

# “The Effectiveness of Hip Abductor versus Quadriceps Strengthening on Pain and Function in Patients with Valgus Knee Osteoarthritis: A Comparative Study”

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## ABSTRACT

### Background and objective

Knee osteoarthritis (OA) is a common musculoskeletal condition associated with pain, stiffness, impaired function, and altered lower-limb biomechanics. Valgus knee OA presents with lateral compartment involvement and abnormal frontal-plane mechanics, which may require targeted rehabilitation strategies. Although quadriceps strengthening is commonly prescribed for knee OA, hip abductor strengthening may also play an important role in improving pelvic stability, lower-limb alignment, and functional performance. To compare the effectiveness of hip abductor Strengthening and quadriceps strengthening on pain and functional ability in individuals with valgus knee osteoarthritis.

**Methods:** A comparative study was conducted in the Outpatient Department of Pacific College of Physiotherapy. A total of 60 participants aged 45–70 years were included using simple random sampling and allocated into two groups of 30 participants each. Group A received hip abductor strengthening, while Group B received quadriceps strengthening. Both groups underwent supervised exercise sessions for 20–30 minutes, 3–5 sessions per week, for 6–8 weeks with progressive loading. Pain and functional status were assessed using the Visual Analog Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), respectively. Statistical significance was set at  $p < 0.05$ .

**Results:** Within-group analysis showed statistically significant improvements in both VAS and WOMAC scores in Group A (hip abductor strengthening) and Group B (quadriceps strengthening), with  $p < 0.001$  for both outcome measures. Between-group analysis revealed a statistically significant difference in VAS and WOMAC scores ( $p < 0.05$ ). The post-intervention VAS score was lower in Group A ( $2.9 \pm 0.7$ ) compared with Group B ( $3.8 \pm 0.8$ ). Similarly, the post-intervention WOMAC score was lower in Group A ( $42.1 \pm 5.2$ ) compared with Group B ( $48.7 \pm 5.9$ ). These findings indicate greater improvement in pain and functional ability following hip abductor strengthening compared with quadriceps strengthening.

**Conclusion:** The study concluded that both interventions groups demonstrated significant improvements in pain reduction, functional ability, and overall quality of life. However, participants who underwent hip abductor strengthening exercises showed comparatively greater improvement in pain relief and functional performance than those who performed only quadriceps strengthening exercises.

**Keywords:** Knee Osteoarthritis, Valgus Knee, Hip Abductor Strengthening, Quadriceps Strengthening, Pain, Functional Ability.

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## INTRODUCTION

Knee osteoarthritis (OA) is a common musculoskeletal disorder characterized by pain, stiffness, reduced muscle strength, and functional limitations, particularly in middle-aged and older

adults. It can significantly affect mobility and activities of daily living. Valgus knee osteoarthritis is associated with lateral compartment involvement and altered lower-limb biomechanics,

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which may further contribute to pain and functional impairment.

Exercise therapy is an important component of conservative management for knee OA. Quadriceps strengthening is commonly used to improve knee stability, muscle strength, pain, and physical function. However, hip muscle weakness, particularly of the hip abductors, may also influence lower-limb alignment and knee biomechanics. Strengthening the hip abductors may improve pelvic and lower-limb stability and help optimize movement patterns during functional activities.

Although both quadriceps and hip abductor strengthening exercises have been used in the management of knee OA, limited evidence is available regarding their comparative effectiveness specifically in individuals with valgus knee osteoarthritis. Therefore, comparing these two strengthening approaches may help identify a more effective exercise strategy for reducing pain and improving functional ability.

The present study aimed to compare the effectiveness of hip abductor strengthening and quadriceps strengthening exercises on pain and functional ability in individuals with valgus knee osteoarthritis.

## **AIM & OBJECTIVES OF THE STUDY**

To compare the effectiveness of hip abductor strengthening and quadriceps strengthening in reducing pain and improving functional ability in individuals with valgus knee osteoarthritis.

- To evaluate the effect of hip abductor strengthening on pain and function in patients with valgus knee OA.
- To evaluate the effect of quadriceps strengthening on pain and function in patients with valgus knee OA.
- To compare the effects of hip abductors strengthening exercises and quadriceps strengthening exercises on pain and functional ability in individuals with valgus knee Osteoarthritis.

## **MATERIALS AND METHOD**

The study included 60 participants aged 45–70 years, selected through simple random sampling and divided into two groups of 30 participants each. Group A received hip abductor strengthening exercises, whereas Group B received quadriceps strengthening exercises. The intervention was administered for 20–30 minutes, 3–5 sessions per week, for 6–8 weeks, with progressive loading according to individual tolerance.

Pain and functional ability were assessed using the Visual Analog Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), respectively, before and after the

intervention. Appropriate statistical analysis was performed to evaluate within-group and between-group differences. The paired t-test was used for within-group comparison, while the independent t-test was used for between-group comparison. Statistical significance was set at  $p < 0.05$ .

