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Original Article

# A COMPARATIVE STUDY TO ANALYZE THE EFFECT OF IMPAIRMENT BASED EXERCISE AND RESISTED EXERCISE ON PAIN, FUNCTIONAL TASKS IN INDIVIDUAL WITH KNEE OSTEOARTHRITIS

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## ABSTRACT

**Background**: Osteoarthritis also known as degenerative joint disease it is a most common form of arthritis and a leading cause of disabilities word wide Osteoarthritis results from cartilage destruction, progression deterioration of osteoarthritis causes the normally smooth, white, translucent articular cartilage to become dull, yellow, and granular. That exercise provision for patients with knee OA reduces the pain experienced and the functional incapacity suffered by a small to moderate degree.

**Objective:** To compare the effectiveness of Impairment based exercises and resisted exercise on pain, functional task in individual with knee OA.

**Methods:** 30 patients with knee osteoarthritis were randomized into three groups: group A (Impairment based exercise)(no of patients 10), group B (Resisted exercises)(no of patients 10), group c (control group) (no of patients 10) for 6 weeks exercise program. The outcome measures were VAS, WOMAC, LEFS.

**Result:** The experimental group A showed significant more improvement in VAS, LEFS and WOMAC compared with group B and C after intervention.

**Conclusion:** Impairment based exercises found to be more effective in improvement of function and reduction of pain in patients with knee OA.

**KEY WORDS**: Impairment Based Exercise, Resisted Exercise, Osteoarthritis.

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## INTRODUCTION

With increasing age, a complex process of physiologic changes occur [1]. Osteoarthritis is also known as degenerative joint disease. It is a most common form of arthritis and a leading cause of disabilities word wide [2]. It is the one of the most common musculoskeletal disorder. It is characterized by pain, articular cartilage deterioration, and joint space narrowing and reduced muscle strength. It is a slowly progressive non-inflammatory disorder of the synovial joints. It is so common in the developed world that is the fourth highest impact condition in women and eighth most important in men [3]. Osteoarthritis results from cartilage destruction, progression deterioration of osteoarthritis causes the normally smooth, white, translucent articular cartilage to become dull, yellow, and granular. Affected cartilage gradually becomes

softer, less elastic, and less able to resist wear with heavy use. Continued changes in the collagen structure of the cartilage lead to fissuring and erosion of the articular surfaces. As the central cartilage becomes thinner, cartilage and bony growth increase at the margins [4]. OA is one of the most common causes of disability due to limitations of joint movement, particularly in people old age above 50. People with knee O.A. generally report difficulty with distance walking, stair climbing, standing from sitting position, stooping and kneeling position. Knee pain during movement due to OA is a strong predictor of an increased need for functional assistance, and is the second leading cause of disability [5]. The evidence provided by the literature reviewed suggests that exercise provision for patients with knee OA reduces the pain experienced and the functional incapacity suffered by a small to moderate degree [3]. Exercise therapy programs for knee OA traditionally have been, focusing on impairments associated with knee OA such as lower-extremity joint motion deficits, muscle weakness, and reduced aerobic capacity. Although these programs may be effective in improving these impairments, they do not provide the individual with exposure to other challenges of motor function (e.g., quick stops, turns, and changes in direction; challenges to balance; negotiating obstacles) that may be encountered during daily functional activities [6]. Impairments based exercise program for people with knee O.A. including Agility training and Perturbation training to challenge the balance and functional activities [7]. Resistance training has beneficial effects on musculoskeletal function and body composition, Cardiovascular disease, Insulin action, bone health, energy metabolism, psychological health, functional status. These adaptations to resistance training are potentially very relevant to knee OA because quadriceps weakness, obesity, and abnormal mechanical joint forces have been related to the development and progression of knee OA and are potentially modifiable by resistance training [8]. Resisted exercise may also normalize muscle firing patterns and joint biomechanics leading to reduction in joint pain and cartilage degradation. However Resisted training is also thought reduced functional Instability and pain in O.A. patient by preventing Sarcopenia (a loss of muscle mass and strength) and by improving the strength and function of the surrounding tissue [1]. Thus, we believe examining whether the two different exercises approaches may have different effect on pain and functional task that could have important clinical implication.

## METERIALS AND METHODS

Present study adopted an experimental study using convenient sampling study at the college of physiotherapy with a sample size of 30 subjects, for the duration of 6 weeks. Materials utilized for the study includes: Plinth, Tilt (wobble) board, Sandbags, Ratchet board.

