



Research Article

IMPACT OF KNEE OSTEOARTHRITIS AND ITS CORRELATION WITH BALANCE, FEAR OF FALLS AND QUALITY OF LIFE - A PILOT STUDY

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ABSTRACT

Impact of knee osteoarthritis and its correlation with balance, fear of falls and quality of life - a pilot study

Objective: To correlate balance, fear of falls and quality of life in individuals with knee Osteoarthritis and age - matched controls using CBMS, FES, SF-36.

Methods: Fifty participants in the age group of 40 - 60 years were divided into Group A with diagnosed participants with knee OA using Kellgren-Lawrence scale and American college of Rheumatology (ACR) guidelines and Group B with age matched controls. The balance, fear of falls and quality of life was assessed using CBMS (Community Balance and Mobility scale), FES (Falls Efficacy Scale) and SF-36 respectively.

Results: Balance was affected more in Group A (p value- 0.165). Group A participants depicted more fear of falls (p value- <0.0001). The quality of life was poorer in Group A participants rather than matched controls (P value- <0.0001). Significant correlation was found between balance and fear of falling (r value: -0.4191). The affection of mental domain could be related to poor balance scores (r value: 0.01049). The fear of falling could be related to poorer quality of life (r value: -0.1352).

Conclusion: Knee osteoarthritis causes significant changes in the patient's balance which is directly related to fear of falling which in turn has a negative impact on quality of life.

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INTRODUCTION

Knee osteoarthritis (OA) is one of the most prevalent musculoskeletal complaints worldwide, affecting 30 - 40% of the population by the age of 65 year¹. It is one of the causes of impairment and disability among the elderly. Osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India^{2,3,5}.

This also causes a serious economic burden on the community⁴. OA is more common in women than men, but the prevalence increases dramatically with age^{2,5,6}. Individuals with knee OA suffer progressive loss of function, displaying increasing dependency in walking, stair climbing and more loading on other lower extremity. Balance is an integral component of these and many other activities of daily living. Individuals with knee OA display reductions in quadriceps strength and activation as well as impaired activation of knee joint proprioception. Balance impairments are associated with an increased risk of falls and poorer mobility in the elderly population. Ageing is associated with a decline in the integrity of the physiological systems that contribute to the control of balance⁷.

These deficits in combination with the ageing process, may culminate in greater impairments in balance and postural stability in this patient population, compared with their age-matched and healthy counterparts. The study "Balance control and knee osteoarthritis severity" conducted by Hee Sang Kim, Dong Hwan Yun, *et al* concluded that balance control reduces with osteoarthritis knee severity¹⁰. Limited research has evaluated the impact of knee OA on balance. It is therefore important that the evaluation of balance incorporates testing procedures that focuses the dynamic nature of such locomotor tasks. Expensive apparatus like postural sway are not readily available to the majority of clinicians, and are thus not appropriate for use in the clinical setting. Simple, inexpensive and easy-to administer clinical tests are required to allow the clinician to assess balance readily and quickly in patients with knee OA. Measures of dynamic balance and function, such as the Berg Balance Scale (BBS), the Timed Up & Go Test (TUG), and measures of gait speed, have been used previously to assess dynamic balance and mobility. However, it has been shown that the BBS and TUG have a ceiling effect in individuals who can ambulate independently in the community, including those with mild knee OA⁸. The Community Balance and Mobility Scale (CB&M) was developed to assess community-level functional deficits in both dynamic balance and mobility⁸. The CB&M is sensitive to change⁸ and does not suffer from ceiling effects⁸.

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A direct correlation has been noted between decrease balance and increase in fear of falls, this fear of fall has been the main reason for reduced activities of daily living and hence a huge impact on the quality of life. Some previous studies have evaluated quality of life in patients with knee osteoarthritis using WOMAC, AIMS etc., but these questionnaires deal specifically with osteoarthritis, failing to measure important aspects of patients mental, social and emotional health. The Medical Outcomes Study-36 - Item Short -Form Health Survey (SF-36) is short and easy to administer and understand; moreover, since it is a generic instrument, it enables comparisons of the impact of quality of life in knee osteoarthritis with other health conditions, allowing correlation with psychosocial aspects.

