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ORIGINAL ARTICLE

Effects of Retro-Walking on Pain, Functional Disability and Performance in Knee Osteoarthritis

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ABSTRACT

Background: Osteoarthritis is a degenerative disease, considered common cause of disability. Treatment options include pharmacological interventions, joint cavity injections, physical exercises and joint replacement surgeries.
Aim: To determine effects of combined retro-walking and conventional therapy on pain, functional disability and performance in knee osteoarthritis.
Method: Randomized controlled trial conducted at Max Rehab Physiotherapy Department. 36 patients meeting criteria randomly allocated into two groups through random number allocation method. Experimental group treated with Retro-walking with conventional therapy; duration of the session was 30 minutes, three days a week for 6 weeks. Control group received conventional therapy alone for period of 30 minute; 1 set of 10 repetitions twice for 1.5 months, Pre-assessment and post-assessment evaluated through NPRS, WOMAC & TUG. Data analyzed using SPSS 21.
Results: Experimental group had significant decrease in pain intensity level and functional disability than control group i.e. p = 0.000. Experimental group showed improvement in timed up and go test i.e, p = 0.000. Analysis of experimental group versus control group revealed significant difference in reducing pain (p< 0.001). Differences in rest of outcome variables were not significant (p>0.001).
Conclusion: Combination of retro walking along with conventional therapy is useful to improve pain, functional disability in patients suffering from knee osteoarthritis.
Keywords: Osteoarthritis, Retro-walking, Physical Therapy

INTRODUCTION

Osteoarthritis (OA) is a degenerative and non-inflammatory rheumatological disease of the joints characterized by the joint stiffness resulting in the joint immobility and dysfunction. It mostly affects the joints of the hands, knees, hips and spine[1]. It is considered as second most common cause of disability around the globe[2], which is affecting about twenty percent of the people worldwide[3] with more frequency in the females. Most of the people develop OA before sixty five years of age but incidence increases with advancing age[4,5]. It was believed in the past that OA involves only articular cartilage. Now it considered a disease affecting joint cavity, synovial fluid, ligaments and tissues resulting in the subchondral bone erosion, meniscus deterioration, decrease ligament laxity and Impaired contractile function of the joint[6,7]. Osteoarthritis (OA) mostly presents with the painful joints, stiff muscles and decrease in the muscle mass which ultimately leads to impairment and reduction in the joint movement[2,8]. Overweight and having family history of osteoarthritis (OA) are two most important Risk factors for OA[9-11] but heredity factors account more for the female in the development of OA. Sports player, special profession, diabetic neuropathies, accidents, bodybuilders, excessive knee bending and joint immobility are other factors[12,13].

Different treatment options have been developed for the pain management and improvement in the joint mobility. Among them, Analgesics are extensively prescribed drugs for the osteoarthritic pain reduction but certain adverse effects and temporary pain alleviation limit their use[3]. Other therapeutic choices include local injections and surgeries[14]. Different physical exercises are also in use for the improvement in the joint mobility, strengthening of the muscles and rehabilitation of the affected individuals which includes weight bearing exercises, aerobics, dynamic trainings and backward and forward locomotion[15,16]. Among them, retro-locomotion is the commonly used adjunct therapy for the osteoarthritis worldwide (OA)[14,17]. An RCT phase 1 revealed that about an hour walk is safe and tolerable in patients with knee osteoarthritis (OA) but it has counter effect by increasing the duration of walking[18]. Another RCT phase 2 claimed that a three months walking has healthy effect on the cardio respiratory system but it has nothing to do with the pain[19]. Moreover, exaggeration of pain followed by walking has also been observed[20]. For strengthening of muscles and a good body balance backward locomotion is an efficient closed chain theory of exercises[21,22]. Studies have shown that retro- locomotion exercise has more beneficial effect than forward-locomotion in healthy individuals[21-24]. Forward walking results in knee flexion, extension and then flexion in support stage but in backward walking there is extension, flexion and then extension in the support stage before flexion and extension during swing. Backward walking limit disability by decreasing the range of extension of joint and increasing the actual functional range of the joint movement[4]. Moreover, backward locomotion also increases the strength of quadriceps muscles because in backward locomotion quadriceps muscles remain functional for longer duration of time. It also decrease the compression force and loading rate on joint hence lessens the incidence of traumatic damage to the joint[25]. Backward-walking improves the muscle strength, reduces the range of adduction of knee joint and increases the stretching force of hamstring, all are contribute to the improvement of joint mobility and functional movement[4,26].

