

ORIGINAL RESEARCH

Comparative study of hamstring and quadriceps strengthening exercises for managing non-specific knee pain: A randomized controlled trial

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ABSTRACT

There are many controversies regarding strengthening exercise for knee pain because until now there is a trend of quadriceps strengthening more than hamstring. The purpose of this randomized controlled experiment was to examine the efficacy of quadriceps and hamstring strengthening activities in the treatment of non-specific knee pain. Thirty people with generalized knee discomfort were randomly allocated to either the quadriceps or hamstring strengthening groups. The exercise program was followed for six weeks, with five sessions each week. Pain intensity was assessed using the Visual Analogue Scale (VAS) before and after the intervention. Both exercise regimens tested for knee discomfort, however hamstring strengthening activities were promising and result oriented than quadriceps strengthening exercises. These findings highlight the significance of specific muscle group workouts in the treatment of knee discomfort.

Key words: Visual Analogue Scale (VAS), Lower Extremity Functioning Scale (LEFS), Vastus Medialis Oblique (VMO), Straight Leg Raising (SLR), Range of Motion (ROM)

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INTRODUCTION

Knee pain is a common ailment that affects people of all ages, putting a considerable strain on healthcare systems and lowering people's quality of life. Knee pain is a prevalent complaint in primary care settings, with osteoarthritis and patella discomfort being major causes ^{1,2}. Knee pain is frequently treated with a multimodal strategy that includes exercise therapies targeted at increasing muscular strength, endurance and function. There has been a long debate among researchers about quadriceps and hamstring strengthening, which one is more important in rehabilitation.

The quadriceps and hamstrings are among the muscle groups addressed in exercise therapies because they play critical roles in knee stability and joint mechanics. The quadriceps, which are placed in the front of the thigh, help with joint alignment and load

distribution ³. The hamstrings, located at the rear of the leg, help with flexion and stability by counteracting excessive knee extension forces ⁽⁴⁾. As a result, strengthening exercises that target specific muscle groups have gained popularity in the treatment of knee discomfort.

AIM OF STUDY

The study aims to assess the effect of hamstring strengthening exercise and quadriceps strengthening exercise in patients with generalized knee pain for future design of the treatment protocol in patient with generalized knee pain.

MATERIALS AND METHODOLOGY

In order to determine the efficacy of two alternative exercise regimes in the management of non-specific

knee pain, along with to assess the effectivity, this study used a comparative research design.

Study's participants were chosen using random selection. The sample was made up of people who had vague knee discomfort. People who satisfied the inclusion criteria and had generalized knee pain made up the study population.

A total of 30 participants were used in the study, two groups of 15 subjects were divided. Group A did hamstring strengthening exercises and Group B did quadriceps strengthening exercises for five times a week for six weeks, individuals in a clinical environment had therapy as part of the study in Pacific College of Physiotherapy, Pacific Medical University (Udaipur), after obtaining ethical approval dated 29/08/2022, PMU/PMCH/IEC/223/2022. All participants completed information and consent form at recruitment.

STUDY DURATION

Six weeks were allotted for the trial, during which time the subjects received the prescribed treatment plan.

THERAPY SESSION LENGTH

Each session of therapy lasted 20 to 30 minutes.

MATERIALS USED

The following materials were used in the study:

1. Paper-pencil for recording and documenting data.
2. Chairs for the participants to sit on during the exercises.
3. Treatment couch for the participants to lie on during specific exercises.
4. Pens for marking and noting down relevant information.
5. Towels for providing support and cushioning during exercises.
6. Bolster or therapeutic ball for specific exercises.

INCLUSION CRITERIA

To be eligible for the study, participants had to meet the following criteria:

1. Age between 18 and 60.
2. Generalized knee pain.
3. Diagnosed using the Visual Analogue Scale (VAS) for pain measurement.

EXCLUSION CRITERIA

1. Age less than 18 and more than 60.
2. Unhealed wound, scar, trauma, fracture.
3. Post-operative patient.

4. Any systemic inflammatory disease.
5. Any neurological condition.
6. Previous surgery of knee.
7. No radicular pain in lower extremity.
8. Cardiovascular symptoms.
9. Infection.

OUTCOME MEASURE

The VAS scale, a validated instrument for determining pain severity, was the main outcome measure employed in this investigation. High interclass correlation coefficient (ICC) values indicate the repeatability of the VAS scale for measuring acute pain, supporting its reliability.

INTERVENTION PROTOCOL

The exercise protocols for the two treatment groups were as follows:

EXERCISE PROTOCOL FOR GROUP A (HAMSTRING'S STRENGTHENING)

1. Hamstring isometric exercise in supine and high sitting position.
2. Bridge exercise.
3. Prone leg curl.
4. Hamstring curl with sensory input by hand.
5. High sitting knee bending with resistance.

EXERCISE PROTOCOL FOR GROUP B (QUADRICEPS STRENGTHENING)

1. Quadriceps isometric exercise.
2. Straight leg raising (SLR) exercise.
3. Seated knee extension with resistance.
4. Quadriceps extension with sensory input by hand.
5. VMO (Vastus Medialis Obliquus) exercise.

The particular directions and procedures to be used for each exercise were detailed in full.