For the increasing prevalence of OA in the general population, it is important to pay attention to all the limiting factors. Symptomatic relief in OA patients is the primary aim of therapy and balance and quality of life are often considered secondary by the patient and the therapist. Hence, the purpose of this study was to evaluate balance, fear of falls and quality of life in individuals with symptomatic knee OA and in an age-matched control group.

METHODS

Participants: In this study twenty five participants (16 females, 9 males) with knee OA and twenty five age- matched controls (11 females, 14 males) participants in the age group of 40 to 60 years were selected for the study. These patients were chosen when they came to the K. J. Somaiya Hospital for physiotherapy treatment. Diagnosis of OA was confirmed by an orthopedic, based on the American College of Rheumatology classification criteria and Kellgren Lawrence Scale. Participants with OA were included if they had knee pain (> 4 cm on the VAS – visual analogue scale) on most days of the previous three months, BMI more than 18.5 and MMSE score more than 24. All participants were independent in activities of daily living. Matched controls were of the age group 40 to 60 years, without any knee pain complain since the past 3 months, BMI more than 18.5 and MMSE score more than 24. Participants who have undergone knee or hip replacement surgeries in the past 1 year, those having any neurological conditions, lower limb fractures in the recent 1 year duration and subjects having cognitive, perceptual and uncorrectable visual disturbances were excluded from this study. Written consent was taken from all the participants. The participants were asked to fill the SF-36 and FES and later, CBMS was performed

Knee radiographs: Participants with OA had X-rays (skyline, weightbearing AP and lateral) of the tested knee taken in the previous 1 year.

Severity of OA was evaluated by a radiologist according to the Kellgren and Lawrence system, with 32 % of participants graded as mild (grade I and II) and 68 % graded as severe (grade III and IV).

Community Balance and Mobility Scale

The Community Balance and Mobility Scale (CB&M) was designed to evaluate balance and mobility in patients who were ambulatory but also had balance impairments which reduce their full engagement in community living. It consists of 13 activities which the patients had to perform and they

were assessed on a scale of 0-5. The activities included unilateral stance; tandem standing; 180 degree pivot; lateral foot scooting; hopping forward; crouch and walk; lateral dodging; walking & looking; running with controlled stop; forward to backward walking; walk, look and carry; descending stairs and step-ups x 1 step and an additional point was given for successfully climbing down stairs with a basket in hand; showing maximum maintenance of balance along with mobility. The total score is 96. In the knee OA group, scores on all balance and mobility tests were significantly correlated with CB&M scores, with correlations ranging from .52 to .74, indicating moderate convergent validity¹⁵. Scores on the CB&M were highly reliable in people with knee OA (ICC=.95, 95% confidence interval [95% CI]=0.70 to 0.99; SEM=3, 95% CI=2.68 to 4.67)¹⁵.

Falls efficacy scale

The Falls Efficacy Scale-International (FES-I) is a short, easy to administer questionnaire that measures the level of concern about falling during social and physical activities inside and outside the home. There are 14 that are listed and the level of concern of falling is asked. The level of concern is measured on a four point Likert scale¹⁴ (1=not at all concerned to 4=very concerned) (Yardley *et al.*, 2005). The subjects were asked their level of fear on each activity and the readings were noted. The FES-I demonstrated high test-retest reliability (intraclass correlation coefficient, model 3,1: 0.94; 95% confidence interval, 0.90 0.97) and had concurrent validity with other self-report and physical performance measures¹⁹.

SF- 36

The SF 36 is a multipurpose and easy to understand questionnaire which scores the various domains of physical and mental aspect of health. It is a generic scale and hence can be correlated with many other conditions. The various aspects include vitality, physical functioning, bodily pain, general health perceptions, physical role functioning, emotional role functioning, social role functioning, mental health. The scores range from 0 100. Lower scores means more disability, higher scores means less disability. The sf-36 demonstrated high reliability and validity (correlation coefficients ranging from 0.81-0.88)¹⁶⁻¹⁸.

