Research Article **Allied Science**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

EFFECTIVENESS OF RETRO WALKING TREADMILL TRAINING ON PAIN AND DISABILITY IN KNEE OSTEOARTHRITIS: A RANDOMIZED CONTROLLED TRAIL

HARDIK ANADKAT[1], AJITH S*[2] AND DHANESH KUMAR K U[3]

[1]Government physiotherapy college, Jamnagar, Gujarat, India
[2]Nitte Institute of Physiotherapy, Nitte University, Mangalore, India
[3]Nitte Institute of Physiotherapy, Nitte University, Mangalore, India

ABSTRACT

Osteoarthritis (OA) is the second most common rheumatological problem and is most frequent joint disease with a prevalence of 22% to 39% in India. Standard physical therapy for OA usually consists of strengthening exercises, ROM exercises, manual therapy and stretching and aerobic exercises. The purpose of this study was to determine the effect of Retro walking Treadmill Training, in addition to conventional exercises in knee OA patients. This 3 week study was conducted on 40 patients with knee OA who were randomized into 2 groups. There was statistically significant improvements were observed within the groups with respect to VAS and WOMAC. When the comparison made between groups the difference was statistically significant ($p<.05$) for both the parameters. The study concluded that the combination of retro walking treadmill training and conventional exercises is more effective than conventional exercises alone in knee OA patients to reduce pain and disability.

KEY WORDS: Retro walking, Knee Osteoarthritis, Exercises.

HARDIK ANADKAT
Government physiotherapy college, Jamnagar, Guiarat. India

***Corresponding author**

INTRODUCTION

Worldwide, Osteoarthritis is estimated to be the fourth leading cause of disability. Most of this disability burden is attributable to the involvement of the hips or the knees. Osteoarthritis is strongly associated with ageing and the Asian region is ageing rapidly. The disease usually occurs late in life and most commonly affects the knee joint because of its weight bearing requirements[1].Osteoarthritis is the most commonly encountered disease of the musculoskeletal system. The physical disability arising from knee Osteoarthritis prevents the performance of daily life activities and negatively affects life quality[2].Degenerative osteoarthritis patients go through great pain and the decrease of extremity especially in the quadriceps, mobility, stiffness of joint, limited movement, and proprioception[3]. In addition, they have a lot of functional limitation when sitting and standing or going up and down stairs. In recent years, the predominant philosophy of physical therapists and athletic trainers in treating lower extremity injuries has focused on the use of closed kinetic chain exercises[4,5,6]. While a variety of treatments are typically used to create a closed kinetic environment, one that has evoked particular interest is retro walking. It has been suggested that retro walking offers some benefits beyond those experienced through forward walking[7,8,9]. Retro walking is a common tool for lower extremity rehabilitation. This is used increasingly as a rehabilitation technique for individuals with orthopaedic and neurological impairments. In addition during backward walking, the hamstrings are stretched prior to activation in thigh reversal and contact due to hip flexion. When this pre stretch, any additional load, is introduced during weight bearing / backward walking, these can be helpful in both rehabilitation and training scenarios[10]. The treadmill is frequently used in biomechanical studies for locomotion and training. The treadmill allows for a controlled environment and provides a standardized and reliable performance task, a convenient means of taking measurements from a walking subject without the necessity of having to physically follow the subject with the recording equipment; it is therefore often used for locomotion research[11, 12]. Recent studies have/ reported significant decrease in disability which suggests that retro walking is an effective adjunct to conventional treatment in patients with knee osteoarthritis[13]. Pain and disability is a common problem with osteoarthritis knee, many studies have been done to improve pain and disability with conventional methods. Retro Walking has been used for injury prevention, to increase muscle strength and it is also a tool for lower extremity rehabilitation. In retro walking the vertical forces, ground reaction forces acting on the knee joint are shown to be reduced and improvement in the strength and stability have been shown. There are no studies that explain the effect of retro walking treadmill training on knee osteoarthritis, so the need for the present study is to find out the effectiveness of retro walking treadmill training on pain and disability in knee osteoarthritis[14,15]. The objective of our study was to determine the effect of Retro walking treadmill training combined with conventional therapy on pain and disability in patients with knee osteoarthritis, to determine the effect of Conventional therapy on pain and disability in patients with knee osteoarthritis and to compare the effect of Retro walking Treadmill Training combined with conventional therapy versus the effect of conventional therapy alone on pain and disability in patients with knee osteoarthritis.

