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The Relationship Between Pain Pattern And Disability In Patients With Knee Osteoarthritis

Rheumatology And Rehabilitation

Yasser A. Elmotaleb Gazar [1,*]MD; Hatem S. Mohammed [1]MD; Mohammed M. Ghait [1]MD

Corresponding Author:
Yasser A. Elmotaleb Gazar
dr.yasser_rh@yahoo.com

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[1]Rheumatology And Rehabilitation Department,Faculty of Medicine, Al-Azhar University, Cairo , Egypt.

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ABSTRACT

Background: Osteoarthritis (OA) knee pain is a global source of impairment. Additionally, it has a detrimental effect on socioeconomic status. Detecting the site of pain represents an essential technique for diagnosing clinical issues and determining suitable treatments.
Aim of The Work: To detect the pattern and site of knee pain in patients with knee OA confirmed by X-ray and their effect on the functional status.
Patients and Methods: a cross-sectional study included 100 patients with primary knee OA. Diagnosis was according to American College of Rheumatology (ACR) criteria. The Photographic Knee Pain Map (PKPM) has been used to detect pain sites. Participants have undergone Plain X-rays and graded according to Kallgren–Lawrence (K-L) radiograph. The physical status has been defined by The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).
Results: Participants' ages have ranged from 35 to 62 years, with an average of 47.6 ± 6.3 years. Most patients are females (88%). Most patients have experienced morning stiffness (79%) with a duration ranging from 5 to 20 minutes (mean 11.2± 5.7 minutes). The mean VAS for pain has been 6.95± 0.97. The pain has ranged from moderate (29%) to severe (71%), with no patients experiencing mild pain. The mean WOMAC score has been 46.29±13.03. The prominent locations of pain in the left knee have been the medial region (6%), local inferior medial (6%), diffuse knee pain (20%), and patella (25%). In comparison, the main sites at the right knee have been diffuse knee pain (14%), medial joint (16%), and patella (41%). Intense regular duties have been the most challenging task, with an average of 3.26±0.85 (severe to extreme 3-4), then going upstairs (3.03±0.70) (severe to extreme 3-4), followed by going downstairs (2.6±0.92), then getting in and out of a car (2.54±0.83), and shopping (2.43±1.01) (moderate to severe 2-3).
Conclusion: Majority of patients with knee OA had moderate level of knee pain and functional disability in daily living and they had the ability to localize site of pain. Also, the severity of knee pain and stiffness may influence the degree of disability in OA patients. As a result, OA treatments can be based on clinical aspects and functional status rather than relying on radiological findings.

Keywords: *Osteoarthritis; Knee; stiffness; Disability.*

INTRODUCTION

Osteoarthritis (OA) represents a global health issue, with being the second source of disability [1.2]. Moreover, it affects socioeconomic status negatively.[3]

Pain site detection is an efficient tool for diagnosing health issues and providing the best treatment[4]. OA influences physical impairment and pain severity, with recorded poor clinical outcomes[5].

Photographic Knee Pain Map (PKPM) has been optimized to detect ten zones of pain sites with margins based on anatomic boundaries.[6]

This study aims to detect the pattern and site of knee pain in patients with knee OA confirmed by X-ray and their effect on the functional status.

PATIENTS AND METHODS

One hundred patients with primary knee OA have been included in this cross-sectional study. The participants have met the criteria of American College of Rheumatology (ACR) for OA diagnosis.[7] They have been selected from the Rheumatology and Rehabilitation outpatient clinic, El-Hussein University Hospital. Patients with hip disorders, knee surgery, post-traumatic, and secondary knee OA have been excluded.

PKPM[6] has been used to determine pain sites in most symptomatic knee based on anatomic landmarks in areas such as the posterior knee zone, tibia, patella tendon, medial and lateral patella, quadriceps tendon, superior medial and lateral zone, and lateral and medial joint line areas. Pain has been classified as absent or present in the previous zones.

Posterior-anterior (PA) and lateral views of knees have been obtained using plain X-rays. The Kallgren–Lawrence (K-L) radiograph score[i] has been used for scoring as follows: grade 2 represents possible joint space narrowing (JSN) and definite osteophytes. Grade 3 reflects possible bone deformity, definite JSN, and moderate multiple osteophytes. Grade 4 indicates definite bone deformity, severe sclerosis, marked JSN, and large osteophytes.

