



STRENGTHENING EXERCISES IN PERSISTENT KNEE PAIN FOLLOWING TOTAL KNEE ARTHROPLASTY: A CASE STUDY

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ABSTRACT

Osteoarthritis has been the major cause of knee pain in the society from long. Although patients are taking medicines, still they are facing knee pain a lot. Total knee arthroplasty is the only measure to deal with these painful situations. An adverse effect of total knee arthroplasty is persistent knee pain. Therefore study are to analyze and treat that muscular imbalances causing painful knee after total knee arthroplasty. In this study data from single case, 64 years old female, was used in physiotherapy clinic. She was having persistent knee pain after total knee arthroplasty. That was not resolved 34 months after surgery. She felt knee pain constantly and it became aggravated during any stressful or weight bearing activities. Patient was assessed and analyzed for having cause of their knee pain. Muscular and other dysfunctional issues were found at the time of assessment. Resultant mechanical changes led to the mal-alignment and instability of knee joint. In this study, some physical therapeutic approaches were applied. Patient got relieved after physical treatment up to the mark. Thus adequate physical evaluation of patient's related problems before treatment is mandatory. Furthermore other mechanical causes also need to be analyzed. These factors can be used to help in reduce the incidence of persistent pain after total knee arthroplasty. If actual physiotherapeutic applications are applied on the basis of clinical findings regarding biomechanical changes, these biomechanical abnormalities could be treated with ease. Thus unnecessary revision surgeries could be avoided for knee pain after total knee arthroplasty. Therefore overloading of healthcare system might be reduced. And excessive financial burden over the society can be avoided as well.

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INTRODUCTION

Total knee arthroplasty has demonstrated superior efficacy in terms of pain relief and functional improvement and 10 years survival rates of the surgical procedures have been replaced to be $\geq 90\%$. [1] A TKA with instability is one in which the supporting soft tissue have failed or unable to function due to component size and/or position. Instability following TKA can lead to need for surgery in 10-20% of revision cases. Patient may complain of give way, difficulty in climbing stairs and knee buckling under stress. Physical findings may include soft tissue tenderness, recurrent joint stiffness and joint laxity. [2] According to literature satisfaction rate may vary between 75 and 89%. Within the first five years after primary implantation, the revision rate is 2.8% and rate of reoperations without exchange of component is 4.3%. [3] A painful TKA cause a lot of medical, social and legal problems and long term survival is about 60 - 80% of all revision surgeries.

They causes financial burden as well and main reasons for surgeries are infection, polyethylene wear, aseptic loosening and instability. [4, 5]

In society number of clients has been found suffering from this type of problems and there in no clear cut solution for that. They have chronic/persistent knee pain post TKA. And for this number of reasons are presented by researchers. One of the most probable cause is muscular imbalance\functional or dynamic problems. Other reasons are mechanical such as misalignment and loosening of implants after TKA. [3, 4] Patients have taken a lot of conservative treatments and revision surgeries but are unsatisfied. [4] They could be treated by using some exercises adequately to improve muscular performance. In that each case is different from others, the way of treatment should be changed for each and every case.

Few case studies have been done to solve this type of problems. But there is still a need to improve or manage these problems with the help of physical interventions in a better way to provide satisfactory results. Therefore this study has

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highlighted how to face these scenarios concerning persistent painful knee post TKA.

MATERIALS AND METHODS

Report of case

The patient having persistent knee pain was 64 years old male who had come into physical therapy department. He had received TKA both the knee before 34 months. He had been walking with very difficulty using a stick while entered in department. He would feel continuous pain while he used to try stand up from sitting or climb up or down stairs. But later on pain gets decreased gradually up to some extent.

Examination and evaluation

Patient explained that pain as moderate in both the knees was 5/10 on vas scale. As he started to walk, pain became severe and it was 7/10 on vas scale. Client was having difficulties with ADLs. He was 30/80 on lower extremity functional scale (LEFS). His main objective was to return to the life pain free. His knees were looking good without redness, swelling and edema. Incision site was in good condition as well. He had 110° range of motion at both knees pain free. On the basis of patient’s history and observation following specific physical tests were performed to assess the patient’s clinical condition-

Table 1 Clinical assessment

| s. n. | Test | Reason | Response/findings |
|-------|----------------------------------------------------------------|-------------------------------------------------|--------------------------------------------|
| 1. | Varus/lateral stress in 0° and 20 to 30° of knee flexion | To determine lateral instability | Negative in both ranges |
| 2. | Valgus/medial stress | To determine medial instability | negative |
| 3. | Lachman test in 0°, 30 to 45° of knee flexion | To determine anterior knee flexion instability | Positive only in 30 to 45° of knee flexion |
| 4. | Sitting anterior drawer in 90° of knee flexion | To determine anterior knee flexion instability | positive |
| 5. | Posterior drawer test in 0°, 30 to 45° and 90° of knee flexion | To determine posterior knee flexion instability | negative |
| 6. | Craig’s test for hip anteversion or retroversion | To determine degree of misalignment | negative |

