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Comparison of Effectiveness of Forward Walking vs Retro Walking on Pain and Function in Patients with Postmenopausal Osteoarthritis of Knee

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ABSTRACT

Background and Objectives: Osteoarthritis (OA) is the most common form of arthritis and the leading source of physical disability with severely impaired quality of life in people. The overall prevalence of OA in India is found to be higher in females than in males. Rehabilitation exercises in the form of Closed Kinetic Chain Exercises (CKCE) are an effective way in the management of OA knee. This study aims to evaluate the effectiveness of forward walking versus retrowalking on pain and function in postmenopausal women with OA knee.

Methods: 30 postmenopausal females diagnosed with OA knee were randomly allocated into 2 groups. Group A received forward walking while Group B received retrowalking. Both the groups received conventional physiotherapy such as strengthening exercises and Ultrasound along with their assigned interventions. The outcomes were measured in terms of Numerical Pain Rating Scale (NPRS) and Western Ontario and McMaster Universities Arthritis Index (WOMAC) at the start of the intervention and at the end of 6 weeks.

Results: The results of the present study showed statistically significant difference within the groups for all outcome measures; but significant difference was found only for WOMAC scores between the groups. Further it was also found that ROM of the knee showed a significant difference both within the groups as well as between the groups. Group B showed better improvement that Group A for pain and function of the knee.

Interpretation and Conclusion: The present study concludes that both forward walking and retrowalking are individually effective in reducing pain and improving function of post-menopausal women with OA knee. However, retrowalking results in greater reduction in pain and improved function of postmenopausal women with OA knee.

Keywords: Retro walking, Forward Walking, Osteoarthritis, Menopause

INTRODUCTION

Osteoarthritis Knee (OA) is the most common type of arthritis and is defined as a heterogenous group of conditions which lead to joint symptoms and signs associated with defective integrity of articular cartilage in addition to related changes in the underlying bone at the joint margins.[1] Traditionally, it has been considered a disease of articular cartilage. However, according to the current concept, osteoarthritis involves the entire joint, including the subchondral bone, menisci, ligaments, periarticular muscle, capsule, and synovium.[2, 3] The precise etiology of OA is unknown, but it results from a combination of metabolic, genetic and mechanical factors. Some of the prominent risk factors for the development of OA include older age, female sex, obesity, previous knee trauma, occupational load, ethnicity and genetics. Other risk factors for OA include sex hormones, biomechanical malalignment,

joint laxity and quadriceps muscle weakness.[4] Although OA affects both males and females, its prevalence is reported to increase in females during perimenopausal age and remains high throughout menopause as compared to males. Many experimental, clinical and epidemiological studies suggest that estrogen loss during menopause increases a woman's risk of getting osteoarthritis.[5] Studies have found that rate of progression of OA knee is reduced with the use of estrogen replacement therapy. Similarly long term hormone replacement therapy increases bone mineral density in women with natural menopause.[6] Females are found to have more severe OA, more number of joints involved, and have more symptoms.[7,8] Average menopausal age in Indian women is 46.3 years as compared to 51 years in western countries. Thus, Indian women are predisposed to the development of OA at an earlier age in comparison to their western counterpart.[5] The worldwide prevalence estimate for symptomatic OA is 9.6% among men and 18% among women.[9] In India, the prevalence of OA in females is found to be 31.6%; the overall prevalence being 28.7% among both men and women.[10] OA is leading cause of disability in both developed and developing world.[11] Women are at a greater risk of developing OA knee than men. Indian women are predisposed to OA knee at an earlier age than the western counterpart. This results in large costs to the health sector, as well as indirect costs due to work disability. The goal of physiotherapy aims to decrease pain, increase the range of motion, increase the overall functional strength, educate about posture and gait, as well as to improve physical fitness levels and mobility. Osteoarthritis Research Society International (OARSI) guidelines recommend that patients with OA knee should be encouraged regular aerobic walking exercises. Walking is a closed kinetic chain exercise and it promotes initiation of weight bearing and early mobilization in a knee rehabilitation program. Regular walking exercises are recommended for reduction of pain and disability in people with OA knee. There are studies showing that walking has a moderate effect compared to home-based quadriceps strengthening exercises on pain and function of the knee.[12] Recently, Loew et al reported improved pain relief and aerobic fitness level, without aggravating symptoms following walking programs in patients with OA knee.[13] Retro walking is supposed to be an effective closed kinetic chain exercise which helps to improve lower muscles strength and the equilibrium of the human body.[14] Retro walking significantly lowers peak compressive forces on the patellofemoral joint and a significantly slower rate of loading has been found when walking backwards. Consequently, trauma to the articular cartilage is reduced during retro walking.[15]

There are studies correlating OA Knee and menopause in literature but this study aims to evaluate the parameters of pain and functional impairment in post menopausal women. Exercise therapy as first line non-pharmacological intervention for management of OA knee symptoms has been supported by strong evidences from international guidelines and findings from systematic reviews [16,17] Not many studies were found about the efficacy of retro walking in comparison to forward walking for management for postmenopausal OA knee. Hence a need arises to find out whether retro walking will show any effect in outcome measures for postmenopausal women with OA knee than forward walking.