Literature revealed the beneficial effect of retro-walking as compared to the forward walking with regard to decrease in the compression force and improving the muscle power but limited data was present on functional recovery in patients with knee osteoarthritis (OA).

The study aimed at evaluating the efficacy of retro-walking along with the conventional therapy on pain, functional disability and performance in joint osteoarthritis.

METHODOLOGY

Trial design: The study is a randomized controlled trial comparing retro-walking along with the conventional group and control (only conventional therapy). After permission from Institutional Ethical Committee, the study was conducted at Max Rehab Physiotherapy Department. The participants were randomly allocated to study and control group. After considering the inclusion and exclusion

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criteria, participants are asked to draw either number one or two from a box. Number one was allocated to group A and number two was allocated to group B. An informed consent form was signed by the participants for ethical consideration. The CONSORT guidelines were followed and CONSORT diagram was used to describe the flow the participants at each stage of the trial.

Participants: Total 36 participants with knee osteoarthritis OA were included in this study. Inclusion criteria was: Patient suffering with knee Osteoarthritis for at least three months, patients with 40-70 years of age, 1–3 radiographic grades on the Kellgren-Lawrence scale and patients with Bilateral knee osteoarthritis. Participants were excluded on the basis of traumatic knee joint, Inflammatory and Infectious knee conditions (RA, gout, and psoriatic arthritis), history of knee surgery, tumors or malignancy of bones.

Intervention: The first group which was the treatment group was given Retro-walking with conventional therapy and the duration of the treatment was 30 minutes, three days a week for 6 weeks. The second group which was the control group received conventional therapy alone and the period of the ministrations comprised of 30 minutes, with 1 set of 10 repetitions twice a day for 1.5 months.

Outcomes Measurement: Outcomes were assessed by a physiotherapist who has the experience of about 10 years. The scales used to calculate the outcomes were Western Ontario &Mc-master Osteoarthritis Index (WOMAC), Numerical Pain Rating Scale (NPRS), Time Up & Go Test (TUG) (simple).

Sample size: Epitools epidemiological calculator was used to calculate the sample size which was 34 with 0.80 power of study and 5% margin of error by taking ± SD. Two tail t test was used and sample size 38 was calculated by assuming 10% attrition rate with power of 80%, 5% margin of error and 95% confidence interval. It yields 18 participants to be included in each group with total of 36 participants in the study after exclusion.

Statistical analysis: The data was analyzed using SPSS for Windows software, version 21. Mean and standard deviation were calculated for all the outcomes. The level of significance was set as $p < 0.05$ with 95% confidence interval.

RESULTS

A total of 36 subjects took part in this 6-week randomized controlled trial (Fig 1). The completion rate for both primary and secondary outcomes after 6 weeks was 100 % in both Experimental and Control group with no attrition. All the 36 participants were included in analysis.

Patient characteristics: Baseline patient characteristics of both experimental and control group are given in Table 1. Baseline scores of measures of outcomes for both the groups were not significant (Table 1).Eighty percent of the subjects were females.

Outcomes: The final assessment of outcomes at the end of 6 week randomized controlled trial is summarized in Table 3.Analysis shows that experimental group had a significantly greater decrease in pain intensity level and functional disability than control group i.e., (Mean changes, 4.66 versus 3.28; p=0.000) and (Mean changes, 15.67 versus 10.11; p=0.000).Similarly, experimental group had a greater improvement in timed up and go test i.e, (Mean changes, 1.61 versus 1.11; p= 0.000.Additionally, between the group analysis of experimental group versus control group revealed significant difference in reducing pain (p< 0.001).Differences in rest of the outcome variables was not significant (p>0.001).

Serious Adverse event: No serious adverse event was reported in our trial in both groups

Table 1: Patient Characteristics at baseline

	Experimental Group	Control group	p-value
Mean (S.D) Age, years	52.22±7.36	53.78±7.36	------
Gender (male/female), n	4/14	3/15	------
Mean (S.D) NRS	7.44±0.98	7.50±0.92	0.86
Mean (S.D) WOMAC %	37.61±8.03	37.33±8.03	0.91
Mean (S.D) TUG, sec	13.44±0.74	13.58±0.66	0.56

NRS: Numerical Rating Scale, **WOMAC:** Western Ontario and McMaster Universities Osteoarthritis Index, **TUG:** Timed up and go test.

