Effectiveness of Isometric Exercise and Counseling on Level of Pain Among Patients With Knee Osteoarthritis

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Abstract

Introduction: Osteoarthritis (OA) is one of the emerging health issues in Asian countries in elderly population. Knee osteoarthritis (KOA) is a major age related public health issue characterized by progressive loss of articular cartilage resulting in pain, functional impairment, disability and diminished quality of life. The aim of this study was to assess the effectiveness of Isometric exercise and counseling on level of pain among patients with KOA.
Methods: Quantitative research approach and a quasi-experimental pretest-posttest control group research design was utilized. The study was conducted at MIOT hospital and Devadoss Hospital, Madurai, Tamil Nadu, India. Data was collected from a total of 200 patients with KOA, 100 in the study and 100 in the control group. These patients were clinically diagnosed to have Grade I, II and III KOA. The demographic variables and clinical profile were recorded for both groups. The self-administered WOMAC questionnaire was used to assess the level of pain of KOA patients. Post-test assessment was carried out on Day 15, Day 30, Day 60 and Day 90. The data was analyzed using SPSS windows 16.
Results: The comparison of level of pain between the study and control group has showed a remarkable reduction in level of pain among patients with KOA in the study group. The post-test level of pain in the study group was 14.9% (13.3% -16.5% with 95% CI) and was 2.1% (1.2% -3.0% with 95% CI) in the control group. It showed that the reduction in the level of pain was higher in the study group than the control group.
Conclusion: The study found that a 12-week Isometric exercise and counseling program has significantly reduced pain, stiffness and improved physical function. Therefore, the Isometric exercise and counselling should be adopted as a routine care in the hospitals treating patients with KOA.

Keywords

long term disability, osteoarthritis, counseling, knee osteoarthritis, isometric exercise

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The most prevalent health hazard in the world's population is chronic diseases of musculoskeletal system. Osteoarthritis (OA) is one of the most common rheumatologic health problem and a joint disease that occurs frequently. The prevalence of OA is 22% to 39% in India. The women are most frequently affected than men. However, the prevalence is on the rise due to aging. On an average, 45% of women above 65 years' experience the symptoms. The radiological evidence is seen in 70% of the people over 65 years. OA was estimated to be the 10th leading cause of non-fatal burden (Pal et al., 2016). OA is the eighth common predictor of health problem in men and fourth common predictor in women across the world (Bhandarkar et al., 2016).

OA is one of the emerging health issues among elderly population in Asian countries. The estimates states that approximately 3.8% of the world's population are affected by a functional disability. The pathological

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changes in OA includes destruction and progressive loss of articular cartilage, formation of osteophytes, thickening of subchondral bone, inflammation of the synovium in varying degrees, degeneration of menisci and ligaments of the knee and hypertrophy of joint capsule (Anzari, 2018). Singh et al. (2014) found that the prevalence of OA was 41.1%, out of which 37.7% had bilateral osteoarthritis, whereas 3.4% had unilateral osteoarthritis.

OA of knee is one of the main reasons for knee pain and a major cause of impairment in mobility, mainly in females. Knee osteoarthritis (KOA) is a foremost age related health problem, which is seen with a functional impairment, loss of articular cartilage, pain, disability and poor quality of life. Around 37% of people above 60 years are diagnosed with KOA. In 2025, the prevalence of KOA will increase by 40% mainly due to the increased number of aged population (Kawano et al., 2015). Considering the global disability, KOA is considered as the 11th contributor. KOA is the 38th contributor for disability-adjusted life years. The global age-standardized prevalence of KOA is 3.8%. The years of life lived with disability (YLDs) for KOA increased from 10.5 million in 1990 to 17.1 million in 2010 (Cross et al., 2014).

National Health and Nutritional Examination Survey reported that the overall prevalence of symptomatic KOA was 15.6 million, among them 8.5 million individuals reported with advanced KOA in adults aged under 45 years. In this age group, KOA is found higher in males (36% to 40%) than the females (28% to 35%). Among the individuals aged between 45-65 years, the symptomatic KOA is found in 7 million people, in which the prevalence was higher among the females than the males. Among the women over 65 years of age, one in five are estimated to have symptomatic KOA, with two third of them having the disease at an advanced stage (Deshpande, 2015).

