPS).They made anteroposterior (AP) plain X rays from standing semiflexed knee position and their average score of Timed Up and Go test(TUG) and WOMAC were recorded as a measure of knee pain ,stiffness and function.Comparison between the mean values of different variables in the two groups was performed using unpaired student t test. P value less or equal to 0.05 was considered significant.
RESULTS: there were significant differences between the studied variables between the experimental and control groups except the values of AAE at 30^{O}. Also there were no significant correlation between the clinical findings (pain,function,muscle strength and proprioception) and the severity of arthritic changes in X rays
CONCLUSION: From the finding of the current study we can conclude that there were a significant difference between the both groups in all studied parameters (the WOMAC ,functional level, quadriceps muscle strength and the joint proprioception).Also this study did not support the dependency on radiological findings in management of knee OA as the radiological features did not necessarily indicate the level of structural damage of patients with knee OA and we should consider the clinical features in our treatment plan.

KEYWORDS: radiological knee osteoarthritis, joint position sense, peak torque, proprioception, WOMAC, isokinetic assessment.

INTRODUCTION

OSTEOARTHRITIS (OA) of the knee joint is considered the most common form of arthritis and causing disability in walking and stair climbing than any condition in elderly population [1].

Radiographic evidence of OA is rare below the age of 40, but it becomes more common with radiological disorder being apparent in about 75% of those aged population 60-70 years [2].

Plain radiography has been the primary diagnostic modality for OA for many decades. Osteophytes and joint space narrowing (JSN) are considered to be hallmarks of OA. However, the relationship of these radiological findings correlates of OA pathology with clinical signs and symptoms is less than perfect[3].

There were a contradictory results in the relation between OA and proprioception deficiency some showed there was a decrease in both the sense of the joint position and movement while others showed a significant decrease in the sense of joint position [4].

Knee proprioception comes from integration of afferent inputs from proprioceptive receptors in different structures of the knee joint[5].

Felson et al.,(2009).reported that there was an association between impaired position sense and the progression of function activity limitation using Western Ontario, MC Master Universities OA index (WOMAC)[6].

Lower limb muscle strength has been shown to be an important correlate of locomotor function in patients with OA of the knee [7,8].

Knee osteoarthritis patients often display decreased quadriceps related moments[9]and knee flexion angles[10] during gait. It has been hypothesized that improved quadriceps strength may allow for increased quadriceps related moments and increased joint angles in patients with knee osteoarthritis[11].

Knee pain is the cardinal symptom in knee (OA), and reduced knee muscle strength is common among these patients [12,13]. Pain reduction and restoration of muscle function are thus primary goals in the treatment of knee OA and in fact there was an evidence that muscle strengthening exercisesresult in improvements in pain[12].

Muscle weakness is a well-accepted impairment in knee OA, with patients being reported 20 to 40% weaker than healthy controls[12].

The results of a cohort study indicated that concentric strength of the thigh muscles did not appear to reduce the risks of development of frequent symptoms of the knees[14,15].

Marked weakness of the quadriceps muscles is typically observed following knee injury, after knee surgery and in patients with arthritis. This is partly due to muscle atrophy and partly to ongoing neural inhibition that prevents the quadriceps from being fully activated, a process known as arthrogenic muscle inhibition (AMI). AMI has been linked to articular swelling, inflammation, pain, joint laxity, and structural damage[16,17].

Slemenda et al., (1998)[18]sought to determine whether quadriceps weakness was a risk factor for onset of frequent knee symptoms among older men and women without preexisting knee pain or stiffness. The impaired muscle

function is suspected to play a pathologic role in structural degeneration of the knee joint in patients with OA [19].

There is a known correlation of the severity of pain with the severityof radiographic findings as defined by global scales of OA severity such as the Kellgren -Lawrence grading system[20,21].

In a previous study to see the relation between ROA and pain showed that up to 40% of people with severe radiographic changes are symptomatic free[22].

Many of the structural changes are progressive with disease severity [23].While pain traditionally is weakly correlated to radio graphical knee OA severity[23,24].

