Medical Science

pISSN 2321–7359; eISSN 2321–7367

Physical therapy rehabilitation in patient with post ACL reconstruction

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To Cite:
Riya Bansal, Deepak Jain, Deepali Patil, Pratik Phansopkar, Mohit Dadlani. Physical therapy rehabilitation in patient with post ACL reconstruction. Medical Science, 2022, 26, ms257e2223.
doi: https://doi.org/10.54905/disssi/v26i124/ms257e2223

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Peer-Review History
Received: 08 April 2022
Reviewed & Revised: 11/April/2022 to 23/June/2022
Accepted: 24 June 2022
Published: 29 June 2022

Peer-review Method
External peer-review was done through double-blind method.

URL: https://www.discoveryjournals.org/medicalscience

ABSTRACT

Background: There are four major ligaments around the articulation of the knee. The ligaments of the knee help to keep the knee stable. Each ligament has a specific purpose in maintaining appropriate knee stability. The anterior cruciate ligament (ACL) runs from the femur to the tibia and is made up of dense connective tissue. The Anterior cruciate ligament is indeed a critical feature of the knee complex since this resist's patellofemoral translation and rotational pressures. The PCL is the human knee's strongest and largest intra-articular ligament, and it functions as the knee's principal posterior stabilizer. The anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL) are twin structures seen in the knee. (PCL) multi ligamentous injuries are infrequent but devastating injuries. They usually result in functional impairments and additional procedures. The treatment of ACL and PCL tear can require either surgical or conservative treatment. Following is the case of 22-year-old male who was diagnosed Right knee ACL tear, PCL tear and MCL injury after an RTA The patient undergone a series of investigations after which he was intervened with an arthroscopic reconstruction surgery of ACL, MCL and PCL. Physical therapy rehabilitation was started on post-operative day one. A specific protocol for exercise treatment was established which was divided in weeks. *Conclusion:* The case report is suggestive of the improvement of the functional goals after physiotherapy rehabilitation.

Keywords: ACL, PCL, arthroscopy, reconstruction, physiotherapy rehabilitation.

1. INTRODUCTION

Physicians treating knee injuries, particularly the uncommon and more morbid multi ligamentous knee injuries, must have a solid grasp of knee ligament anatomy and biomechanics (Anderson et al., 2018). The anterior cruciate ligament (ACL) is a tough fibrous tissue which extends first from femur towards the tibia. The ACL is an essential part of the knee joint since that opposes anterior tibial translation and rotational loads (Gaur et al., 2021). The ACL (PLB) is separated into two sections: the anteromedial loop (AMB) and the posterolateral bundle (PLB). They are not static, with the key differentiator indicating that throughout flexion, the AMB lengthens while the

PLB compresses (Duthon et al., 2006). The ACL's complex ultrastructural framework and sophisticated flexible boarding process it to endure multiaxial loads and fluctuating tensile strains. The ACL is innervated by the posterior articular segments of the tibial nerve, whose are vascularized by branches of the intermediate genicular artery. Injuries to the anterior cruciate ligament (ACL) among athletes under the age of 18 have increased (Hassebrock et al., 2020). Higher BMI, overpronation of the subtalar joint, generalised ligamentous laxity, and reduced neuromuscular regulation of knee motion are all intrinsic risk factors for ACL damage (Bele et al., 2021).

ACL injuries frequently necessitate surgery and/or months of therapy. In contrast to anterior cruciate ligament (ACL) injuries, impairment from isolated posterior cruciate ligament (PCL) injuries varies from little hindrance in daily activities to functional impairments (LaBella et al., 2014). PCL injuries are much more common in high-energy vehicle collisions, but injuries in low-energy trauma, such like sports, are less severe. Despite the fact that currently employed conventional methods typically achieve low efficiency in regaining ligament integrity, previous therapeutic reconstruction in knees with simultaneous PCL and posterolateral instabilities gave the best clinical results and a high percentage of patient satisfaction (Wang, 2002). Meniscal root tears are a subtype of meniscal injuries that typically result in major knee joint abnormalities. They are less prevalent than meniscal body rips and sometimes go unnoticed (Bhatia et al., 2014).

The meniscus root attachment helps meniscal function by stabilising the meniscus and allowing for optimal shock-absorbing performance in the knee. The biomechanics and kinematics of the knee are altered, and the tibiofemoral contact pressure is greatly increased (Hassebrock et al., 2020).

