

Multimodal Physiotherapy Treatment Following Supracondylar Fracture of the Femur: A Case Report

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ABSTRACT

Background: Intercondylar comminuted supracondylar femur fractures can cause postoperative pain, stiffness, restricted ROM, muscle weakness, and impaired mobility. Prolonged immobilization may worsen these limitations. Consistently physiotherapy can improve knee mobility, strength, balance, gait, and functional independence following ORIF with bone grafting and MUA.

Objective: To evaluate the effectiveness of progressive physiotherapy rehabilitation on postoperative knee stiffness, pain, range of motion, muscle strength, gait, and functional independence following ORIF with bone grafting and manipulation under anesthesia

Case description: A 20-year-old male sustained a comminuted left distal femur fracture following a road traffic accident. He underwent ORIF with a locking compression plate, followed by bone grafting and manipulation under anesthesia due to persistent postoperative knee stiffness. Initial assessment demonstrated severe pain (NPRS 9/10), active knee flexion of 30°, passive knee flexion of 45°, quadriceps and hamstring strength of Grade 2+, and poor functional status (LEFS 28/80).

Intervention: The patient underwent an individualized 9-week progressive physiotherapy rehabilitation program consisting of cryotherapy, patellar mobilization, active-assisted ROM exercises, CPM, Mulligan and Maitland mobilization, muscle energy techniques, scar mobilization, dry needling, cupping therapy, paraffin wax therapy, progressive resistance strengthening, lower-limb stretching, balance and proprioceptive training, gait training, weight-shifting exercises, and open and closed kinetic chain functional exercises.

Result: Pain reduced to 3/10, active knee flexion improved to 100°, passive flexion to 120°, muscle strength improved to Grade 5, and LEFS improved from 28/80 to 70/80, indicating better functional mobility

Conclusion: A 9-week progressive physiotherapy rehabilitation program effectively reduced postoperative knee stiffness, improved knee ROM, muscle strength, functional mobility, and overall independence.

Keywords: Distal femur fracture, ORIF, Bone grafting, MUA, Knee stiffness, Consistently Physiotherapy rehabilitation, Dry needling, Cupping therapy.

1. INTRODUCTION

The femur is the longest and strongest bone in the human body and plays a fundamental role in weight transmission, locomotion, and postural stability. The distal femur comprises the medial and lateral femoral condyles, intercondylar notch, patellar surface (trochlea), epicondyles, and metaphyseal region. It articulates with the proximal tibia and patella to form the knee joint, which is responsible for flexion, extension, and rotational movements required during walking, running, stair climbing, squatting, and sitting.

The stability of the distal femur is maintained by surrounding ligaments, including the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial collateral ligament (MCL), lateral collateral ligament (LCL), and the joint capsule. Dynamic stability is provided by the quadriceps, hamstrings, gastrocnemius, popliteus, and gluteal muscles.¹

Because of its anatomical complexity and close relationship with the knee joint, injuries involving the distal femur often result in pain, joint stiffness, muscle weakness, altered biomechanics, and functional disability. Restoration of normal anatomy and biomechanics is therefore essential for optimal recovery.

Distal femur fractures are generally managed surgically when displaced, unstable, or intra-articular. Open Reduction and Internal Fixation (ORIF) with a Locking Compression Plate (LCP) has become the gold standard because it provides stable fixation while preserving the biological environment required for fracture healing². Locking plate technology offers improved angular stability and minimizes disruption of periosteal blood supply, promoting faster fracture union and early mobilization.

In patients with delayed union or bone defects, autologous bone grafting is performed to enhance osteogenesis and improve biological healing. However, prolonged immobilization, postoperative inflammation, scar tissue formation, and periarticular fibrosis may lead to persistent knee stiffness³. In such cases, Manipulation Under Anesthesia (MUA) is considered when conservative treatment fails, allowing controlled breaking of intra-articular adhesions and restoration of joint mobility. Although MUA improves knee ROM, it should always be followed by intensive physiotherapy to maintain the gained motion and prevent recurrence of stiffness.

Distal femur fractures represent approximately 3–6% of all femoral fractures and about 0.4% of all fractures. The incidence demonstrates a bimodal distribution, occurring in younger individuals following high-energy trauma such as road traffic accidents and in elderly patients following low-energy osteoporotic falls.⁴

Young adults commonly sustain these injuries due to high-velocity motor vehicle accidents, resulting in comminuted fractures with extensive soft tissue damage. These injuries are associated with prolonged hospitalization, multiple surgical procedures, delayed rehabilitation, loss of productivity, and significant socioeconomic burden.

