Comparative study between effect of Retrowalking and self-selected pace forward walking on improving pain and function in people with osteoarthritis knee

Nazim Malik M and Aparna Sudhan M

DOI: https://doi.org/10.22271/kheljournal.2023.v10.i1c.2773

Abstract

Background: Osteoarthritis is a common cause of knee pain and lower limb disability. Previous studies reported the beneficial effects of walking in individual with mild to moderate knee osteoarthritis (OA). The current study aimed to compare the effect of retrowalking and self-selected pace forward walking along with conventional treatment on improving pain and function in people with OA knee.

Objective: To compare the effect of retro-walking along with conventional exercise and self-selected pace forward walking along with conventional exercise on improving pain and function in people with OA knee.

Method: 30 subjects with OA knee fulfilled the inclusion criteria were randomly assigned into 2 groups, group A and group B[15 in each group]. Group A received retro-walking along with conventional treatment and group B received self-selected pace forward walking along with conventional treatment. The treatment duration will be 45 min in each session for a regular period of 6 days in a week. Pre-test values were taken on the first day and post-test values was taken on the third week of treatment. Outcome measures used were WOMAC, VAS and Isometric H and Held Dynamometer.

Result and Discussion: Statistical analysis of inter group significance by Independent sample t-test for WOMAC [t=3.83>table value, t=2.05], VAS [3.09>table value, t=2.05], and Isometric knee extension strength [t=4.83>table value, t=2.05] reveals that group B (retrowalking) shows significant difference between pre-test and post-test values of WOMAC, VAS and Isometric knee extension strength than in group A (self-selected pace forward walking).

Conclusion: Both group shows significant difference in their pre and post-test values of WOMAC, VAS and Isometric knee extension strength. But group B who received retrowalking along with conventional treatment shows greater improvement on pain and physical function in people with OA knee than in group A who received self-selected pace forward walking along with conventional treatment.

Keywords: Retro-walking, self-selected pace forward 7 walking, osteoarthritis of knee (OA)

Introduction

Osteoarthritis is a degenerative joint disease, occurring primarily in older person, characterized by erosion of the articular cartilage, hypertrophy of bone at the margins that is osteophytes, subchondral sclerosis, and a range of biochemical and morphological alteration of the synovial membrane and joint capsule. The prevalence of osteoarthritis (OA) is gradually increasing in both low- and highincome countries. The Global Burden of Disease studies recently indicated that knee OA is the fastest increasing major health disorder and the second global cause of disability. Men are affected than women before 50 years of age whereas after 50 years of age the prevalence in women is 2-3 times greater than men. The common clinical manifestations of knee OA include pain, stiffness, joint enlargement, crepitus, muscle weakness, deformity, impaired proprioception, reduced joint motion, and disability. Walking can reduce the pain and improves the function in patients with OA Knee by rebuilding the Joints, strengthens the legs, and reduces body weight. Retro-walking is walking backwards. 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.
Backward walking increases stride rate decreases stride length and increases support time. Muscular structure supporting ankle and knee reversed their role during retro-walking. In retro-walking knee provides the primary power producer and ankle plantar flexors shock absorber. Direction of knee joint shear force directed forward initially during backward walking where as backward in forward walking. According Flynn et al. [1995] backward walking produces significantly lower patellar compressive force than forward walking and helps to reduce maximal vertical force and impulsive force on knee in comparison to forward walking because of toe heel contact 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.

Outcome measures used in this study are Western Ontario and McMaster Universities Arthritis Index (WOMAC), Visual Analogue Scale and Baseline push-pull Hand Held Isometric dynamometer. WOMAC is used to assess pain, stiffness, and physical function levels in the subjects. It measures five items for pain, two for stiffness, and for functional limitation. Physical functioning questions cover activities of daily living. Pain can be assessed with Visual Analogue Scale with terminal descriptors of “no pain” and “worst pain” possible. A Baseline Push-Pull Hand Held Isometric dynamometer is used to measure the isometric strength of quadriceps muscle.

According to studies, both retro-walking and forward walking along with conventional exercise can improve the pain and function in people with osteoarthritis knee. In this study, aims to compare the effectiveness of retro-walking and self-selected pace forward walking on improving pain and function in people with osteoarthritis knee.