The most common symptoms of KOA are joint enlargement, pain, stiffness, muscle weakness, crepitus, impaired proprioception, deformity, reduced movement of joints, and disability (Alghadir, 2019). Ho-Pham et al. (2014) reported that the prevalence of KOA increases with the advancement of age. Self-reported knee pain was found in 35% of men and 62% of women. Murphy et al. (2016) reported an annual incidence in the rates of KOA with an incidence of 3% radiographic OA, 2% symptomatic OA, 2% severe radiographic OA, and 0.8% severe symptomatic OA.

Individuals with KOA report pain and difficulty in carrying out routine activities and experience difficulties in sleep and fatigue. These patients also experience physical impairments including muscle weakness, joint stiffness, joint abnormalities and limited balance. It can later lead to psychological problems such as depression and anxiety (Parmelee et al., 2015). Muscle impairments connected with KOA are the main cause of functional limitations, such as difficulty in standing up from a chair, struggle in going up and down the stairs, and strain in the level of surface walking (Alnahdi, 2012).

Therapeutic exercises including isotonic, isokinetic, and isometric exercises are found beneficial in reducing the pain among patients with KOA. Among these exercises, isometric exercise is the most applicable and easy exercise that can be performed by the patients and can be safely performed at home as it requires no or minimal device. Also, isometric exercise reduces the intra-articular inflammation, bone destruction and pressure (Anwer & Alghadir, 2014).

A meta-analysis on the effect of exercise on improvement in various impairment with KOA was done in 2013. The meta-analysis included 33 randomized controlled trials which consisted of 3192 KOA patients. The results of the meta-analysis reported that exercise intervention improves maximal oxygen uptake, reduces pain, stiffness, and gives improvement in knee extensor and flexor muscle strength. The results of the meta-analysis also reported that the exercise reduced the BP in pregnancy by 9%. Furthermore, the exercise prevented new episodes of sick leave due to lumbo-pelvic pain (Tanaka et al., 2013).

Exercise increases the functional ability of joints and thus reduces the pain perception. Strengthening of the hamstring and quadriceps muscle is important for reduction in KOA and improving the range of motion and decrease the limitation of functional performance of patients with KOA (Al-Johani et al., 2014). As isometric exercise is beneficial and easy to practice, the investigators felt the importance of these exercise and counselling in a view to meet the felt needs of the patients suffering from KOA to improve their functional ability. So the investigator aimed to determine the effectiveness of isometric exercise and counselling on reduction of pain among patients with knee osteoarthritis.

Material and Methods

The study adopted quantitative research approach and a quasi-experimental pre-test post-test control group research design. The study was conducted in two different settings, MIOT hospital, Madurai, Tamil Nadu, India as control group and Devadoss hospital, Madurai, Tamil Nadu, India as study group. The investigator randomly allocated the study and control group. In both the groups, the participants were matched for age and sex. In both the study and control groups, the participants and the person who was assessing the outcomes were blinded. The study was conducted over a period of one year. The sample included patients with KOA grade I, II & III seeking health service from

orthopedic out-patient department. A total of 200 eligible samples were selected by using non-probability convenient sampling technique. 100 samples were assigned to the study group and 100 samples to the control group. The confirmed patients of KOA, patients with radiological evidence of primary OA of grade I, II & III on the Kellgren Lawrence scale, aged between 45–65 years, both males and females, patients having unilateral or bilateral involvement were included as participants of the study.

Patients with other inflammatory joint disease, critically ill patients, patients with the history of mal alignment of the knee including varus/valgus, having any other co-morbidity disease, having major psychiatric disorder, patients who had the plan to undergo joint replacement surgery, patients receiving steroid injection, patients who had knee orthroplasty, and the patients who were undergoing physiotherapy in the past 6 months were excluded from the study.

Before initiation of the study, the ethical approval (75/1) was obtained from the Devadoss hospital, Madurai, Tamil Nadu, India which was approved by ethics committee of Annamalai University. The permission for data collection was sought from MIOT hospital, Madurai, Tamil Nadu, India and Devadoss hospital, Madurai, Tamil Nadu, India. The participants were explained in detail on the research procedures and the written informed consent was signed by the participants. The participants were assured that their participation is voluntary and they were given the freedom to leave the research at any point of time without giving a reason.

Socio-demographic information, clinical profile and anthropometric measures were assessed using the tools prepared by the investigators of the study. The level of pain was assessed using WOMAC scale. All WOMAC subscales (pain, stiffness, and physical function) were internally consistent with Cronbach's coefficient alpha of 0.91, 0.81, and 0.84, respectively (Salaffi et al., 2003).

The patients were given the data collection instruments and their responses were marked on the instruments. It took 30-35 minutes to collect the pre-test data from each sample. After the pre-test, routine care was provided to the patients with KOA of control group and the participants of study group received counselling and isometric exercise along with routine care.

