

Effect Of Extensor Muscle Strengthening In The Recovery Of Osteoarthritis Of Knee: A Case Series

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ABSTRACT

- Abstract-
- Osteoarthritis of Knee is a common degenerative condition that causes functional limitation and pain in the knee joint which compromises quality of life to greater extent. The most common manifestation in OA knee is Pain, Muscle weakness that causes decreased physical activity and result in negative health outcome. Early physical therapy intervention can delay the progression of disease and is vital to improve activities of daily living and quality of life In addition to the conventional Physical Therapy approaches including hamstrings, gluteus and lumbar extensors strengthening can improve overall outcomes in pain, walking, balance and activities of daily living. Present study aims to identify the role of extensor muscles strengthening in recovery of Osteoarthritis of Knee.
- Methodology and Procedure: Case series with experimental design.
- Outcome measures: NPRS for pain, Universal Goniometry for ROM and TUG Test for balance and muscle power.
- Results: 3 out of 5 patients showed significant improvement in knee ROM and 4 out of 5 patients showed significant reduction in Pain.
- Conclusion: It is proved that adding extensors muscle strengthening might improve pain , ROM and functional mobility in Knee Osteoarthritis patients.
- Keywords : Knee Osteoarthritis, Hamstrings strengthening, Extensors strengthening, TUG Test, Universal Goniometry, NPRS

CHAPTER I

INTRODUCTION

Knee osteoarthritis is identified by pain in the knee joint, deterioration of an articular cartilage, narrowing of the joint space and reduction in muscle strength¹. Degenerative osteoarthritis is a very common type of arthritis in the world and it is the major source of morbidity and functional restriction, it does occur very often in the elderly patients². Osteoarthritis is linked to individuals due to pain, decrease in range of motion, quadriceps and Hamstring dysfunction, and diminished proprioception². Moreover, knee osteoarthritis could be the reason behind the impaired ability of the quadriceps and hamstring muscle to control force in patients who is having osteoarthritis¹. Osteoarthritis is a progressive disorder that's why it will not resolve easily. Osteoarthritis is typically determined by chronic pain in the joint². Some evidence suggests that unnatural motion at the knee joint regularly leads to degenerative changes with decrease in the tibio-femoral rotation for a mechanism leading to the growth of cartilage degeneration. Even though pain is an indication of osteoarthritis that is present in almost all the classification criteria for osteoarthritis, there's usually harmony between reports of pain and radiologic osteoarthritis. It is suggested that harmony applies, particularly, into the less severe rates of knee osteoarthritis and this pain is more common in more severe grades of OA (1 and 2). The relationship between pain intensity and knee joint position sense is very essential for patients with osteoarthritis from the improvement of rehabilitation programs. Therefore, the aim of this study was to examine the effect of a physiotherapy

treatment program that is extensor muscle strengthening on moderate knee osteoarthritis with different grades of pain intensity. Osteoarthritis may be the next most common rheumatologic problem and it's by far the most frequent joint disease with an incidence of 22% to 39% in India. Nearly, about 45% of women over age 65 years have outward symptoms while 70% of those over 65 years have radiological evidence of osteoarthritis³. Osteoarthritis is of two types that is Primary osteoarthritis and secondary osteoarthritis. Primary osteoarthritis cause is not known, common in older peoples. Secondary osteoarthritis its cause is predisposing factors which cause injury to the joints, including previous infections, Rheumatoid arthritis, deformities and hyperthyroidism. Risk factors are older age, gender, obesity, joint accidents, genetics, bone deformity and general metabolic disorders⁴. In older age the possibilities of developing osteoarthritis increases. In gender women are more prone to develop osteoarthritis, even though its cause is not clear. Obesity carrying extra weight contributes to the greater risk of osteoarthritis. Higher weight adds strain to weight bearing joints, like hips and knees. In addition, fat tissue produces proteins which can result in harmful inflammation in and around the joints. In Joints, Injuries those which occur while playing sports or from an accident, can increase the risk of osteoarthritis. Even injuries that happened many years ago and apparently healed can improve your chance of osteoarthritis. Repeated stress over the joint. Even a sports you play which places repetitive stress over the joint, then this joint could ultimately develop osteoarthritis. In genetics few peoples inherit a tendency to produce osteoarthritis. In Bone deformities some individuals are born with malformed joints. In certain metabolic disease include diabetes and a state in which the body has too much iron (hemochromatosis).