Physical function and experienced pain throughout daily activities have been evaluated by Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). The pain subscale ranges from zero (no pain) to four (severe pain), with an optimum score of 20. The physical function subscale ranges from zero (no physical dysfunction) to four (severe physical dysfunction), with an optimum score of 68.[9]

Statistical analysis

Statistical Package for Social Science version 16, Chicago, IL, USA (SPSS) has been used to gather, tabulate, and analyze data. Percentages and frequencies have been used to demonstrate qualitative data. Moreover, mean ± standard deviation has been used to represent quantitative data, with the significant results obtained at P values less than 0.05.

RESULTS

Table (1) shows the demographic characteristics of the studied patients. The mean age of the patients was 47.6 ± 6.3 years with a range of (35-62) years. Most patients were females (88%)

Table (2) shows the total WOMAC score, stiffness, and pain characteristics of the studied patients. Most patients had morning stiffness (79%) with a duration ranging from 5 to 20 minutes (mean 11.2± 5.7 minutes). The mean VAS for pain was 6.95± 0.97. The pain was ranged from moderate (29%) to severe (71%), with no patients experiencing mild pain. The mean total WOMAC score was 46.29± 13.03.

Figure (1) shows the right knee pain map of the studied patients. The most common site of pain was localized at the patella (41%), followed by medial joint pain (16%), and then diffuse knee pain (14%).

Figure (2) shows the left knee pain map of the studied patients. The most common site of pain was localized at the patella (25%), followed by diffuse knee pain (20%) and then localized inferior medial (6%) and medial region (6%).

Table (3) shows the WOMAC pain items of the studied patients. The mean walking pain, night pain and standing WOMAC for pain was ranged from moderate to severe (2-3). The mean WOMAC pain on upstairs was ranged from severe to extreme (3-4). The mean WOMAC resting pain was ranged from mild to moderate (1-2).

Table (4) shows the WOMAC stiffness items of the studied patients. The mean WOMAC for morning stiffness was ranged from mild to moderate (1-2). The mean WOMAC stiffness later the day was ranged from none to mild (0-1).

Table (5) shows the WOMAC physical function items of the studied patients. The most difficult function to perform was heavy domestic duties with a mean of 3.26±0.85 (severe to extreme 3-4), followed by going upstairs with a mean of 3.03±0.70 (severe to extreme 3-4) and then going downstairs, getting in and out of a car, and shopping with a mean of 2.6±0.92, 2.54±0.83, and 2.43±1.01 respectively (moderate to severe 2-3).

		Total (n=100)	
Age	Mean (SD)	47.6	6.3
	Range	35	62
Gender	Male (%)	12	12.0
	Female (%)	88	88.0
Occupation	Occupied (%)	69	69.0
	Housewives (%)	31	31.0

SD: standard deviation

Table 1: Demographic characteristics of the studied patients (n=100)

		Total (n=100)	
Morning stiffness	Present (%)	79	79.0
	Absent (%)	21	21.0
Stiffness duration (minutes)	Mean (SD)	11.2	5.7
	Range	5	20
Pain VAS	Mean (SD)	6.95	0.97
	Range	5	9
Pain severity	Mild	0	0.0
	Moderate	29	29.0
	Severe	71	71.0
Total WOMAC score	Mean (SD)	46.29	13.03
	Range	0	68

Table 2:WOMAC score, stiffness, and pain characteristics of the studied patients (n=100)

SD: standard deviation, VAS: visual analogue scale (0-10), 1–4 for mild pain, 5–6 for moderate pain, and 7–10 for severe pain, total WOMAC =0-96.