Statistical analysis

The statistical analysis was carried out using Graph Pad InStat version 3.0. The data the distribution was conformed to a Gaussian distribution using the Kolmogorov-Smirnov test of normality. The unpaired t tests and Mann-Whitney tests were used for group comparison. For correlation between balance, fear of falls and quality of life Spearman and Pearson correlation coefficient was used.

RESULTS

Age of participants

50 participants ranging in the age group of 40-60 years were included in the study. The graphs below show the distribution

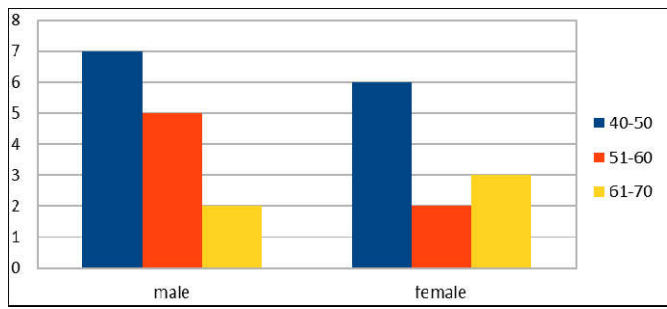


Illustration 1 participants with knee osteoarthritis

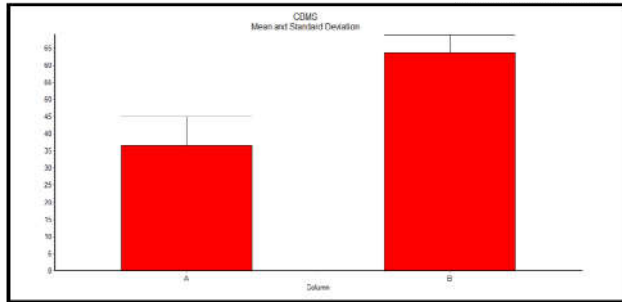


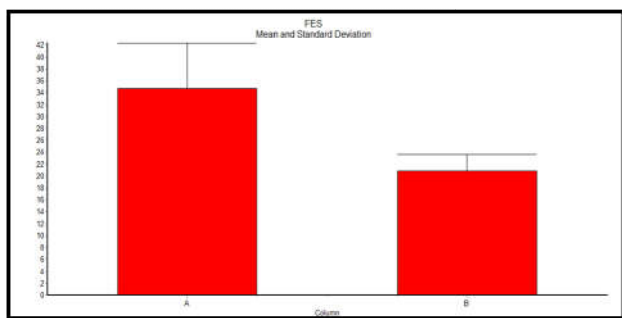
Illustration 2 participants without knee osteoarthritis

Balance

Scores of the community balance and mobility scale were analyzed. Unpaired t-test was used for groups comparison. Group A consisted of participants with knee osteoarthritis and Group B consisted of matched controls. P value was found to be 0.0165.

Fear of Falls

Unpaired t test was used for between group comparisons. The P value was <0.0001.



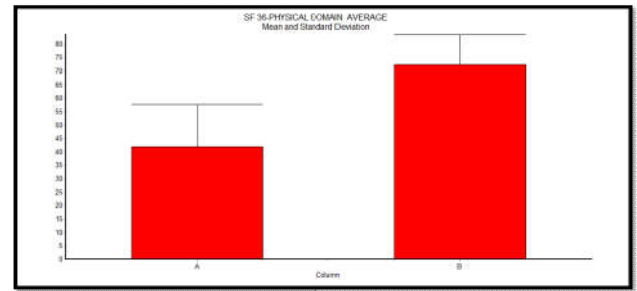
Sf 36

The physical and mental domains along with final scores were assessed in the two groups. unpaired t test was used to assess the physical and mental domain. Mann Whitney test was used to assess the final score of

SF- 36

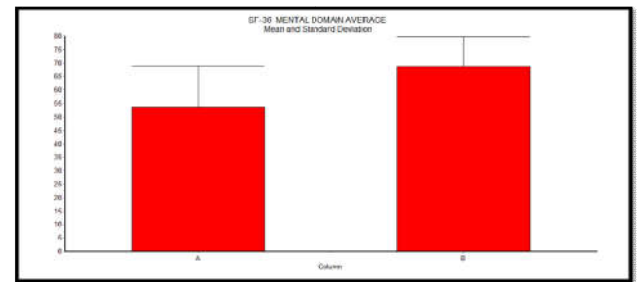
Physical Domain

The p value for physical domain was 0.0967.



