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EFFECT OF RETRO-WALKING VERSUS OTAGO EXERCISES ON BALANCE AND PROPRIOCEPTION IN PATIENTS WITH OSTEOARTHRITIS KNEE–AN EXPERIMENTAL STUDY

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ABSTRACT :

BACKGROUND: Osteoarthritis also known as degenerative arthritis or degenerative joint disease is a group of mechanical abnormalities involving degradation of joints, including articular cartilage and subchondral bone. It results in damage and loss of articular cartilage, remodelling of subarticular bone, osteophyte formation, ligamentous laxity, weakening of periarticular muscle and synovial inflammation.

METHODOLOGY: An experimental study done on total 56 patients with knee osteoarthritis. Patients were randomly assigned to one group (retro walking + conventional exercise) and other group (Otago exercise + conventional exercise). The outcome measures included the following: step test and position sense test. The measurements were taken at baseline and end of 4 weeks of intervention.

RESULT: 56 patients enrolled in study and randomized in group A and group B. Mean age of patients in group A was 49.75 ± 3.779 and group B 48.58 ± 2.932. Normality was checked and data were normally distributed ($p>0.05$) so, there was a paired t test used for within group analysis and unpaired t test used for between group analysis. There was a significant difference between pre step test and post step test, pre position sense test and post position sense test for both groups. In between group analyses, there was a significant result between balance and proprioception.

CONCLUSION: This study concludes that the Otago exercise is effective for improving balance and proprioception when given along with conventional exercise.

KEY WORD: Knee osteoarthritis, retro walking, Otago exercise, Balance, Proprioception.

INTRODUCTION:

Osteoarthritis also known as degenerative arthritis or degenerative joint disease is a group of mechanical abnormalities involving degradation of joints, including articular cartilage and subchondral bone. OA is the most common form of arthritis. There are two forms of OA, Primary and Secondary OA. It results in damage and loss of articular cartilage, remodelling of subarticular bone, osteophyte formation, ligamentous laxity, weakening of periarticular muscle and synovial inflammation (2)

Age-related deterioration in balance can contribute to decreased independence, with increased fear and frequency of falls in elderly persons. Patients with knee OA typically have impairment of proprioception within the joint or weakness in the quadriceps muscles as compared with those without knee OA. These impairments associated with the disease may explain the poorer balances within these patients (4). Kinesiophobia is a condition in which a patient has an excessive, irritational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or re injury. The influence of biological (e.g.; X-ray changes) as well as severity of pain, kinesiophobia in individual physical functioning. As there is progression in level or stage of OA there is increase in severity of pain which leads to further increase in level of kinesiophobia in individuals with OA of knee (5). The prevalence of knee pain is high (32.2% in men and 58.0% in women) in this elderly community-dwelling population in Korea (6). In patients with knee OA, there is a prominent loss in proprioception compared with control subjects of the same age and gender. It has been demonstrated that impaired proprioception adds to functional insufficiency by generating impairment in walking rhythm, shortening step distance, and a decrease in walking speed and total walking time(10).

Patients with OA of the knee joint usually have radiographic narrowing of the joint space accompanied by joint degradation, subchondral bone sclerosis and osteophyte formation. These result in chronic knee pain, stiffness and physical disability. This chronic and disabling condition not only reduces an individual's quality of life (QOL), but also increases anxiety, fear and even depression. The signs and symptoms of knee OA can only be alleviated with joint replacement so far (7).

Variety of conventional treatment such as non-pharmacologic, drug, and

surgical procedure is available for osteoarthritis of knee. According to American college of Rheumatology pharmacological treatment include painkiller like paracetamol, NSAIDs and intra-articular injection (13). Physiotherapy also choice of conservative management, which include various strategies such as manual therapy, exercises, patellar taping and electrical modalities with or without thermal modalities as measure for pain reduction (12). Closed kinematic chain exercises have drawn much attention in the management of OA knee. Close kinematic chain exercise for knee joint can be incorporated in many ways. Closed kinematic chain exercise programme aims to increase the strength and stability of knee joint. These exercises help to promote muscle strength, improve range of motion, increase mobility and ease pain. Retro walking is one of them (12). Retro walking is walking backwards. Since there is propulsion in backward direction and reversal of leg movement in retro walking, different muscle activation pattern s required then forward walking (10). Unlike forward walking, backward walking has no heel contact in the early stance phase and thus leads to lower compression force at the patella femoral joint and decreased force absorption at the knee joint (11). Retro-walking significantly lowers peak patella femoral joint compressive force and a significantly slower rate of loading has been found during backward walking. Consequently, trauma to the articular-cartilage is reduced during retro walking; there for it could be used as a mode of training after sustaining injuries to the lower Limb. A gait cycle during retro walking can be defined as toe-on of a limb to the subsequent toe-on of the same limb. Also, trauma to the articular cartilage is reduced during retro walking. 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 (10).