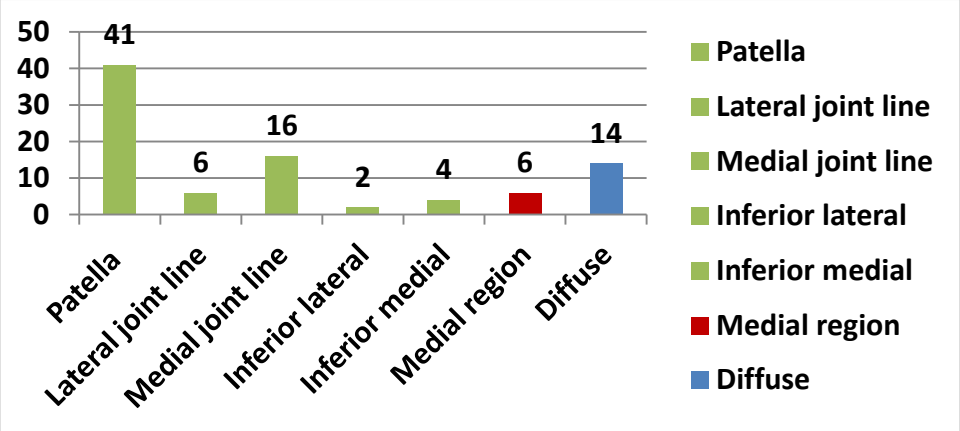

Fig. 1: Right knee pain map of the studied patient

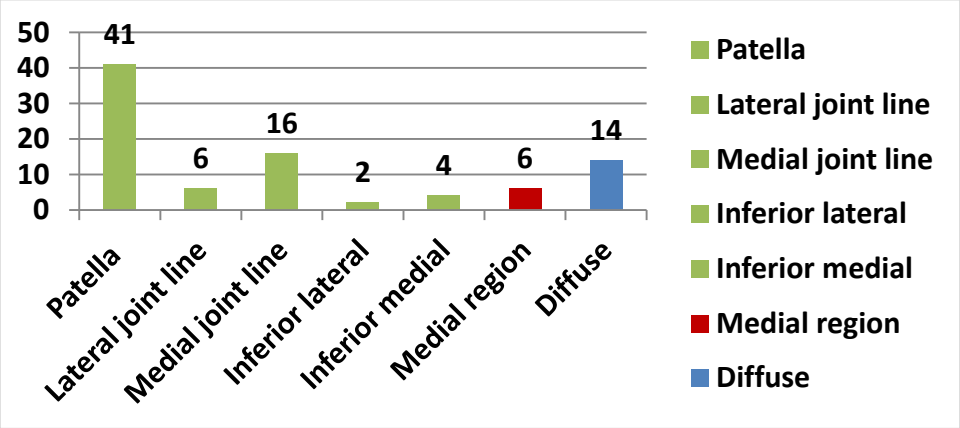

Fig. 2: Left knee pain map of the studied patients

WOMAC pain items	**Total (n=100)**	
	Mean	**SD**
Walking pain	2.45	1.09
Pain on upstairs	3.27	0.67
Nocturnal (night) pain	2.15	0.90
Rest (sitting) pain	1.38	0.68
Weight-bearing (standing) pain	2.78	1.03
Total WOMAC pain	11.78	3.75

Table 3: WOMAC pain items (n=5) of the studied patients (n=100)

SD: standard deviation, the ordinal pain scale of every item: 0-4, the Likert scale for all items: none (0), mild (1), moderate (2), severe (3), and extreme (4), total pain=0-20.

WOMAC stiffness items	**Total (n=100)**	
	Mean	**SD**
Morning stiffness	1.46	1.02
Stiffness later the day	0.85	0.68
Total WOMAC stiffness	2.26	1.66

Table 4: WOMAC stiffness items (n=2) of the studied patients (n=100)

SD: standard deviation, the ordinal pain scale of every item: 0-4, the Likert scale for all items: none (0), mild (1), moderate (2), severe (3), and extreme (4), total stiffness=0-8.

WOMAC function: difficulty with	**Total (n=100)**	
	Mean	**SD**
Going downstairs	2.60	0.92
Going upstairs	3.03	0.70
Arising from sitting	1.83	0.59
Standing	1.46	0.66
Bending	1.52	0.58
Walking on flat ground	1.56	0.54
Getting in and out of a car	2.54	0.83
Shopping	2.43	1.01
Taking off socks	1.55	0.64
Lying down	1.35	0.63
Putting on socks	1.51	0.61
Arising from bed	1.38	0.57
Getting in and out of the bath	1.60	0.87
Sitting	1.69	0.84
Getting on and off the toilet	1.96	0.77
Heavy domestic duties	3.26	0.85
Light domestic duties	1.64	0.68
Total WOMAC function	32.25	8.86

Table 5: WOMAC physical function items (n=17) of the studied patients (n=100)

SD: standard deviation, the ordinal pain scale of every item: 0-4, the Likert scale for all items: none (0), mild (1), moderate (2), severe (3), and extreme (4), total function=0-68.

DISCUSSION

This study aims to evaluate OA pain patterns and their relationship to physical function and pain severity.

Previous studies have concentrated on assessing the duration and frequency of knee pain, besides its location, and pattern via several techniques such as the knee diagram[ii].

Our study has shown that OA patients' ages have 35 to 62 years, with an average of 47.6 ± 6.3 years. Most patients have been females (88%). Thompson et al.[5] have performed a similar study to evaluate the relationship between OA risk factors and the different types of knee pain. Most of the participants' ages have ranged from 45-64 years. Most of patients have been females (62%).

The mean VAS for pain has been 6.95± 0.97. The pain has ranged from moderate (29%) to severe (71%), with no patients experiencing mild pain. The mean WOMAC has been 46.29± 13.03.

