



EFFECTIVENESS OF STRENGTHNING OF CHIEF PELVIC STABILIZER ON PAIN AND DISABILITY IN OSTEOARTHRITIS KNEE

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Introduction

Hip muscle weakness occurs as consequence of OA knee and mechanism behind it is same as quadriceps weakness. i.e. because of pain functionality is reduced that lead to less activation of muscle causing atrophy of muscle fibers leading to muscle weakness^[1,2,3]. People with knee OA demonstrate significant weakness of the hip musculature. Hip abductor muscle weakness leads to impaired control of pelvis in frontal plane which results in drop of pelvis towards opposite side which ultimately results into shifting of center of mass away from the stance limb towards swing side. That causes excessive loading at medial knee joint of stance limb which results in pain and functional abnormality^[2, 4]. Weaker hip abductors associated with lower external hip rotation moment on the osteoarthritis stance limb would result in additional pelvic drop of the contralateral swing limb, shifting the body's COG towards swing limb. This would lengthen the lever arm at the osteoarthritic knee, thus increasing medial knee load provoking the disease progression

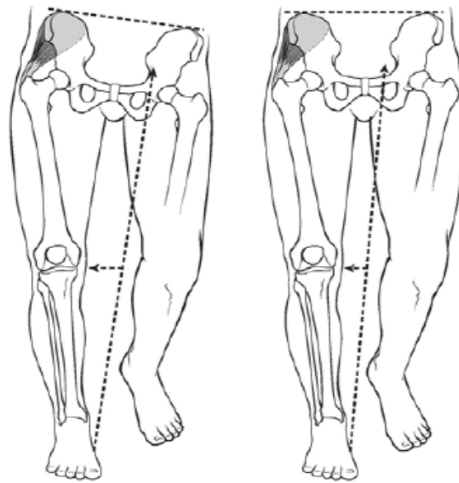


Fig 1: Hip abductor weakness leading to increase stress at medial compartment of knee joint ⁽²⁾

Hinman *et al* concluded that People with knee OA demonstrate significant weakness of the hip musculature. Findings from this study support the inclusion of hip strengthening exercises in rehabilitation programs ⁽³⁾. Zhang *et al* concluded that weakness of hip abductor in OA knee leading to shifting of pelvis on contralateral side. That causes more loading of medial knee joint causing provocation of the condition ⁽⁵⁾. K.L. Bennell *et al* concluded that isolated strengthening of the hip muscles improves symptoms and functionality in the patients with OA knee ^(6,7,8). Shakoor N. *et al* concluded that significant improvements in knee pain and functionality in the patients with OA knee following the standard quadriceps strengthening exercise. Khalil Khayambashi *et al* concluded that hip abductor strengthening is effective in improving pain and health status compare to quadriceps strengthening in female with PFPS⁽⁸⁾. So the incorporation of hip abductor strengthening should be considered while designing a rehabilitation protocol.

Methodology

PROCEDURE OF THE STUDY:

- STUDY DESIGN: Experimental
- STUDY DURATION: 1 Year
- STUDY POPULATION: Patients with Osteoarthritis of knee joint
- SAMPLING TECHNIQUE: Purposive random sampling
- SAMPLE SIZE CALCULATION

Sample size was calculated on G*power software. Based on previous studies estimated sample size of 25 participants in each group. By taking into account a probable 15% drop out rate, the sample size is increased by 4 patients in each group – 29 participants per group; so total 58 patients were included in this study.

● INCLUSION CRITERIA

- Age 40 to 65 years.
- Both Male and Female
- Patient with knee pain, crepitation, stiffness of joint.
- Average knee pain >4 on an 11-point scale [NPRS] (0 =no pain; 10 = maximal pain)
- Patient with Grade- 2 & 3 OA knee as per Kellgren-Lawrence classification.

- BMI should be within this range: 18.5 to 24.9.
- **EXCLUSION CRITERIA**
- Any inflammatory arthritis
- Patients who have taken intra-articular corticosteroid or hyaluronic injections within last 6 months,
- History of hip or knee joint replacement or tibial osteotomy,
- Unable to ambulate without assistive device.