Otago exercise program is also one of the close chain exercise programs (14). The Otago exercise program which addresses the risk factor of poor balance and lower limb weakness with an individually prescribed, strength and balance exercise program in older adults (15). The Otago Exercise Program is an individually tailored, home-based balance and strength fall prevention program. It was developed by John and Clare, PhD, researchers at the University of Otago in New Zealand and the New Zealand Falls Prevention Group. Most of falls are associated with one or more identifiable risk factor; e.g. weakness, unsteady gait, confusion, diminished strength. This loss has a direct impact on strength, endurance, mobility, ability to perform smooth control motor responses (14)

Exercise at comfort intensity, suitable surface for patient is important in reducing pain, fear of movement, improving balance which is important for increase physical activity level. OA knee patients who have fear of fall and pain report reduce level of functionality with balance issues and reduce position sense. Patients should be encouraged to increase their level of functionality by physical activity that is comfortable for them, and that can be integrated in to activity of daily living. Such approach is more sustainable long term. Hence, the need of study is to compare retro walking and Otago exercise program to design a suitable physiotherapy protocol to improve balance, position sense, functionality level with reduce in pain and fear of movement in patients with OA knee.

METHODOLOGY:

STUDY DESIGN: Experimental study.
STUDY POPULATION: Adult patients with osteoarthritis with age 40-60 years.
SAMPLING TECHNIQUE: Convenient sampling.
STUDY DURATION: 1 year.
SAMPLE SIZE: Prior to conducting the main study, a pilot study was conducted for 1 month to find out the prevalence of OA knee by effect size of one of the outcomes. Based on the pilot study, the sample size was calculated, and 56 patients were included in the study. 28 patients in each group were included.

STUDY SETTING: Various physiotherapy OPDs of Surat.
SELECTION CRITERIA:
INCLUSION CRITERIA:
1. Subjects who are willing to participate and ready to give consent.
2. Patients with unilateral and bilateral knee involvement.
3. Both male and female with age group 40-60 years.
4. Knee osteoarthritis Kellgren-Lawrence grade 2 and 3.
5. Person can walk and stand without assistive device.
6. Subjects having knee issues for more than 3 weeks and less than 6 weeks.
7. Individual not doing exercises such as walking, jogging, and running for > 1 month.
8. Patients who know English and Gujarati language.

EXCLUSION CRITERIA:
1. Patients who have a history of any lower limb injury or underlying pathology in the affected limb.
2. Patients who are diagnosed with Osteoporosis.
3. Patients who have any neurological disorder including motor and sensory.
4. Patients who have taken intra-articular injection for knee for the last 6 months.
5. Patients who have undergone any surgery or taken injection in the same-sided knee joint in the last 6 months.

PRIMARY OUTCOME:

- Balance (Step test)

- Proprioception (Position sense test)

PROCEDURE:

The ethical clearance was taken from the Institutional Ethical committee of S.P.B. physiotherapy college, Surat. Subjects were blinded regarding types of interventions and to which group they will belong. Treatment duration: After familiarization with all exercises, all participants had performed exercise 3 sessions per week up to 4 weeks.

GROUP-A: Conventional treatment + Retro walking

GROUP-B: Conventional treatment + Otago exercise program

CONVENTIONAL TREATMENT:

- Static quadriceps exercises
- High sitting knee extension
- Hip flexion in supine with SLR
- Hamstring stretching
- Hip abduction in side lying with SLR
- Hip extension in prone lying with SLR

RETROWALKING:

- Backward walking
- Heel toe walk backward

OTAGO EXERCISE:

- Squats
- One leg stand
- Walking and turning around
- Sideways walk
- Tandem walk

STATISTICAL ANALYSIS:

Statistical analysis was done using Jamovi Version 2.3.38 Software. Baseline characteristics were compared to check homogeneity between intervention groups. Shapiro-wilk test was applied to check the normality of pre-treatment outcome data.