Counselling and Isometric Exercise

Individualized counselling was given by the investigator to the participants of study group in six sessions for 6 days using flash cards and power point presentation. The topic included, protecting joint from knee pain, role of body weight on knee pain, relaxation techniques and prevention of complications. The counselling session lasted for 20 minutes. The participants were encouraged to express to their difficulties and their doubts were clarified.

After the counselling session, Isometric exercises were taught to the patients daily on one-to-one basis for 40 minutes on six consecutive days. On the same day, the patients were asked to re-demonstrate the isometric exercise. The set of exercise begins with warm-up exercise including knee lift, leg bend and lift, heel raise and toe-raise for 5 minutes. Followed by isometric exercises, Quadriceps, adduction, hamstring set and knee tangle exercise were performed for 35 minutes.

All the participants were encouraged to continue to do home-based isometric exercise 3 times a day for 12 weeks. The investigator provided the exercise log to the patients to make record of their exercise activities daily. It helped the investigator to assess the exercise adherence of the participants. A validated and pre-tested exercise pamphlet and counselling booklet were given to the participants for their self-reference. At the end of the data collection, exercise pamphlet and booklet were given to participants of control group.

Post-test was carried out on Day15, Day 30, Day 60 and Day 90. Further reinforcement was done by the researcher when the patient visited the orthopedic out-patient department during their subsequent visit. Their exercise log was checked and they were motivated to continue the exercises, besides their doubts were clarified. No attrition of participant was observed in the study. There were no deviations happened in the study from the original protocol planned.

Frequency, percentage, mean and standard deviation were used as descriptive statistics to analyze the data. Repeated measures of ANOVA was used to compare the pain in two groups with four assessments. Normality checks were carried out on the residuals, which were approximately normally distributed. Sphericity is tested with Mauchly's test. Study data had not met the assumption of sphericity, so we used one of the alternative univariate tests- Greenhouse-Geisser correction. So repeated measures ANOVA with a Greenhouse-Geisser correction were used in this study. Unpaired 't' test and paired 't' test, were used to compare the mean of the variables in the independent and dependent samples. Chi-square test was conducted to compare the distribution of demographic variables and Anthropometric measures that were similar to the group. Percentage with 95% CI and Mean difference with 95% CI were used to find the differences between pretest and posttest score. A P-value less than 0.05 considered to be statistically significant.

Results

The current study determined the effectiveness of isometric exercise and counselling on level of pain among

the patients with KOA. Majority of patients with KOA in the study group (41%) and (45%) in the control group belonged to the age group of 45–50 years. 56% of the patients in the study group and 60% in the control group were females. With regard to educational status, 35% in the study group were graduates and 32% in control group had middle school education. Most of the patients in both study and control group were private employees; 46% and 39% respectively. Majority of (60%) patients in the study group and 55% in the control group were moderate workers. 92% of them in the study group and 83% in the control group were married. Majority of (53%) patients in the study group and 45% in the control group had 1–2 children. In relation to family type, 59% of them in the study group and 49% in the control group were in nuclear family. Regarding the family income, 53% of them in the study group and 38% in the control group had their income above Rs.9000.

In this study, majority of patients in the study group (72%) and (71%) in control group had duration of pain between 7 months to one year. With regard to the site of knee pain, 42% in the study group had pain in the right knee and 46% in the control group had pain in both the knees. Regarding joint-stiffness among the patients with KOA, all of them in both the groups (100%) had joint stiffness less than 30-minutes. In the radiological score of KOA, majority (64%) in the study group and 68% of them in the control group were found to be in stage II and 28% of them in the study group and 21% of them in the control group had Stage-I. Most of the patients in the study group (51%) and in the control group (59%) had taken treatment for 1-4 months. In both the groups, 100% of the participants were under the treatment with NSAID.

Regarding menopause, 39% of them in the study group and 33% of them in the control group had menopause in 41–45 years. Regarding moving pain, all the patients in both the groups, (100%) had moving pain. With regard to resting pain, majority 71% of them in the study group and 68% of them in the control group had resting pain. Regarding limitation of movement, a majority (76%) of them in the study group and 71%

of them in the control group had limitation of movements. In terms of crepitus, 87% of them in the study group and 84% of them in the control group had crepitus. Among the participants, 56% of them in the study group and 60% of them in the control group had attained menopause. Of the samples, 32% of them in the study group and 38% of them in the control group had family history of KOA.