MATERIALS AND METHODS

We recruited 40 subjects who were diagnosed with OA by orthopaedician from the patients of the department of orthopaedics as well as physiotherapy department of a medical college hospital, by using purposive sampling and having Grade 3 osteoarthritis changes on radiological evaluation using Kellgren and Lawrence system and fulfilling inclusion criteria were selected in the study**.** The study was approved by the University ethics committee and informed written consent was obtained from all the subjects before recruitment into the study. The study design was a single-blinded Randomized controlled trial by using convenient Sampling. We included both male and female patients aged

between 40-60 years, clinical diagnosis and radiographic evidence of OA, who can walk 10 steps forward and 9 steps backward without any discomfort. Pain more than 3 on Visual Analog Scale and pain, stiffness and disability more than 25% on WOMAC index.[18] We excluded the patients with recent surgeries around knee joint, soft tissue injuries around knee joint, fixed flexion deformity, any recent fracture in lower extremity, cardiac and balance problems and bilateral knee osteoarthritis. Initial assessment was taken and then patients were randomly divided into two groups of 20 patients each with the help of sealed opaque envelops, where group 1 received retro walking treadmill Training, in addition to conventional exercises and Group 2 received only conventional exercises. Wax therapy was given prior to the intervention for both the groups using the paint brush method.

Group 1: Experimental Group

The patients in this group were given retro walking treadmill training in addition to conventional exercises. Subjects who were unfamiliar with forward or backward treadmill locomotion were supported by the therapist to walk on the treadmill. The protocol consisted of 3 minutes warm up forward walking on treadmill at self selected velocity. Patients then walked backward on a treadmill at a self selected velocity at 0' inclination for 10 minute's period. Patients were instructed to hold the rails of treadmill for support while doing retro walking. Patients were stopped immediately once they report pain or discomfort during retro walking on treadmill. The participant was blinded to the treadmill speed, as they were facing away from the treadmill consol. Conventional exercises were then given which included static quadriceps exercises, knee bending exercises, mini squats and step ups for 15-20 minutes as described for control group. Each patient received 15 sessions over a period of 3 weeks (5 sessions per week).Total duration of the treatment was 30-35 minutes in a session.

Group 2: Control Group

The patients in this group received conventional exercises which included static quadriceps exercises, knee bending exercises in prone lying, mini squats and step ups. For static quadriceps, the patient was positioned in supine and the therapist was seated. A rolled towel was kept under the affected knee joint of the patient and the patient was asked to press down the knee and hold for 10 seconds. Then, knee bending exercises were given for the affected knee in prone lying position. Patients then performed mini squats by bending at the hips until the knees are flexed 45 degrees. Patient was told to hold this position for 10 seconds and come back to normal position. For step ups, we advised patient to place their affected foot in the middle of step as they balance their body for 1-2 seconds on the affected leg. Step down was done by the unaffected leg. Each patient received 15 sessions over a period of 3 weeks. All exercises were done in sets of 10 repetitions, 1 set of all exercises for the 1st week and progressed to 2 sets in 2nd week and 3 sets in 3rd week. Total duration of the treatment was 15-20 minutes in a session. Evaluation was carried out at the beginning, after 2nd week and at the end of 3rd week for both the groups, pain was assessed by visual analog scale (VAS)[19]. Pain, stiffness and Disability were assessed using WOMAC index.

RESULTS

Data were analysed using SPSS version 21.0 and Medical version 12.0. The results are expressed as means, standard deviations, and/or 95% confidence interval $p<.05$ was considered statistically significant. For the outcome of the study, repeated Measures of ANOVA was used to examine the effects of treatment at each measurement occasion with a group as between subject variable and as within subject variable. 50 subjects with OA knee were screened for eligibility criteria. 40 subjects satisfied all eligibility criteria, agreed to participate, and were randomized to the control (n=20) and experiment (n=20) group. The reasons for ineligibility were bilateral knee pain symptoms (n=5), no confirmation with the diagnosis with radiographs (n=3), and the Presence of deformity (n=2).