For the same we included the subjects with fallowing criteria: Age between 40 to 65 years, both the genders, with Primary O.A., Pain around medial compartment of knee joint and Kellegren and Lawrence grading: 2,3,4 grade.

Also excluded the subjects with under 40 years, subjects with secondary O.A, Serious medical condition such as heart or pulmonary conditions, Spinal problems and patients with recent knee surgery.

**Outcome measures:** Visual Analogue Scale (VAS), Western Ontario and Universities (WOMAC) osteoarthritis Index, Lower Extremity functional scale (LEFS).

**Methods of collection of data:** The Subjects were taken for this experiment, directly referred to college of Physiotherapy**.** After that all the patients were chosen according to the inclusion and exclusion criteria. Thirty Subjects were taken with Osteoarthritis of the Knee. The written informed consent was Obtained from each Subject after explaining the details of various non-invasive tests and training to be conducted. Then subjects were randomized in an experimental groups ( A and B ) and control group. Ten subjects are being in each group.

**Procedure**: Before the treatment, all subjects were assessed thoroughly and also assessed for the pain status using Visual Analogue Scale, Functional ability using Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index and Lower Extremity functional scale (LEFS). They are randomly assigned either in the

experimental groups (A and B) and control group. The duration of the treatment program for the subjects was 6 weeks.

**Exercise Regimens:**

**Group A: impairment based exercises**: side stepping, Brading, Front and back crossover step during forward ambulation, shuttle walking, different direction walking on command, perturbation training on tilt board (10-30 sec for each)**.** Conventional exe: last degree extension, VMO, strengthening, pandular exercise and stretching of calf and hamstring(30 sec hold,3 rep).

**Group B: Resisted group**: Hip abduction/ adduction, Straight leg rising, Toe standing, Leg press, leg curls, squats. Conventional exercise: last degree extension, VMO strengthening, pendular exercise and stretching of calf and hamstring (30 sec hold, 3 rep). Each exercise for 8-10 rep and 2 sets starting with 10 RM.

**Group C: control group** Conventional exercises: last degree extension, VMO strengthening, pendular exercise and stretching of calf and hamstring (30 sec hold, 3 rep).Each exercise for 8-10 rep and 2 sets. With N=10 each.

**Data analysis:** Paired t-tests were used to compare the outcome measurement data between three groups. ANOVA were used to determine whether pain intensity (VAS), functional ability (WOMAC) and LEFS were significantly different before and after intervention. Data analysis software SPSS 15.0 version has been used for the data analysis of present study.

**Descriptive analysis of data:** Subject's descriptive data was analyzed to see homogeneity of three groups for all the possible confounding factors.

1. Mean ± SD of age for the study of group A was 53.4±5.44

2. Mean ± SD of age for the study of group B was 53.1±6.50

3. Mean ± SD of age for the study of group C was 53.2±3.82

**Data Anailysis of Outcome Measures in Three Groups:**

**Data analysis of pain with VAS:** Pre- test Mean ± SD for group A , group B and group C were 6 ±0.66 , 5.8 ± 1.03 , 5.4 ± 1.07 respectively. Post test Mean ± SD for group A , group B and group C were 5.1 ± 0.73,5.7 ± 0.9 , 4.5 ± 0.97 respectively. 't' calculated values for group A , group B and group C were 0.41 , 0.43 , 6.0 respectively at degree of freedom 9. This findings showed that there was a significant difference in VAS in the pre-test and post-test values in the all three groups (graph 2a, 2b).

**Data analysis of functional disability with WOMAC index**: Pre- test Mean ± SD for group A , group B and group C were 0.54 ± 0.10, 0.58 ± 0.06, 0.53 ± 0.10 respectively. Post –test Mean ± SD for group A , group B and group C were 0.43 ± 0.10, 0.52 ± 0.07, 0.41 ± 0.08 respectively. 't' calculated values for group A, group B and group C were 6.34, 2.92, 4.549 respectively at degree of freedom 9. This findings showed that there was significant difference in WOMAC in the pre-test and post-test values in the all three groups (graph 3a, 3b).

**Data analysis of LEFS:** Pre- test Mean ± SD for group A, group B and group C were 44.19 ± 6.00, 42.58 ± 6.93, 43.58 ± 6.89 respectively. Post – test Mean ± SD for group A , group B and group C were 66.56 ± 8.66, 58.2 ± 6.39, 45.06 ± 7.20 respectively. 't' calculated values for group A , group B and group C were 7.791, 3.567, 4.031 respectively at degree of freedom 9. . This findings showed that there were significant difference in LEFS in the pre-test and post-test values in the all three groups (graph 4a,4b).