**Methodology**

**Outcome measures**
- WOMAC [Western Ontario and McMaster universities osteoarthritis index]: is used to assess pain, stiffness and physical function levels in the subjects. It measures five items for pain, two for stiffness, and for functional limitation. Physical functioning questions cover activities of daily living.
- Visual Analogue Scale (VAS)
- Isometric baseline push pull Hand Held Dynamometer

**Variables**

**Dependent Variables**
- Pain
- Function

**Independent variables**
- Retro-walking
- Self selected pace forward walking

**Selection criteria**

**Inclusion Criteria**
- Patients with clinical diagnosis of OA knee
- (Tibiofemoral) confirmed by x-rays
- Symptoms more than 3 months
- Age: 55-60 years both genders
- Unilateral involvement
- Sub-acute OA [Kellengran and Lawrence scale 2-3]

**Exclusion Criteria**
- Previous history of any lower limb surgery
- Systemic inflammatory disease
- Osteoporosis
- Patients with balance problems
- Patient who had undergone physiotherapy treatment for the same condition before 3 months
- Patients with poor eye sight
- Non cooperative patients

**Study Procedure**

All the participants with pain in the joint and who are clinically diagnosed as osteoarthritis of knee will be screened and included in this study based on selection criteria and an informed consent will be taken. The study population will include 30 patients with unilateral OA knee fulfilling both inclusion and exclusion criteria. They are divided into 2 groups, Group A and Group B. A brief description about the procedure will be given to the subjects before commencing the study. A total of 30 subject should be divided equally into two groups by random sampling methods Group A [n=15] and Group B [n=15].

**Group A**

Group A received conventional treatment and 30 minutes of self selected pace forward walking conducted in clinic’s corridor where patients walked on a tiled floor surface that was hard and smooth.

**Group B**

Group B received a combination of conventional treatment and retro-walking in treadmill (two sessions per day (10 min per session)). The total treatment duration was 45 min in each session for a regular period of 6 days in a week. Both group received hot pack for 10 min prior to exercise in order to warm up the muscle. Pre-test values were taken on the first day and the post-test values were taken after the total study duration of 3 weeks.
Conventional treatment

- The patient is positioned in supine lying for application of hot pack over knee for 10 min.
- Stretching exercises of the posterior, anterior, medial and lateral muscles of the lower limb
- Concentric and eccentric isotonic progressive resistance exercises of the lower limb muscles.
- Cooling off exercises, with breathing exercises.

All exercises were given in sets of 10 repetitions.1 set of all exercise for 1st week and progressed to 2 sets in 2nd week and 3 sets in 3rd week.

Isometric Knee Strength Measurement Method

Isometric Base line Push/Pull Hand Held Dynamometer with 50lb/20 Kg capacity, which can measure muscle strength in kilograms (kg) or in pounds (lb). Maximal isometric strength of knee extensors was measured. Knee extensors with the participant seated, hip and knees flexed at 90°. Dynamometer placed on the anterior aspect of the shank, proximal to the ankle joint. Maximum isometric contraction is measured.

Table 1: Demographic profile of the people with OA knee

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>57.6</td>
<td>1.84</td>
<td>55</td>
<td>60</td>
</tr>
<tr>
<td>Group B</td>
<td>57.9</td>
<td>2.03</td>
<td>55</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 2: Age distribution of people with OA knee

<table>
<thead>
<tr>
<th>Age</th>
<th>Group A Frequency Percentage</th>
<th>Group B Frequency Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 - 57 yrs</td>
<td>53.3%</td>
<td>60%</td>
</tr>
<tr>
<td>58 - 60 yrs</td>
<td>46.7%</td>
<td>40%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Graph 1: Age distribution of people with OA knee
Graph 2: Height distribution of people with OA knee

Graph 3: Weight distribution of people with OA Knee

Graph 4: Statistical analysis of WOMAC using t-tests Comparison of Pre-test Post-test WOMAC In Group A and Group B

Table 3: Mean S.D. and t-value to compare Pre-test Post-test WOMAC In Group A

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean change</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>table value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>65.13</td>
<td>6.32</td>
<td></td>
<td>15.6</td>
<td>15</td>
<td>18.9114</td>
<td>2.15</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Post-test</td>
<td>49.53</td>
<td>5.65</td>
<td></td>
<td>15.6</td>
<td>15</td>
<td>18.9114</td>
<td>2.15</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

