Retrowalking as an Adjunct to Conventional Treatment Versus Conventional Treatment Alone on Pain and Disability in Patients with Acute Exacerbation of Chronic Knee Osteoarthritis: A Randomized Clinical Trial

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Abstract

Background: Increased external knee adduction moment during walking alters the joint biomechanics; which causes symptoms in chronic knee osteoarthritis patients. Aims: To assess additional effects of Retro-walking over conventional treatment on pain and disability in patients with acute exacerbation of chronic knee osteoarthritis. Materials and Methods: Thirty chronic knee osteoarthritis patients were randomly assigned into 2 groups. Group ‘A’ (7 men, 8 women) received conventional treatment. Group ‘B’ (8 men, 7 women) received conventional treatment and Retro-walking. Pain, assessed through visual analogue scale (VAS), and Western Ontario and McMaster Universities Arthritis Index (WOMAC) were the primary outcomes and knee range of motion (ROM), hip abductor and extensor strength were secondary outcomes; measured pre-intervention, after 1 week and after 3 weeks of intervention. Results: Two factors analysis of variance for repeated measures was used for all outcomes. At the end of 3 weeks; WOMAC score showed highly significant difference within ($P < 0.0001$) and significant difference between groups ($P = 0.040$) also by Time × group interaction ($P = 0.024$), VAS showed highly significant difference within groups ($P < 0.0001$). Knee ROM showed significant difference within groups. Hip abductor and extensor strength showed significant difference by Time × group interaction ($P < 0.05$). Conclusion: Retrowalking is an effective adjunct to conventional treatment in decreasing disability in patients with knee osteoarthritis.

Keywords: Backward-walking, Knee osteoarthritis, Pathomechanics, Retrowalking

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Introduction

A chronic degenerative joint disease, osteoarthritis (OA) is a leading cause of disability, affecting 15-40% of people aged 40 and above; and 60-70% of the population older than 60 years.\textsuperscript{1,2} It has a multifactorial etiology characterized by wear and tear of articular cartilage, hypertrophy of bone at the margins and a host of biochemical and morphological alterations of the synovial membrane and joint capsule.\textsuperscript{3} It is the most frequent joint disease with a prevalence of 22-39% in India.\textsuperscript{4} Although most joints of the lower extremity may be involved, the knee is the most common site for OA with characteristic signs like pain during weight bearing, limitation of knee range of motion (ROM), crepitus, joint effusion, and local inflammation.\textsuperscript{3} If left untreated, it may result in a reduction in physical function and independence.

In knee OA, the medial compartment is more frequently affected than the lateral. This is due to higher transfer of loads through the medial compartment than through the lateral, resulting in higher external knee adduction...
moment. According to studies, the first peak knee adduction moment during walking is a strong predictor of the severity and rate of progression of medial compartment of knee OA.[3]

Management of knee OA necessitates a multidisciplinary approach with physiotherapy as the main choice of conservative management; which includes various strategies such as manual therapy, exercises, patellar taping and electrical modalities with or without thermal modalities as measures for pain reduction.[2]

Recently, closed kinematic chain exercises have drawn much attention in the management of knee OA.[5] Studies suggest that these exercises are more effective and functional than the traditionally employed open kinematic chain exercises.[6] Closed kinematic chain exercises for knee joint can be incorporated in many ways; one of them is Retro-walking.[5] Retro-walking is walking backwards.[2] Since there is propulsion in backward direction and reversal of leg movement in Retro-walking, different muscle activation patterns from those in forward walking are required.[7] The effects of backward walking and backward running in strength gains and joint stress reduction and hence in facilitating rehabilitation are discussed in several studies.[6] Along with a unique muscle activation pattern; Retro-walking is associated with increased cadence, decreased stride length and different joint kinematics as compared to forward walking and hence may offer some benefits over forward walking alone.[5,6]

Though a growing body of evidence suggests the role of exercises in improvement of symptoms and joint function in knee OA; precise guidelines as regards their type and dosage have not been laid. Hence, Retro-walking may offer additional benefits in this population. The current study aimed at finding out the effectiveness of Retro-walking as an adjunct to conventional treatments on pain and disability in patients with knee OA.

**Participant selection**

The participants fulfilling three out of the six clinical criteria listed by The American College of Rheumatology were diagnosed as knee OA which was confirmed using radiological investigations.[9] The criteria are (1) Age >50 years, (2) Morning stiffness lasting <30 min, (3) Crepitus with active motion, (4) Bony tenderness, (5) Bony enlargement, and (6) No warmth to touch.

Patients having knee pain for more than 6 weeks were included. Patients with bilateral involvement, a history of any lower extremity injury or underlying pathology, a history of any inflammatory joint disease and balance problems or using an assistive device for ambulation were excluded.

**Testing instruments**

The tools used for measurement of the two primary outcomes: (1) A 10 cm visual analogue scale (VAS) for rating the intensity of perceived pain. The scale had 0 (no pain at all) and 10 (maximum pain felt at this moment) at either ends. The patient was asked to mark his/her pain where he felt it would take its position in the scale. (2) Western Ontario and McMaster Universities Arthritis Index (WOMAC) of OA, a patient reported scale, was used to assess pain, stiffness and physical function levels in the subjects. It measures five items for pain, two for stiffness, and 17 for functional limitation. Physical functioning questions cover activities of daily living. Its Psychometric properties have been established. It has good test-retest reliability in pain and physical function domain.[10]

The tool used for measurement of the secondary outcome: Medical Research Council grading was used to assess concentric strength of hip abductors and hip extensors muscles and a Universal Goniometer was used to assess knee joint ROM in prone position.