A majority (53%) in the study group and 60% of them in the control group had height ranging between 151–160 cms. Of the participant, 34% of them in the study group and 29% of them in the control group weighed between 61–70 kgs. With regard to BMI, 47% of them in the study group and 48% of them in the control group had the BMI of more than 30.

The level of pain among the patients with KOA in study and control groups before the intervention are presented in Table 1. None of them had mild pain. A total of 40% of them in the study group and 39% in the control group experienced moderate level of pain. 38% of them in the study group and 41% in the control group had severe level of pain. Among the remaining patients, 22% of them in the study group and 20% of them in the control group experienced extreme level of pain. The results showed no statistically significant difference in level of pain between the study group and the control group (χ 0.22, P = 0.89).

The mean score of overall level of pain was found to be 73.77 in the study group and 73.60 in the control group and this indicted that the level of pain was high in both groups. The 't' test was applied to calculate the statistical difference between the level of pain in both the groups before the intervention and the non-significant 'p' value (P > 0.05) confirmed that there was no significant difference between the study and control groups and the groups were almost similar and comparable. This data is presented in Table 2.

The result of the present study indicates that the mean score of pain decreased from 16.32 in the pretest to 13.51 in the post test IV, and the mean difference was 2.81 after the intervention. The calculated 'F" ratio was 868.14 at p < 0.001 level. The mean score of stiffness decreased from 4.08 in the pretest to 2.78 in the post

Table 1. Level of Pain in Patients With KOA in Study and Control Group Before Intervention (n=200).

Level of pain	Study group (n=100)		Control group (n=100)		χ^2	P-value
	No.	%	No.	%		
Mild (0–24)	0	0	0	0	0.22	0.89 (NS)
Moderate (25–48)	40	40	39	39		
Severe (49–72)	38	38	41	41		
Extreme (73–96)	22	22	20	20		

Non-significant (NS) at P > 0.05 level.

Table 2. Mean and Standard Deviation of Level of Pain Among Patients With KOA in Study and Control Groups Before the Intervention (n = 200).

	Score		Study group (n=100)		Control group (n = 100)			
Dimensions of level of pain	Min.	Max.	Mean	SD	Mean	SD	't' value	P-value
Pain	0	20	16.32	2.33	16.52	1.56	0.71	0.47 (NS)
Stiffness	0	8	4.08	1.03	4.00	0.92	0.58	0.56 (NS)
Physical function	0	68	53.37	7.58	53.08	7.05	0.28	0.78 (NS)
Overall level of pain	0	96	73.77	9.60	73.60	7.58	0.14	0.89 (NS)

Non-significant (NS) at P > 0.05 level.

Table 3. Effectiveness of Isometric Exercise and Counseling on Level of Pain Among Patients With KOA in Study Group (N = 100).

	Score		Level of pain											Repeated measure ANOVA F-test	
			Pre-test		Post-test I		Post-test II		Post-test III		Post-test IV		Mean		
Dimension	Min	Max	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	difference	F value	P value
Pain	0	20	16.32	2.33	15.82	2.43	14.91	2.31	14.30	2.41	13.51	2.52	2.81	868.14	0.001***
Stiffness	0	8	4.08	1.03	3.90	0.96	3.58	1.05	3.26	1.17	2.78	1.05	1.3	524.32	0.001**
Physical function	0	68	53.37	7.58	52.38	7.85	49.71	8.07	47.04	8.80	43.15	8.56	10.22	756.45	0.001***
Overall pain level	0	96	73.77	9.60	72.10	9.93	68.20	10.10	64.60	10.56	59.44	10.23	14.33	724.73	0.001***

** Significant at P < 0.01 level.
*** Highly significant at P < 0.001 level.

test IV, and the mean difference was 1.3 after the intervention. The calculated 'F" ratio was 524.32 at p < 0.001 level. The mean score of physical dysfunction reduced from 53.37 in the pretest to 43.15 in the post test IV and the mean difference was 10.22 after the intervention. The calculated 'F" ratio was 756.45 at p < 0.001 level. The overall pain decreased from 73.77 in the pretest to 59.44 in the post test IV, and the mean difference was 14.33 after the intervention. The calculated 'F" ratio was 724.73 at p < 0.001. Overall, the results inferred that there was reduction in pain, stiffness and physical dysfunction of the patients with KOA, in the study group after the isometric exercise and counselling. This data could be seen in Table 3.