TOOLS AND MATERIALS USED

- Weighing Scale
- Measure tape
- WOMAC Questionnaire
- Informed consent form
- Data recording sheet

PROCEDURE

GROUP-A (EXPERIMENTAL GROUP)

- Hip abduction in side lying
- Isometric hip abduction
- Hip abduction in standing
- Along with these exercises subjects in experimental group also received the **conventional**

exercise as described in **GROUP – B. GROUP-B (CONTROL GROUP)**⁽¹¹⁾

- Static quadriceps exercise
- VMO strengthening exercise using booster
- Terminal knee extension in high sitting position
- Outer range knee extension exercise
- Inner range knee extension exercise

Outcome

Numerical pain rating scale:

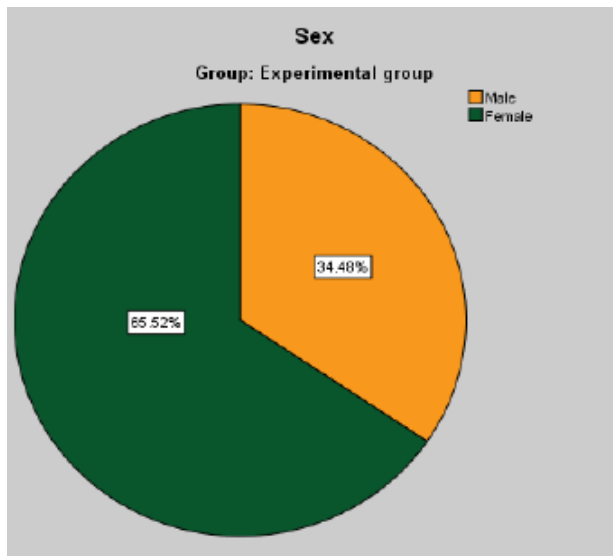
Using an 11-point scale, ranging from 0 (no pain) to 10 (worst pain imaginable), patients were asked to answer the following question: “On a scale of 0 to 10, where 0 corresponds to no pain and 10 to the worst pain evaluate the intensity of your knee pain at this moment”. The NPRS is moderately reliable (ICC = 0.76), and has a clinically important difference of 20%⁽¹³⁾.

WOMAC:

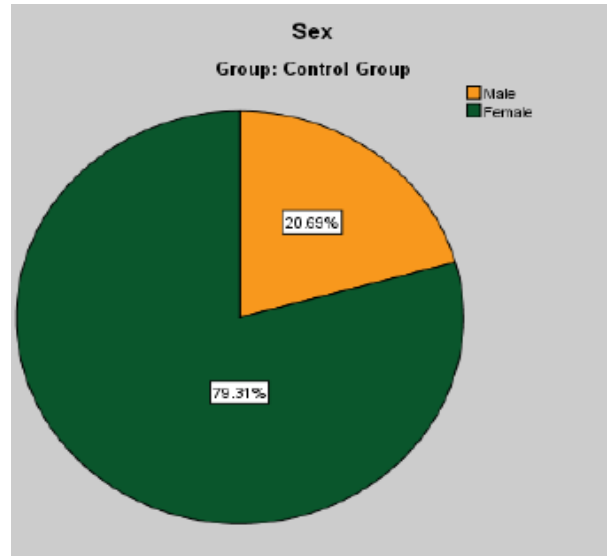
The Likert Scale version uses the following descriptors for all items: none, mild, moderate, severe, and extreme. These correspond to an ordinal scale of 0-4. On the Likert Scale version, the scores are summed for items in each subscale, with possible ranges as follows: pain=0-20, stiffness=0-8, physical function=0-68. A total WOMAC score is created by summing up the items for all three subscales (Appendix-III). ICCs for intra-rater reliability ranged from 0.53-0.78 and for inter-rater reliability, ranged from 0.62-0.97⁽¹⁴⁾.

DATA ANALYSIS AND RESULTS

- IBM SPSS version 20.00 was used for Data Analysis.



Graph-1: Demographic Data in Experimental Group



Graph-2: Demographic Data in Control Group

Table 1: Normality Test

OUTCOME	p Value by (Shapiro-Wilk test)
NPRS	0.00
WOMAC	0.00

As the p values for all the outcome is less than 0.05 (<0.05) that indicates data are not normally distributed.

Table 2: Baseline Equality

OUTCOME	p Value by (Independent samples Mann-Whitney U test)
NPRS	0.185
WOMAC	0.141

- As the data are not normally distributed non-parametric test (independent samples Mann-Whitney U test) for baseline assessment has been used.
- As the p values for both the outcome is greater than 0.05 (>0.05) that indicates Baseline for both outcome is equal.

TABLE-3 Within Group Comparison of NPRS Related sample Wilcoxon Signed Rank test.(p< 0.05).