METHODOLOGY

A randomized controlled trial study of 30 subjects using simple random sampling and allocation with envelop method was done. A sticker containing letters A (Forward Waking) or B (Retro walking) was inside the envelope. After reading the sticker it was attached to subjects' file. 15 subjects with the letter 'A' were enlisted under forward walking group

and the other 15 subjects with the letter 'B' under Retro Walking group.

As the study includes human subjects, ethical clearance is obtained from ethical committee of K.T.G. College of physiotherapy and KTG Hospital, Bangalore as per the ethical guidelines for Bio-Medical research on human subjects, 2000 ICMR, New Delhi. The subjects were treated in the physiotherapy department for 6 weeks except Sunday and public holidays. Informed written consent was taken from each subject.

Post menopausal females >45years of age diagnosed with knee OA according to American College of Rheumatology Criteria with an ability to walk without any external support were included in this study. Those having any history of previous knee surgery, amputation, soft tissue injury around the knee , diabetes, neurological and/or vestibular disorder. previous total joint arthroplasty in any weight bearing joint, systemic inflammatory arthropathy like rheumatoid arthritis, gout etc were excluded from the study. The participants were assessed for OA knee based on the pain and functional status. Outcome measures of NPRS and WOMAC were taken for each participant pre and post study.

The participants in Group A, enlisted in the forward walking group, were initially made to walk 10 steps forward and observed for any discomfort. Once comfortable, the participants underwent 10min of supervised forward walking training 3 days a week for 6 weeks at their comfortable walking speed along with a routine physiotherapy treatment. The therapist was walking besides the participant.

Fig 1: Stages of Forward Walking

The participants in Group B, enlisted in the retro walking group, were initially made to walk 5 steps forward and 5 steps retro walk and observed for any discomfort. Since retro walking is not a part of our routine lives and the subjects were not accustomed to walking backward, they were given training on day 1 before the actual intervention in the parallel bars. Only when they had gained confidence in walking backward, were they allowed to walk backward without support. The session

included 10min of supervised retro walking training 3 days a week for 6 weeks at their comfortable walking speed along with a routine physiotherapy treatment. The therapist was walking besides the participant. Conventional treatment in the form of static quadriceps exercise, dynamic quadriceps exercise, straight leg raise along with hip abductor strengthening exercises, partial squatting and Ultrasound was given to subjects of both Group A and Group B. Hamstrings, Rectus femoris and tendo-achilles stretching was also given.

Fig. 2: Stages of Retro walking

Outcome measurements (NPRS, ROM and WOMAC) were taken at the beginning and after 6 weeks of study. The differences of pre and post test values were compared between the groups using statistical analysis.

Outcome Measurements

1. Numerical Pain Rating Scale: [18,19]

Pain intensity is measured on an 11-point pain intensity numerical rating scale, from0-10, where 0 = no

pain and 10 = worst possible pain. The number that the participant indicates on the scale to rate their pain intensity is recorded.

2. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC): [20,21]

The WOMAC is used to assess pain, stiffness and physical function in patients with hip and / or knee osteoarthritis. It can be used to monitor the course of the disease and to examine changes following treatment including physiotherapy. The WOMAC consist of 24 items divided into 3 subscales: pain (5 items), stiffness (2 items), and physical function (17 items). 5 point scale is used to score each items. These correspond to an ordinal scale of 0-4. Higher the score on WOMAC indicate worse pain, stiffness and physical limitations.