Table 4 shows the mean and SD level of pain in the control group in the pre-test and post- test IV. The mean score of pain was found to be slightly decreased, from 16.32 in the pretest to 15.88 in the post test IV, and the mean difference was 0.64 after the post test. The calculated 'F" ratio was 0.34 at p > 0.05. The mean score of stiffness was found to be slightly decreased, from 4.08 in the pre-test to 3.67 in the post-test IV, and the mean difference was 0.33 after the post test. The calculated 'F" ratio was 0.61 at p > 0.05. The mean score of physical dysfunction slightly decreased from 53.37 in the pre-test to 52.04 in the post- test IV, and the mean difference was 1.04 after the post test. The

calculated 'F" ratio was 2.16 at p > 0.05. The mean score of overall pain slightly decreased from 73.77 in the pre-test to 71.59 in the post- test IV, and the mean difference was 2.01 after the post- test. The calculated 'F" ratio was 3.00 at p > 0.05. Though, there was a slight reduction of pain, stiffness, and physical dysfunction was found in the post-test in the control group, it is not statistically significant.

Table 5 depicts the level of pain among the patients with KOA in the study and control group. There was no statistically significant difference between the study and control group ($\chi^2 = 0.22$, P= >0.89). It is shown that after the intervention in the post test-I (Day 15), in the study group, 17% of them had extreme pain, 38% of them had severe pain and 38% of them had moderate pain and 7% of them had mild pain; where as in the control group 20% of them had extreme pain, 40% had severe pain, 40% had moderate pain and none of them had mild pain. There was no statistically significant difference between the experimental and control group ($\chi^2 = 7.34$, P= >0.06).

In the post test-II (Day 30), in the study group, 7% of them had extreme pain, 26% of them had severe pain and 37% of them had moderate pain and 30% of them had mild pain where as in the control group 20% had extreme pain 35% had severe pain, 45% had moderate pain and none of them had mild pain. In the post test-III

Table 4. Mean and Standard Deviation of Level of Pain of Patients With KOA in Control Group in Pre-Test and Post-Test (N = 100).

| Dimension | Score | | Level of pain | | | | | | | | | | Mean difference | Repeated measure ANOVA F-test | |
| | | | Pre-test | | Post- test I | | Post- test II | | Post- test III | | Post -test IV | | | | |
	Min	Max	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		F value	P value
Pain	0	20	16.32	2.33	16.35	1.59	16.22	1.61	16.15	1.64	15.88	1.63	0.64	0.34	0.59 (NS)
Stiffness	0	8	4.08	1.03	3.94	.97	3.87	1.02	3.74	1.09	3.67	1.11	0.33	0.61	0.43 (NS)
Physical Function	0	68	53.37	7.58	52.97	7.17	52.80	7.40	52.48	7.60	52.04	7.67	1.04	2.16	0.12 (NS)
Overall pain Level	0	96	73.77	9.60	73.26	7.44	72.89	7.69	72.37	7.89	71.59	7.96	2.01	3.00	0.08 (NS)

Non-Significant (NS) at P > 0.05 level.

Table 5. Comparison of Level of Pain Among Patients With KOA in Study and Control Group Before and After Intervention (N = 200).

| Assessment | Level of pain | Group | | | | χ^2 | P-value |
| | | Study group | | Control group | | | |
		No.	%	No.	%		
Pre-test	Mild	0	0.0	0	0.0	0.22	0.89 (NS)
	Moderate	40	40.0	39	39.0		
	Severe	38	38.0	41	41.0		
	Extreme	22	22.0	20	20.0		
Post- test-I 15th Day	Mild	7	7.0	0	0.0	7.34	0.06 (NS)
	Moderate	38	38.0	40	40.0		
	Severe	38	38.0	40	40.0		
	Extreme	17	17.0	20	20.0		
Post -test-II 30th Day	Mild	30	30.0	0	0.0	38.36	0.001***
	Moderate	37	37.0	45	45.0		
	Severe	26	26.0	35	35.0		
	Extreme	7	7.0	20	20.0		
Post- test-III 60th Day	Mild	42	42.0	1	1.0	61.96	0.001***
	Moderate	43	43.0	44	44.0		
	Severe	10	10.0	37	37.0		
	Extreme	5	5.0	18	18.0		
Post -test-IV 90th Day	Mild	55	55.0	3	3.0	76.79	0.001***
	Moderate	34	34.0	42	42.0		
	Severe	8	8.0	40	40.0		
	Extreme	3	3.0	15	15.0		

Non-Significant (NS) at P > 0.05 level.
*** Highly significant at P < 0.001 level.