2. PATIENT INFORMATION

Patient was apparently alright 8 months back when while travelling on his motorbike he lost balance and fell from bike sustaining injury to right knee. Immediately He was rushed to a private hospital after the crash so because discomfort in his right knee became so intense that he couldn't move on his legs. where his x ray rt knee ap lateral view was done along with MRI rt knee and was diagnosed as a case of Right knee ACL tear, PCL tear and MCL injury and was given a long knee brace. He then went to GMC Nagpur for the same, where he was advised surgery but asked to wait for days. So, he came to AVBRH for further management. Then he underwent arthroscopic surgery for ACL and PCL repair right knee. Then the patient was referred for physiotherapy after surgery

3. CLINICAL FINDINGS:

The patient was seen supine lying, while he was explained about the physical examination and the investigations, he was conscious, cooperative and well oriented to time, place and person, with stable vitals and no signs of cyanosis, icterus, clubbing, and oedema. There was no positive finding son neurological evaluation, all sensations were intact. Patient was examined in supine position, on observation scar mark of 5cm incision over lateral aspect of right distal leg, just above the lateral malleolus, and RJ bandage compression was present over right knee with no presence of oedema and muscle wasting, no obvious bony deformity seen. On palpation, local temperature was slightly raised, bony tenderness of grade 4 was present around the operated site i.e., right knee joint.

Range of Motion

Movement of right knee was painful and limited. The movements of the opposite leg were full and functional (Table 1). The muscle strength was evaluated which is mentioned in the Table 2. Time line is mentioned in table 3.

Right knee

Pain on VAS: 8/10 pre op; No Limb length discrepancy

Special test: MacMurray's test positive for medial meniscus, Lachman test positive

Pre-operatively - Lower extremity functional scale score: 35/80

Table 1 Pre rehab ROM

JOINT	MOVEMENT	LEFT	RIGHT
Hip	Flexion	0-80	0-50
	Extension	0-20	0-10
Knee	Flexion	0-130	0-60

Ankle	Dorsiflexion	0-30	0-20
	Plantarflexion	0-20	0-10

Table 2 Manual Muscle Testing: Pre-Operative

Muscle group	Grades
Hip flexors	Grade 3+
Hip extensors	Grade 3
Hip abductors	Grade 3
Hip adductors	Grade 3+
Knee flexors	Grade 3
Knee extensors	Grade 3+
Ankle plantar flexors	Grade3+
Ankle dorsiflexors	Grade 3+

Table 3 Timeline

Date of RTA	18/02/2021
Date of visiting AVBRH	07/03/2021
Date of Investigations and imaging	08/03/2021
Operated on	11/03/2021
Physiotherapy rehab started on	12/03/2021

Diagnostic assessment

X RAY right knee ap lateral view showed (fig.1) displaced medial tibial plateau fracture.

MRI right knee done on 18/02/21 showed near complete ACL tear, high grade tear of PCL, tear in posterior horn of medial meniscus, high grade medial collateral ligament tear. Routine investigations of CBC, RBS, LFT, KFT, HHH, PT-INR, BLOOD GROUP were done.

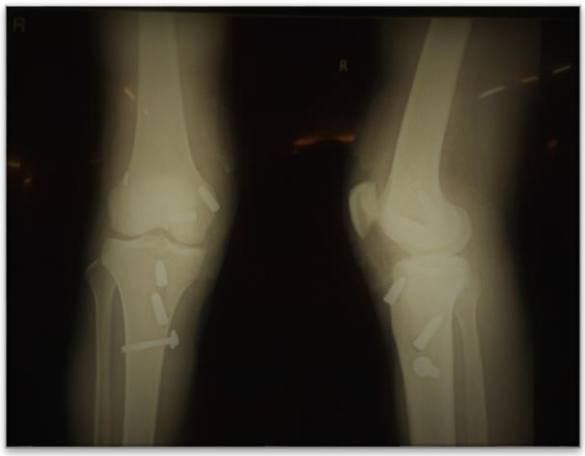


Figure 1 Post-operative X ray rt knee

Figure 2 post-operative sutures

Management

Operative management

Arthroscopic anterior cruciate and posterior cruciate ligament is reconstruction in right side. The standard arthroscopic portals approach was used (Fig 2). A 5 cm incision was taken over lateral aspect of right distal leg, just above the lateral malleolus. Tibia and femoral tunnel in lateral femoral condyle made for ACL reconstruction. Endo button loop 15mm was used in femur graft, inserted and fixed with interference screw 10*25 mm in tibia. RJ bandage compression applied and long knee brace was given.