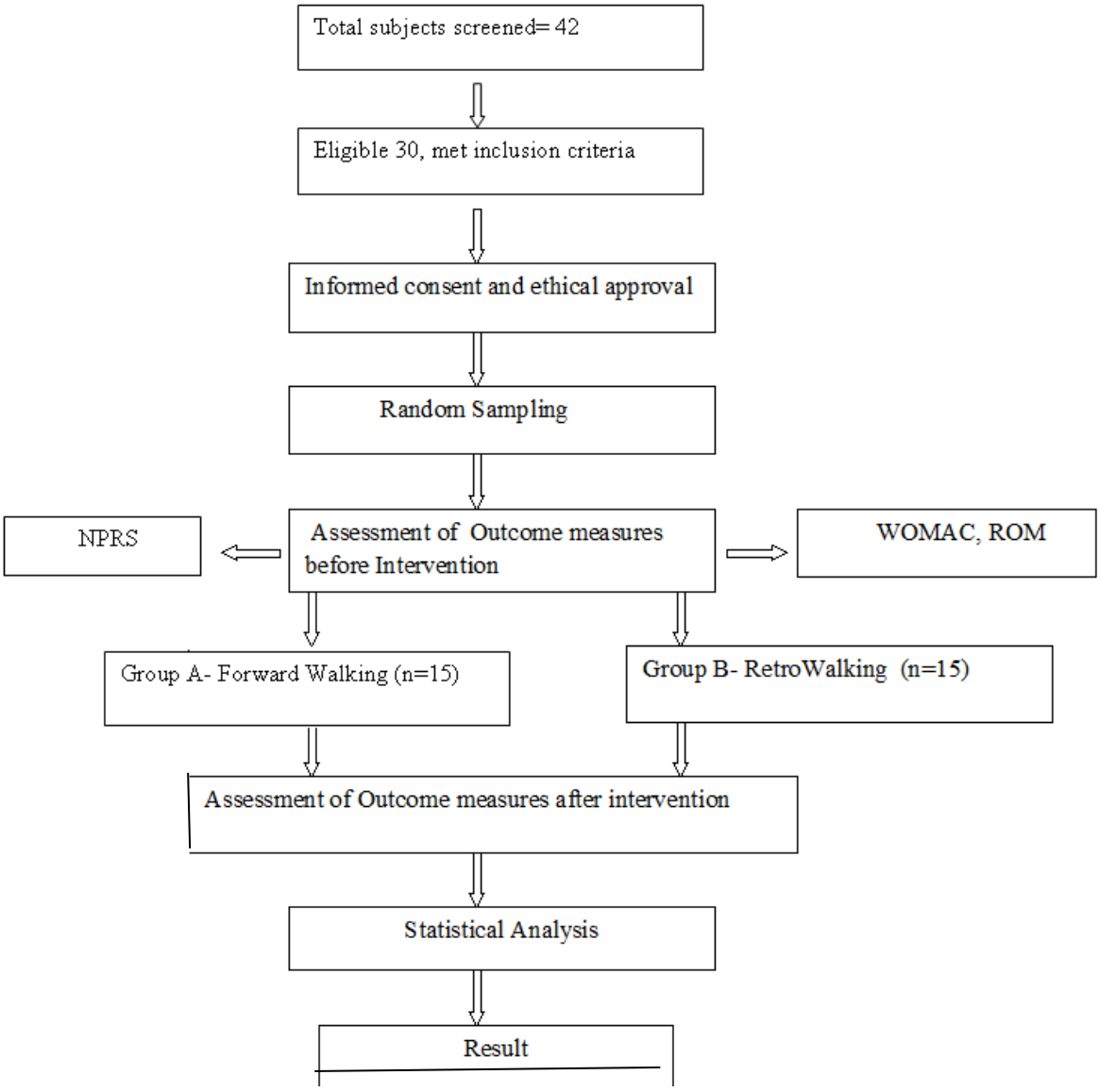

Fig 1 Flowchart of the procedure of selection of subjects.

Statistical Tests

Data was analysed using the SPSS 16.0 software. The level of significance was kept at 5%. All outcome measures along with height, weight and BMI were tested for normal distribution. Wilcoxon signed rank test was used for within group analysis, whereas Unpaired t test was used for analysis between the groups.

RESULTS

Table-1: Range, mean and SD of baseline characteristics of postmenopausal women with OA knee group-A.

Sr No	Outcome measures	Groups		Paired t-test	p-value
		Group-A	Group-B		
		Mean ±SD	Mean ±SD		
1	**Age in years**	59.13±6.93	59.60± 6.71	t=0.246NS	p>0.05
2	**Height(cm)**	157.67±3.26	157.33±3.69	T=0.372NS	p>0.05
3	**Weight (kg)**	69.62±4.60	69.46±4.20	t=0.4621NS	p>0.05
4	**BMI**	28.01±4.60	28.09±1.81	t=0.360NS	p>0.05

NS- denotes Not Significant (p>0.05).

Table-1 shows the age, height, weight and BMI of post menopausal women with OA knee in both the groups. The mean and SD of age in years was 59.13±6.93 in group-A and the mean and SD of age was 59.60± 6.71 in group-B. The unpaired t-test was worked out and it was not significant (p>0.05).