(Day 60), in the study group 5% had extreme pain, 10% of them had severe pain and 43% had moderate pain and 42% of them had mild pain where as in the control group 18% of them had extreme pain, 37% had severe pain, 44% had moderate pain and only one percentage of them in mild pain.

In the post test (Day 90), in the study group only 3% of them had extreme pain, 8% of them had severe pain and 34% of them had moderate pain and 55% of them had mild pain where as in the control group 15% of them had extreme pain 40% of them had severe pain,

42% of them had moderate pain and 3% of them experienced mild pain. The overall results revealed that after the intervention, the difference in the level of pain in the study and control group was statistically significant (P < 0.001) in the post tests II, III & IV.

Table 6 depicts the mean and SD of the level of pain in the study and control group after the intervention in the post -Test-I (Day-15). The mean difference of pain, stiffness, physical dysfunction and overall pain level was 0.53, 0.04, 0.59 and 1.16, respectively. The non-significant 'p' value inferred that the mean difference

in the level of pain in the study and control group was statistically not-significant (P > 0.05) in Post-Test-I (Day-15).

While inferring the mean difference between the study and control group, the pain, stiffness, physical dysfunction and overall pain level was 1.85, 0.48, 5.44 and 7.77 respectively, in the posttest III (Day 60). Furthermore, the findings revealed that the difference observed in the pain, stiffness, physical dysfunction and overall pain score of the patients with knee OA in the experimental group and control group was statistically highly significant (P < 0.001) in posttest-III (Day-60). The mean difference between the experimental and control group, pain, stiffness, physical dysfunction and overall pain level was 2.37, 0.89, 8.89 and 12.15, respectively, in the posttest IV (Day 90). Furthermore, the findings revealed that the difference observed in the pain, stiffness, physical dysfunction and overall pain score of the patients with KOA in the study group and control group was statistically highly significant (P < 0.001) in posttest-IV (Day-90). This data is illustrated in Tables 7 to 9.

Table 10 shows the comparison of percentage of pain reduction among patients with KOA in the study and control group. There was reduction in the level of pain, after the intervention in the study group. The pre-test mean was 73.77, and after the intervention the mean was 59.44. The percentage of mean score was 76.8 in pre-test and after the intervention the percentage of mean score

was 61.9, and the mean difference was 14.33 in the study group, whereas in the control group the pre-test mean was 73.60, and after the intervention the mean was 71.59. The percentage of mean score was 76.7 in pre-test and after the intervention the percentage of mean score was 74.6, and the mean difference was 2.01. The percentage of pain reduction score, in the study group was 14.9% (95% CI), whereas in the control group it was only 2.1% (95% CI). It showed that the reduction in the level of pain was higher in the study group than the control group.

Table 11 shows the Mean difference with 95% CI in the level of pain, stiffness and physical function in the study and control group. The pre and posttest mean difference with 95% CI in pain in the study group was 2.81(2.44–3.17) and the percentage of difference with 95% CI was 14.1% (12.2%–15.9%). The pre and posttest mean difference with 95% CI in stiffness in the study group was 1.30(1.05–1.55) and the percentage of difference with 95% CI was 16.3% (13.3%–19.4%). The pre and posttest mean difference with 95% CI in physical function in the study group was 10.22 (8.85–11.58) and the percentage of difference with 95% CI was 15.0% (13.0%–17.0%). The pre and posttest mean difference with 95% CI in overall pain score in study group was 14.33 (12.82–15.83) and the percentage of difference with 95% CI was 14.9% (13.3%–16.5%).

Table 6. Comparison of Level of Pain Among Patients With KOA in Study and Control Group After Intervention (Post-Test-I Day 15) (n = 200).

Dimension of level of pain	Score		Study group (n = 100)		Control group (n = 100)		Mean difference	't' value	P-value
	Min	Max	Mean	SD	Mean	SD			
Pain	0	20	15.82	2.43	16.35	1.59	0.53	1.82	0.07 (NS)
Stiffness	0	8	3.90	0.96	3.94	.97	0.04	0.29	0.77 (NS)
Physical function	0	68	52.38	7.85	52.97	7.17	0.59	0.55	0.58 (NS)
Overall pain level	0	96	72.10	9.93	73.26	7.44	1.16	0.93	0.35 (NS)

Non-significant (NS) at P > 0.05 level.

Table 7. Comparison of Level of Pain Among Patients With KOA in Study and Control Group After Intervention (Post-Test-II Day 30) (N = 200).