Mental domain

Unpaired t test was used to perform between group comparison. The p

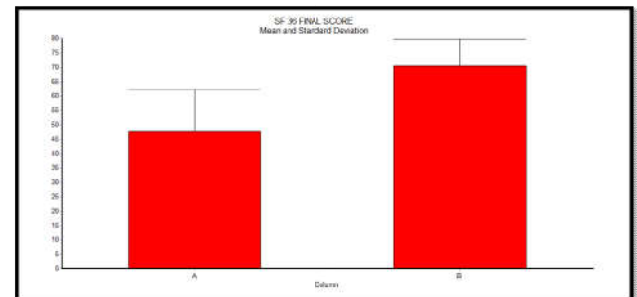


value was found to be 0.1145

Final score

Mann whitney test was used for between group comparison.

The p value was found to be <0.0001



SCALE	GROUP	MEAN	STANDARD DEVIATION	P VALUE
CBMS	OA	36.640	8.386	0.0165
	WOA	63.720	5.062	0.0165
FES	OA	34.680	7.658	< 0.0001
	WOA	20.920	2.691	< 0.0001
SF36 (P)	OA	42.000	15.757	0.0967
	WOA	72.300	11.149	0.0967
SF36 (M)	OA	53.469	15.458	0.1145
	WOA	68.688	11.149	0.1145
SF36 (AVG)	OA	47.735	14.335	< 0.0001
	WOA	70.494	9.357	< 0.0001

FIG 1 Summary of Mean, Standard Deviation And P Value For The Scales

Pearson and spearman's coefficient was used for correlation between balance, fear of falls and quality of life in these two groups.

In osteoarthritis knee participants

CORRELATION COMPONENTS	R VALUE	P VALUE
CBMS + FES	-0.4191	0.0371
CBMS + SF 36 (P)*	-0.02625	0.9009
CBMS + SF 36 (M)*	0.01049	0.9603
CBMS + SF 36 (Avg)*	-0.1570	0.4537
FES + SF 36 (P)*	0.1078	0.6079
FES + SF 36 (M)*	0.1152	0.5836
FES + SF 36 (Avg)*	-0.1352	0.5386

* P- Physical domain
 *M- Mental domain
 * Avg - Average Score

In matched controls

CORRELATION COMPONENTS	R VALUE	P VALUE
CBMS + FES	0.06557	0.7555
CBMS + SF 36 (P)	-0.03195	0.8795
CBMS + SF 36 (M)	0.1031	0.6239
CBMS + SF 36 (Avg)	0.04227	0.8410
FES + SF 36 (P)	0.05846	0.7813
FES + SF 36 (M)	-0.2855	0.1665
FES + SF 36 (Avg)	-0.1350	0.5200

DISCUSSION

Osteoarthritis of the knee is a growing problem for the aging Indian population. The current study was to assess balance, fear of falls and quality of life in subjects with knee OA and its comparison with matched controls.

Out of 50 participants, in the age group of 40-50 years 9 participants, in age group of 51-60 years 9 participants and in age group of 61-70 years 7 participants with knee OA were seen. Also, knee OA was seen more in females compared to males. There were 9 male participants and 16 female participants. This can be attributed to the low bone density and lack of exposure to vitamin D, calcium and the menopausal effect on bones. A large group belonged to the post menopausal phase, in which due to the effect of oestrogen and progesterone, the bone quality decreases.

The CBMS was used to assess balance in the two groups. The mean score for Group A was 36.640 and Group B was 63.720. In CBMS, specific activities which demanded significant weight bearing example: stairclimbing, pivoting, running with controlled stopping, hopping scored lower in group A than group B. This signifies reduced muscle strength which is one of the features of knee OA. The CBMS revealed that the participants with knee OA took significantly fewer steps when weight bearing on osteoarthritic limb compared to controls.