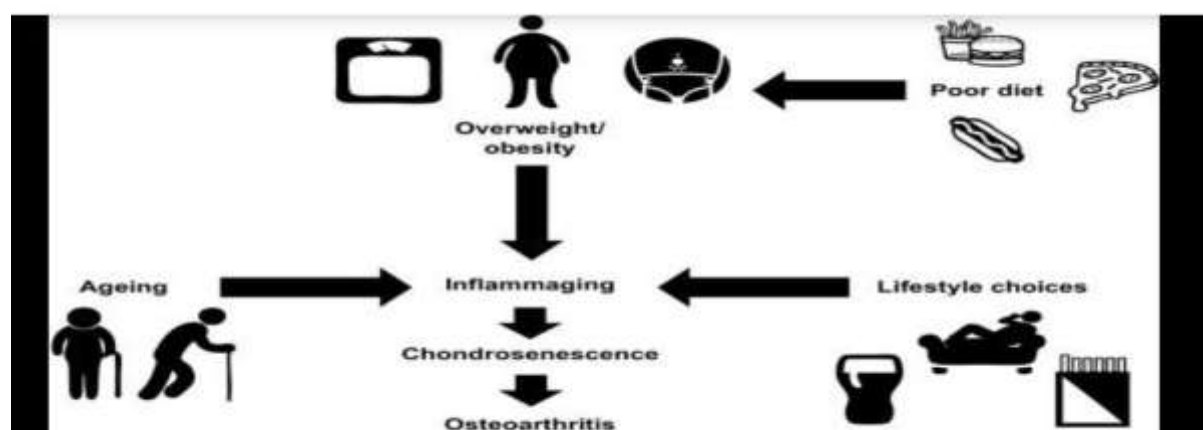


Fig: 1 Illustration of risk variables of osteoarthritis

Ref:6 <https://www.sciencedirect.com/science/article/pii/S1877065716300847>

Sign and symptoms of knee osteoarthritis are pain on movement, Stiffness, especially early morning stiffness, Loss of range of motion, pain after prolonged sitting or lying, Pain on the joint line, palpation, Joint enlargement, Knee stiffness, Crepitus, higher chance of fall, Reduce gait speed and sleep disturbance.

Pathophysiology of Osteoarthritis is traditionally defined as a “wear and tear” of articular cartilage and is a progressive disease which occurs usually as we grow older. In addition, recent research suggests otherwise. The pathogenesis of osteoarthritis is caused by articular cartilage degeneration and remodelling of bone because of an active response of chondrocytes in the articular cartilage and the inflammatory cells in the surrounding tissue. The releases of enzymes from these cells break down the collagen fibres and proteoglycans, destroying the articular cartilage. The exposure of the underlying sub-chondral bone results in apoptosis, followed by reactive remodelling changes that lead to the formation of osteophytes and sub-chondral bone cysts. The joint space is progressively lost over time.