Table 1
Descriptive statistics of both groups

Variable	Experimental Group Mean ±SD	Control Group Mean ±SD
Age, (years)	51.30±6.48	49.95±6.93
Gender, (M/F)	8/12	11/9
Vas Pre	8.35±1.30	8.55±1.09
Vas2ndweek	5.45±1.46	6.25±1.33
Vas3rdweek	2.75±0.96	4.30±1.12
Womac pre	57.85±7.52	54.60±11.01
Womac2ndweek	40.33±8.68	40.09±9.15
Womac3rdweek	22.41±8.09	25.98±13.19

Abbreviation: VAS, Visual analog scale and WOMAC, western Ontario and Mcmaster arthritis index. Values are mean±SD

The Mean and Standard deviation is described for the 2 groups from pre treatment to the end of 3rd week in table 1.

Table 2
repeated measures of anova

Within subjects effect	Measure	Mauchly'W	Approx. Chi-Square	Df	Sig.	Epsilon[b]		
						Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Factor 1	VAS	.941	2.264	2	.322 p>.05	.944	1.000	.500
	WOMAC	.910	3.505	2	.173 p>.05	.917	.987	.500

In the above table, Mauchley's test of Sphericity for VAS is not showing significant result p>0.05, hence we look for the Greenhouse-Geisser for VAS in table 3. Mauchley's test of sphericity for WOMAC is not showing significant result p>0.05, hence we look for Greenhouse-Geisser for WOMAC.

Table 3
Test of within subjects effects

Source		Measure	Type III Sum of Squares	Df	Mean Square	F	Sig.
Factor 1	VAS	Sphericity assumed	485.61	2	242.808	504.65	.000
		Greenhouse Geisser	485.61	1.88	257.222	504.65	.000 P<.05
		Huynh-Feldt	485.61	2.00	242.80	504.65	.000
		Lower-bound	485.61	1.00	485.61	504.65	.000
	WOMAC	Sphericity Assumed	20520.98	2	10260.49	222.33	.000
		Greenhouse –Geisser	20520.98	1.83	11187.92	222.33	.000 P<.05
		Huynh-Feldt	20520.98	1.97	10398.98	222.33	.000
		Lower-bound	20520.98	1.00	20520.98	222.33	.000
Factor*group	VAS	Sphericity Assumed	9.15	2	4.575	9.50	.000
		Greenhouse –Geisser	9.15	1.88	4.847	9.50	.000
		Huynh-Feldt	9.15	2.00	4.575	9.50	.000
		Lower-bound	9.15	1.00	9.150	9.50	.004
	WOMAC	Sphericity Assumed	234.26	2	117.13	2.53	0.86
		Greenhouse –Geisser	234.26	1.83	127.71	2.53	0.91
		Huynh-Feldt	234.26	1.97	118.71	2.53	0.87
		Lower-bound	234.26	1.00	234.26	2.53	.119