Variable	Level	Mean±SD	Z value	P value
NPRS (Experimental group)	Base	8.2±0.55	-4.83	0.00
	4 th Week	3.34±0.97		
NPRS (Control group)	Base	8.06 ±0.25	-5.31	0.00
	4 th Week	4.00 ±0.70		

Result shows significant difference between baseline and 4th week (p< 0.05) in both the groups

TABLE-4 Within Group Comparison of WOMAC Related sample Wilcoxon Signed Ranktest. (p< 0.05).

Variable	Level	Mean±SD	Z value	P value
WOMAC (Experimental group)	Base	79.58±6.85	-4.70	0.00
	4 th Week	32.37±7.71		
WOMAC (Control group)	Base	77.72 ±6.53	-5.23	0.00
	4 th Week	44.10 ±6.28		

Result shows significant difference between 4th week (p< 0.05) in both the groups.

Table 5: Normality of Improvement Scores [Pre-Post]

Improvement scores	Shapiro-Wilk test p-value
Improvement NPRS	0.00
Improvement WOMAC	0.584

Test of normality by Shapiro-Wilk test

- Significance level Improvement NPRS is less than 0.05 (p<0.05).So for between group comparison non-parametric test has been used.
- Significance level of WOMAC is greater than 0.05 (p>0.05).So for between group comparison parametric test has been used.

TABLE 6: Between Group Comparisons of NPRS Independent Sample Mann –Whitney Utest
Significance level ($p < 0.05$).

Variable	Level	Mean±SD (Experimental group)	Mean±SD (Control group)	Z value	P value
NPRS	Base	8.2±0.55	8.06 ±0.25	-1.32	0.18
	4 th Week	3.34±0.97	4.00 ±0.70	-4.0	

Between groups comparison for and NPRS result shows no significant difference between two groups as $p > 0.05$.

Graph-3: Between Groups comparison of Pre-Post NPRS

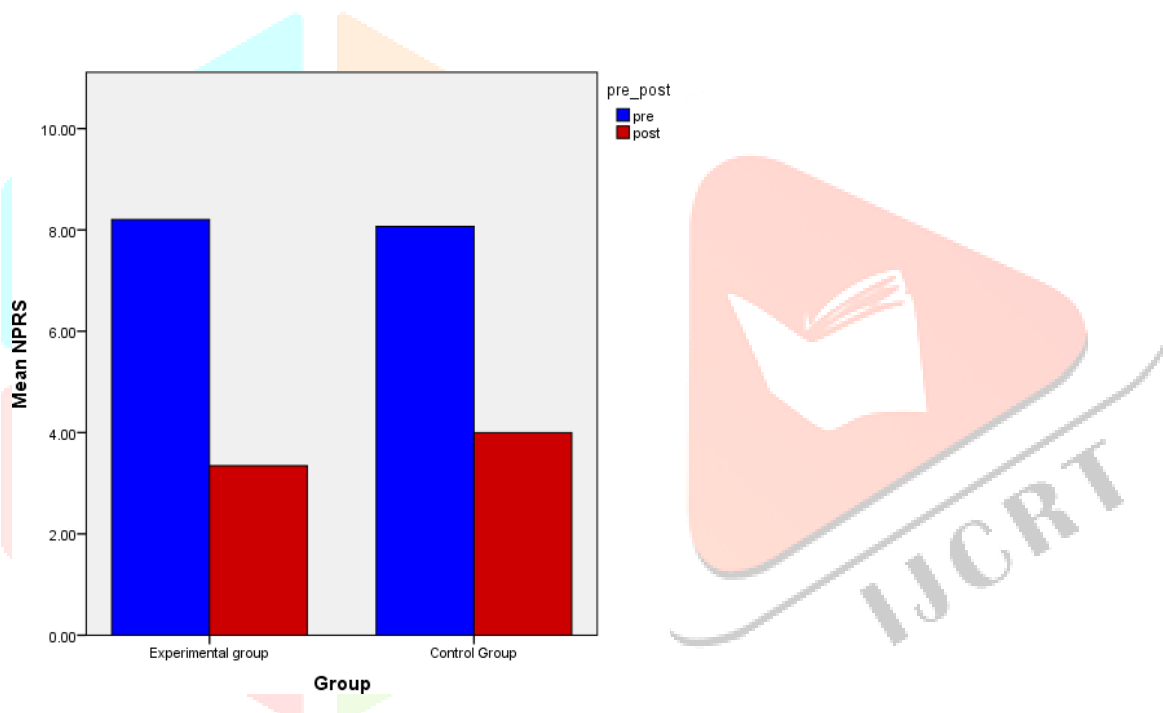
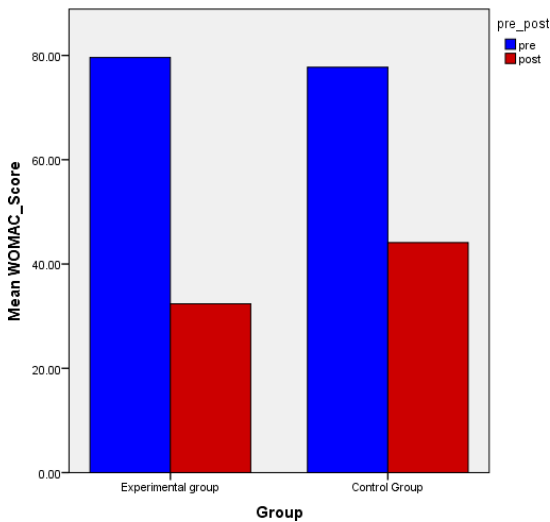