Although modern fixation techniques have improved fracture healing rates, achieving successful functional recovery remains a major challenge because complications such as postoperative pain, edema, quadriceps weakness, reduced ROM, knee stiffness, gait abnormalities, and impaired balance continue to affect patient outcomes.⁵

Current evidence strongly supports early physiotherapy intervention to minimize postoperative complications. Rehabilitation protocols generally progress through four stages:

Pain and Edema control, Restoration of joint mobility, Muscle strengthening and neuromuscular re-education, Functional retraining and return to activities, Recent advances in musculoskeletal rehabilitation emphasize multimodal, patient specific and evidence-based physiotherapy rather than conventional exercise programs alone.

Physiotherapy Rehabilitation Approach

Emerging interventions include Maitland Joint Mobilization, Mulligan Mobilization with Movement, Muscle Energy Techniques (MET), Progressive Resistance Exercise, Dry Needling Cupping Therapy, Instrument-Assisted Soft Tissue Mobilization (IASTM), Scar Mobilization Balance and Proprioceptive Training, Neuromuscular Re-education, Open and Closed Kinetic Chain Exercises, Functional Task Training The present case utilized a 9-week progressive rehabilitation protocol consisting of cryotherapy, patellar mobilization, CPM, active-assisted ROM exercises, Mulligan mobilization, Maitland mobilization, MET, scar mobilization, dry needling, cupping therapy, paraffin wax therapy, progressive strengthening, proprioceptive training, gait retraining, balance exercises, stationary cycling, stair training, and sport-specific functional activities.

This case demonstrates that an individualized, structured, and progressive physiotherapy rehabilitation program can effectively reduce postoperative knee stiffness, improve joint mobility, restore muscle strength, normalize gait, and enhance functional independence following ORIF with bone grafting and manipulation under anesthesia. It also contributes clinical evidence supporting multimodal rehabilitation strategies in the management of complex postoperative distal femur fractures.

2. CASE DESCRIPTION

Patient history\subjective findings

A 20-year-old male student presented as a follow-up case of a left distal femur fracture, sustained following a self-fall from a bike on 23/11/2025. The patient underwent ORIF with LCP on 24/11/2025, followed by bone grafting on 24/01/2026. Due to persistent knee stiffness and restricted movement, manipulation of the left knee under spinal anesthesia was performed on 09/06/2026. Physiotherapy was prescribed on 12/01/2026 followed for 2 months till the patient become independent.

At presentation, the patient complained of left knee pain, stiffness, swelling and difficulty in bending the knee. Pain was reported as sharp/dull aching, with a severity of 9/10 on NPRS, and was aggravated by standing. Early morning stiffness and disturbed sleep were also reported.

3. CASE ASSESSMENT

Table 1: Patient demographic and clinical characteristics

Demographic Assessment	
Age	20 years
Gender	Male
Occupation	Student
Dominance	Right
Place	Koira, Doddaballapur
Mechanism of injury	Self-fall from bike
Date of injury	23/11/2025
Primary diagnosis	Left distal femur fracture
First Surgery	ORIF with LCP - 24/11/2025
Second Surgery	Bone grafting - 24/01/2026
Third procedure	Left knee manipulation under SA - 09/06/2026

Initial Assessment findings	
Area of symptoms	Left knee
Wound	Previous open wound over left knee
Swelling	Present previously
Warmth	Present previously
Redness	Present previously
Tenderness	Grade 2+
Muscle spasm	Present over Tibia
Tissue texture / tension	Present
End Feel	Firm/ Hard
Second Surgery	Bone grafting - 24/01/2026
Third Surgery	Left knee manipulation under SA - 09/06/2026

Table 1.1 OUTCOME MEASURES

The patient demonstrated significant improvement following the progressive physiotherapy rehabilitation programme after left distal femur ORIF and bone grafting. Pain reduced from 9/10 to 3/10; knee ROM improved from 30° to 100° active flexion and 45° to 120° passive flexion.

Outcome Measure	Pre-Intervention	Post-Intervention
LEFS	28/80	70/80
KOOS	38/100	61/100
Lysholm Knee Score	46/100	84/100
Oxford Knee Score (OKS)	18/48	30/48
Knee Society Score (KSS)	78/180	142/180

Table 2: Pre and Post Intervention Functional scores and measures

4. INVESTIGATIONS

X- ray of the left knee/femur – AP and lateral views was used to assess the postoperative status following distal femur ORIF and subsequent bone grafting.