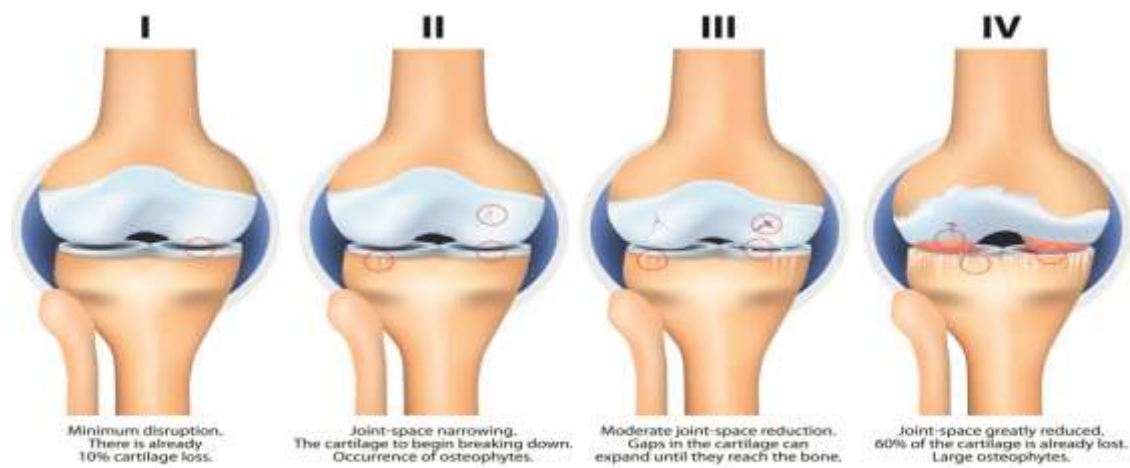


Fig No: 2 Sequence of degeneration in osteoarthritis.

Ref:7 <https://teachmesurgery.com/orthopaedic/principles/osteoarthritis/>

Complication of osteoarthritis, it is a degenerative disease that can worsen over time. Joint pain and stiffness can become severe. Some people are not able to work and perform the activities of daily living and may require joint replacement surgery.

Medical management: Osteoarthritis can't be reversed however treatments can decrease pain and helps the patients to move better.

Medications that can help in relieving osteoarthritis symptoms, primarily pain and swelling, include: Acetaminophen. Acetaminophen (Tylenol, others) was shown to help many people with osteoarthritis who have mild to moderate pain. Taking more than the recommended dose of acetaminophen may cause liver damage. Non-steroidal anti-inflammatory drugs (NSAIDs). Stronger NSAIDs are available by prescription. NSAIDs can lead to stomach upset, cardiovascular difficulties, bleeding problems, and kidney and liver damage. NSAIDs as gels, placed on the skin over the affected joint, have fewer side effects and may relieve pain just as well. Duloxetine (Cymbalta). Normally used as an antidepressant, this medication can be approved to treat chronic pain, including osteoarthritis pain.

Management the current management of osteoarthritis, which comprises both non-pharmacologic and pharmacologic modalities, is primarily targeted toward pain control and loss in operational limitation⁵.

Non pharmacological therapy education: Patient education, it is an important part of rehabilitation program, educate the patients for lifestyle modifications, weight control and maintaining good and healthy lifestyle.

Therapeutic Exercises in the past several decades, there are numerous studies that have demonstrated the efficacy of exercise and physical exercise for most those who have knee osteoarthritis. Although exercise and physical activity programs are shown to be beneficial the overall effects of the intervention have now been proven to give small to moderate effects at best for those who have knee osteoarthritis⁸. For instance a systematic review of the effectiveness of exercise for reducing pain, stress and improving mobility have been proved.

Exercise therapy, the exercise therapy will help in improving the joint mobility and decreasing the joint pain. Adding mild to moderate exercise protocol in daily routine will help in better outcome⁹. Strengthening exercise is generally recommended, which includes Calf Stretch, Straight Leg Raise, Quad Set, Seated Hip March, Pillow Squeeze, Heel Raise and Side Leg Raise using therabands and weight cuff. Patients with knee osteoarthritis are likely to have reduced muscle strength as a result of reduction in physical activity and pain inhibition¹⁰. Therefore including these exercises in rehabilitation program will in help in improving the muscle strength.

Manual Therapy Taping the knee, in particularly the patella is actually a physiotherapy treatment strategy recommended in the management of knee osteoarthritis by several clinical guidelines¹¹. Knee taping involves the application of adhesive rigid strapping tape to the patella and/or associated soft tissue

structures. The mechanism by which taping reduces pain is not clear, but may include changes in patellar alignment and improved function and activation of both the muscles¹².

Electrotherapy, it has been shown to reduce the intensity of osteoarthritis pain using the electrical modalities such as Ultrasound that helps in speed up and improve the quality of tissue healing and Transcutaneous Electrical Nerve Stimulation (TENS) have found to be an effective in treating the condition of osteoarthritis pain¹³.

CHAPTER II METHODOLOGY

PARTICIPANTS

All the participants were selected from the community with the age between 55 to 65 years including both the gender male and female with O.A in both the knees [B/L] . The inclusion criteria are the patient who are suffering with the OA knee, diagnosed and categorised with grade 3 of OA with the help of American college of rheumatology classification criteria, the patients who scores more than 5 points on NPRS has been included in the study. The exclusion criteria involves any systemic pathologies Dementia, Diabetes mellitus, any kind of knee surgery before 1 years , neurological conditions [stroke, multiple sclerosis, Parkinson, motor neuron disease, muscular dystrophy] , any fracture within last 6months and unstable heart conditions .