PURPOSE OF THE STUDY:

The purpose of this study was to investigate whether or not there is a correlation between the severity of the clinical signs and symptoms of OA representated by WOMAC including (pain, knee stiffness and physical function) quadriceps muscle weakness, proprioception deficiency, knee health status and mobility (TUG) and the severity of radiological changes, And what are the importance of these clinical features in physical therapy when treating patients with knee OA.

SIGNIFICANCE OF THE STUDY

Current prevalence data shows that knee OA is approximately twice as common as hip OA, affecting some 10% of those over the age of 50, and in a significant proportion of younger adults[25]. Radiological OA is estimated to be prevalent in 30% of people over 65 years of age.

In a community cohort, **Dippe et al., (1997)**[23]found that the development of radiographic knee OA over time was predicted by the strength of the quadriceps muscle in women. This is a plausible finding, as the quadriceps muscle is the main stabilizer of the joint. People with the most severe radiographic changes at the knee joint also have the most severe symptoms.

In a study performed on 21 female patients with knee OA the researchers found a significant impairment in motion sense but a minimal impairment in position sense [26]. Other studies performed on 134 knees with OA showed no difference in impairment of position sense or motion sense when compared to age matched healthy controls[4].

Several studies have shown both diminished muscle strength and a poor proprioception in patients with knee OA compared to healthy controls. Since proprioception for a big part depends on the input from the muscle spindles it was hypothesized that poor muscle strength is related to a poor proprioception or vice versa[26].

SUBJECTS, MATERIALS, AND METHODS

This study was conducted in the Isokinetic lab of the faculty of physical therapy, Cairo University and El Ahram Center for radiology in Dokki .

Subjects:

Two groups of subjects with age ranged from 35 to 70 years old participated in the study:

1- THE STUDY GROUP:

The experimental group which included 51 patients with age ranged between 35-70 years. Each patient in the involved group was referred from the orthopedic surgeon with a diagnosis of unilateral or bilateral primary knee OA confirmed by X rays films recruited from the general community in health care and from various multiple clinic in Cairo.

2-THE CONTROL GROUP:

The second group is the control group which includes 21 healthy subjects who were age matched without any previous history of knee pain, with age ranged between 35-68 years for comparison purpose.

Inclusion Criteria:

Patients had to meet the following criteria in order to participate in the experimental group:

- Diagnosed clinically and radiological as unilateral primary knee OA.
- Age ranged from 35-70 years.
- Independent gait (using a single cane is allowed).
- Sufficient understanding to perform the tests.

EXCLUSION CRITERIA:

Patients were excluded according to the following conditions:

- Patients with a secondary OA (traumatic cause).
- The subjects had undergone any surgical operations for hips or knees.
- Individuals who had a ROM lower than 90^O of knee flexion and 10^O of flexion (developed knee flexion contracture), with less than 90^O of hip flexion were excluded due to difficulties in performing the assessment procedure.

- Associated comorbidities such as neurological diseases, malnutrition, and other inflammatory and / or infectious diseases.

- Patients who were under influence of medications as NSAIDs or corticosteroid or were undertaking physical therapy sessions.

INSTRUMENTATIONS:

Biodex isokinetic dynamometer (Fig.1)

Muscle torques of each subject were recorded using Biodex system 3 pro isokinetic dynamometer **(Biodex Medical Systems, Inc. Shirley, New York, USA).**

PROCEDURES:

Initially, the participants were informed about the objectives of the study and invited to sign informed consent.

THE JOINT POSITION SENSE:

The protocols for assessing the JPS consisted of passive knee joint positioning, followed by active repositioning at a pre-determined angle, i.e., the passive–active test. The target angles established for these tests were 30^{O} and 45^{O} for knee flexion [27,28,29]**.** The order of the tests was randomly selected for each subject.

During this test, the participants were blind folded, so that visual cues were eliminated**.**

Three repetitions were carried out for each target angle and the mean values at each angle were considered for analysis.