Figure 1:
X- ray showing left distal femur fracture

5. EVALUATION / DIAGNOSIS

- Post-operative left distal femur fracture following ORIF and bone grafting.
- Severe left knee stiffness with restricted ROM.
- Pain: NPRS 9/10.
- Knee ROM: Active flexion 30°, passive flexion 45°.
- Muscle weakness: Quadriceps and hamstrings Grade 2+.
- Restricted weight bearing with impaired gait.
- Functional limitation: LEFS 28/80.
- Diagnosis: Post-operative knee stiffness with pain, muscle weakness and impaired functional mobility following distal femur fracture.



Figure 4 & 5: Assessment of left knee active range of motion, Assessment of left knee passive range of motion

6. METHODOLOGY

- Study duration: 9 weeks
- Number of subjects: 1
- Study design: Case study
- Subject source: Aadya multi-specialty hospital, Doddaballapur rural Bangalore
- Duration of treatment: 9 weeks
- Patient: 20-year-old male student with a history of left distal femur fracture managed surgically with ORIF and subsequent bone grafting and manipulation of the left knee joint.
- Mode of treatment: Progressive physiotherapy rehabilitation
- Materials used: 1 -2 kg weight cuff, Cupping therapy equipment, Dry-needling equipment, IASTM instrument, Exercise equipment, Balance board, Elliptical trainer, goniometer, measuring tape, Towel, Mat, Swiss ball.

7. PROCEDURE

The patient underwent an initial physiotherapy assessment before starting the intervention. A 9-week progressive physiotherapy rehabilitation programme was provided based on the patient's clinical condition. The treatment initially focused on reducing pain, preventing joint stiffness and improving knee ROM. Progressive muscle strengthening, joint mobilization and stretching exercises were then introduced. Balance, proprioception, weight-shifting and functional task training were gradually incorporated. The intensity of exercises was progressed according to the patient's tolerance and functional improvement. Pre- and post-intervention outcomes were assessed using pain, ROM, MMT, LEFS and functional mobility measures

8. INTERVENTION

The patient underwent a 9-week progressive physiotherapy rehabilitation programme consisting of pain and swelling management, knee ROM exercises, joint mobilization, muscle strengthening, dry needling, cupping therapy, scar mobilization, balance and proprioceptive training, and progressive functional and gait training. The intervention was progressively advanced according to the patient's clinical status and functional tolerance.

Table 3 - Phase Wise Progressive Physiotherapy Rehabilitation Protocol

Phase	Goals	Intervention
Phase I Week 1-2	• Reduce pain and swelling • Prevent joint stiffness	• Cryotherapy • Isometric exercises for quadriceps, hamstrings, and gluteals

	• Maintain circulation	• Ankle-toe movements • Active-assisted knee bending – 10 minutes • Active-assisted heel drags
Phase II Week 3–4	• Improve knee range of motion (ROM) • Initiate muscle strengthening	• Continuous passive motion (CPM) – 15 minutes, up to 115° knee flexion • Contrast bath – 10 minutes • Straight-leg raises (SLR) – active and passive, in all directions • Active-assisted knee flexion – 10 minutes • Toe movements and grip strengthening • Vastus medialis oblique (VMO) strengthening • Mulligan mobilization • Muscle energy techniques (MET)
Phase III	Improve muscle strength	• CPM – 15 minutes, up to 120° flexion; knee extension to 10°
Week 5–7	• Improve functional control and prepare for upright activities • Relieve muscle stiffness and increase knee ROM • Reduce extension lag	• Muscle energy techniques (MET) • Cupping therapy – twice, on alternate days • Dry needling over the quadriceps and hamstrings, on alternate days • Scar mobilization • Contrast bath • Paraffin wax bath using the towel method – once, on alternate days • Resistance exercises using a 1 kg weight cuff • Active knee bending – once, on alternate days

		• Maitland mobilization • Postural control training • Progressive/aggressive resistance exercises – 10–20 repetitions × 3 sets • Lower-limb stretching
Phase IV	• Enhance functional independence	• Cupping therapy
Week 7–9	• Prepare for gait training	• Maitland mobilization • Dry needling • Instrument-assisted soft-tissue mobilization (IASTM) for hamstring stiffness, followed by passive knee stretching • Static and dynamic balance exercises • Strengthening with increased resistance • Static standing • Weight-shifting exercises • Proprioceptive training • Functional task training • Open kinetic-chain exercises • Closed kinetic-chain exercises, including leg press • Hip abduction – contra kicks/Steamboat exercises