RESULT:

Total 60 patients were assessed for eligibility. 56 patients were enrolled in the study and randomized by lottery method, to one of the treatment groups (28 in group A and 28 in group B). Mean age of participants in group A was 49.75 + 3.779, and of group B was 48.58 + 2.932. All 48 patients were assessed for all the outcome measures at the end of the 4th week of intervention. As there were 4 dropouts in each group. Frequency and percentage of male and female patients in the study and each group was calculated.

TABLE-1 DEMOGRAPHIC DATA:

		GROUP A	GROUP B
AGE (MEAN)		49.75	48.58
GENDER	MALE	13 (54%)	13 (54%)
	FEMALE	11 (46%)	11 (46%)
TOTAL		24 (100%)	24 (100%)

Table–1 shows demographic data of both groups. Mean age of group A is 49.75 year and group B is 48.58 year. Male and female distribution among both groups is 13(54%) and 11(46%).

TABLE-2 NORMALITY OF DATA: GROUP-A

Outcome Measure	Group A Normality (By Shapiro wilk test)
Step Test Pre	0.416
Position Test Pre	0.115

According to normality distribution of pre data, pre step test p value is > 0.416 which is >0.05, preposition sense test p value is > 0.115 which is. It indicates that there is no significance difference and data is normally distributed. So, further analysis of group Awas done by using parametric test. within group analysis was done by using Paired t test.

TABLE-3 NORMALITY OF DATA: GROUP-B

Outcome Measure	Group A Normality (By Shapiro wilk test)
Step Test Pre	0.227
Position Test Pre	0.132

According to normality distribution of pre data, pre step test p value is > 0.227 which is >0.05, pre position sense test p value is > 0.132 which is >0.05. It indicates that there is no significance difference and data is normally distributed. So, further analysis of group B was done by using parametric test. Within group analysis was done by using Paired t test.

TABLE-4 PATIENTS BASELINE CHARACTERISTICS:

Variable	Group-A	Group-B	p value
Age	49.75±3.779	48.58±2.932	0.238
Gender	M-54%, F-46%	M-54%, F-46%	
Pre Step Test	9.208±1.61	9.291±1.30	0.845
Pre Position Sense Test	6.958+1.96	8.375±1.40	0.061

As p value of baseline characteristic of each variable is >0.05, it indicates the homogeneity of data among both groups. The GROUP A receiving conventional+ retro walking Intervention with Mean ± SD age of 49.75 ± 3.779 and mean pre step test and pre position sense test is 9.208 ± 1.61 , 6.958 ± 1.96. The GROUP B receiving conventional + Otago exercise program with Mean ± SD age of 48.58 ± 2.932 and mean pre step test and pre position sense test 9.291 ± 1.30 , 8.375 ± 1.40.

TABLE-5 WITHIN GROUP COMPARISON OF OUTCOME VARIABLE: GROUP-A

Variable	Group-A (Paired t Test)		
	Pre Intervention	Post Intervention	p value
Step Test	9.208±1.61	12.208±1.44	<0.01
Position Sense Test	6.958±1.96	2.916±1.34	<0.01

Table (5) shows p value for within group comparison of step test; position sense test is <0.01.
Mean of post treatment of step test is more compare to pre treatment mean; it indicates that step test shows more improvement in post treatment. Mean of post treatment of position sense test is more compare to pre treatment mean; it indicates that position sense test shows more improvement in post treatment.

TABLE-6 WITHIN GROUP COMPARISON OF OUTCOME VARIABLE: GROUP-B

Variable	Group-B (Paired t Test)		
	Pre Intervention	Post Intervention	p value
Step Test	9.291±1.30	14±1.93	<0.01
Position Sense Test	8.375±1.40	3.458±1.28	<0.01

Table (6) shows p value for within group comparison of step test, position sense test p is <0.01. Mean of post treatment of step test is more compare to pre treatment mean; it indicates that step test shows more improvement in post treatment. Mean of post treatment of position sense test is more compare to pre treatment mean; it indicates that position sense test shows more improvement in post treatment.