**Methods**

The subjects were randomly allocated to either of the two treatment groups.

**Group A (conventional treatment group)**

Subjects in this group received deep heating modality (Short Wave Diathermy) (Electro Medical Control, Electrotherm [250 W]) for 20 min for pain relief and free exercises (static and dynamic quadriceps, knee bending exercise in prone lying, hip flexion exercise in supine, hip abduction in side lying and hip extension in prone lying position). All exercises were done in sets of 10 repetitions; 1 set of all exercises twice-a-day for 1st week and progressed to 2 sets twice-a-day in 2nd week and 3 sets twice-a-day in 3rd week.
Group B (conventional treatment and retro-walking group)
Subjects underwent three sessions of Retro-walking per day (10 mins. per session) for 3 weeks on a flat surface at their maximum pace along with conventional treatment as mentioned above.

Data collection
The two patient reported outcomes were taken before treatment, after 1 week of treatment and after 3 weeks of treatment as shown in Figure 1.

Statistical analysis
The outcomes were analyzed using two factors analysis of variance for repeated measures and Bonferroni test with level of significance set at \( P < 0.05 \); using SPSS version 13.0 for Windows.

Results
Thirty three patients fulfilling the inclusion criteria were screened and included in study after obtaining their consent. Three patients were lost to follow-up. The study population thus had 30 adults (15 men, 15 women) of mean age 63.43 ± 6.202 years. Scores were analyzed pre intervention, at the end of 1 week and at the end of 3 weeks in both the groups [Table 1]. VAS showed highly significant difference within the groups, but no significant difference was seen between the two groups and with Time × group interaction [Tables 2 and 3].

WOMAC score showed highly significant difference within and significant difference between both the groups and with Time × group interaction [Tables 2 and 4]. Knee joint ROM showed significant improvement within group but not between the groups and with Time × group interaction [Table 5]. Strength of hip abductor muscles and hip extensor muscles did not show significant improvement within or between the groups but showed significant improvement with the Time × group interaction [Table 5].

Discussion
Present study examines the efficacy of Retro-walking as an adjunct to conventional treatment in reducing pain and disability in patients with acute exacerbation of knee OA. Group × time interaction analysis revealed that Retro-walking is more effective in reducing disabilities as compared to conventional treatment. However, both are equally effective in relieving pain.

Pain relief after conventional treatment could be attributed to the thermal effects associated with deep heating modality, strengthening exercises for hip and knee helping to steady the knee and give additional joint protection from shock and stress. In addition to this, Retro-walking may have effect on pain relief by reducing excess adductor moment at knee joint decreasing the compressive forces on medial compartment of knee joint.

Statistically, significant improvement in function is seen in both the groups and between the groups. However, the improvement in Group B is greater than that of Group A. Improvement in function may be attributed to the reduction of pain, reduction in abnormal joint 

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**Table 1: Primary and secondary outcomes (with respect to groups and time interval)**

| Parameter       | Group | Pre         | After 1 week | After 3 weeks |
|-----------------|-------|-------------|--------------|--------------|
| VAS             | Group A | 7.53±1.06   | 5.70±0.80    | 4.07±1.18    |
|                 | Group B | 7.70±0.99   | 5.83±1.08    | 3.53±1.33    |
| WOMAC           | Group A | 67.26±14.67 | 60.02±13.24  | 52.60±13.29  |
|                 | Group B | 62.80±14.95 | 51.33±11.57  | 37.13±12.68  |
| Knee ROM        | Group A | 111.7±6.45  | 113.0±5.60   | 117.0±4.14   |
|                 | Group B | 112.3±10.50 | 118.0±6.50   | 125.2±5.40   |
| Hip abductors   | Group B | 3.53±0.51   | 3.80±0.42    | 4.60±0.50    |
| strength        | Group A | 3.86±0.35   | 4.00±0.00    | 4.26±0.59    |
| Hip extensors   | Group B | 3.93±0.25   | 3.93±0.25    | 4.46±0.51    |
| strength        | Group A | 3.80±0.41   | 4.13±0.35    | 4.93±0.25    |

VAS: Visual analogue scale; WOMAC: Western ontario and Mcmaster universities arthritis index; Knee ROM: Knee range of motion
kinetics and kinematics during functional movements and improved muscle activation pattern. Studies have shown that compared to forward walking; backward walking creates more muscle activity in proportion to efforts.\textsuperscript{[11] } As advantages of Retro-walking include improvement in muscle activation pattern, reduction in adductor moment at knee during stance phase of gait and augmented stretch of hamstring muscle groups during the stride; all of these may have helped in reducing disability thus leading to improved function. There is a possibility that proprioceptive and balance training may have occurred during Retro-walking adding to its benefits. Retro-walking also has effect on improving strength of hip extensors leading to reduced hip flexion moment during stance phase and thus preventing abnormal loading at knee joint and, in turn, the disability. As a result of exercises and Retro-walking there was improvement in the strength of muscles at knee and hip which may have reduced functional disability.

There were certain limitations in the current study. Medications of patients, activities of daily living and recreational activities of patients were not taken into account. The compliance of patients with the home exercise program was not monitored.

## Conclusion

Retro-walking as an adjunct to conventional treatment is more effective than conventional treatment alone, in reduction of disability in patients with knee OA.

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