McLendon et al.11 have shown that knee pain is more valuable in determining physical dysfunctions than radiographic characteristics of knee OA.

Zhang and Jordan[12] have illustrated how difficult it is to investigate risk variables for symptomatic OA. While OA pain has been regarded as chronic, it is not always persistent. Throughout the disease, physicians frequently find that patients with OA experience pain aggravation.

However, few studies have been performed to evaluate the association between risk variables and pain patterns due to methodological and practical challenges.

In our study, the WOMAC total pain score has been 12± 3.8. and Most of our patients (75%) have experienced severe WOMAC pain.

Similarly, Cubukcu et al.[13] have reported that the WOMAC pain score (mean ± SD) is 14± 3.35, which indicates that most of their patients have experienced severe WOMAC pain.

In our results there was moderate correlation between VAS pain score and WOMAC pain score (r=0.472, p<0.0001).

Basaran et al.[14] have performed a similar study to assess the reliability and validity of the WOMAC OA index and WOMAC has shown moderate correlation with VAS and his study concluded that WOMAC pain represents a consistent index to be used with OA patients.

Our study has reported that the mean WOMAC for morning stiffness ranges from mild to moderate (1-2). A remarkable association has been found between severe pain measured by VAS pain score and degree of stiffness measured by WOMAC stiffness (r=0.636, p<0.0001).

Our findings have revealed a positive correlation between severe pain measured by WOMAC pain score and the following: severe stiffness measured by WOMAC stiffness (r=0.357, p<0.0001). Physical impairment measured by WOMAC function (r=0.857, p<0.0001). Higher values of total WOMAC score (r=0.916, p<0.0001).

Similarly, Cubukcu et al.[13] have documented that WOMAC pain scores are significantly associated with WOMAC disability (r=0.631, p<0.0001) and WOMAC stiffness (r=0.342, p<0.01).

Alkan et al.[15] have performed a study to determine relationships between conventional clinical measures and self-reported disability. In OA patients, they have found that pain areas and physical function are significantly correlated with WOMAC subgroup scores and VAS pain (p < 0.05).

There have been significant correlations between severe pain measured by VAS pain score and severe difficulty in physical functions measured by WOMAC function (r=0.521, p<0.0001),

The likelihood of disability is increased in communities where knee pain is prevalent. Thus, it is critical to comprehend the elements that contribute to disability in patients with knee OA. Several studies have examined the association between pain and physical function in people with knee OA[11.16.17]

In line with these investigations, we have found a positive association between pain severity and disability using WOMAC subscales. The WOMAC scale has enabled an in-depth examination of pain. Patients have rated the severity of their pain while undertaking activities using the WOMAC pain subscale. We have interpreted this finding as the result of a vicious cycle of pain, causing decreased functional abilities.

According to our findings, most of patients hav been localized pain pattern (63%), consistent with Thompson et al.[5], who have revealed that localized pain represented 50.6%, then regional (25.9 %), and diffuse pain (23.5%). The pain patterns in both knees have been consistent.

It is critical to detect the precise area of knee pain for diagnosis. It is unknown whether the site of knee pain varies naturally as the condition progresses.[18.19]

Sengupta et al.[20] have compared pain emanating from the patellofemoral, lateral, and medial regions to osteophytes visible on magnetic resonance imaging scans.

Our results have revealed that there were significant correlations between severe pain measured by VAS pain score female sex (r=0.56, p<0.0001), as well as higher disease duration (r=0.303, p=0.01).

Moreover, there have been significant correlations between severe pain measured by WOMAC pain score and female sex (r=0.44, p<0.0001).

Females are more exposed to experience knee OA[12], which may be due to differences in the pathophysiology. For instance, there may be alterations in cartilage and bone associated with differences in pain sensitivity between the two genders.

Fischbach and Jordan[21] have discovered that female sex is linked with decreased medial cartilage in OA patients using magnetic resonance imaging (MRI). However, variations in pain rating have not been investigated.

Functional MRI (fMRI) has demonstrated that gender variation is associated with activating pain sensation and processing centers such as the cerebellar cortex, hippocampus, dorsolateral prefrontal cortex, and mid-cingulate cortex.[22]

CONCLUSION

Majority of patients with knee OA had moderate level of knee pain and functional disability in daily living and they had the ability to localize site of pain. Also, the severity of knee pain and stiffness may influence the degree of disability in OA patients. As a result, OA treatments can be based on clinical aspects and functional status rather than relying on radiological findings.