Table-2: Range, mean and SD of outcome measures of postmenopausal women with OA knee group- A

Sr No	Outcome measures	Group-A				Wilcoxon test/ Paired t-test	p-value
		Pre test		Post test			
		Range	Mean ±SD	Range	Mean ±SD		
1	**NPRS**	4-8	6.40±1.05	2-7	4.60± 1.13	t=3.852*	p<0.001
2	**WOMAC**	33-45	37.26±3.59	28-41	32.13±3.90	t=3.421*	p<0.001
3	**ROM**	95-120	107.00±7.51	105-130	116.83±7.51	t=5.653*	p<0.001

Note; * denotes –Significant,

Table-3: Range, mean and SD of outcome measures of postmenopausal women with OA knee group-B

Sr No	Outcome measures	Group-B				Wilcoxon test/ Paired t-test	p-value
		Pre test		Post test			
		Range	Mean ±SD	Range	Mean ±SD		
1	**NPRS**	2-9	5.47±1.98	2-7	4.00± 1.41	t=3.852*	p<0.001
2	**WOMAC**	22-49	33.97±6.34	22-42	29.73±5.07	t=3.421*	p<0.001
3	**ROM**	95-135	116.67±10.77	105-135	126.00±6.81	t=6.724*	p<0.001

Note; * denotes –Significant,

Table-4: Comparison of pre and post test outcome measures of postmenopausal women between the groups.

Sr No	Outcome measures	Pre test		Post test	
		Group-A	Group-B	Group-A	Group-B
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
1	**NPRS**	6.40±1.05	5.47±1.98	4.60± 1.18	4.00± 1.41
2	**WOMAC**	37.26±3.59	33.97±6.34	32.13±3.90	29.73±5.07
3	**ROM**	107.00±7.51	116.67±10.77	116.83±6.93	126.00±6.81
Between group comparisons: Unpaired t-test		• NPRS: z=0.276, p>0.05, NS • WOMAC: z=0.499, p>0.05, NS • ROM: t=0.462, p>0.05, NS		• NPRS: z=1.301, p>0.05, NS • WOMAC: z=1.998, p<0.05, S • ROM: t=3.254, p<0.05,S	

Note: S-denotes significant (p<0.05); NS – not significant (p>0.05).

Unpaired t test was carried out to assess the statistical significance between pre and post test scores comparing both the groups. No significant difference was found in the pre-test and post-test values for NPRS between Group A and Group B.

For the WOMAC scores, no significant difference was found. (p>0.05) in the pre test values between the groups. However, WOMAC score was significantly different post test between the 2 groups. (p<0.05)

Regarding ROM, no significant difference was found in the pre test values between the groups (p>0.05). In the post test, the mean and SD for Group A and Group B was 116.83±6.93and126.00±6.81 respectively. ROM was found to be significantly different post test between the two groups. (p<0.05)

DISCUSSION

Osteoarthritis is the most common form of arthritis in aging population. The symptoms affect activities of daily living consequently deteriorating the quality of life of the patients. The overall prevalence of OA knee is found to be 28.7% in India, with females affected more than males. Treatment of OA aims to reduce the pain and disability and improve function and

quality of life of people. Closed kinetic chain exercises have shown to be beneficial in reducing pain and improving function in patients with OA knee. Walking is a closed kinetic chain exercise program that can be performed at any time and even at home without the need of any specialist.

The present study aimed to compare the effect of Forward Walking versus Backward Walking (Retro Walking) on pain and function in postmenopausal women with Osteoarthritis knee. An experimental study design was conducted with 30 postmenopausal women diagnosed with osteoarthritis knee. The subjects were randomized into two groups- Group A (n=15) and Group B (n=15). The subjects in Group A received forward walking while the subjects in Group B received retro walking. Both the groups received conventional physiotherapy treatment along with their assigned intervention for three supervised sessions for 6 weeks. Outcome measures of pain and knee function were measured using NPRS, WOMAC and ROM respectively for each subject of both the groups before and after the study. Group A received forward walking and it was found to have significant difference in the pre and post test values of NPRS, WOMAC and ROM of the subjects. Baseline and post intervention measurements of this group are summarised in Table 2. After the intervention, the NPRS and WOMAC scores were found to be decreased from 6.40±1.05 and 37.26±3.59 to 4.60± 1.13 and 32.13±3.90, respectively. The ROM of the subjects was found to be increased from baseline value of 107.00±7.51 to 116.83±7.51 post intervention. Thus it was evident that there is a significant decrease in NPRS and WOMAC and increase in ROM among post menopausal women with OA knee.