TABLE 7: Between groups comparison for WOMAC (independent sample t-test).
Significance level ($p < 0.05$).

Variable	Level	Mean±SD (Experimental group)	Mean±SD (Control group)	t value	P value
WOMAC	Base	79.58±6.85	77.72±6.53	6.90	0.00
	4 th Week	32.37±7.71	44.10±6.28		

Result shows significant difference between two groups as $p < 0.05$.



Graph-4: Between Groups comparison of Pre-Post WOMAC score

DISCUSSION

The results of the study are discussed in context of statistical analysis of present data and also compared with the previous studies. The possible explanations for the results are also discussed below according to supporting literature.

This study attempted to find out the effectiveness of hip abductor strengthening exercise and conventional physiotherapy on knee ROM and functional status in patients with knee OA. This study was carried out on 58 subjects having OA knee and aged between 40 to 65 years.

They were randomly divided into 2 groups. There were 10 male and 19 female included in Experimental group; 6 male and 23 female included in the control group. Mean age of the Subjects in experimental group was 52.72 and in control group 54.86.

Baseline is same for all four outcomes in both the groups as p-value is greater than 0.05 WOMAC $p = 0.141$, NPRS $p = 0.185$. So, for within group comparison Mann-Whitney U test has been used. Mean WOMAC at base experimental was 79.58 ± 6.85 and at the 4th week 32.37 ± 7.71 . That shows statistical improvement as well clinical improvement (Table - 3). Mean NPRS at base experimental was 8.2 ± 0.55 and at the 4th week 3.34 ± 0.97 . That shows statistical improvement as well clinical improvement (Table - 4). Mean WOMAC of control group at base was 77.72 ± 6.53 and at the 4th week 44.10 ± 6.28 . That shows statistical improvement as well clinical improvement (Table - 3). Mean NPRS of control group at base was 8.06 ± 0.25 and at the 4th week 4.00 ± 0.70 . That shows statistical improvement as well clinical improvement (Table - 4).

Between groups comparison was done by using independent sample t-test for WOMAC. That shows significant difference in experimental and control group. As mean of WOMAC of experimental group at 4th week is 32.37 ± 7.71 of WOMAC of control group at 4th week 44.10 ± 6.28 . So, experimental group shows more statistical and clinical improvement (Table - 6).

Between groups comparison was done by using independent sample Mann Whitney U test for NPRS. That shows significant difference in experimental and control group. As mean of NPRS of experimental group at 4th week is 4.00 ± 0.70 NPRS of control group at 4th week 3.34 ± 0.97 . So, experimental group shows more statistical improvement. But clinically it is not significant (Table - 7).

LIMITATION

- Result cannot be generalized to entire OA knee population as this study is having criteria regarding age, BMI, grade of OA.

Future Recommendation

- As this RCT is focused over only two outcomes i.e. WOMAC and NPRS, in the next studies importance of Pelvic stabilizers on Functionality or other object based outcome can be checked.
- The study should have a follow up in order to evaluate the consistency of effectiveness of hip abductor strengthening exercise that is maintained or not over the period of time.
- The study can be done with other different tools for measurement of hip abductor strength.

CONCLUSION:

- This study reveals that hip abductor strengthening can be considered for the treatment of OA knee. As hip abductor strengthening along with conventional therapy reduces pain and disability, Pelvic stabilizer should be included in protocol of OA knee in order to reduce pain and disability by reducing biomechanical load over the medial compartment of Knee joint. This helps in delaying of progression of the condition.

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