Tests’ procedure

1. Varus stress test (Magee, 2009) [16] -- this test was first done with the knee in full extension and then with the knee in 20 to 30° of flexion. Patient was taken in to supine position with one hand on ankle to stabilize it and other on medial aspect at the knee pushing laterally. There was no excessive gap at lateral aspect of knee.
2. Valgus stress test (Magee, 2009)[16] --this test was first done with the knee in full extension and then with the knee in 20 to 30° of flexion. Patient was taken in to supine position with one hand on ankle to stabilize it and other on lateral aspect at the knee pushing medially. There was no excessive gap at the medial aspect of knee.
3. Lachman test (Magee, 2009) [16] -- in this patient was in supine position. And patient’s knee was hold in full extension, 30 to 45° in flexion. Patient’s femur was stabilized with one hand while the proximal aspect of tibia was moved forward with the other. Then soft end feel was found.

4. Sitting anterior drawer test (Magee, 2009)[16] --Patient was in sitting position with the leg hanging relaxed over the examining table. By placing the both hand around the tibia, pulled tibia forward slowly. Then excessive anterior shift was found.
5. Posterior drawer test (Magee, 2009)[16] -- Patient was in supine position with hip and knee flexed to 90°. And lower leg was supported between the examiner’s trunk and forearm. By being placed the both hand around the tibia, it was pushed backwardly on the femur. Then no excessive movement was found.
6. Craig’s test(Magee,2009) [16]-Patient was in prone with knee flexed to 90°.And posterior aspect of greater trochanter of femur was palpated. Then passively hip was rotated medially and laterally until the greater trochanter was parallel with the examining table or reaches its most lateral position. The degree of ante version was then estimated, based on the angle of lower leg with the vertical. This angle was found 18°.Michael T Cibulika *et al*,[12] stated that in adults without pathology, the femur is twisted so the head and neck of femur are angled forward between 15 and 20 degrees from the frontal plane of the body.

Table 2 Manual muscle testing (MMT)

| S. n | Muscles | Grade(left side) | Grade(right side) |
|------|-----------------------|------------------|-------------------|
| 1 | Knee extensors | 3 | 3 |
| 2 | Knee flexors | 4 | 4 |
| 3 | Hip abductors | 3 | 3 |
| 4 | Hip adductors | 5 | 5 |
| 5 | Hip flexors | 5 | 5 |
| 6 | Hip extensors | 3 | 4 |
| 7 | Hip external rotators | | 4 |
| 8 | Hip internal rotators | 5 | 5 |

This method involves testing key muscles from the upper and lower extremities against the examiner’s resistance and grading the patient’s strength on a 0 to 5 scale.

Radiological examination



Fig 1 pre-surgery Xray

Pre surgery AP (anteroposterior) and LAT (lateral) radiographs were showing osteoarthritic changes with mild subluxation of tibia over femur laterally, with no medial gap in both knees.



Fig 2 post surgery X ray

And post surgery AP and LAT views were looking aligned with medial and lateral gaps maintained. Although subtle changes could not be detected with these radiographs such as mild implant loosening after surgery. A study by Carlos higuera *et al*, [15] reported that in clinical practice early loosening is very difficult to diagnose on x-ray. And diagnosis becomes clearer only upon follow-up x-rays.

Clinical findings: following completion of initial examination and evaluation, patient's current impairment included-

1. Pain in both the knees
2. Both lower extremity weakness
3. Instability in both lower limbs.
4. Decreased weight bearing status in both limbs during ambulation and transfer

Examination and evaluation showed, patient was in good condition for therapy sessions.

Interventions

1. Consent form was get signed by patient to initiate physical treatment.
2. Total 12 weeks treatment was provided on daily basis.
3. Patient received physical therapy one time per day at 20 minutes sessions (10 minutes for each limb) continuously for 12 weeks.
4. 40 repetitions were given for each impaired muscle group (knee extensors, knee flexors, hip extensors, hip abductors and external rotators) in which 20 isometric and 20 dynamic contractions with an interval of 2 minutes.
5. Side to side rocking exercises was provided in standing with hand placed over both the pelvis to stabilize it, to improve the hip abductor strength under consideration.
6. Squatting exercises started with initial 5° knee flexion and gradually increased up to 30 to 90° of knee flexion.
7. About prescribed exercises patient was taught to gain effective results after treatment.
8. During or post exercise pain was managed by application of ice at both the knee joints.
9. To overcome problem with walking (waddling and stiffed gait), specific gait training program had been included.
10. Patient was instructed to do home exercise program (HEP) once daily and some written materials and pictures was also given to help patient and caregiver in case of forgetting the exercises.

During overall treatment procedure, quadriceps and gluteus medius and minimus had been on greater vigilance.

