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https://kuey.net/ **Research Article**

"A Comparative Study of Increase in range of motion in knee joint by using Quadriceps strengthening exercises vs Quadriceps and Hamstring strengthening Exercises protocol in patients with Osteoarthritic knee Post Total knee replacementCases"

Dr. Soumya Sharma[1]*, Dr. Arti Yadav[2], Dr. Anand Mohan Jha[3], Dr. Ankit Pachori[4], Dr. Ayushi Tiwari[5]

[1]Assistant Professor, Vivekananda Global University
[2]Assistant Professor, Vivekananda Global University
[3]Assistant Professor, Vivekananda Global University
[4]Associate Professor, Vivekananda Global University
[5]Assistant Professor, Vivekananda Global University
[1]Email: soumyasharma028@gmail.com, Contact -9660189881

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ARTICLE INFO

ABSTRACT

Study objectives: To find out The effectiveness of strengthening post TKR, isometric exercises and home based exercise programme of both quadriceps and hamstring strength in post surgery cases.
Participants: 60 subjects ongoing post TKR rehab. All were divided into group A and group B with 30 patients in each group**.**
Outcome measures: Goniometer is usedto measure range of knee joint in both of the groups post rehabilitation and strengthening exercises.
Results: Comparative results can be seen by graphs and tables.
Conclusion: It can be concluded from this study that is there any increase in range in group of subjects with both quadriceps and hamstring strengthening exercises.
Procedure: a comparative study was conducted to evaluate the effects of quadricepsstrengthening exercises versus a combined protocol of quadriceps and hamstring strengthening exercises on range of motion in patients with osteoarthritic knee post-total knee replacement (TKR) cases.
The study aimed to assess whether the addition of hamstring exercises in combination with quadriceps exercises would lead to greater improvements in range of motion compared to quadriceps exercises alone.
The study likely involved two groups of patients, where one group followed a specific quadriceps strengthening exercise protocol, while the other group followed aprotocol that included both quadriceps and hamstring strengthening exercises. Measurements such as range of motion (including flexion and extension), assessment were likely taken before and after the intervention period.

Keywords: Total knee replacement surgery, Goniometer, Isometric exercise.

INTRODUCTIONKNEE JOINT

There is no joint in the body larger than the knee. It joins the femur (thigh bone) to the tibia (shinbone). It allows you to stand, move, and maintain your balance. Ligaments such as the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), and meniscus are also located in your knees. The biggest joint in the body, the knee links the lower leg to the thigh. The kneejoint, like other joints in the skeletal system, is composed of cartilage, muscles, ligaments, and nerves. A person's knees allow them to walk, run, and leap because they bear the body's weight and allow the leg to move freely. (Flandry and Hommel, 2011) According to Flandry F. Hommel (2011), your knees allow your legs to flex and move while also supporting your weight. Walking, sprinting, and leaping are just a few examples of the many leg-based motions that rely on the knees.

KNEE JOINT RANGES

Role of the Knee: 135 degrees, or completely bent. Range of Motion (ROM) for the knee when extended straight: zero degrees Ten degrees of internal knee rotation The range of motion for the external knee is 30–40 degrees.A knee's range of motion may be observed in three distinct ways: The range of motion (ROM) of the knees while the knee muscles are actively contracting without the use of an external assistance is called active knee ROM.When the knee is relaxedand moved by an outside force, like a person, the range of motion (ROM) of the knee is measured passively.When the knee is weak or hurts, a therapist or other outside source may aid with active assisted range of motion (ROM) assessments.