METHODS AND MEASURES:

The intervention focuses on the extensor group in which three muscles group were included that is Hamstring, Gluteus and lumbar extensors for this following exercises were prescribed.

- 1 Prone curls for Hamstring muscle

Prone Hamstring Curl



Fig:- 3 Prone hamstring curls

Ref:-

<https://www.northshore.org/healthresources/encyclopedia/encyclopedia.aspx?DocumentHwid=zm5028>

Patient position is in prone lying and therapist position is in walk standing. Ask the patient to bend the knee and pull their heel toward there buttock by keeping the thigh and hip on the mat. Stop when can't pull any more, and return back to the starting position.

Complete 10 repetition and 3 days per week for 4 weeks of duration.

2 Prone SLR for gluteus muscle



Fig: 4 Prone SLR for gluteus muscle

Ref: <http://healthmybabies.blogspot.com/2016/01/physiotherapist-and-knee-pain.htmlm=1>

Patients position prone lying and therapist position is in walk standing. Ask the patient to lie face down on the floor. Gently tighten the core muscles by keeping the abdominal muscles engaged, should still be able to breathe while doing this. Keeping the knees straight, slowly lift one leg up backward. Patient should keep the knee straight as while thigh lifts from the floor. Patient should hold the straight leg up in the air for two seconds, and then slowly lower the leg back to the floor. Be sure to not rotate the back or pelvis while lifting the leg. Perform the exercise slowly for 10 repetitions and 3 days per week for 4 weeks of duration.

3 Superman exercise for lumbar extensors



Fig:-5 Superman exercise for lumbar extensors

Ref:- <https://www.spotebi.com/exercise-guide/superman/>

Patient position in prone lying and therapist in walk standing, ask the patient to lie face down on the stomach with arms and legs extended while holding the neck in a neutral position. keep the arms and legs straight (but not locked), simultaneously elevate the arms and legs up toward the ceiling to form an elongated "u" shape with body — back arches and arms and legs lift several inches off the floor. Hold for few seconds and lower back down to complete one. Perform the exercise slowly for 10 repetitions and 3 days per week for 4 weeks of duration.

Complete session was of 40 to 45 minutes of duration

OUTCOME MEASURES:

1. ROM [universal goniometry]
2. PAIN [NPRS]
3. TIME UP AND GO TEST

GONIOMETRY: Range of motion of flexion is checked for knee joint both pre and post exercise. Patient position is in prone lying with leg extension.

Goniometer Placement:

AXIS LOCATION	STATIONARY ARM	MOVEMENT ARM
lateral epicondyle of the femur	along the femur to the greater trochanter	along the fibula to lateral malleolus

Table :- (1.1) Goniometer placement

Ref:- <https://www.physio-pedia.com/Goniometry: Knee Flexion>

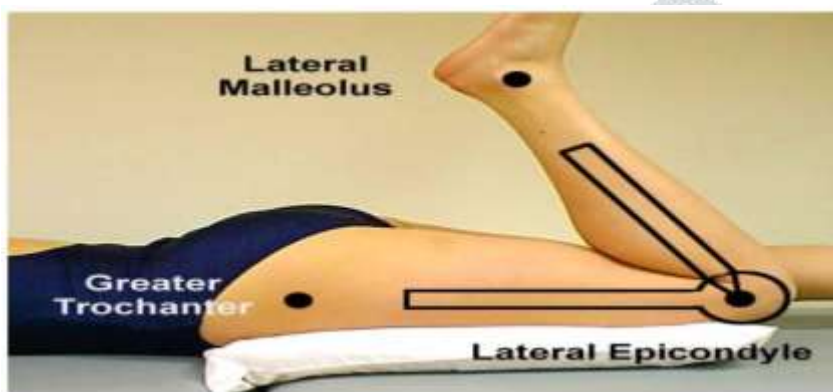


Fig 6: Knee flexion goniometry placement

Ref: www.scranton.edu

PAIN: Using NPRS [numerical pain rating scale] is a subjective measure for pain, in which individuals rate their pain on an eleven point numerical scale.