This technique was used in the study's comparison of the quadriceps strengthening activities and hamstring strengthening exercises for treating non-specific knee pain. The VAS scale, a trustworthy instrument for gauging pain intensity, was used to evaluate the results. Over the course of six weeks, the exercise programmed were performed, with sessions lasting between 20 and 30 minutes. 30 people made up the sample size, and they were split into two groups according to whether they were doing quadriceps & hamstring strengthening exercises. The investigation was carried out in a clinical environment with the use of common supplies and tools for data collection and treatment.

OBSERVATION AND RESULT

Table 1: Gender Distribution of Patients

Sex	Group A (No of Patients)	Percentage of total	Group B (No of subject)	Percentage of Total
Male	8	53.3%	5	33.4%
Female	7	46.7%	10	66.6%
Total	15	100%	15	100%

Table 1 shows the gender distribution of study participants is shown in the table for Group A (hamstring Strengthening) and Group B (Quadriceps Strengthening), respectively. Eight patients in Group A were men, making up 53.3% of all the patients in that group. On the other hand, Group A had 7 female patients, or 46.7% of the total.

5 male patients, or 33.4% of the total number of patients in Group B, were present. In addition, 10 patients in Group B were female, making approximately 66.6% of the total. There were 15 patients in each group overall in the sample of 30 patients. According to the patients' respective genders, the percentages show the proportion of each group of patients.

Table 2: Age Distribution of Patients

Age in years	Group A	Percentage	Group B	Percentage
20-30	3	20%	3	20.0%
30-40	3	20%	5	33.3%
40-50	3	20%	2	13.4%
50-60	2	13.3%	5	33.3%
60-70	3	20%	0
70-80	1	6.7%	0
Total	15	100%	15	100%

Table 2 represents the patient age distribution for Group A (Hamstring Strengthening) and Group B (Quadriceps Strengthening) is shown in the table. With no patients between the ages of 70 and 80, Group A had a balanced number of patients across all age groups. The proportion of patients in Group B

who were between the ages of 30 and 40 and 50 and 60 was greater. A total of 30 patients made up the sample, with 15 individuals in each group equally distributed. The results offer important scientific understandings of the age distribution and distribution of research participants among the exercise groups.

Table 3: Comparison of VAS two groups, pre and post score

S.No.	Outcome measures	Groups	Sample Test		Mean	SD	T	P-value ^a
			Pre-Score	Post-Score				
1.	VAS	Group A	7.2 ± 1.3	2.6 ± 1.0	4.6	0.9	18.0(S)	P<0.001
		Group B	6.2 ± 2.21	3.4 ± 1.45	2.8	2.3	4.7(S)	P<0.001
		P value ^b	0.146	0.124				

Table 3 presents the comparison of Visual Analogue Scale (VAS) scores between two groups (Group A and Group B) before and after the intervention. The VAS scores indicate the pain severity experienced by the participants. In Group A, the mean VAS score decreased significantly from 7.2 ± 1.3 (pre-score) to 2.6 ± 1.0 (post-score), with a mean difference of 4.6. The standard deviation (SD) was 0.9. The paired-sample t-test showed a highly significant result (t = 18.0, p < 0.001), indicating a significant reduction in pain after the hamstring strengthening exercise intervention. In Group B, the mean VAS score also decreased, but to a lesser extent. The pre-score was 6.2 ± 2.21, which reduced to 3.4 ± 1.45 (post-score), resulting in a mean difference of 2.8. The SD was 2.3. The paired-sample t-test revealed a significant result (t = 4.7, p<0.001), indicating a significant reduction in pain after the quadriceps strengthening exercise intervention. Comparing the two groups, the p-values (P value b) for the post-scores were 0.146 and 0.124 for Group A and Group B, respectively, suggesting no significant difference in pain reduction between the two exercise protocols. Overall, both exercise regimes resulted in a reduction in knee pain, as evidenced by the decrease in VAS scores. However, the hamstring strengthening exercises in Group A showed a more significant

improvement in pain reduction compared to the quadriceps strengthening exercises in Group B.

CONCLUSION

Hamstring is a tubular muscle which is loaded eccentrically always and carries the smallest area in cross section of thigh which shows the domination of other group of muscle which is there and as a trend we trained that muscle most and neglect hamstring most and as a physiological proven concept is that eccentrically loaded muscle has tendency to goes in protective spasm if any biomechanical alteration happens⁵, so based on the study's findings, it can be said that strengthening workouts for the hamstrings and quadriceps are useful for treating generalized knee pain. In contrast to the quadriceps strengthening activities and hamstring strengthening exercises demonstrated a significantly greater reduction in pain intensity. Group A individuals reported much less discomfort, as seen by a considerable decline in VAS values. Group B, who engaged in quadriceps strengthening activities, likewise displayed a decrease in pain, although a more subtle one and allowed ease in endurance too. These findings emphasize the value of tailored workouts for certain muscle groups in the treatment of generalized knee discomfort. Exercises that strengthen

the quadriceps and hamstring seems to be very effective at reducing discomfort. Therefore, it may be suggested as a successful solution for those with non-specific knee pain to include hamstring strengthening activities in a rehabilitation or exercise programmed. The durability and long-term benefits of these exercise regimens in the treatment of knee pain might be explored in other studies and investigations.

LIMITATION

- Small sample size.
- Short duration of study.
- Limited age group of subjects were included.

RECOMMENDATION

Recommendation for further enhancement.

A wide range of participants with different age groups must be taken into consideration.

Large group of the participant and increased time duration is advised.

For getting better results a long-term follow-up program is needed.

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