GONIOMETER

In physical therapy, a goniometer is a typical tool for determining a joint's ROM. A goniometer is made up of two hinged "arms"—one that is fixed and one that is moving. Withthe goniometer's center lined up with the target joint, the therapist places it at strategic locations on the patient's body. The hinge's hash markings make it easy to quantify the rangeof motion (ROM) in degrees.
Jonathan Seares (2011)
The following procedures constitute the gold standard for measuring knee mobility: Place the goniometer's axis above the lateral femoral epicondyle as you lie on your back withyour leg straight on a flat, ideally firm surface.
With the outer thigh's greater trochanter in line with the goniometer's stationary arm,while aligning the opposite goniometer arm with the ankle's lateral malleolus.
Before taking a measurement, make sure your knee is as straight as possible by gently pressing itdown into the floor using your leg muscles instead of your hands.
Slide your foot up toward your buttocks while maintaining the go-niometer's arms and axis in place. Then, bend your knee to its maximum extent to assess knee flexion.
On the other hand, if your leg is unrestricted, you may sit and evaluate knee flexion. Using ahigh chair or the edge of a table, sit up straight, line up the goniometer as described before, and bend your knee as much as you can. Citation: B. Jolles (2015) muscular quadriceps When considering size and function, the Quadriceps femoris stands head and shoulders above all other muscles in the human body. The rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius are the four muscles that make up this joint, which flexes the hip and extends the knee. These muscles are among the strongest in the body and make up the majorityof the thigh. The quadriceps femoris is a group of four muscles that originate at the front of the thigh: namely the vastus medialis, vastus intermedius, rectus femoris, and vastus lateralis. These muscles originate close to the knee and join the patella via the quadriceps tendon; they then adhere to the patella. Although the rectus femoris aids in hip flexion, the main job of thequadriceps femoris is to extend the knee. The vastus medialis stabilizes the kneecap and aids in adducting, extending, and externally rotating the thigh. A wide range of athletic and daily movements rely on strong quadriceps, including leaping in basketball and other sports as well as walking, climbing stairs, squatting, and getting out of a chair. Kicking, leaping, cycling, and running are some of the activities that use them, and they are most active when a person is just starting to walk or run.

- **Function of quadriceps**

The quadriceps mainly help in bending the knee and hip joints, as well as stabilizing the knee by keeping the patella in a groove on the thigh or femur. Jumping, running, and kicking are the key activities that put these muscles to work.
The significance of strengthening the quadriceps after TKR
When it comes to getting back on your feet after a total knee replacement (TKR), strengthening your quadriceps is a must. Here are a few reasons why strengthening your quadriceps is a good idea:
In order to restore muscular strength, it is important to be aware that TKR surgery, in particular the quadriceps muscles, might temporarily weaken and atrophy. When you strengthen your quadriceps with workouts, you improve the stability and function of your knee joint.
Enhanced Stability of the Knee Joint: Quadriceps strengthening helps stabilize the knee joint, which is especially crucial for patients recovering after total knee replacement (TKR) since it lessens strain on the artificial joint and keeps the knee in good alignment.

Increased Flexibility and Mobility: The front thigh muscles, known as quadriceps, arecrucial for moving the knee joint. After total knee replacement (TKR), patients may strengthen these muscles to increase their range of motion, which makes everyday tasks less taxing and more pleasant. Walking, other weight-bearing exercises, and functional movements involving the lower limbs all need strong quadriceps muscles. You may enhance your gait mechanics, boost your stamina, and walk more smoothly by strengthening these muscles.
Enhanced Capacity to Walk and carry Weight: The ability to walk, carry weight, and perform functional actions involving the lower limbs all depend on strong quadriceps. Improving one's gait mechanics, increasing one's endurance, and encouraging a more fluid walking pattern may be accomplished by strengthening the quadriceps muscles.

Protecting the Knee Joint: Having strong quadriceps muscles may assist in absorbing and distributing pressures throughout the knee joint, which can lessen the strain on the artificial joint and lessen the likelihood of problems or harm to the prosthesis.It is recommended to seek the advice of a healthcare professional or physical therapistwhen beginning and continuing an exercise program to strengthen the quadriceps. These professionals can recommend the best exercises, correct form, and monitor andadjust the program based on each person's needs and progress.

RESTRICTING MUSCLE

One of the main functions of the three muscles that make up the hamstrings is to bendthe knee. The Biceps femorisis one such muscle; it crosses two joints and has long tendons at both ends, as well as several muscle-tendon junctions (MTJs). As the muscle contracts and relaxes, the MTJs spread out into the belly of the muscle, overlap within the belly, facilitate the transfer of forces, and distribute forces across the MTJ.

Function of the hamstring muscle complex

The hamstring muscle complex is mainly responsible for extending the hip andflexing the knee. In walking, the complex gait cycle—which includes absorbingkinetic energy and protecting the knee and hip joints—is carried out by the hamstrings. When we walk, the hamstrings pull the tibia backwards, a process called the swing phase. The quadriceps, an antagonist muscle of the hamstrings, contracts in complicated synchronization with the hamstrings

Post-TKR hamstring strengthening: Strength in Balance:

Enhanced Flexibility and Range of Motion:

When you strengthen your hamstrings, you're able to put less stress on your knee joint, which in turn reduces pressure on other components and may even alleviate discomfort. The ability to tolerate weight-bearing activities and general joint function may both improve as a result of this.