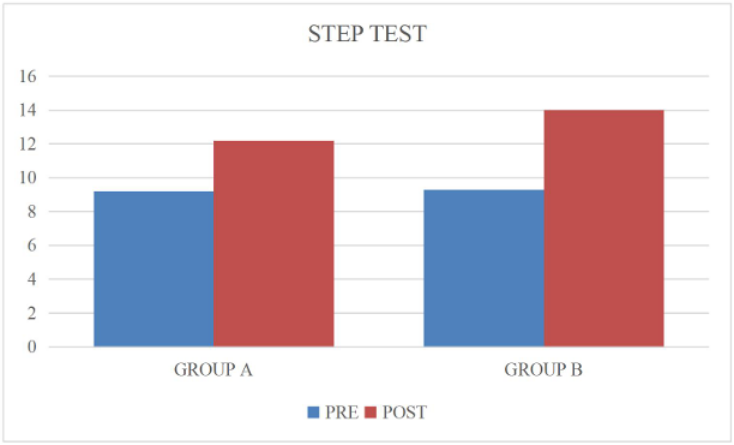
TABLE-7 NORMALITY OF DIFFERENCES:

Outcome Measure	Group A Normality (By Shapiro wilk test)
Step Test Pre	0.091
Position Test Pre	0.081

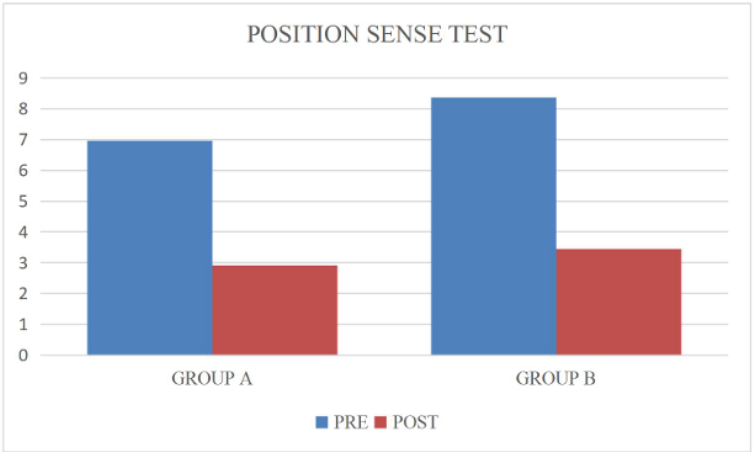
Table (7), shows normality of difference done by Shapiro wilk test. p value of Step test is 0.091, which is >0.05 that indicate normal distribution of data of step test. p value of position sense test is 0.081, which is >0.05 that indicate normal distribution of data of position sense test. So, independent t test was used for between group difference analyses.

TABLE-8 BETWEEN GROUP COMPARISONS OF OUTCOMEMEASURE

Variable	Group-A and Group-B(Between Group Comparison by independent t test)		
	Group-A	Group-B	p value
Step Test	2.916±1.316	4.833±1.274	<0.001
Position Sense Test	4.041±1.122	4.916±1.017	<0.028



Graph-1 Between Group Step test



Graph-2 Between Group Position Sense Test

Table (8) shows p value for within group comparison. p value of step test is 0.001, which <0.05. It indicates there is difference in step test between both the groups. As the mean of step test is more in group B it indicates Group B is more effective in improving balance. p value of position sense test is 0.028, which <0.05. It indicates there is difference in position sense test between both the groups. As the mean of position sense test is more in group B it indicates Group B is more effective in improving proprioception.

DISCUSSION:

The current study was conducted to find out the effectiveness of Retro-walking and Otago exercise program on Balance and Proprioception among adult OA knee patients. In this study, step test and position sense test were taken as outcome measures. Proprioception was measured by Goniometer.
In this study, retro walking exercise was given in group A and Otago exercise program was given in group B along with conventional therapy in both groups. Total 60 patients were assessed for eligibility, and 56 patients in each group were included. There were 4 dropouts from each group.

The results showed that both groups were clinically significant for improving balance and proprioception, but group B (Otago exercise) was more effective. Closed kinematic chain exercises have drawn much attention in the management of OA knee. These exercises help to promote muscle strength, improve range of motion, and increase mobility.
Retro-walking significantly lowers peak patello femoral joint compressive force and a significantly slower rate of loading has been found during backward walking. Otago exercise program addresses the risk factor of poor balance and lower limb weakness with an individually prescribed, strength and balance exercise program in older adults.
The study found that both groups were effective in improving balance and proprioception, but Otago exercise showed more effectiveness. The limitations of this study include a small sample size, short-term evaluation, and limited age criteria.

CONCLUSION:

This study concludes that both retro walking and Otago exercise are effective along with conventional treatment for improving balance and proprioception. Otago exercise shows more effectiveness for improving balance and proprioception than retro walking

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