Table 4: Mean S.D. and t-value to compare Pre-test Post-test WOMAC in Group B

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean change</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>table value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>66.93</td>
<td>5.55</td>
<td></td>
<td>22.4</td>
<td>15</td>
<td>14.1314</td>
<td>2.15</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Post-test</td>
<td>44.53</td>
<td>5.96</td>
<td></td>
<td>22.4</td>
<td>15</td>
<td>14.1314</td>
<td>2.15</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

Table 5: Mean S.D. and t-value to compare the pre-test WOMAC between Group A and Group B using t-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test Mean</th>
<th>S.D.</th>
<th>Difference in mean</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>table value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>65.13</td>
<td>6.32</td>
<td>1.8</td>
<td>300.82928</td>
<td>2.05</td>
<td>p = 0.414</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group B</td>
<td>66.93</td>
<td>5.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Mean S.D. and t-value to compare the post-test WOMAC between Group A and Group B using t-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test Mean</th>
<th>S.D.</th>
<th>Difference in mean</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>table value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>65.13</td>
<td>6.32</td>
<td>1.8</td>
<td>300.82928</td>
<td>2.05</td>
<td>p = 0.414</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group B</td>
<td>66.93</td>
<td>5.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical analysis of VAS (Pain) Using t-tests

Table 7: Comparison of Pre-test Post-test VAS in Group A and Group B

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>S.D.</th>
<th>Post-test mean</th>
<th>S.D.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>6.8</td>
<td>1.08</td>
<td>4.07</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Group B</td>
<td>7.07</td>
<td>0.79</td>
<td>3.07</td>
<td>0.88</td>
<td></td>
</tr>
</tbody>
</table>

Table 8: Mean S.D. and t value to compare Pre-test Post-test VAS in Group A

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean change</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>table value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>6.8</td>
<td>1.08</td>
<td>2.73</td>
<td>15</td>
<td>11.9714</td>
<td>2.15</td>
<td>p &lt; 0.05</td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>4.07</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9: Mean S.D. and t value to compare Pre-test Post-test VAS in Group B

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean change</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>table value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>7.07</td>
<td>0.79</td>
<td>4.0</td>
<td>15</td>
<td>23.6614</td>
<td>2.15</td>
<td>p &lt; 0.05</td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>3.07</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10: Mean, S.D. and t value to compare the pre-test VAS between Group A and Group B using t-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test Mean</th>
<th>S.D.</th>
<th>Difference in mean</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>table value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>6.8</td>
<td>1.08</td>
<td>0.27</td>
<td>300.76828</td>
<td>2.05</td>
<td>p = 0.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group B</td>
<td>7.07</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 11: Mean S.D. and t value to compare the post-test VAS between Group A and Group B using t-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test Mean</th>
<th>S.D.</th>
<th>Difference in mean</th>
<th>n</th>
<th>t</th>
<th>df</th>
<th>table value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>65.13</td>
<td>6.32</td>
<td>1.8</td>
<td>300.82928</td>
<td>2.05</td>
<td>p = 0.414</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group B</td>
<td>66.93</td>
<td>5.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical analysis of Knee extension strength using t-tests
arthritis and the major cause of musculoskeletal pain and mobility disability in the elderly, and there for represents a significant burden on healthcare provision. This study was a comparative study conducted to assess the effectiveness of retro-walking and self selected pace forward walking along with the conventional exercise for reducing pain and improving physical function in people with OA knee. In this study subject with sub acute OA (Kellgren and Lawrence scale 2-3) were taken into consideration. The subjects were selected by proper screening and fulfilling the inclusion and exclusion criteria. 30 patients were diagnosed with sub acute OA were divided into two groups Group A and Group B (15 patients ion each group). Group A received conventional exercise along with self selected pace forward walking and Group B received conventional exercise along with retro-walking. Each group received treatment for a total period of six week, 45 minutes in each session for a regular period of six days in a week.

The present randomized controlled trial aimed to compare the effects of retro or self selected pace forward walking programs on improving pain and function in people with OA knee. Statistical analysis revealed that conventional exercise along with retro-walking shows significant effect over conventional exercise along with self selected pace forward walking in reducing pain and improving strength and physical function.

