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Role of structured physiotherapy in functional recovery after high energy Tibia Fibula fracture associated with common peroneal nerve palsy.

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Abstract

High energy tibia fibula fractures with common peroneal nerve (CPN) injury are frequent following Road traffic accident and often lead to long term disability. Ilizarov fixation provide stable alignment in such open fractures while allowing early mobilization. Physiotherapy is essential for pain control, mobility, restoration and neuromuscular recovery.

In this case, a young adult male sustained a Grade II open proximal tibia fracture (Schatzker type V) With associated midshaft tibia, Proximal fibula fracture, and CPN palsy. He underwent staged fixation with an Ilizarov ring fixator and structured physiotherapy. Within six weeks, he achieved partial motor and sensory recovery, improved mobility, and regained functional independence.

Keywords: High energy tibia fibula fracture, common peroneal nerve palsy, Physical therapy rehabilitation, Rd traffic accident, functional recovery, structured physiotherapy protocol, Neuromuscular rehabilitation.

Keywords*: High Energy Tibial Fracture, physiotherapy management, physical therapy, Rehabilitation.*

1. Introduction:

High-energy tibia fibula fractures make up around 2% of all adult fractures. They're considered the most common long bone injuries in orthopaedic trauma cases(1). Road traffic accidents cause most of these breaks.

(RTA's), Which remain a leading cause of Musculoskeletal injuries worldwide. Studies report that lower limb fractures, especially of the tibia and femur, Are the most frequent injuries sustained in RTA's, With an incidence of up to 42.1%(2).

These injuries are typically multi-fragmentary and high energy, classified OTA/OA Type 42-C fractures(3). In open fractures, staged fixation using a Ilizarov external fixator is the preferred Choice, as it provides rigid stabilization, facilitates wound care, and reduces the risk of infection while early mobilization(4).

A well-recognized complications of these injuries is common peroneal palsy, reported in 3-12% of tibial plateau and shaft fractures(5). This results from the nerve's superficial Course around the fibular neck, Making it highly vulnerable to traction, Compression, Or direct injury during high energy trauma(6).

Physiotherapy is critical in such cases to prevent stiffness, control pain and oedema, and restore functional mobility. Early rehabilitation also supports neuromuscular recovery, which is essential for regaining independence in patients with CPN palsy(7).

This case aims to highlight the role of structured physiotherapy rehabilitation in the recovery of a patient with a complex tibia fibula fracture associated with common peroneal nopales managed by staged fixation with an Ilizaro external fixator.

2. Case Presentation:

A young adult male in his 20s, presented to the emergency unit on 15th July 2025 following a high-energy RTA. Patient complained of severe pain, swelling and inability to bear weight on the right lower limb. The mechanism of injury was direct impact from a fall during the accident. He had no relevant past surgical or medical history.

On examination, the Patient was conscious coma oriented and vitally stable. The right lower limb showed deformity, swelling and an open wound over the proximal tibia consistent with a grade II open injury. Digital pulses were intact Neurological examination revealed weakness of ankle dorsiflexion and toe extension with sensory loss over the dorsum of the foot and first web space, indicating common peroneal nerve palsy. Plantar sensation was intact. Range of motion (ROM) and manual muscle testing (MMT) were default initially due to pain and immobilization.

Radiographs revealed a Schatzker Type V proximal tibial fracture with associated mid shaft tibia fracture and proximal fibula fracture.

The patient under wound up treatment and temporary external fixation followed by definitive Ilizaro ring fixation. Post operatively he was managed with intravenous antibiotics, analgesics, DVT prophylaxis, calcium and vitamin D supplementations, and regular pin site care.

Then he was referred to physiotherapy Structured rehabilitation program was initiated focussing on pain and oedema control protection of fixation and muscle activation. The Ilizaro Fixator was scheduled for removal after approximately six weeks following with advanced rehabilitation. The timeline of events is summarized in (table1).

Sr. No.	Events	Dates
1	Date of Incidence	15/7/2025
2	Visited OPD, and diagnosed with schatzker type V Fracture along with proximal fibula fracture and common peroneal nerve injury	16/7/2025
3	Underwent temporary external fixation and wound debridement	16/7/2025
4	Fixation with Ilazarov's Fixator	18/7/2025
5	Referred for physiotherapy	19/7/2025
6	Physiotherapy Started	19/7/2025

Table 1: Timeline of events

3. Clinical Findings and Physical Examination:

A young adult male in his 20s, presented to the emergency unit on 15th July 2025 following a high-energy RTA. Patient complained of severe pain, swelling and inability to bear weight on the right lower limb. The mechanism of injury was direct impact from a fall during the accident. He had no relevant past surgical or medical history.