**Data Analysis of Outcome Measures Between Three Groups:**

When compare the pre test by using ANOVA for VAS, WOMAC and LEFS between Groups, F ratio was 1.050, 0.63, and 0.1505. These findings showed that there was no significant difference in VAS, WOMAC and LEFS between the groups (graph 5).

When compare the post test, by using ANOVA for VAS, WOMAC and LEFS between, Groups F ratio was 3.552, 4.850, and 27.55. These findings showed that there was significant difference in VAS, WOMAC and LEFS between the groups (graph 6).

## RESULTS

After 6 weeks intervention of program there is statistical significant improvement in VAS,

WOMAC and LEFS compared with pre interventional measurement. This study showed that there is significant improvement in VAS and functional ability with impairment based exercise group as compared to resisted group.

**Table 1:** Data analysis of VAS with in group A, Group B, Group C.

| Groups | VAS | | | | t Value | Df |
|---|---|---|---|---|---|---|
| | PRE TEST | | POST TEST | | | |
| | MEAN | SD | MEAN | SD | | |
| A | 6 | 0.66 | 5.1 | 0.73 | 0.41 | 9 |
| B | 5.8 | 1.03 | 5.7 | 0.9 | 0.42 | 9 |
| C | 5.4 | 1.07 | 4.5 | 0.97 | 6 | 9 |

**Table 2:** Data analysis of WOMAC with in Group A, Group B, Group C.

| Groups | WOMAC | | | | t Value | Df |
|---|---|---|---|---|---|---|
| | PRE TEST | | POST TEST | | | |
| | MEAN | SD | MEAN | SD | | |
| A | 0.54 | 0.1 | 0.43 | 0.1 | 6.34 | 9 |
| B | 0.58 | 0.06 | 0.52 | 0.07 | 2.929 | 9 |
| C | 0.53 | 0.1 | 0.41 | 0.08 | 4.531 | 9 |

**Table 3:** Data analysis of LEFS within Group A, Group B, Group C.

| Groups | LEFS | | | | t Value | Df |
|---|---|---|---|---|---|---|
| | PRE TEST | | POST TEST | | | |
| | MEAN | SD | MEAN | SD | | |
| A | 44.19 | 6 | 66.56 | 8.66 | 7.791 | 9 |
| B | 42.58 | 6.93 | 58.2 | 6.39 | 3.567 | 9 |
| C | 43.58 | 6.89 | 45.06 | 7.2 | 4.031 | 9 |

**Table 4a:** ANOVA Table for VAS-Pre.

| Source of variation | Sum of squares | Degree of freedom | Mean of squares | F ratio |
|---|---|---|---|---|
| Between | 1.867 | 2 | 0.93 | |
| Within | 24 | 27 | 0.88 | 1.05 |
| Total | 25.87 | 29 | | |

**Table 4b:** ANOVA Table for WOMAC-Pre.

| Source of variation | Sum of squares | Degree of freedom | Mean of squares | F ratio |
|---|---|---|---|---|
| Between | 0.011 | 2 | 0.0056 | |
| Within | 0.24 | 27 | 0.0089 | 0.63 |
| Total | 0.2531 | 29 | | |

**Table 4c:** ANOVA Table for LEFS-Pre.

| Source of variation | Sum of squares | Degree of freedom | Mean of squares | F ratio |
|---|---|---|---|---|
| Between | 13.22 | 2 | 6.611 | |
| Within | 1186 | 27 | 43.92 | 0.1505 |
| Total | 1199 | 29 | | |

**Table 5a:** ANOVA Table for VAS-Post.

| Source of variation | Sum of squares | Degree of freedom | Mean of squares | F ratio |
|---|---|---|---|---|
| Between | 6.8 | 2 | 3.46 | |
| Within | 26.1 | 27 | 0.9 | 3.552 |
| Total | 32.9 | 29 | | |

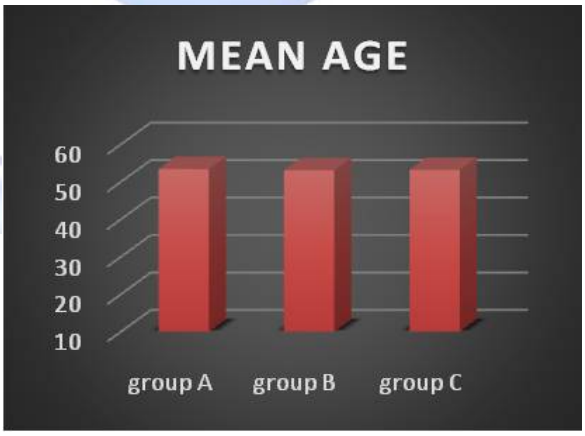
**Table 5b:** ANOVA Table for WOMAC-Post.