Dimension of level of pain	Score		Study group (n = 100)		Control group (n = 100)		Mean difference	't' value	P-value
	Min	Max	Mean	SD	Mean	SD			
Pain	0	20	14.91	2.31	16.22	1.61	1.31	4.65	0.001 ***
Stiffness	0	8	3.58	1.05	3.87	1.02	0.29	1.98	0.05 *
Physical function	0	68	49.71	8.07	52.80	7.40	3.09	2.82	0.01 **
Overall pain level	0	96	68.20	10.10	72.89	7.69	4.69	3.69	0.001 ***

* Significant at P ≤ 0.05 level.
** Significant at P < 0.01 level.
*** Highly significant at P < 0.001 level.

Table 8. Comparison of Level of Pain Among Patients With KOA in Study and Control Group After Intervention (Post-test-III Day-60) (N = 200).

Dimension of level of pain	Score Min	Max	Study group (n = 100) Mean	SD	Control group (n = 100) Mean	SD	Mean difference	't' value	P value
Pain	0	20	14.30	2.41	16.15	1.64	1.85	6.35	0.001***
Stiffness	0	8	3.26	1.17	3.74	1.09	0.48	3.00	0.01**
Physical function	0	68	47.04	8.80	52.48	7.60	5.44	4.67	0.001***
Overall pain level	0	96	64.60	10.56	72.37	7.89	7.77	5.89	0.001***

** Significant at P < 0.01 level.
*** Highly significant at P < 0.001 level.

Table 9. Comparison of Level of Pain Among Patients With KOA in Study and Control Group After Intervention (Post-Test-IV Day-90) (N = 200).

Dimension of level of pain	Score		Study group (n = 100) Min	Max	Control group (n = 100) Mean	SD	Mean difference	't' value	P value	Mean	SD
Pain	0	20	13.51	2.52	15.88	1.63	2.37	7.88	0.001***		
Stiffness	0	8	2.78	1.05	3.67	1.11	0.89	5.82	0.001***		
Physical function	0	68	43.15	8.56	52.04	7.67	8.89	7.73	0.001***		
Overall pain level	0	96	59.44	10.23	71.59	7.96	12.15	9.39	0.001***		

*** Highly significant at P < 0.001 level.

Table 10. Comparison of Percentage of Pain Reduction Among Patients With KOA in Study and Control Group.

Group	Score Min	Max	Mean score Pre-test	Post-test	Percentage of mean score Pre-test	Post-test	Mean difference with 95%CI	Percentage of difference with 95% confidence interval
Study group	0	96	73.77	59.44	76.8	61.9	14.33 (12.82–15.83)	14.9% (13.3%–16.5%)
Control group	0	96	73.60	71.59	76.7	74.6	2.01 (1.13–2.88)	2.1% (1.2%–3.0%)

Discussion

The objective of this study was to evaluate the effect of isometric exercise and counselling on the level of pain in patients with KOA. The results of this study demonstrated that isometric exercise and counselling has brought significant reduction in pain, stiffness and physical dysfunction in the study group after the 12-week home based exercise program.

In our study, a reduction in the level of pain was experienced by the patients with KOA after the intervention in the study group. The pretest mean was 73.77, and after the intervention the mean was 59.44. The percentage of mean score was 76.8 in pre-test and after the intervention the percentage of mean score was 61.9, and the mean difference was 14.33 in the study group, whereas in the control group the pre-test mean was

73.60, and after the intervention the mean was 71.59. The percentage of mean score was 76.7 in pre-test and after the intervention the percentage of mean score was 74.6, and the mean difference was 2.01. The percentage of pain reduction score, in the study group was 14.9% with 95% confidence interval, whereas in the control group it was only 2.1% with 95% CI. It showed that the reduction in the level of pain was higher in the study group than the control group.

The present study findings concur with few other studies that has confirmed the beneficial effects of isometric exercise on strengthening the muscles. Sorour et al. (2014) compared the effect of isometric exercise and acupressure on the level of pain among patients with OA. The study reported that isometric exercise and acupressure were effective in reducing pain, stiffness, and improved physical function. Though, isometric

Table 11. Mean Difference With 95% CI in the Level of Pain, Stiffness and Physical Function in the Study and Control Group.