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Events	Dates
Date of incidence and visit to local hospital	15.07.2025

He visited the emergency department and was diagnosed with a compound grade II schatzker Type V proximal tibia fracture with associated midshaft tibia fracture, proximal fibula fracture and common peroneal nerve palsy	16.07.2025
Underwent temporary external fixation and wound debridement	16.07.2025
Fixation with ilizarov ring fixator	18.07.2025
Referred for physiotherapy	19.07.2025
Physiotherapy started	19.07.2025

Table 1: Timeline of events

CLINICAL FINDINGS AND PHYSICAL EXAMINATION

On examination, the patient was Conscious, oriented and vitally stable the right lower limb was supported in an Ilizarov fixator local inspections showed swelling deformity and surgical scar Over the proximal Tibia. Neurological assessment revealed weakness of ankle dorsiflexion and toe extension with sensory loss over the dorsum of foot and the first web space, Associated with common peroneal nerve palsy. Plantar sensation was intact. Motor assessment (table 1) revealed reduced strength in the right hip, ankle and toe muscles with partial improvement. Sensory testing (Table 2) showed impaired sensation over the dorsum of the foot and first web space with plantar and lateral surface intact. Range of motion (Table 3) was restricted at the right hip and ankle and not accessible at the knee due to pain and the fixator.

Manual Muscle Testing (MMT):

Joint/Muscle group	Right Side (Pre-Treatment)	Right Side (Post-Treatment)	Left Side (Pre-Treatment)	Left Side (Post-Treatment)
Hip Flexors	3/5	4+/5	4+/5	4+/5
Hip Extensors	3/5	4+/5	4+/5	4+/5
Hip Abductors	3/5	4+/5	4+/5	4+/5
Hip Adductors	3/5	4+/5	4+/5	4+/5
Hip Internal Rotators	3/5	4+/5	4+/5	4+/5
Hip External Rotators	3/5	4+/5	4+/5	4+/5
Knee Extensors (Quadriceps)	Not assessed	Not assessed	Not assessed	Not assessed

Knee Flexors (Hamstrings)	Not assessed	Not assessed	Not assessed	Not assessed
Ankle Dorsiflexors	2/5	3+/5	4+/5	4+/5
Ankle Plantar Flexors	3/5	4/5	4+/5	4+/5
Toe Extensors	2/5	3+/5	4+/5	4+/5

TABLE 2: MMT

MMT: manual muscle testing; 3+:full range of motion against gravity; 4+:full range of motion against gravity with minimal resistance;

Sensory Examination

Dermatome (Region Tested)	**Right Side (Pre-Treatment)**	**Right Side (Post-Treatment)**	**Left Side (pre-Treatment)**	**Left Side (post-Treatment)**
L4 (medial leg & medial malleolus)	Intact	Intact	Intact	Intact
L5 (dorsum of foot & first web space)	Impaired	Improved (partial recovery)	Intact	Intact
S1 (lateral foot & plantar surface)	Intact	Intact	Intact	Intact

TABLE 3: SENSORY EXAMINATION: On sensory examination, the patient showed loss of sensation over the dorsum of right foot, corresponding to common peroneal nerve involvement, while the sensation over the left lower lib were intact.

Range of Motion Assessment

Joint & Movement	**Right Side (Pre)**	**Right Side (Post)**	**Left Side (Pre)**	**Left Side (Post)**
Hip flexion	Not assessable	0–90°	0–100°	0–100°
Hip extension	Not assessable	0–10°	Not assessed	Not assessed
Knee flexion	Not assessable	0–80°	0–110°	0–110°
Knee extension	Not assessable	0–10° lag	0–110°	0–110°
Ankle dorsiflexion	0°	0–10°	0–20°	0–20°
Ankle plantarflexion	Not assessable	0–30°	0–40°	0–40°
Toe extension	Absent	Minimal flicker	Normal	Normal

Table 4: Range of motion Assessment

4. Investigations:

An X-ray was obtained. Pre-operative X-ray was done which revealed compound grade II schatzker Type V proximal tibia fracture with associated midshaft tibia fracture, proximal fibula fracture and common peroneal nerve palsy of right side (figure 1) and post operative X-Ray showed Fixation with ilizarov ring fixator of right side (figure 2)