This shows a reduced ability to maintain balance while performing a destabilizing activity. Balance is achieved by maintaining the body's center of gravity (COG) over the base of support (BOS) during both static and dynamic situations. Balance mainly depends on the combined effects of 3 systems: sensory, central nervous system and neuromuscular systems. Since patients with any neurological deficits or sensory loss have been excluded, it is evident that the loss of balance is due to musculoskeletal fatigue and a reduction in the motor activation of the lower extremities. An accurate evaluation of balance control in knee OA patients is necessary so that it can be combined with the current practices which mainly focuses on pain relief and maintenance of range of motion. Significant correlation was found between balance and fear of falls (r value : -0.4191) As balance increases, fear of falling reduces. Balance causes maintenance of COG[center of gravity] and thus reduces the chances of falling. In the study conducted by Marigold DS, Eng JJ it was found that asymmetrical weight bearing could lead to falls in post stroke patients^{11,12}. Assymetrical weight bearing is also present in knee osteoarthritis due to pain and changes present in the joint. Balance loss and instability are one of the main reasons for loss of mobility and increased dependence. Tinetti and Powell(1993) defined fear of falling as " a lasting concern about falling that leads to an individual avoiding activities that he/she remains capable of performing"⁹. The FES was assessed in both the groups and scores were noted. Group A had a mean score of 34.680 while Group B had a score of 20.920. Scores were found higher in Group A compared to Group B. The fear mainly was walking on any unstable surface such as an uneven road or a slippery surface. Knee osteoarthritis causes reduction in proprioceptive activation, reduced muscle strength, loss of balance and eventually fear of falling. This fear of falling causes tension and lack of self confidence in majority of population. Fear of falling could be inversely relatable with the quality of living (r value: -0.1352) The better quality of life is seen in participants with lower fear of falling.

Quality of life was evaluated in the participants and significant differences were found between Group A and Group B. The mean of SF-36 was found out to be 47.735 in Group A compared to 70.494 in Group B. SF-36 has two subdomains: physical and mental domain. The mean score of physical domain was 42.000 in Group A and 72.300 in Group B. In the study conducted by Marcio Massao Kawano, Ivan Luis Andrade Araújo, *et al* assessment of quality of life in patients with knee osteoarthritis it was found that activity limitation due to osteoarthritis of knee is directly related to low quality of life values¹³. OA patients often experience loss of range of motion and muscle weakness. This causes reduced physical functioning and limitations in activities. Pain associated with knee OA results in reduced loading of the affected joint causing deterioration of the general health. There is major restriction in independent mobility of an individual and more dependence on either family members or walking aids. OA participants had a score of 53.469 on the mental domain assessment compared to 68.688 in matched controls. Vitality is mainly affected due to reduced physical functioning. There is an increase of consciousness among OA patients which impacts involvement in ADLs. There is less of concentration and more unsatisfaction due to reduced inputs. The reduced muscle strength and eventual loss of balance causes limitations in social functioning and low mental health perceptions. A direct correlation was found between CBMS and SF-36 mental

domain (r value: 0.01049) Mental domain was majorly affected in active participants since they had a low perception about their future. Mental domain low scores could also be correlated with poorer balance and increased fear of falling. Knee osteoarthritis not only affects the ADLs of the participants but also has a negative impact on the patients mental stability. Hence, counselling and motivational talks should be emphasised along with the regular treatment protocols.

There were few limitations to this study. Many participants were reluctant to admit their fear of falls. There were differences in the levels of perceptions amongst the participants. There was no interrater assessment.

For the future studies, postural sway meter can be used for future studies as it eliminates the chances of human error and provides a standard means of assessing the parameters. A suggestion for further studies is to examine the intensity of fear of falling on the spatial and temporal aspects of gait. Further studies could also explore the efficacy of treatment protocols to see the effectiveness on balance training and reductions in fear of falling.

CONCLUSION

This study found statistically significant differences between the participants having knee osteoarthritis and matched controls. Balance was found to be affected in participants with osteoarthritis more than in those without knee osteoarthritis. Fear of falls was also found to be higher in osteoarthritis knee participants than matched controls. Quality of life was found to be lower in knee osteoarthritis participants than matched controls.

Along with the current practises of pain reduction and improvement of joint mobility for knee osteoarthritis treatment, counselling and balance training should also be made a routine part in the treatment protocol for better results and improvement in quality of life.

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