Physiotherapy management

The rehabilitation consists of instructions to the patient, Configuration, freezing, joint mobility retraining, muscular strength and conditioning, gait re-education, neuromuscular component preparation, and proprioception education are all possibilities. The therapeutic approach for the above case is mentioned in table 4.

Table 4 Physiotherapy management

SHORT TERM GOALS	LONG TERM GOALS
Patient education	Patient and family education
Reduce pain and swelling.	Promote ambulation.
Promote early mobility.	Static and dynamic balance.
Increase strength.	Independent ADLs
Increase range of motion and maintain it.	Ergonomics
Enable patient to carry out the ADL'S independently.	Improve overall quality of life.

Treatment

PHASE 1 (0 to 4 weeks)

The patient was educated regarding the surgery, post-surgical complications and the importance of physical therapy. To reduce pain the patient was instructed only non-weight bearing walking. He was advised to wear the knee brace for stability and keep pillows below his feet. Bed side sitting and positioning was also advised to the patient along withupper limb strength training for shoulder and elbow muscles using minimum weights (Fig 3). To increase lower limb mobility and strength: Continuous active assisted movement of hip and knee, SLR up to 30 degrees with 5 seconds hold and ankle pumps. Electrical stimulation for contraction and heel slides of both lower extremities were given (Fig 4). To improve cardio respiratory functioning, patient was taught purse lip breathing and thoracic expansion exercises to prevent any post-surgical chest complications and enhance lung capacities. Faradic stimulation was given to prevent muscle wasting.

Figure 3 Patient with Upper limb Strengthening

Figure 4 patient performing heel slides: rt knee

PHASE 2 (4 to 8 weeks)

Mobility to increase functional independence: ambulatory training was initiated with bedside standing to check patient response then gradually progressed to walking around the bed and in the corridor (Non weight bearing with walker) under pain tolerance. To further increase ROM of knee and hip joint: Continuous passive movements, active ROM exercises, active assisted SLR 30 with brace on was performed. To strengthen lower limb muscles patient was given dynamic quadriceps, ankle pumps, static glutei, Static hamstrings, calf stretching. Proprioceptive neuromuscular functioning techniques for hamstrings were taught. Upper limb strengthening exercises with weights. Static cycling and continuing breathing exercises was performed as well regularly.

PHASE 3 (8 to 24 weeks)

The following treatment was planned in third phase: bracing only for stressful activities with AROM with maximum range. Flexion to maximum range and terminal extension without weight .SLR up to 60 degrees with 10 secs hold and ankle pumps. B/L closed and open chain exercises between 45-90 degrees; PNF, tubing after 12 weeks and static cycling, aquatic therapy after 20 weeks.

Isokinetic exercises within 90 to 45 degrees of range. Continue ambulation with walker around the corridor; Thoracic expansion and pursed lip breathing exercises.

PHASE 4 (6 to 9 months)

Brace on while performing activities. Full ROM of bilateral lower limbs; Unilateral Closed chain exercises and leg press (0-60degrees). Jogging and running after 22 weeks along with Skill training. Breathing exercises were continued. Exercises to increase strength, endurance and balance like cycling, jogging, and backward brisk walking for improving hamstring functioning. Isokinetic test at 24 weeks and later the patient was expected to return to full competitive activities at 9-11 months.