The scale is composed of 0 [no pain] to 10 [worst pain] markings.

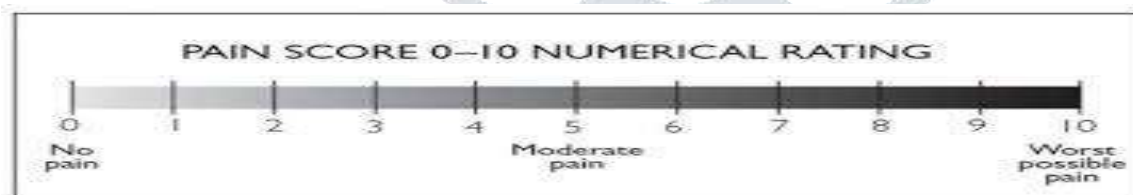


Fig:-7 NPRS SCALE

Ref:- https://www.physio-pedia.com/Numeric_Pain_Rating_Scale

TIME UP AND GO TEST: is a simple test used to assess a person mobility and it require both static and dynamic balance, it uses the time that a person takes to raise from a chair, walk 3 meters, turn around 180 degree , walk back to chair and sit down while turning 180 degrees.

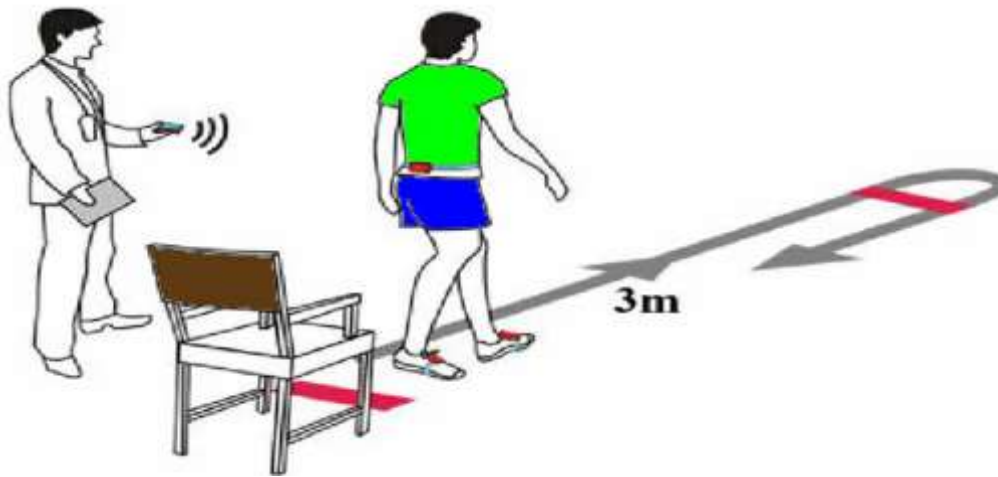


Fig:-8 Time up and go test.

Ref: <https://healthjade.net/timed-up-and-go-test/>

CHAPTER III RESULTS

A total of 5 patients of Osteoarthritis of knee were selected for the study. Out of 5 patients 3 were males and 2 were females. Mean age was 60.2 years

Patient	Age	Gender
Patient:-1	56 years	Female
Patient:-2	65 years	Male
Patient:-3	58 years	Female
Patient:-4	62 years	Male
Patient:-5	60 years	Male

n:- 60.2 years

Tab1.2: Mean age of patients

Rom knee flexion	Pre Test		Post Test	
	Right	Left	Right	Left
Patient 1	0 - 80	0-90	0-85	0-95
Patient 2	0-85	0-60	0-90	0-70
Patient 3	0-85	0-85	0-95	0-95

Patient 4	0-110	0-115	0-115	0-120
Patient 5	0-95	0-95	0-100	0-100

Tab:1.3 Range of motion of knee flexion pre and post test

Patients	TUG TEST (PRE) in sec	TUG TEST (POST) in sec
Patient 1	19.48	18.30
Patient 2	19.00	18.15
Patient 3	22.32	20.13
Patient 4	18.43	17.49
Patient 5	23.19	21.47
	PRE n:- 20.4	POST n:- 19.1
	VARIANCE:- 1.8	VARIANCE:- 1.35