VAS = Visual Analog Scale
WOMAC = Western Ontario and Mcmaster Arthritis Index

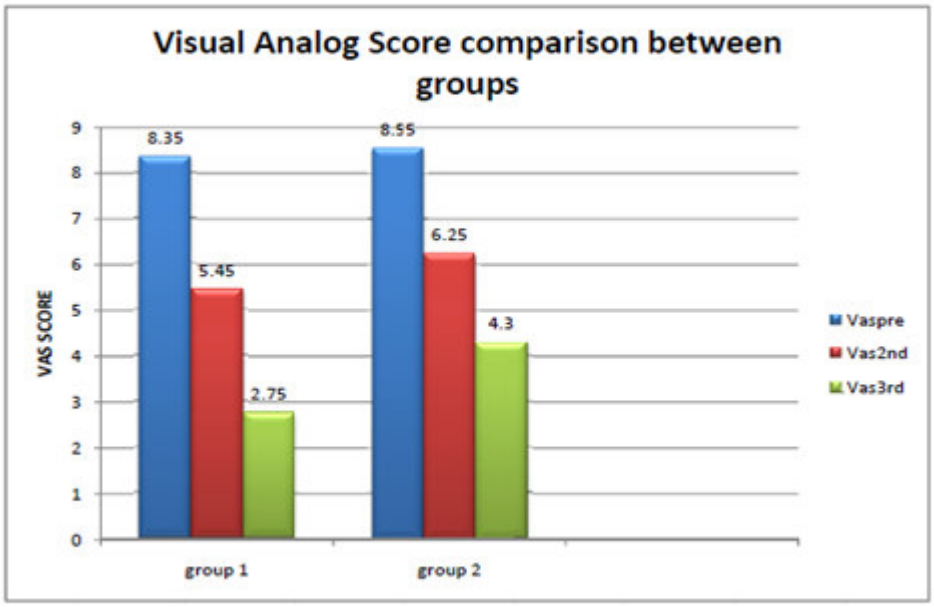
In the above table, our data did meet the Greenhouse-Geisser measure, so here we looked into the significant value of Greenhouse-Geisser. The above table corresponds p value is 0.000 for both VAS and WOMAC which inferences that there is a highly significant difference between both the groups.

Table 4
test of between subjects effects

Source	Measure	Type III sum of Squares	Df	Mean Square	F	Sig.
Intercept	VAS	4236.40	1	4236.40	1187.34	.000
	WOMAC	194067.13	1	194067.13	990.01	.000
Group	VAS	21.67	1	21.67	6.07	.18 P<.05
	WOMAC	.024	1	.024	.000	.991 P<.05
Error	VAS	135.58	38	3.56		
	WOMAC	7448.90	38	196.02		

Between groups, VAS is statistically significant (p<0.05) and WOMAC is not significant, but analysing in the graph 2 WOMAC shows clinically significance.

GRAPH 1: EFFECT OF TREATMENT ON PAIN LEVEL

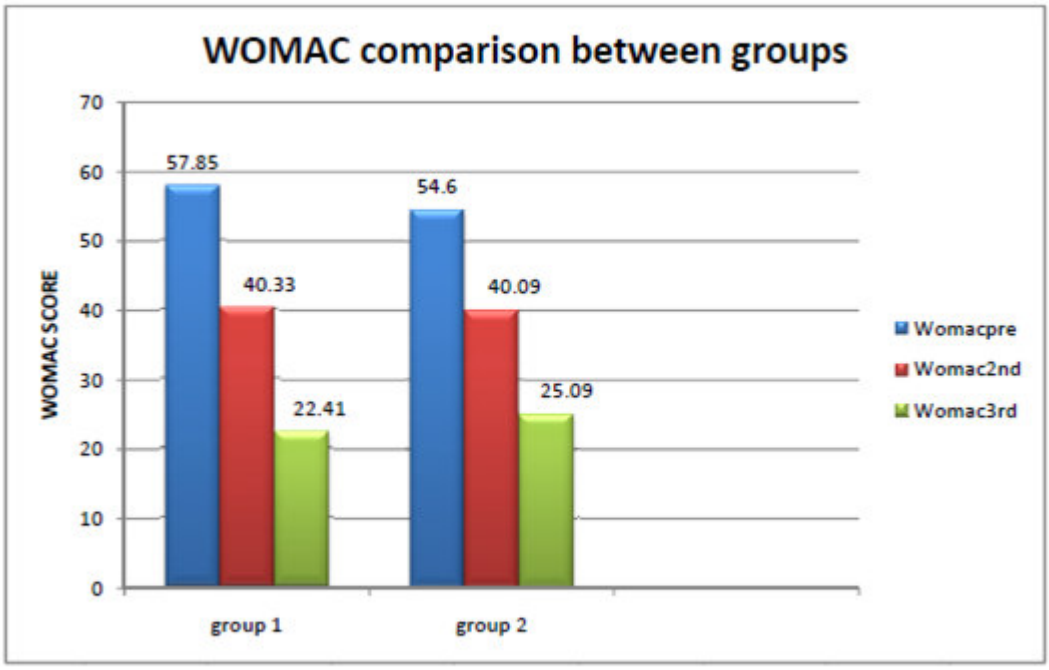


GROUP 1 – experimental group

GROUP 2 – control group

The results of Group 1 had an initial mean value of 8.35 for VAS, which improved to 2.75 at the end of 3rd week showing significant reduction in pain intensity.The results of Group 2 had an initial mean value of 8.55 for VAS, which improved to 4.3 at the end of 3rd week showing significant reduction in pain intensity.The graph shows the effect of treatment on pain level among both the groups. There was a significant reduction in pain level, with the subjects receiving the experimental protocol, exhibiting lesser VAS score as compared to those receiving control protocols after 2nd and 3rd week.