		• Straight-leg raises (SLR) • Single-leg stance with hand assistance • Stationary cycling • Squats and leg press • Lunges • Stair training – concentric and eccentric • Calf raises – bilateral and unilateral • Rotational stability exercises • Balance board exercises • Perturbation training • Shuttle jumping • Aqua jogging • Bridges and clamshells • Monster walks • Figure-of-eight runs • Butt kicks – forward and backward • Dynamic hamstring stretching • Carioca exercise
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9. RESULTS

Following the progressive physiotherapy rehabilitation program, the patient demonstrated clinically meaningful improvements in pain, knee range of motion, muscle strength, functional outcomes, and mobility status. Pain intensity decreased from 9/10 to 3/10 on the NPRS, representing a 66.7% reduction in pain. Active knee flexion improved from 30° to 100°, while passive knee flexion increased from 45° to 120°.

Parameter	Pre-Intervention	Post-Intervention
Pain (NPRS)	9/10	3/10
Active Knee Flexion (AKF)	30 Degree	100 Degree
Passive Knee Flexion (PKF)	45 Degree	120 Degree

Table 4 – Pre and Post Intervention Pain and ROM

Muscle Group	Pre-Intervention	Post-Intervention
Quadriceps	Grade 2+	Grade 5
Hamstrings	Grade 2+	Grade 5
Gluteal muscles	Weak	Improved
Overall lower-limb strength	Reduced	Improved

Table 5 - Pre and Post Intervention Muscle Strength

Parameter	Pre-Intervention	Post-Intervention
Mobility	Bed-bound/ walker dependent	Independent
Weight-bearing	Restricted	Full weights
Gait	Impaired: required assistance	Independent
Walking	Walker/ wheelchair dependent	Independent
Knee movement	Severely restricted	Improved
Standing	Difficulty standing	Independent
Functional activities	Markedly limited	Improved
Overall functional activities	Dependent for mobility	Functional

Table 6 - Pre and Post Intervention Mobility and Functional status

10. DISCUSSION

Distal femur fractures pose significant rehabilitation challenges due to their impact on knee joint biomechanics, quadriceps function, and weight-bearing capacity. In the present case, the patient demonstrated improvements in pain, knee range of motion, muscle strength, and functional mobility following the progressive physiotherapy rehabilitation program.

One of the major impairments observed initially was restricted knee range of motion, with active knee flexion of 30° and passive knee flexion of 45°. Following rehabilitation, active knee flexion improved to 100° and passive knee flexion to 120°. The use of continuous passive motion, active assisted exercises, and progressive joint mobilization may have contributed to improved knee mobility.

Muscle weakness, particularly of the quadriceps and hamstrings, was evident initially, with both graded 2+. Following progressive strengthening exercises, muscle strength improved to Grade 5. Progressive resistance exercises have been shown to improve muscle strength and functional recovery following lower-limb injury and surgical intervention.

Pain was another important component of rehabilitation. The patient's NPRS score reduced from 9/10 to 3/10, indicating a substantial reduction in pain following the intervention. Pain management combined

with therapeutic exercise and gradual functional loading can facilitate improved participation in rehabilitation.

Functional recovery was assessed using the LEFS, which improved from 28/80 to 70/80. Other patient-reported outcome measures also demonstrated improvement, including KOOS from 38/100 to 61/100, Lysholm Knee Score from 46/100 to 84/100, Oxford Knee Score from 18/48 to 30/48, and Knee Society Score from 78/180 to 142/180. These findings indicate improved functional ability following rehabilitation.

The patient also progressed from bed-bound/walker-dependent mobility to independent mobility, with weight-bearing improving from restricted to full weight-bearing and gait progressing to independence. Progressive strengthening, balance training, weight-shifting, and functional task training may have contributed to this improvement.

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11. CONCLUSION

The 9-week progressive physiotherapy rehabilitation program improved pain, knee ROM, muscle strength, and functional mobility. The patient progressed from restricted, walker-dependent mobility to independent mobility with full weight-bearing. Overall, structured and progressive physiotherapy contributed to meaningful functional recovery following surgically managed distal femur fracture.

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