Tab:1.4 TUG test pre and post

Patient	NPRS Test (PRE)	NPRS Test (POST)
Patient 1	6	4
Patient 2	5	2
Patient 3	7	5
Patient 4	4	3
Patient 5	8	5
	PRE n= 6	POST n= 3.8
	VARIANCE:- 2	VARIANCE:- 1.36

Tab:1.5 NPRS pre and post

PRE n:-91	PRE n:- 89	POST n:- 97	POST n :-96
VARIANCE :- 114	VARIANCE:- 379	VARIANCE:- 106	VARIANCE:- 254

CHAPTER IV

DISCUSSION

This study aims to find the effect of strengthening of extensor muscles in the outcome of OA knee. Hamstrings play a major role as antigravity muscle that helps to maintain leg straight. The weakness of hamstrings causes deformity and pain in the knee²¹. Impairment such as pain and joint deformity related to knee osteoarthritis which disturbs the knee biomechanics which may lead to change in walking pattern and hence can result in lack of muscle recruitment for walking and maintaining stability of knee.²²

The strengthening of extensor muscles reduce the pain, stiffness and improve mobility. It's been observed that many patients adapt for quadriceps strengthening and ignore hamstrings strengthening but the studies proved, better outcome can be achieved when both agonist and antagonist group of muscles are considered as they work in synchronous way²³. The goal of adding extensor muscles strengthening was to decrease the disability, pain and to increase the mobility around knee joint.

The study includes 5 participants of which 2 are female and 3 are male with mean age – 55 and the results were assessed by NPRS, TUG Test and Universal Goniometry, it's been observed that in all patient pain was reduced and all of them showed good improvement in walking, however 1 patient reported pain while squatting. Also, all of the patients reported increase in mobility and stability of knee as recorded on TUG Test earlier patients were taking more time to walk 3m due to pain and decreased mobility. 3 out of 5 patients reported increased knee flexion by 05°- 10° and rest it was increased 10°- 15°

Inclusion of extensors strengthening correct the line of forces and decrease compressive loads on the knee and hence reduction of pain.²⁴

Inclusion of gluteus strengthening exercises improves the ability to stand up from the chair due to increased muscle power, increase in overall hip strength results in decreased knee adduction moment due to reduction in contra lateral pelvic drop and increment in medial knee joint stabilization and hence reduction of compressive loads similarly inclusion of hamstring and lumbar strengthening improves the ability to walk faster due to increase in balance and co-ordination.²⁵

Patients with knee Osteoarthritis suffers with lesser knee flexors strength. It has been found in the gait studies that individuals having knee OA show less than normal knee flexion. Inclusion of hamstring strengthening exercises increases knee flexion range by providing enough strength to the muscle to bend the knee, as compared to Quadriceps strengthening alone²⁶. Several muscle groups support the knee. The two main muscle groups that control knee movement and stability are the quadriceps and the hamstrings. The quadriceps and hamstring muscles have the potential to provide dynamic frontal plane knee stability because of their abduction and/or adduction moment arms²⁹. Using a neuromuscular biomechanical model, the quadriceps and hamstring muscles not only have the potential to support frontal plane moments but also provide support to abduction-adduction moments²⁹.

Inclusion of lumbar extensors strengthening especially paraspinal muscles which maintains the kinetic chain of back and knee and redistribute the weight across back and knee²⁷, as weak paraspinal muscles causes change in the posture, to compensate weak back an individual finds ways to adjust the posture or

gait to relief pressure²⁸.The problem arises as the individual take the pressure off from the back, the whole weight is applied to the knee.

CHAPTER V CONCLUSION

As overall conclusion, this study mainly focuses on strengthening the different muscles to lower the impact of disability and increase the mobility .As a result this shown that strengthening of the extensor muscles [hamstrings, gluteus and lumbar extensors] has appear to be beneficial for improving subjective knee pain, range of motion and exhibit a downward trend in limitation of activities of daily living of patient who are suffering with knee osteoarthritis.

As this study was done with the small sample size, in coming time this study can be done with large sample size.

Conflict of Interest: No conflict of interest

Source of Funding: No

Ethical clearance: Board of Ethical committee, LPU, Phagwara, Punjab

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