Measurement tools

During this study three different measurement tools were used:

1. **Visual analog scale (VAS):** [11] VAS is a pain rating scale¹⁻⁹ first used by Hayes and Patterson in 1921. scores are based on self reported measures of symptoms.
2. **Lower extremity functional scale (LEFS):** [14] LEFS is a 20 item condition specific questionnaire LEFS scores range from 0 to 80 points, with higher score representing higher level of functioning.
3. Medical research council (MRC) system; [13] .

Outcomes

Patient was treated in clinic daily. A total of 76 sessions were given over 12 weeks, along with this proper education was provided to do home exercise program. His persistent knee pain was reduced to 0/10 on vas scale both the sides. His

muscles' strength was improved up to 5/5 on MRC grading system including quadriceps. Sitting anterior drawer test and Lachman tests were found negative after completion of treatment. Thus stability and muscular balance between opposite muscles group had been achieved on both sides.

Following 76 sessions of treatment patient had no pain on both the knees and could walk independently without any signs of difficulty. He improved his LEFS score from 30/80 to 80/80. Patient stated that he could walk easily without pain. And he was fully satisfied with physical treatment. How it become possible? Patient said.

DISCUSSION

Knee pain following TKA is mostly found. It has demonstrated efficacy in terms of pain relief. However, 15 to 30% patients present persistent pain after TKA. The source of pain following TKA is difficult to find. [1, 8] This might be due to muscular imbalance and mechanical reasons. Muscular imbalance could be due to muscles weakness. Studies have demonstrated that poor management of acute pain after TKA strongly related to development of chronic pain following TKA. [10] And revision surgeries conducted without identifying a specific reason carries a high risk of failure. Therefore this study was aimed at identification and treatment of subtle underlying cause of persistent knee pain after TKA.

Other studies suggested that evaluating the pain characteristics along with medical history and physical examination would be helpful in deciding the persistent knee pain after TKA. Similarly WikkiWylde *et al.*, [9] reported that in both clinical and research settings the approach to assessing chronic knee pain after TKA needs to be in depth and multidimensional to understand the characteristics and impact of this pain. This could be managed by early detection and targeted treatment. This study was performed to treat the persistent knee pain following TKA. That might be due to functional or dynamic causes which were treated with some strengthening as well as stabilizing exercises. Muscular imbalance could be due to surgical procedure which inhibited the muscle's performance. A study by Wolf Peterson *et al.*, [3] emphasized that cause of knee pain is multifactor's. In this study strength of impaired muscles including quadriceps, gluteus medius and gluteus minimus were improved by strengthening exercises. This could be the cause of improved stability of both knee joints. Further this could lead to decreased pain in both knees. Simon Donell *et al.*, [6] described that quadriceps muscle have important role in patella-femoral tracking. This improves the efficiency of extensor forces. In turn, they improved the stability at the both knee joints.

In this study knee joint instability was demonstrated which might be due to joint laxity. This might be due to muscular weakness. This would be the cause of subtle misalignment. In turn, these mechanical disturbances would lead to intractable knee pain after TKA. A study by Jeffery Charian *et al.*, [7] stated that proper alignment of TKA aids to balance the forces transmitted through the soft tissue envelop, which is crucial for suitable firing of the joint. If they are poor aligned this can result in poor functional outcomes and early failure lading to component loosening. But this subtle component loosening is difficult to evaluate even with radiography, leading to joint instability. This also might be the cause of persistent knee pain after TKA.

Alberto Momoli *et al.*[8] suggested that instability is often in association with pain because of abnormal stress discharge on the knee. Knee flexion instability in sagittal plane causes over stress upon anterior cruciate ligament and posterior cruciate ligament. This further might be the cause of persistent pain after TKA. In this study flexion instability (in 30°) was found while performing Lachman test and in 90° while performing sitting anterior drawer test. This would be another cause of persistent knee pain following TKA. A study by moon chang *et al.*, [1] reported that the instability can be attributed to neuromuscular pathology: Recurvatum is predisposed by quadriceps weakness and medial thrust, by hip abductor weakness. This will lead to over stress upon soft tissue. This will in turn, lead to persistent knee pain after TKA.

Knee pain and instability are demanding, they could be treated by physical therapy with proper identification of pathology through physical testing.

Limitations

Further research is needed to investigate the other causes of instability to minimize the impact of knee pain after TKA.

CONCLUSIONS

Despite improvement in TKA procedure, painful knee after TKA is adverse outcome. To ensure that optimal care is provided to the patients, clinical effectiveness of individualized or multidisciplinary approach should be evaluated. Targeted interventions should be provided for identified problems. All the associated factors, which may cause pain, should be considered during interventions. By which revision surgeries could be avoided. Thus financial burden may be reduced.

Conflict of interest

Authors declare no conflict of interests.

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Appendix

TKA-total knee arthroplasty, VAS-visual analog scale, LEFS-lower extremity functional scale,

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