Ethical approval was taken from the Institutional Ethical Committee of Pacific Medical College with the registration number - **PMU/IEC/MPT/2025/22**. All participants were informed about the study procedure and provided informed consent before participation.

## **INTERVENTION**

### **Group A Hip Abductor strengthening**

### **GROUP B Quadriceps strengthening**

| Group                                          | Exercises                                     | Frequency                           | Reps/Sets             | Duration          | Progression                                    |
|------------------------------------------------|-----------------------------------------------|-------------------------------------|-----------------------|-------------------|------------------------------------------------|
| <b>Group A</b><br>(Hip Abductor Strengthening) | - Side-lying hip abduction                    | 3 sessions/week (e.g., Mon-Wed-Fri) | 2–3 sets × 10–15 reps | 30–45 min/session | - Increase resistance band level every 2 weeks |
|                                                | - Standing hip abduction with resistance band |                                     |                       |                   | - Add ankle weights from week 3                |
|                                                | - Clam shells                                 |                                     |                       |                   |                                                |
|                                                | - Lateral step-ups                            |                                     |                       |                   |                                                |
|                                                | - Monster walks (with band)                   |                                     |                       |                   |                                                |
| <b>Group B</b><br>(Quadriceps)                 | - Straight leg raises (SLR)                   | 3 sessions/week (e.g., Tue-Wed-Fri) | 2–3 sets × 10–15      | 30–45 min/session | - Increase hold time (5–10 min)                |
|                                                | - Quadriceps isometric                        |                                     |                       |                   |                                                |

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|                |                          |          |      |  |                               |
|----------------|--------------------------|----------|------|--|-------------------------------|
| Strengthening) | s (static quads)         | Thu-Sat) | reps |  | sec)                          |
|                | - Seated knee extensions |          |      |  | Add ankle weights from week 3 |
|                | - Wall sits              |          |      |  |                               |
|                | - Mini squats            |          |      |  |                               |

### STATISTICAL ANALYSIS

Prior to inferential analysis, the distribution of data was assessed for normality using appropriate tests such as the Shapiro-Wilk test. Since the data followed a normal distribution ( $p > 0.05$ ), parametric tests were applied for further analysis. Statistical analysis was performed using paired t-tests for within-group comparisons and unpaired t-tests for between-group comparisons, with the level of significance set at  $p < 0.05$ .

### RESULTS

A total of 60 participants with Knee osteoarthritis with valgus deformity were included in the present study. All participants fulfilled the predicted inclusion and exclusion criteria and completed the assessment and were equally divided into two groups: Group A ( $n = 30$ ), which received Hip abductor strengthening, and Group B ( $n = 30$ ), which underwent Quadriceps strengthening.

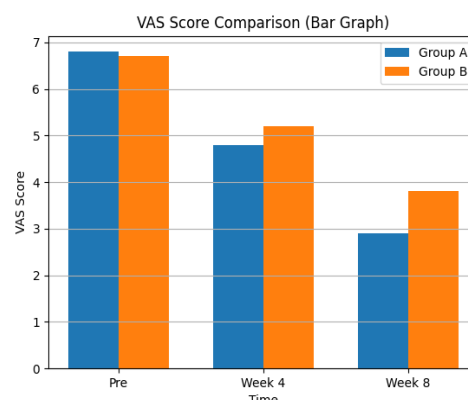
The baseline demographic characteristics indicated that both groups were comparable. The mean age of participants in Group A was  $58.3 \pm 6.2$  years, while in Group B it was  $57.9 \pm 5.8$  years. Gender distribution of males and females was nearly equal across both groups, with Group A consisting of 14 males and 16 females and Group B including 13 males and 17 females. There were no statistically significant differences between the groups in terms of age or gender ( $p > 0.05$ ), confirming homogeneity at baseline.

**TABLE 1: Demographic Data (Age & Gender Distribution)**

| Variable         | Group A (n=30) | Group B (n=30) |
|------------------|----------------|----------------|
| Mean Age (years) | $58.3 \pm 6.2$ | $57.9 \pm 5.8$ |
| Male (n)         | 14             | 13             |
| Female (n)       | 16             | 17             |

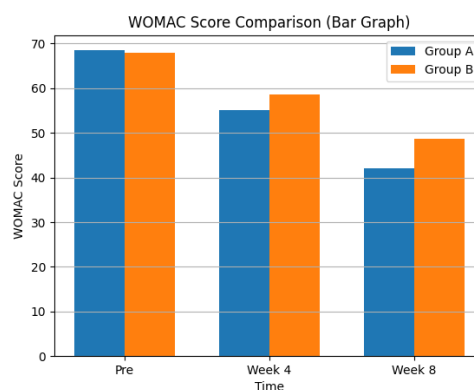
**TABLE 2: Within Group Comparison of VAS Scores**

| Group   | Pre (Mean $\pm$ SD) | Week 4        | Week 8        | p-value  |
|---------|---------------------|---------------|---------------|----------|
| Group A | $6.8 \pm 0.9$       | $4.8 \pm 0.8$ | $2.9 \pm 0.7$ | $<0.001$ |
| Group B | $6.7 \pm 1.0$       | $5.2 \pm 0.9$ | $3.8 \pm 0.8$ | $<0.001$ |