Table 2: Outcome measures at six weeks after completion of trial in experimental and control groups in n = 36 subjects.

Variables	Experimental Group (EG)				Control Group (CG)				Between the group EG vs CG) P value	
	Mean	SD	Mean change	P	Mean	SD	Mean change	P	P value	
NRS	2.78	0.94	4.66	0.00	4.22	1.16	3.28	0.00	0.862	0.000
WOMAC(%)	21.94	5.59	15.67	0.00	27.22	6.39	10.11	0.00	0.918	0.013
TUG (sec)	11.83	0.74	1.61	0.00	12.47	0.69	1.11	0.00	0.560	0.012

NRS: Numerical Rating Scale, **WOMAC:** Western Ontario and McMaster Universities Osteoarthritis Index, **TUG:** Timed up and go test.

DISCUSSION

Though there are several treatment options available for knee osteoarthritis, our study focused on comparing the effectiveness of adjunctive Retro-walking and Conventional therapy with conventional therapy alone in decreasing pain and disability symptoms n patients with knee osteoarthritis. Results of our study revealed that combination of retro-walking and Conventional therapy has greater efficacy in reducing morbidity of knee osteoarthritis patients as compared to conventional therapy alone.

The physiology of walking patterns in osteoarthritic patients is altered actively by the patients themselves in order to reduce pain and disability symptoms. It is evident by the studies that the patients of knee osteoarthritis walk slowly with enhanced adduction movements and decreased excursion at knee joint. This is basically a secondary adaptation in patients as a compensation to reduce osteoarthritis symptoms. But the secondarily adopted compensatory gain is a threat itself as muscle strength and flexibility is compromised by imbalance of muscle ultimately leading to deformity[27]. Retro walking, comprising of support swing ratio similar to forward walking, is beneficial to patients of knee osteoarthritis as in retro-walking knee extends, flexes and again extends in support phase prior to flexion and extension during swing phase. Further, the role of muscles supporting ankle and knee joint is reversed in retro-walking i.e., there is coordinated contraction of hamstring and quadriceps muscle whereas plantar flexors of ankle acts as shock absorber. Additionally, patellar compressive force produced by retro-walking is far lower than forward walking[28].

Greater improvement in experimental group than control group in our study may be the result of fact that retro-walking reduces impulsive forces on knee due to toe-heel contact pattern. Eccentric contraction of muscle of posterior compartment dissipates the vertical forces throughout the dorsiflexion prior to heel strike in backward walking[29]. It is evident from literature that retro-walking reduces the shear force in knee joint by allowing excessive activation of hamstrings hence decreased patella-femoral and tibiofemoral compression. The results of our study are consistent with Balraj AM et al who concluded that retro-walking aids in lowering disability parameters in knee Osteoarthritis patients[30]. According to one study, backward walking is advantageous because it leads to improvement in muscle

activation pattern and increased stretching effect of hamstring muscle. Another study states that retro-walking improves strength of hip extensors hence decreasing loading of knee joint his might be justification of our results due to which pain and disability is reduced more in experimental group than control group in which only conventional therapy was used[31].

Improvement in control group is also observed in our study though lesser than the experimental group. This may be due to the fact that exercise involved in conventional treatment do stimulates proprioception. Thus, adjunctive treatment module including combination of retro-walking and conventional treatment can prove an excellent alternative to isolate conventional treatment in osteoarthritis of knee joint[4].

Results of our study shows statistically as well as clinically significant results in terms of NPRS, WOMAC scale and TUG. Both retro walking & conventional therapy are well accepted methods of treatment of subjects with knee osteoarthritis. In this study it was indicated that combination of retro walking along with conventional therapy was helpful in pain relief, improving functional mobility, & performance in subjects with knee osteoarthritis.

Our study has a few limitations. Firstly our study consists of small sample size with majority of females so the results may be gender-biased. Secondly, follow-up time for the patients was short in our study. Thirdly, retro-walking is not an appropriate therapy for all the patients due to fear of fall so the eligibility criteria of patient should be determined first. Further studies on the topic with large sample size is encouraged.

CONCLUSION

In conclusion, this study indicates that 6 weeks Retro-walking with conventional therapy is more effective technique to improve pain, functional disability in patients suffering from knee osteoarthritis as compared to conventional therapy alone Conventional therapy alone is also effective but results showed significant effects of retro walking with conventional therapy.

Conflict of Interest: Authors declare that there was no conflict of interest.

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Figure 1: CONSORT Flow Diagram