GRAPH 2: EFFECT OF TREATMENT ON PAIN, STIFFNESS AND DISABILITY



GROUP 1 – experimental group

GROUP 2 – control group

The results of Group 1 had an initial mean value of 57.85 for WOMAC, which improved to 22.41 at the end of 3rd week showing significant reduction in pain, stiffness and disability level. The results of Group 2 had an initial mean value of 54.6 for WOMAC, which improved to 25.09 at the end of 3rd week showing significant reduction in pain, stiffness and disability level.

DISCUSSION

This study was aimed to examine the effectiveness of retro walking treadmill training in addition to conventional exercises and conventional exercises alone in the Knee osteoarthritis patients. In this study, 40 patients were recruited for the study i.e. 20 patients in the experimental group (retro walking treadmill training and conventional exercises) and 20 patients in the control group (conventional exercises). Both males and females were included but the majority of the participants turned out to be females. This can be attributed to the fact that OA is more common in females than males. Both the groups were assessed for pain intensity, stiffness and disability prior to the commencement, after 2nd week and at the end of completion of the treatment program after 3 weeks. The outcome measures used for assessment were the Visual Analog Scale (VAS) and the Western Ontario and Mcmaster Arthritis Index (WOMAC).[18] In the experimental group, the mean value for VAS was reduced at the end of 3rd week, showing a significant reduction in pain. The mean value for WOMAC was also reduced at the end of 3rd week, showing a significant improvement in pain, stiffness and disability. In the control group, the mean value for VAS reduced significantly at the end of 3rd week. The mean value for WOMAC was reduced significantly at the end of 3rd week, In the within group comparison for the VAS, the p value was 0.000($p<.05$) while for WOMAC also it was 0.000($p<.05$). On analyzing between group comparison for VAS, the p value was 0.018($p<.05$) while for WOMAC it was 0.991($p>.05$). This shows that both group 1 and group 2 had significance in pain reduction, stiffness and improvement in disability, but on inter group comparison VAS showed significant difference and WOMAC

showed a clinical difference. Improvement in pain and disability was seen in both the groups. But a much better improvement was seen in experimental group. This correlates to the study conducted by Gauri Arun Gondhlekar et al[13], which states that retrowalking as an adjunct to conventional treatment is more effective than conventional treatment alone, in reduction of disability in patients with knee OA. Despite the fact that patients in the control group performed conventional exercises to reduce pain and to improve physical function, changes were identified. These findings are consistent with the results of Marlene and Mary[20], who used the same exercise program in this population.The result of this study also suggests that retro walking positively influences pain and disability in this age group. It is unknown that the similar result might be obtained for specific other patient population.Given the suggestive results of this study, this is an area of inquiry that deserves further research.

LIMITATION

This study had a limited sample size with a short duration. Treatment time for the experimental group was more, when compared to the control group and a follow up was not carried out.

FUTURE PROSPECTIVE STUDIES

A sufficient longer duration study or a follow up study to derive the effects of Retro walkingTreadmill training. Nevertheless, more studies with long term follow up and using different methods are needed.

CONCLUSION

This study provides evidence that retro walking treadmill training in addition to conventional exercises is beneficial to reduce pain with knee osteoarthritis patients. However, the treatment approach did not produce significant changes in disability of the patients. Thus, we can conclude that Retro walking Treadmill Training is a suitable adjunct to conventional exercises in patients with knee osteoarthritis. Ultimately, it might be feasible to include this intervention to the management protocols for knee osteoarthritis.

CONFLICT OF INTEREST

Authors agree that there was no source of conflict of interest.