**TABLE 3: Within Group Comparison of WOMAC Scores**

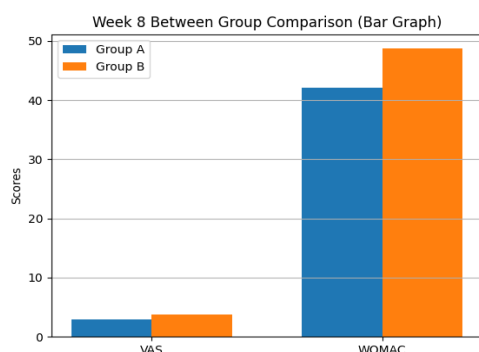
| Group   | Pre (Mean $\pm$ SD) | Week 4         | Week 8         | p-value  |
|---------|---------------------|----------------|----------------|----------|
| Group A | $68.5 \pm 6.3$      | $55.2 \pm 5.8$ | $42.1 \pm 5.2$ | $<0.001$ |
| Group B | $67.9 \pm 6.7$      | $58.6 \pm 6.1$ | $48.7 \pm 5.9$ | $<0.001$ |



**TABLE 4: Between Group Comparison at Week 8**

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| Outcome | Group A    | Group B    | p-value |
|---------|------------|------------|---------|
| VAS     | 2.9 ± 0.7  | 3.8 ± 0.8  | <0.05   |
| WOMAC   | 42.1 ± 5.2 | 48.7 ± 5.9 | <0.05   |



### DISCUSSION

The present study compared the effectiveness of hip abductor strengthening and quadriceps strengthening exercises on pain and functional ability in individuals with valgus knee osteoarthritis. The findings demonstrated significant improvements in both groups in terms of VAS and WOMAC scores ( $p < 0.001$ ), indicating that both strengthening interventions were effective in reducing pain and improving functional ability.

However, between-group analysis showed significantly greater improvement in the hip abductor strengthening group compared with the quadriceps strengthening group ( $p < 0.05$ ). The lower post-intervention VAS score in Group A ( $2.9 \pm 0.7$ ) compared with Group B ( $3.8 \pm 0.8$ ), along with lower WOMAC scores in Group A ( $42.1 \pm 5.2$ ) compared with Group B ( $48.7 \pm 5.9$ ), suggests better outcomes following hip abductor strengthening.

The greater improvement observed with hip abductor strengthening may be explained by its influence on proximal lower-limb control and knee biomechanics. Hip abductor weakness can contribute to altered femoral alignment and increased dynamic valgus, potentially increasing stress on the knee joint. Strengthening these muscles may improve pelvic stability and lower-limb alignment, thereby reducing abnormal loading and improving functional performance. These findings are consistent with previous studies reporting beneficial effects of hip strengthening on pain and functional outcomes in individuals with knee osteoarthritis.

Quadriceps strengthening also produced significant improvements, supporting its established role in knee osteoarthritis rehabilitation. However,

quadriceps strengthening primarily targets knee extensor strength and may have a comparatively limited effect on proximal and frontal-plane biomechanical abnormalities associated with valgus knee osteoarthritis. Thus, the superior outcomes observed with hip abductor strengthening may be related to its ability to address proximal control in addition to improving muscle strength.

Overall, the findings support the incorporation of hip abductor strengthening into physiotherapy rehabilitation for individuals with valgus knee osteoarthritis. A biomechanically oriented rehabilitation approach that addresses both proximal and local muscle function may be beneficial for improving pain and functional ability.

### CONCLUSION

The present study concludes that both intervention groups demonstrated significant improvements in pain reduction, functional ability, and overall quality of life.

However, participants who underwent hip abductor strengthening exercises showed comparatively greater improvement in pain relief and functional performance than those who performed only quadriceps strengthening exercises

### LIMITATION OF THE STUDY

- Small Sample Size
- Short Duration of Intervention
- Lack of Long-Term Follow-Up
- Limited Outcome Measures
- Single- Center Study
- No Combined Intervention groups

### RECOMMENDATION

Further study could be performed with

- Large number of samples
- Duration of study for long period
- Hip abductor strengthening should be included in physiotherapy management of valgus knee osteoarthritis.
- Further studies should investigate the effectiveness of hip strengthening across different stages of knee osteoarthritis.
- Rehabilitation should address overall lower-limb biomechanics rather than a single muscle group.

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