Preventing ailments:

Osteo arthritis

The non-inflammatory joint condition known as osteoarthritis (OA) causes articular cartilage to degenerate while new bone is formed at the surfaces and borders of affected joints. The spine, knees, hips, and ankles are the most usual places to find osteoarthritis as we age, although it may develop in any joint. New evidence suggests that osteoarthritis, long thought to be a degenerative illness, really causes an imbalance between the processes of cartilage regeneration and degeneration. When a person has osteoarthritis, they may have discomfort in their joints, changes intheir structure, crepitus, bony enlargements, deformity, instability, and restricted mobility. Weakness and atrophy of the muscles that are involved are also possible. Morning stiffness is typical, although it often goes away within a few minutes. A.V. Kulkarni (1999) states that the common behavior of sitting and crouching cross-legged increases the prevalence of knee osteoarthritis in India. Osteoarthritis causes deterioration and erosion of hyaline cartilage because it is not innervated by nerves. Injuries to the cartilage are therefore undetected until a synovialresponse occurs. The innervated synovium is responsible for transmitting signals of pain. The mechanical failure of hyaline cartilage can be caused by a variety ofabnormalities, and according to Graham Apley (1993),osteoarthritis is a chronic joint disorder that manifests itself in a gradual softening and disintegration of articular cartilage, as well as in the growth of new bone and cartilage at the joint margins (osteo-phytes) and capsular fibrosis. When cartilage deterioration exposes innervated and pain-sensitive bone, as pointed out by René Calliet (1992), pain ensues. Joint stiffness is caused by the formation of osteophytes, which occur when cartilage breaks down as a result of friction.

Total knee replacement

Pain is the main sign of osteoarthritis, although it usually goes away when you do something active, like walking. The pain has no defined site and is characterized as dull and painful. Mild swelling of the infected joint and stiffness, especially first thingin the morning, are possible symptoms of the condition. Minimal discomfort and gritty crepitus may be detected upon evaluation by healthcare personnel. Loose bodies inside the joint could cause the patient to feel as if it locks or gives way. It is not uncommon for people to have limited range of motion at the knee joint. Stiffness that the patient may feel first thing in the morning often goes away as the day progresses and the patient becomes more active. Genu varum malformation may manifest in extreme instances. Artificial components, sometimes called prosthetic elements, are used to replace the damaged or diseased sections of the knee joint during a surgical process called a totalknee replacement. Patients with debilitating knee pain or impairment may find relief and an improvement in their quality of life via this operation, which is sometimes called total knee arthroplasty. When other therapies, such medicine or physical therapy, have failed, it is usually suggested as a last resort. Since children's bones are still developing, the surgery is usually not advised for them. Restoring knee joint function and alleviating pain are the primary goals of knee replacement surgery. The patient's mobility and quality of life are also intended to be maintained or enhanced. Reliability, predictability, and great long-term outcomes are hallmarks of the treatment. Various portions of the knee joint, including as the patella, the lower endof the thigh bone (femur), and the upper end of the shin bone (tibia), are replaced withmetal and strong plastic components in total knee arthroplasty.

Ellen MI (2009) statesthat the process entails transferring healthy bone and cartilage from one knee joint to another using artificial components. Osteoarthritis and other chronic knee diseases may be effectively treated with this method.

ACHE/EVALUATION METER

Evaluation of Pain Achim Elfering states that patients' pain levels may be evaluated usinga Numerical Rating Scale (NRS), which asks them to circle a number from 0 to 10 that they feel best describes their pain level. The lower limit usually denotes "absolute absenceof pain," while the higher range normally denotes "the most excruciating agony imaginable." We will be use a scale from 0 to 10 in this investigation.

NEED FOR A STUDY

To get the clear image of how the hamstring strengthening exercises would Help in the rehab protocol after total knee replacement surgery.
AIM OF A STUDY

➢ To find out the range of motion difference between both individual groups (one with only quadriceps strengthening exercises and another with both quadriceps and hamstring strengthening exercises

OBJECTIVES OF A STUDY

Objective of this study is to know that whether there is an effect of hamstring strengthening too on increase joint mobility.
HYPOTHESIS. NULL HYPOTHESIS Are is no significant difference exists between Rangeof motion of patients undergone total knee replacement and doing quadriceps strengthening vs quadriceps and hamstring strengthening protocoL
There will be no significant effect of Hamstring strengthening exercises in increasing range of motion in Group B
ALTERNATE HYPOTHESIS: Are is significant difference exists between Range of motion of patients undergone total knee replacement and doing quadriceps strengthening vs quadriceps and hamstring strengthening protocol

There can be a significant effect of Hamstring strengthening exercises in increasing range of motion in Group B

MATERIAL AND METHODS

Goniometer, Plinth Chair, Pillows, Towels, Foam Roller, Foam short arch exerciser, Theraband, Weight cuff, Sheets, Markers.