Walking is a closed kinetic chain exercise program which allows initiation of weight bearing and early mobilization in knee rehabilitation. Regular walking exercises are beneficial, and it is recommended to reduce pain and disability in people with OA knee [41-43]. Kovar et al. reported improved function and no worsening of OA related symptoms after supervised fitness walking program compared to patient education program [44].

Biomechanically muscles around ankle and knee reverse their action during retro-walking. In retro-walking knee gives the primary power producer with co54 -contraction of quadriceps and hamstring and ankle planter flexors works as shock absorber [45]. Direction of knee joint shear force directed forward initially during retro-walking where as backward in forward walking [46]. Retro-walking produce significantly lower patellar compressive force than forward walking [47]. Retro-walking helps to reduce maximal vertical force and impulsive force on knee compare to forward walking because of toe-heel contact pattern. It is well known that physical exercise in the form of walking is cost-effective, accessible, and effective in reducing cardiovascular disease [48], obesity [49-50], and symptoms of depression [51-52]. Additionally, walking is the most common form of physical activity in the United Kingdom and the United States [51-54]. Another study indicated that the retro-walking reduces eccentric activity of the quadriceps, while isometric and concentric quadriceps activity was maintained [53]. This is one of the advantages of retro walking over forward walking. Reduced eccentric activity of quadriceps will results decrease compressive force at knee joint, therefore, pain intensity at the knee will be reduced. The results of current study indicate a large significant effect of retro walking compared to self-selected pace forward walking.

In addition to walking program, conventional exercise including stretching and strengthening are also used in this study for better outcome. Strengthening of lower limb muscles surrounding knee joint give additional protection from shock and stress. Stretching exercises will restore or increase the extensibility of the muscle-tendon unit and,
therefore, regain or achieve the flexibility and ROM required for necessary or desired functional activities. In addition to improving flexibility and ROM, stretching exercises used for warm-up prior to or Cool-down following walking program [50]. The outcome measures used in this study are WOMAC, VAS, and isometric hand held dynamometer.

On statistical analysis, the mean pre-treatment WOMAC of Group A and Group B is 65.13 and 66.93 and mean post treatment WOMAC is 49.53 and 44.53 respectively. This result shows that there is a decrease of 15.6% in group A and 22.4% in group B. Group B shows significant less WOMAC as compared to Group A.

The mean of pre-treatment VAS of group A and group B is 6.8% and 7.07% and mean of post treatment VAS is 4.07% and 3.07% respectively. This result shows that there is a decrease of 2.73% in group A and 4% in group B. This shows that there is a considerable decrease of pain in group B.

The mean pre-treatment knee extension strength of group A and group B is 12.8% and 13.97% and mean post treatment knee extension strength is 13.7% and 17.1% respectively. This result shows that there is an increase of 0.9% in group A and 3.13% in group B. Which shows that there is a considerable increase in knee extension strength in group B. Statistically both groups show significant improvement in pain function and strength. Findings shows that, the improvement in group B is greater than that of group A.

The present study had some potential limitations. A long-term follow-up was not included in the present study due to a poor history of patient follow-up in the current hospital setting. Long term trial might bring greater changes in the outcomes and therefore, we could see significant difference between retro- and self-selected pace forward-walking programs. In addition, only subjects aged 50–60 years participated. Impaired cognitive function and severe pain were reported in patient’s ≥70 years with knee OA. Furthermore, another study reported a relationship between poor physical function and worse cognitive function in elderly individuals with knee OA. [57] Moreover, a risk of falls was increased in elderly individuals with knee OA as reported previously. In the future, we should include both younger and older patients to see a comprehensive clinical picture of these exercise program.

**Conclusion**

The study was to compare the effect of retro-walking and self-selected pace forward walking along with conventional treatment on people with OA knee. Both regimen shows improvement in pain and function in OA knee patients. However, according to statistically observed result, the effect of retro-walking along with conventional treatment is greater than that of self-selected pace forward walking. Hence retro-walking adjacent to conventional treatment is a better regimen for OA knee patients.

**References**


6. Web Md. Osteoarthritis Feature Stories: Walking to ease knee pain by Mary Jo Dilonardo