Post-operative VAS: 4/10

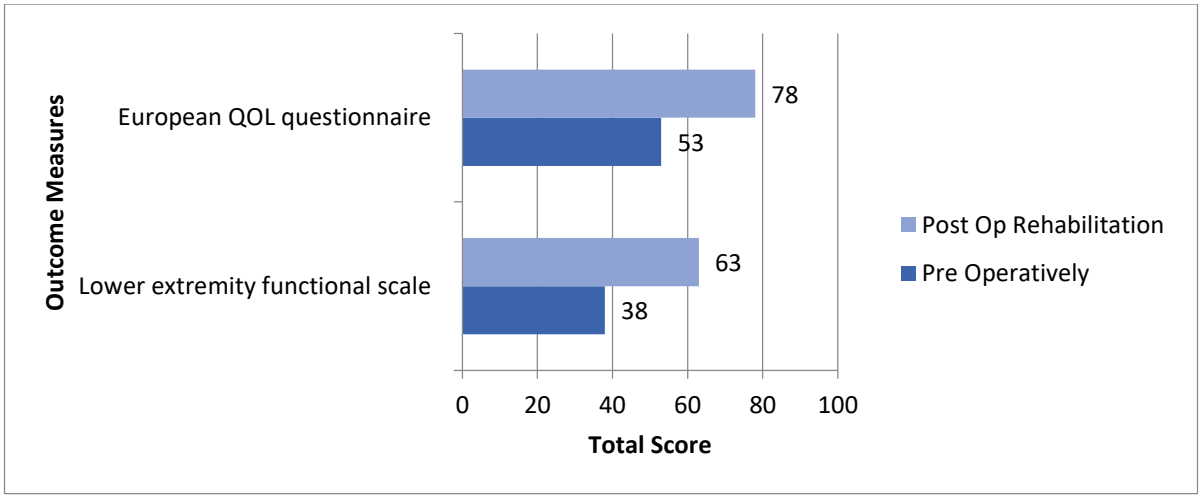
Post-Operative rehabilitation and outcome measures are mentioned in Table 5A and B and graph 1.

Table 5 A Post rehab ROM Assessment

JOINT	MOVEMENT	LEFT	RIGHT
Hip	Flexion	0-100	0-80
	Extension	0-20	0-15
Knee	Flexion	0-150	0-90
Ankle	Dorsiflexion	0-30	0-25
	Plantarflexion	0-20	0-20

Table 5 B Manual Muscle Testing: Post-Operative rehab

Muscle group	Grades
Hip flexors	Grade 4
Hip extensors	Grade 4
Hip abductors	Grade 3+
Hip adductors	Grade 4
Knee flexors	Grade 3+
Knee extensors	Grade 4
Ankle plantar flexors	Grade4
Ankle dorsiflexors	Grade 4+



Graph 1 Outcome measures

4. DISCUSSION

Knee soft-tissue injuries, primarily involving the acl injury (ACL), medial collateral ligament (MCL), and menisci, occur prevalent, and recuperation required extensive and prolonged physiotherapy post non-surgical or operative treatment (Dragicevic-Cvjetkovic et al., 2014). The use of a rehabilitative schedule that relates to the operating process which results in the highest postoperative

efficacy and improved function of patients compared with pre levels of productivity. The perks of the rehabilitative regimen lead to a significant increase in the diameter of the quadriceps muscle and a speedier functional improvement for clients who have had their ACL reconstructed (Eitzen et al., 2010). The innovative rehabilitation program's efficacy allows for a faster restoration, permitting for a speedier comeback to social, sports, and professional activities.

Blood flow restricted training has been it has been confirmed to be similarly effective and safe in boosting quadriceps muscle strength among patients who have deficits. Short-term vascular occlusion and gentle strength exercises are usually safe following knee surgeries (Barber-Westin and Noyes, 2019). Nerve activity, when paired with typical rehabilitation services, has the potential to significantly ensure high functional capacity following surgery (Imoto et al., 2011). Quick incremental exercise treatment programs are quite well absorbed and should be utilized in early Ligament recovery to improve knee function preparatory to Arthroplasties or as a first step of perioperative management. Physiotherapy can allow you to keep physical mobility while somehow increasing the quality of life (Peultier-Celli et al., 2017).

5. CONCLUSION

Injuries of ACL and PCL and soft tissues are very common. The treatment can be conservative or surgical. In both cases, physiotherapy plays an essential role in increasing the functional independence, increasing joint mobility and gaining muscle strength. Planning and intervention resulted into improving the functional goals progressively.(Table 4 A,B) A set of exercise program was followed which led to increased muscle power, increased active range of motion and reduction in pain while knee movements. Exercises like knee bending, co-contractions, AROM, closed chain exercises were of significant results. We conclude that a well-planned physical therapy programme combined with suitable ergonomic advice and medicine has reduced discomfort, increased muscle ROM and strength. It enhances patients' overall quality of life.

Acknowledgement

We thank the participants who were all contributed samples to the study.

Author contribution

Dr. Pratik Phansopkar proposed the case. Dr Deepali Deshpande and Riya Bansal planned and designed the case report. Riya Bansal prepared the report. Dr. Mohit Dadlani and Dr. Deepak Jain contributed in planning the post-surgical treatment protocol and pictures. The final case was inspected and authorized for publication by Dr. Pratik Phansopkar.

Informed consent

Written and oral informed consent was obtained from the patient included in the study.

Funding

This study has not received any external funding.

Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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