METHODOLOGY STUDY DESIGN- Comparative study design.
SAMPLING TECHNIQUE- Random sampling technique.

A sample of 60 subjects of individuals irrespective of there gender of age 40 to 65 years Will be taken. Subjects will be divided into 2 groups of 30 each. GROUP A: Individuals Following quadriceps strengthening exercises protocol. GROUP B: Individuals Following Both quadriceps and hamstring strengthening exercises protocol
SAMPLE SIZE Study sample consists of 60 subjects.

STUDY METHOD

Subjects were divided into Group A and Group B Sample of 60 subjects will be individual with post operative Total knee replacement from day 0 to 28 selected into two groups (30 each) one group With quadriceps strengthening training and one with both quadriceps and hamstring strengthening exercises .

VARIABLES

- **INDEPENDENT VARIABLE**

Post operative total replaced knee jointDEPENDENT VARIABLES
The dependent Variable are as followRange of motion

STUDY SETTING

Fortis Escort Hospital Jaipur, Vijayvargiya orthopedic Hospital Jagatpura Jaipur, Rukmani Devi Physiotherapy Clinic jaipur.

PERIOD OF STUDY Three monthsPROCEDURE:

In this study there will be 2 groups A and B.
It is a comparative study. One of the groups would have individuals following quadriceps strengthening exercises and the other group will have Individuals following Both quadriceps andhamstring strengthening exercises.
All the individuals within both the groups are tested for:

a) Range of motion of knee joint

The values of observation are noted.
Range of motion of knee tested in degrees 0 to 130 degrees

GROUP A EXERCISES

Group A will perform only quadriceps exercises

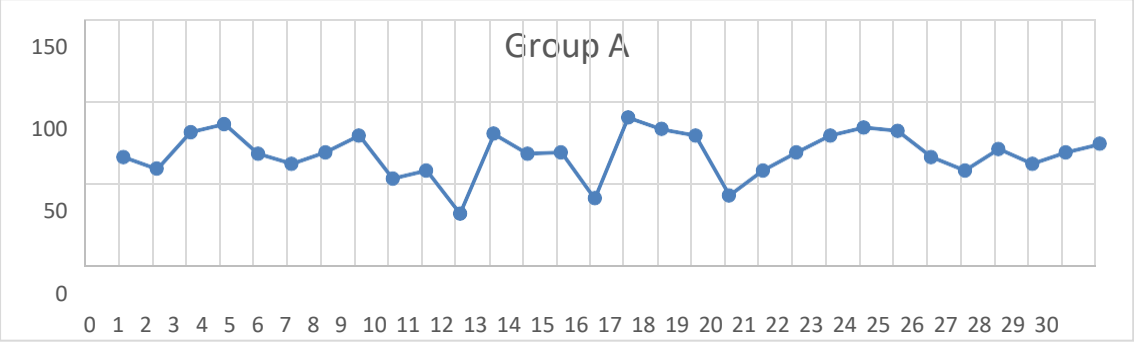
DATA PRESENTATION

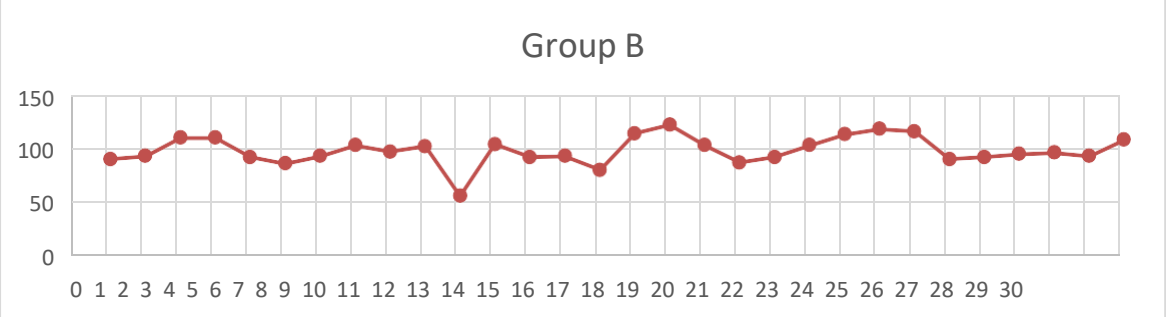
TABLE 1 Comparitive measurement of range of flexion in both group A and group B withthe help of goniometer device. And the data is as following.