| Source of variation | Sum of squares | Degree of freedom | Mean of squares | F ratio |
|---|---|---|---|---|
| Between | 0.077 | 2 | 0.038 | |
| Within | 0.21 | 27 | 0.0079 | 4.85 |
| Total | 0.29 | 29 | | |

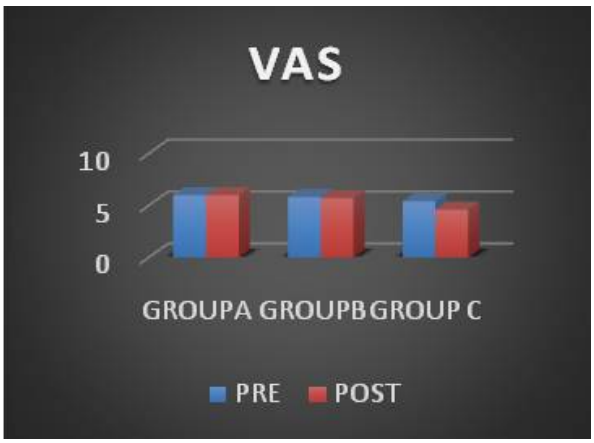
**Table 5c:** ANOVA Table for LEFS-Post.

| Source of variation | Sum of squares | Degree of freedom | Mean of squares | F ratio |
|---|---|---|---|---|
| Between | 3083 | 2 | 1541 | |
| Within | 1510 | 27 | 55.94 | 27.55 |
| Total | 4593 | 29 | | |

**Graph 1:** Comparison of mean age between the Groups.

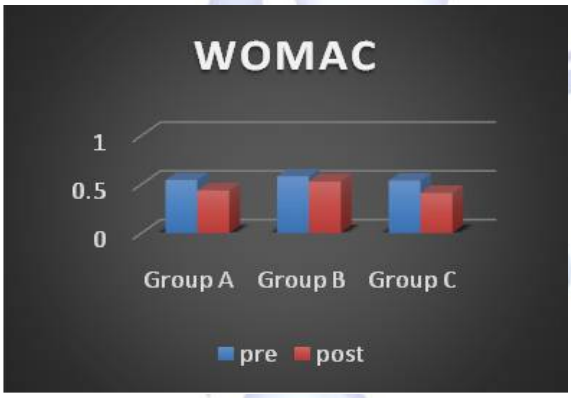



**Graph 2a:** Comparisons of MEAN of VAS in Group A, Group B and Group C.

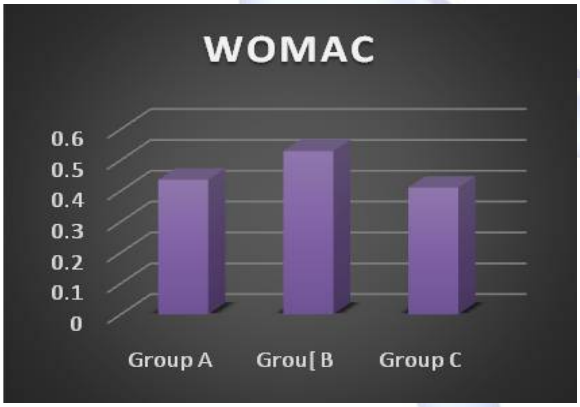


**Graph 2b:** Comparisons of Mean of VAS between Group A, Group B and Group C.

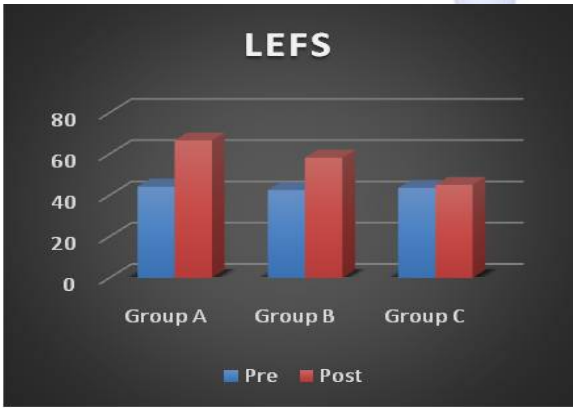

Graph 3a: Compressions of Mean WOMAC in Group A, Group B and Group C.