REFERENCES

1. Marlene Fransen, Lisa Bridgett, Lyn March, Damian Hoy, Ester Penserg. The Epidemiology of osteoarthritis in Asia. International journal of rheumatic disease, 14(2):113-121, (2011).
2. Demirhan Diracoglu, Resa Aydin, Akin Baskent, and Ajda Celik. Effect of kinaesthesia and balance exercises in knee osteoarthritis. Journal of clinical rheumatology, 11(6):303-310, (2005).
3. Chet .R. Whitley and Janet S. Dufek. Effect of backward walking on hamstring flexibility and low back range of motion. International journal of exercise science, 4(3):192-198, (2011).
4. Hutton CW. Osteoarthritis: the cause not results for joint failure? Annals of the Rheumatic Diseases, 48(11): 958-961, (1989).
5. Kellgren and Lawrence. Atlas of Standard Radiographs. The epidemiology of chronic rheumatism. Blackwell scientific Publications Oxford, 2: 88-94,(1963).
6. Young Dae Yuna, Hee Joon Shinb, Sung Joong Kimc, Sang Wan Limd, SukJu Choie. The Effects of Resistance Exercise and Balance Exercise on Proprioception and WOMAC Index of Patients with Degenerative Knee Osteoarthritis. International academy of Physical Therapy Research,1: 169-175, (2010).
7. Vilensky JA, Gankiewicz E and Gehlsen G. A kinematic comparison of backward and forward walking in humans. Journal of Human Movement Studies, 13:29-50,(1987).
8. Laufer Y. Age and Gender related changes in the temporal spatial characteristics of forward and backward

gaits. Physiotherapy Research International, 8(3):131-142,(2003).
9. Grey.G.W. Backward walking: A cinematographic and electromyographic pilot study. Physiotherapy Can, 33: 77-86,(1989).
10. Marisa brink. The effects of backward running on upper leg strength of patients following anterior cruciate ligament reconstruction. Journal of sports science, 21:33-60,(2010).
11. Murray, M. P., Spurr, G. B., Sepic, S. B., Gardner, G, M., & Mollinger, L. A.Treadmill vs floor walking. Kinematic, electromyogram, and heart rate. Journalof Applied Physiology,59 (1):87-91,(1985).
12. T. R. Nanda Kumar & Muddasir Ashraf. The Effect of Backward Walking Treadmill Training on Kinematics of the Trunk and Lower Limbs. Serbian journal of sports science, 3(3):121-127,(2009).
13. Gauri Arun Gondhalekar and Medha vasant deo. Retro walking as an adjunct to conventional therapy versus conventional therapy alone on pain and disability with acute exacerbation of chronic knee osteoarthritis: a randomized controlled trial. North american journal of medical science, 5(2):108–112, (2013).
14. Grasso,R,, Bianchi,L, & Lacquaniti, F. Motor Patterns of human Gait,Backward versus Forward locomotion. Journal of human physiology*. 80:1868-1885,(*1998).
15. Threlkeld, Horn, Wojtowicz, Rooney and Shapiro. Kinematics, ground reaction force, and muscle balance produced by backward running. Journal of orthopaedic sports physical therapy, 11(2): 56-63,(1989).
16. Carmen Lara-Munoz, Sergio Ponce de Leon, Alvan R. Feinstein, Alicia Puente and Carolyn K. Wells, Comparison of Three Rating Scales for Measuring Subjective Phenomena in Clinical Research, Archives of Medical Research,35:43–48,(2004).
17. Quintana, J jose, Escobar. Health related quality of life and appropriateness of knee and hip joint replacement. Archives of internal medicine, 166:220-226, (2006).
18. Bellamy N, Buchanan, Campbell J. Validation study of WOMAC. Journal of Rheumatology, 15(12): 1833-40, (1988).
19. Ferraz MB, Quaresma MR, Aquina LR, Atra E, Tugwell P. Reliability of pain scales in the assessment of literate and illiterate patients with rheumatic arthritis. Journal of Rheumatology, 17: 1022-1024, (1990).
20. Marlene F, Mary and Sara McConnell. Therapeutic exercises for people with osteoarthritis of hip and knee. Journal of Rheumatology, 29(8): 1737-1745, 2002.