A- QUADRICEPS MUSCULAR STRENGTH ASSESSMENTS

Measures of muscular performance was obtained according topreviously established protocols [30]**.** The average peak torque values, normalized by body weight, a reliable measure of the actual forces exerted during the isokinetic test, were collected at the angle of 45^{O} of knee flexion for the quadriceps muscles.Although a 60° angle of flexion has been demonstrated to be the angle of maximal isometric force generation [31,32]the 45° of knee flexion was used for two reasons. First, it is close to 60° of knee flexion in which MVIC was produced, and second, MVIC is also easily detected and monitored when using the MMT method in the clinical setting.

Three isometric submaximal repeations . Throughout the tests, the subjects received verbal encouragements to perform the tests as fast and as forcefully, as possible.The measures were taken in the dominant limb by asking person about his or her dominant hand which is considered the first to be affected

A subject during assessing the peak quadriceps torque during isometric contraction**(Fig 1).**

(B)-WOMAC is a disease and joint specific instrument, developed for the evaluation of knee and/or hip osteoarthritis (OA). Since its initial validation it has been widely used and has become the measure of choice for the assessment of OA patients both in clinical trials and observational studies. The questionnaire includes three subscales that target three of the most relevant outcomes in OA[33]**.**

Arabic version was used in this study [34].

It consists of three items: pain, stiffnesss and physical function.

(C)- THE KELLGREN AND LAWRENCE SCALEwas used to assess Osteophytes and joint space width changes in the narrowest medial compartment of tibio-femoral joint[35].

Radiographs were scored using overall grading systems developed by Kellgren and Lawrence by one radiologist familiar with radio-graphic reading in clinical studies using the atlases of Kellgren and Lawrence .

(D)-The Timed Up AndGo Testis one of the most widely USE clinical tests to assess balance and mobility[36]. The TUG is a powerful test that allows the evaluation of several mobility skills at the same time; yet because of its simplicity it is often included in screening protocols [37]**.**Traditionally, the major drawback of the TUG has been that its outcome is limited to the total time taken to complete the test.

The timed up an Go test measured in seconds the time taken by an individual to stand up from a standard arm chair , walk a distance of 3 meters ,turn , walk back to a chair and sit down again**.**

STATISTICAL ANALYSIS

Results are expressed as mean ± standard deviation (SD). Comparison between the mean values of different variables in the two groups was performed using unpaired student *t* test. Comparison between categorical data [n (%)] was done using Chi square test. Correlation between different parameters in the experimental group was performed using Pearson and Spearman correlation. SPSS computer program (version 12 windows) was used for data analysis. P value less or equal to 0.05 was considered significant and less than 0.01 was considered highly significant.

RESULTS

TABLE (1): Correlation between x ray OA grades and different clinical findings in the experimental group:

Clinical Findings	***X Ray OA Grades***	
	R	***P***
Timed Up And Go Test	0.049	0.732^{NS}
Womac	0.203	0.153^{Ns}
Torque/Weight	-0.147	0.304^{NS}
AAE At 45	0.023	0.872^{NS}
AAE At 30	-0.110	0.443^{NS}

r= Spearman Correlation, p = p value.
NS= p> 0.05 = not significant.

There was no statistically significant correlation between the grades of OA in radiology and the values of average TUG test scores in the experimental group**.**

There was no statistically significant correlation between the grades of OA in radiology and the values of WOMAC scores in the experimental group.

There was no statistically significant correlation between the grades of OA in radiology and the values of PT/BW in the experimental group.

There was no statistically significant correlation between the grades of OA in radiology and the values of AAE at 45^{O} in the experimental group.

There was no statistically significant correlation between the grades of OA in radiology and the values of AAE at 30^{O} in the experimental group.

There was no statistically significant correlation between the grades of OA in radiology and different clinical findings in the experimental group.

DISCUSSION

This study was conducted to determine if there is a correlation between the values of the clinical findings (pain, function, muscle strength, proprioception) with the radiological findings in the experimental group.

TORQUE

There was no statistical significant correlation between radiological findings and the values PT/BW in the experimental group, thus the level of Quadriceps muscle weakness did not reflect the value of knee OA as evidenced in x rays by using the Kellgran / Lawrrance scale.

The results of the current research work is supported by [15] work as there was no significant predictive level of muscle weakness in development of knee OA.

This may help to explain why 72% of knees in men and 57% of knees in women that developed knee symptoms had a Kellgran / Lawrrance scale grade (KL) less than (2) at baseline[15].