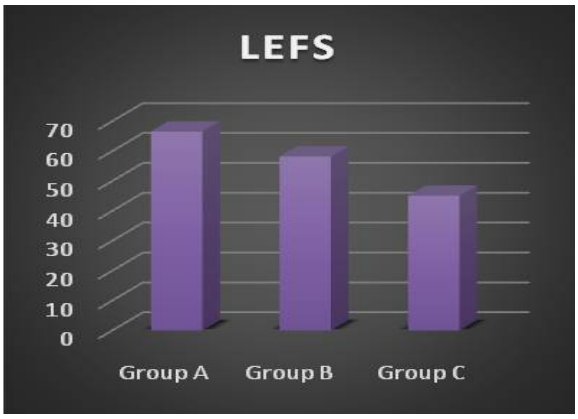

**Graph 3b:** Comparisons of Mean WOMAC between Group A, Group B and Group C.



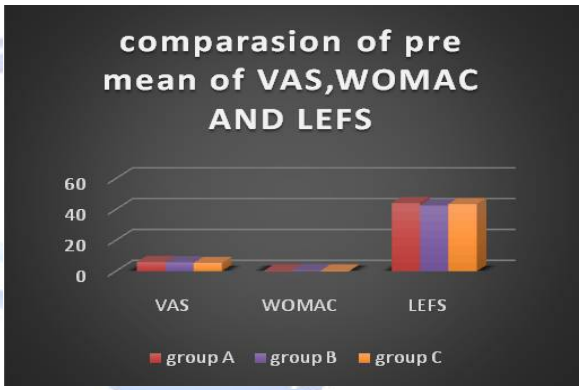

**Graph 4a:** Comparisons of mean LEFS in Group A, Group B and Group C.



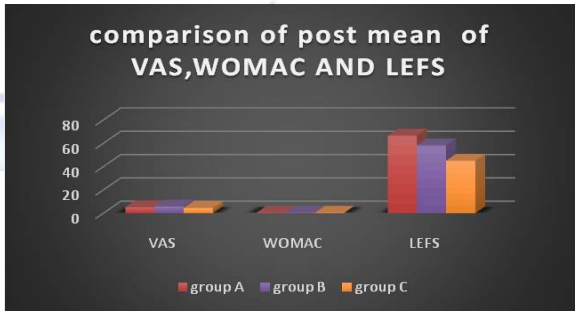

**Graph 4b:** Comparisons of mean LEFS between Group A, Group B and Group C.




**Graph 5:** Comparisons of Pre Mean of VAS, WOMAC and LEFS.




**Graph 6:** Comparisons of Post Mean of VAS, WOMAC and LEFS.




## DISCUSSION AND CONCLUSION

In this study 30 subjects with osteoarthritis of knee were participated. Both genders were included in this study. Participants were randomly divided into three groups; experimental group A and B and control group C. Following 6 weeks intervention, all groups showed significant improvement in pain intensity (VAS), function (WOMAC) and functional task (LEFS). But when the post intervention values of all groups were compared, experimental group A has shown significantly improvement in functional ability and pain. These findings are in concurrence with study conducted by Paulo

E.P et al. Who found that there is improvement in a variety of function.nal task following impairment based exercise [7]. The idea is that exposing individual to activities that challenge the knee to potentially destabilizing loads during therapy may help them to deal with regular daily activity [9]. Ryuchi et al. found that there is significantly reduce knee pain and improve muscle strength and functional ability following combine balance and resisted exercise [10]. Apart from these findings, there is study conducted by Kelley Fitzgerald et al. Who found that there was no reduction in knee pain or improvement in performance base function [6]. Diracoglu et al. compared the effectiveness of kinaesthetic and balance training plus strengthening exercise versus only strengthening exercises. They found at the end of 8 week that there is significant improvement in both group. However WOMAC was better in kinaesthetic and balance training group. This study is concurrence with our study that there is significant improvement in impairment based exercises group as compared to resisted group [11]. Several study support that high resistance strength training can significantly reduce pain in patient with OA [1]. However, High-intensity training (high resistance/load) might be expected to result in greater strength gains in people with lower limb OA but could not potentially overload the joint and exacerbate symptoms. Thus our finding shows that impairment based exercise along with conventional exercise help in improving functional ability and reduction in pain in individuals with osteoarthritis knee as compared to resisted group.

**Conflicts of interest:** None

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