The pain relief in this group could be because of the aerobic effects of walking. Aerobic walking programs are effective with individuals diagnosed with OA of the knee since they are found to relieve pain and promote nutrition and remodeling without any increase in the stress on the affected joint.[13] This is supported in a study conducted by Evcik and Sonel who evaluated the effects of home-based exercise program and walking program on pain, physical function, and quality of life (QOL) in subjects with OA of the knee. They concluded that walking reduces pain in subjects with OA of the knee but it is not better in comparison to home-based exercise program.[22] Another study conducted by Kovar et al, concluded that a supervised fitness walking and patient education program can improve functional status without worsening pain or exacerbating arthritis-related symptoms in patients with osteoarthritis of the knee.[23]

The present study agrees with the results in the above mentioned studies. Incorporating supervised walking program as a part of rehabilitation of OA knee is effective in reducing pain and improving function of the patients.

Retro walking was the rehabilitation protocol for Group B. It was found to have significant difference in the pre and post test values of NPRS, WOMAC AND ROM of the subjects. Table 3 summarises the baseline and post intervention measurements of this group. After the intervention, the NPRS and WOMAC scores were found to be decreased from 5.47±1.98and 33.97±6.34 to 4.00± 1.41and 29.73±5.07, respectively. The ROM of the subjects was found to be increased from baseline value of 116.67±10.77 to 126.00±6.81post intervention. All the values were found to be statistically significant ($p<0.05$). Thus it was evident that there is a significant decrease in NPRS and WOMAC and increase in ROM among post menopausal women with OA knee in Group B.

These results are in agreement with the study conducted by Balraj AM et al who evaluated the effect of retro walking on pain, disability and ROM in chronic OA of knee. They concluded that retro walking reduces pain and improves ROM of the

knee and thus it should be included in the rehabilitation protocol for OA knee.[24]

During forward walking there is flexion, extension and again flexion in the stance phase at the knee joint, where as in retro walking knee initially extends, flexes and extends in support phase, and then flexes and extends during swing phase. The pain relief in retro walking occurs because of the fact that patellofemoral joint reaction forces, and eccentric loading of the patellar tendon are both reduced. Specifically, peak patellofemoral joint compressive forces are significantly lower and occur significantly later in the stance phase in backward locomotion in comparison to forward locomotion. Also, pain relief can be due to a reduced adductor moment at knee joint which decreases the compressive forces on medial compartment of knee joint. Another study conducted on comparative effects of conventional treatment and Retro walking in chronic OA knee also concluded that retro walking provides additional benefits in reducing pain and improving disability against conventional treatment in OA knee.[15] Gondhalekar G et al[25] stated that as advantages of retro walking include improvement in muscle activation pattern, reduced adductor moment at the knee during stance phase of gait and increased stretch of hamstring muscle groups during the stride; all of these may have helped in reducing disability thus leading to improved function. Furthermore, retro walking can also help in proprioceptive and balance training adding to its benefits.

Thus this study is in agreement with the above mentioned studies which conclude that retro walking helps in reducing pain and improving function in patients with OA knee.

Both the groups showed statistically significant difference within the groups for all outcome measures. However, significant difference was found only for WOMAC and ROM scores between the groups. These values are summarised in Table 4. Retro walking was found to be more effective in improving function than forward walking. NPRS scores did not show any significant difference between the groups. The improvement in physical function seen in the retro walking group could be due to reduced patellofemoral compressive forces, augmented hamstring stretch and reduced eccentric activity of the quadriceps.

In the present study, it was found that both forward walking and retro walking showed reduction in pain and improvement of physical function of the subjects. This may eventually reduce the burden of life and the individual can perform his ADLs without any complaints.

Thus, the results of the present study indicated that both the interventions in group-A and group-B were individually effective in reducing pain and improving function of post-menopausal women with OA knee but, the intervention of Retro walking in group-B was better than forward walking administered in group-A.

CONCLUSION

The present study proves that both forward walking and Retro walking are individually effective in reducing pain and improving function of post-menopausal women with OA knee. However, retro walking results in greater reduction in pain and improved function of postmenopausal women with OA knee.

Limitations of the Study

- Small sample size; making it difficult to generalize the effects of forward walking and retro walking for both the groups respectively.
- The exercise program used in this study was 6 weeks long, which is a relatively short amount of time, and therefore, the results of this study could not determine the long-term effects of the exercise.
- Findings are based on only NPRS and WOMAC; other variables too can be studied.
- The speed of walking was not monitored for both forward walking and retro walking group.

Recommendations for future research

- Future studies with long-term follow-up can be undertaken
- Studies monitoring the intensity of walking can be done
- Further study can be done measuring effect on other outcome measures.

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