The results of current study did not support the evidence that patients with knee ROA display a side-to-side asymmetry in quadriceps muscle strength (i.e., muscle weakness) of 20–30% [38,39,40].

PROPRIOCEPTION:.

CORRELATION BETWEEN RADIOLOGICAL FINDINGS AND AAE FINDINGS IN THE EXPERIMENTAL GROUP.

There was no statistical significant correlation between the grades of knee OA in radiological films and the values of AAE at 45^{O} in the experimental group which is evidenced by the work done by **Felson et al (2009)**free[15]found no association between position sense and both onset and progression of radiographic OA at 2.5 years follow-up in 2243 persons with or at high risk for knee OA[6].

While our results did not support the work done by **Hassan et al., (2001)** who compared a group of individuals with knee OA to similarly aged asymptomatic individuals, deficits in knee joint proprioceptive acuity were well documented in patients with knee OA [41,42,43.44].

In the current study was no statistical significant correlation between the grades of knee OA in radiological films and the values of AAE at 30^{O} in the experimental group.

Results of the current study were supported by other previous studies which were performed in about (3682) knee OA patients in total showed no significant association between ROA and position sense[15,45,46].

In a Contradiction to our results in a previous study performed by **Sharma et al., (1997)** found that patients with unilateral knee OA had poorer proprioception than controls in both knees with no clinical or radiographic evidence of OA in either knee. Based on these findings, they speculated that impaired proprioception does not exclusively result from local disease in knee OA[47].

WOMAC:.

CORRELATION BETWEEN RADIOLOGICAL FINDINGS AND WOMAC FINDINGS IN THE EXPERIMENTAL GROUP.

Also in the current study there was no statistical significant correlation between the grades of knee OA in radiological films and the values of WOMAC scores in the experimental group that measure three parameters of knee health status including knee pain, joint stiffness and the difficulty of performing many ADL.

These findings are supported by the work of **Segal et al., (2009 a)** who said that patients with knee OA commonly experience knee pain and limitation of function and joint stiffness may occur in absence of radiological findings that found in knee OA.free[15].

In a Contradiction to our results pain and stiffness, the major symptoms of OA, occur in 25 to 50% of patients with radiographic evidence of the diseasefree[47].

CORRELATION BETWEEN RADIOLOGICAL FINDINGS AND TUG FINDINGS IN THE EXPERIMENTAL GROUP.

There was no statistical significant correlation between the grades of knee OA in radiological films and the values of average TUG scores in the experimental group which measures the level of the mobility of the knee joint during performing the normal ADL

Sharma et al(1998) free[5].found in 236 knee OA patients that impaired motion sense was associated with a poor outcome on a chair standing test, but not with a poor outcome on WOMAC function at 3 years follow-up.

According to my knowledge a few research works have tested the relation between the scores of TUG and the degree of knee OA in x rays using Kellgran-Lawrance scale.

LIMITATIONS OF THE STUDY:

-The sample was small. The study was limited by its small sample size. Further studies with a larger number of patients are needed to determine the possible clinical findings.The number of the sample was small to be classified according to the grades of Kellgran / Lawrrance scale.

-We should measure the value of Abosulte Angular Error (AAE) at different angles that was prevented due to fixed angles in the software that I used.

SUMMARY

There was no significant correlation between the clinical and radiological findings in the experimental group of patients with knee OA.

The results showed that there was no significant difference between the mean values of the clinical findings when classified according to the radiological findings.

CONCLUSION

From the finding of the current study we can conclude that there was no significant correlation between the clinical and radiological findings among patients suffered knee OA.

This study did not support the dependency on radiological findings in managing knee OA as the clinical features did not necessarily indicate the level of structural damage of patients with knee OA. So we should relay on the clinical features of the patient with knee OA that determine the suitable plan of treatment from physical therapy point of view as the dependency on the radiological findings alone using x ray did not make us able to introduce the best methods of treatment in regard to physical therapy management of knee OA as the radiological findings did not reflect the level of functional impairments of patients including(pain,knee function ,muscle weakness and the level of joint proprioception).

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