Sr No	Group A (Followed Quadriceps Strengthening programme)	Group B (Followed Quadriceps and Hamstring Strengthening programme)
1	82	92
2	75	95
3	97	112
4	102	112
5	84	94
6	78	88
7	85	95
8	95	105
9	69	99
10	74	104
11	48	58
12	96	106
13	84	94
14	85	95
15	57	82
16	106	116
17	99	124
18	95	105
19	59	89
20	74	94
21	85	105
22	95	115
23	100	120
24	98	118
25	82	92
26	74	94
27	87	97
28	78	98
29	85	95
30	90	110

Group A	Group B
83.93 degree of flexion	100.1 degree of flexion

Below graph of Subjects in X axis and Range of motion in Y axis for Group A and Group B respectively.





RESULTS

As this study revealing the data and all the interpretation of the criteria of interpretation ofthe criteria of interpretation of the criteria of Range of motion difference in patient undergone total kneereplacement surgery cases and doing early rehabilitation exercises the quadriceps strengthening is important but mostly the hamstring strengthening protocol is being under estimated and ignored. Due to this phenomena the knee repair and rehab in post replacement cases is bothered and affected somewhere and the effectiveness is decreased.

By the concluded result below. This study would make and compare the data of rangeof motion another criteria of subjects such as muscle strength and pain assessment in post TKR subjects just after hospital discharge post surgery and in indoor patient department itself

The result of the major criteria of this comparison study is Range of motion. Group A (followed quadriceps strengthening exercises only)

Got the sum of the range of motion that is 2518 degree and the average ROM of groupA And is 83.93 degree approximately:-84 degree of ROM

Where as the effectiveness of the range of motion is clearly visible in the data of - group B (Followed Quadriceps and hamstring strengthening both) Sum of Group B Range of motion is 3003degrees and the average ROM of group B is100.1 approximately 101 degree ROM Hence the hamstrings strengthening added with quadriceps strengthening make the knee more mobile and enhance the range of motion.

Conclusion

The results of these studies can vary, depending on several factors such as the specific exercise protocol, duration of the intervention, patient characteristics, and study design. Some studies have shown that a combined protocol of quadriceps and hamstring strengthening exercises leads to better improvements in range of motion, functionaloutcomes, and muscle strength compared to quadriceps exercises alone.

Hence, it can be Concluded in this study that The Hamstring muscle strengthening playequal and important role to increase the range of knee joint. so it should be included in the protocol after total knee replacement surgery post osteoarthritis.

Discussion

This indicates that incorporating Hamstring strengthening exercises alongside Quadricepsexercises can lead

to better outcomes in terms of increased range of motion in the knee joint for patients with Osteoarthritic knee after TKR. The Hamstring muscles play a complementary role in knee joint stability and function, which could explain the additional benefits observed in the combined exercise protocol.It is important to note that the study had certain limitations, such as a relatively small sample size and a specific focus on patients with Osteoarthritic knee after TKR. Further research with larger sample sizes and broader patient populations would be beneficial to validate these findings and explore the potential benefits in other scenarios.
In conclusion, this comparative study suggests that a combined Quadriceps and Hamstring strengthening exercise protocol may be more effective in increasing the range of motion in the knee joint for patients with Osteoarthritic knee after TKR compared to using Quadriceps strengthening exercises alone. These findings have implications for postoperative rehabilitation strategies and could contribute to better outcomes for patients undergoing knee replacement surgery.

SUGGESTIONS AND LIMITATIONS

- ➢ This study was very short term and Therefore to make it morevalid long term is necessary.
- ➢ Since a study has been done with smaller number of subjects furthar studies should beconducted with large group of population.
- ➢ Further study can be done use more exercises and different techniques as well.
- ➢ Variation in climate, drugs, diet, personal habit, side of involvement, gender, age couldnot be controlled.

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