REFERENCES

1. Neogi T., The epidemiology and impact of pain in osteoarthritis. *Osteoarthritis Cartilage*. 2013 ;21(9):1145–53.
2. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al., Years lived with disability (YLDs), a systematic analysis for the Global Burden of Disease Study. *Lancet*. 2012 ;380(9859):2163–96.
3. Dillon CF, Rasch EK, Gu Q, Hirsch R.: Prevalence of knee osteoarthritis in the United States: arthritis data from the third national health and nutrition examination survey. *J Rheumatol* 2006;33(1):2271–9.
4. Bennell KL, Kyriakos M, Metcalf B, Egerton T, Wrigley TV, Hodges PW, et al. Neuromuscular versus quadriceps strengthening exercise in people with medial knee osteoarthritis and varus malalignment: a randomized controlled trial. *Arthritis Rheum.* 2014; 66:950-9.
5. Thompson LR, Boudreau R, Newman AB, Hannon MJ, Chu CR, Nevitt MC, Kent Kwoh C; OAI Investigators. The association of osteoarthritis risk factors with localized, regional and diffuse knee pain. *Osteoarthritis Cartilage*. 2010 Oct;18(10):1244-9. doi: 10.1016/j.joca.2010.05.014. Epub 2010 Jul 13.
6. Elson DW, Jones S, Caplan N, Stewart S, St Clair Gibson A, Kader DF. The photographic knee pain map: locating knee pain with an instrument developed for diagnostic, communication, and research purposes. *Knee.* 2011; 18:417-23.
7. Altman R, Asch E, Bloch D, Bole G, Bornstein D, Brandt K, et al. Development of the criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. *Arthritis Rheum*. 1986;29(8):1039–49.
8. Kallgren JH and Lawrence JS. Radiological assessment of osteoarthrosis. *Ann Rheum Dis*. 1957; 16:494-502.
9. McConnell S, Kolopack P & Davis AM. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC): a review of its utility and measurement properties. *Arthritis Rheum*. 2001; 45:453-61.
10. Hochberg MC, Lawrence RC, Everett DF, Cornoni HJ. Epidemiologic associations of pain in osteoarthritis of the knee: data from the National Health and Nutrition Examination Survey and the National Health and Nutrition Examination-I Epidemiologic Follow-up Survey. *Semin Arthritis Rheum*. 1989; 18(4 Suppl 2):4–9.

11. McLendon TE, Cooper C, Kirwan JR, Dieppe PA. Determinants of disability in osteoarthritis of the knee. *Ann Rheum Dis*. 1993; 52(4): 258–262.
12. Zhang Y and Jordan M. Epidemiology of Osteoarthritis. *Clin Geriatric Med*. 2010; 26(3): 355–369.
13. Cubukcu D, Sarsan A & Alkan H. Relationships between Pain, Function and Radiographic Findings in Osteoarthritis of the Knee: A Cross-Sectional Study. *Arthritis* 2012; 1:5.
14. Basaran S, Guzel R, Seydaoglu G, Guler-Uysal F. Validity, reliability, and comparison of the WOMAC osteoarthritis index and Lequesne algo functional index in Turkish patients with hip or knee osteoarthritis. *Clin Rheumatol*. 2010; 29(7):749-56.
15. Alkan BM, Fidan F, Tosun A, Ardıçoğlu O. Quality of life and self-reported disability in patients with knee osteoarthritis. *Mod Rheumatol*. 2013; 175-23.
16. Guccione AA, Felson DT and Anderson JJ. Defining arthritis and measuring functional status in elders: methodological issues in the study of disease and physical disability. *Am J Public Health.* 1990; 80(8):945–949.
17. Ay S and Evcik D. Effectiveness of pain, disease severity and radiological grading on disability of daily living activities in knee osteoarthritis. *Romatizma* 2008; 23(1):14–17.
18. Munro J and Edwards CRW. MacLoed's clinical examination. *Churchill Livingstone*; 1995; Ninth ed. 29–32.
19. McRae R. Clinical orthopaedic examination. *Churchill Livingstone*; 1997; Fourth ed. New York:202–3.
20. Sengupta M, Zhang YQ, Niu JB, Guermazi A, Grigorian M, Gale D, et al. High signal in knee osteophytes is not associated with knee pain. *Osteoarthritis Cartilage* 2006;14: 413–7.
21. Mehrnaz MF and Joanne MJ. Sex differences in magnetic resonance imaging-based biomarkers and in those of joint metabolism. *Arthritis Research & Therapy* 2010; 12:212
22. Henderson LA, Gandevia SC & Macefield VG., Gender differences in brain activity evoked by muscle and cutaneous pain: a retrospective study of single-trial fMRI data. *Neuroimage*. 2008; 39(4):1867–76.