Group	Domains	Maximum score	Pre-test		Post-test		Mean difference with 95%CI	Percentage of difference with 95% CI
			Mean	SD	Mean	SD		
Study group	Pain	20	16.32	2.33	13.51	2.52	2.81 (2.44–3.17)	14.1% (12.2%–15.9%)
	Stiffness	8	4.08	1.03	2.78	1.05	1.30 (1.05–1.55)	16.3% (13.3%–19.4%)
	Physical function	68	53.37	7.58	43.15	8.56	10.22 (8.85–11.58)	15.0% (13.0%–17.0%)
	Overall pain score	96	73.77	9.60	59.44	10.23	14.33 (12.82–15.83)	14.9% (13.3%–16.5%)
Control group	Pain	20	16.32	2.33	15.88	1.63	0.64 (0.33–0.95)	3.2% (1.7%–4.8%)
	Stiffness	8	4.08	1.03	3.67	1.11	0.33 (0.17–0.49)	4.1% (2.1%–6.1%)
	Physical function	68	53.37	7.58	52.04	7.67	1.04 (0.30–1.78)	1.5% (0.0%–2.6%)
	Overall pain score	96	73.77	9.60	71.59	7.96	2.01 (1.13–2.88)	2.1% (1.2%–3.0%)

exercise was beneficial in relieving stiffness and enhancing physical function, acupressure acted better on pain. Similarly, Shakoor et al. (2010), found that the level of pain reduced gradually and there was a statistically significant improvement in the muscle functioning at p = 0.001 level. The results also revealed that the isometric quadriceps muscle strengthening exercise was beneficial in reducing the symptoms in KOA. Exercise may decrease the need of NSAID's and thereby the side effects of NSAID's could be avoided.

The results of the present study showed that the 12-week period of intervention of isometric exercise and counselling has significantly reduced knee pain and improved the physical functioning in the study group at the end of 12th week. The significant reduction in pain and improvement in the physical functioning in the study group may be attributed to improved quadriceps strength and therefore increased functional ability of the knee joint. The current study findings are supported by the findings of previous studies that have described that exercise can reduce pain and increase the functional abilities of patients with OA. Yilmiz et al. (2013) determined the effectiveness of a 12-week home-based isometric and isotonic exercise program and joint range of motion exercise on pain, functional capacity and quality of life of patients with KOA. The study reported that that home based isometric exercise program increased the functional level, quality of life and reduction in pain.

Another study done by Anwer and Alghadir (2014) and Iwamoto et al. (2011) also supports the current study findings. The above mentioned studies observed the beneficial effects of isometric exercise program on pain and physical functioning. The 5-week exercise program has beneficial effects on pain, quadriceps muscle strength, and functional disability in patients with KOA. Further study done by Palo et al. (2015) recommended that motivation and counselling with leg strengthening exercises should be incorporated with pharmacotherapy in each OA prescription. Hafez et al. (2013) reported that strengthening of hamstring muscles along with the strengthening of quadriceps muscles reduces knee pain, improves the range of motion and decreases the limitation in functional performance. Furthermore, Saw et al. (2016) identified that the exercise and education shows significant reduction in the level of pain and improvement in muscle strengthening in patients with KOA. Similarly, Piyakhachornrot (2011) suggested that the integrated health education and exercise program is beneficial in patients with KOA.

Though pain and disability are interdependent, a reduction in one will cause a reduction in the other. Exercise increases the functional ability of joints and thus reduces the pain perception. But many are ignorant about the positive effects of exercises on osteoarthritis. The patients with KOA have a notion that physical activities may worsen the pain and increases the functional disability. Thus, patients usually hesitate to perform the exercises in the home setting. Hence, our study signified the importance of isometric exercise and counselling in a view to meet the needs of the clients suffering from knee osteoarthritis to improve their functional ability and quality of life.

Conclusion

The result of the present study indicates that the mean score of pain decreased from 16.32 in the pretest to 13.51 in the posttest IV, and the mean difference was 2.81 after the intervention. The calculated 'F" ratio was 868.14 at p < 0.001 level. Statistically significant reduction in the pain score proves the effectiveness of isometric exercise and counselling. Therefore, our study concluded that isometric exercise and counselling were effective in reduction of pain among patients with KOA. However, similar studies are recommended to be conducted with more samples in other settings by adopting randomization to have results that are more authentic and to enhance the generalizability of research findings.

Since the isometric exercise is a cost effective, easily adaptable, and a home based exercise program with no side effects, this is highly recommended to be followed

by the patients with KOA. Nurses play a major role in the out-patients orthopedic department to initiate early identification and can counsel the patients to perform isometric exercise to manage the knee pain. Repeated counselling for their problems, in follow up visits can help the patients to overcome the severity of pain and develop self-management strategies.

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