5. Operative and Medical Treatment

The patient underwent wound debridement and temporary external fixation under spinal anesthesia. Two days later, definitive fixation was carried out using an Ilizarov Ring external fixator for stabilization of the proximal TBR with associated mid shaft tibia and proximal fibula fractures the common peroneal nerve palsy was managed conservatively with ankle foot orthosis and physiotherapy. Intraoperative findings confirmed Comminated fracture fragments with surrounding soft tissue oedema but no vascular compromise. The procedure was uneventful, and postoperative alignment was satisfactory. Post operative care including medications like Antibiotics, analgesics, DVT prophylaxis, supplements are given in (table 5). Early physiotherapy started to aid recovery and restore mobility. Physiotherapy treatment is given in (Table 6)

Drugs	Dose & Duration
Ceftriaxone IV	1 gm twice daily × 5 days
Metronidazole IV	500 mg 3 times daily × 5 days
Paracetamol IV/PO	1 g every 8 hours × 7 days
Tramadol IV	50 mg every 12 hours × 3 days (then SOS)
LMWH (Enoxaparin) SC	40 mg once daily × 7 days
Calcium carbonate + Vitamin D3	1 tablet once daily × 6 weeks

Table 5: Post Operative Medications

Physiotherapy Management:

Phase	Week	Goals	Physiotherapy management	Dosage
Acute	**1**	Pain & oedema control; protect fixation; prevent stiffness; patient education	• Patient & caregiver education (injury precautions, AFO use, pin-site care) • Cryotherapy, elevation, limb positioning • Breathing exercises (3–6–9) • Passive/assisted ROM (hip, knee not assessed due to pain/fixator, ankle within comfort) • Isometrics (quadriceps, hamstrings, gluteals)	• Cold packs 10–15 min, 2–3×/day • Breathing 10 reps ×3/day • ROM 10 reps ×2 sets, 2–3×/day • Isometrics 5 s hold ×10 reps ×3/day • NMES 15–20 min, 1–2×/day

			• Ankle dorsiflexion activation attempts; AFO fitting(6)	
Early subacute	**2**	Maintain mobility; initiate early strengthening; prevent chest deconditioning	• Active-assisted ROM (hip; knee deferred); ankle within comfort • Straight-leg raises (active contralateral, assisted ipsilateral) • Unilateral pelvic bridging • Sensory retraining (texture exposure, tapping, vibration)(8) • Bed sitting; transfer practice	• ROM 10–12 reps ×2/day • Bridging 5 s hold ×7 reps ×3/day • Sensory retraining 10 min ×2/day
Late subacute	**3**	Improve muscle activation; initiate safe mobility; prevent foot drop	• AFO-assisted standing and gait • Toe-touch partial weight-bearing with walker • Gait training with support • Mirror therapy & sensory re-education (9)	• NMES 15–20 min, 1–2×/day • Gait 50 m, 2–3×/day
Transition to loading	**4**	Progress strength; controlled mobility; balance	• Progressive resistance (hip) • Dynamic quadriceps (within hardware precautions) • Sit-to-stand with walker • Gait training with AFO; advance WB as cleared • Hydrotherapy for ROM & gait practice (10)	• Strength 10–12 reps ×2/day • Sit-to-stand 5–10 reps ×3/day • Hydrotherapy 20 min, 2–3×/week
Advanced neuromotor	**5**	Endurance; coordination; sensory recovery	• Robotic/anti-gravity treadmill progression(11) • Proprioceptive training (balance board/BOSU)(12) • Dual-task gait (cognitive + motor) • Kinesio taping to assist dorsiflexion strengthening(13)	• FES during ambulation sessions • Balance 10–15 min/day • Dual-task 10 min/day • BFR: 20–30% 1RM, 75 reps/session (30-15-15-15), 2–3×/week
Functional integration	**6**	Functional independence; community mobility	• Aquatic therapy for mobility & gait • ADL training • Outdoor gait with AFO; surface variability	• Aquatic 20–30 min, 2–3×/week • ADL daily • Strength 10–15 reps ×2–3/day

			• Strength progression (weights/elastic bands)(14) • Task-specific practice/work-simulated tasks •FES/NMES after the ilizarov ring fixator is removal (15),	• Community ambulation targets set per tolerance

Table 6: Physiotherapy Management Protocol.

6. Outcome Measures and Follow up

Sl. No.	Outcome Measure	Pre-treatment	Post-treatment
1	Pain (VAS, 0–10)	Rest: 4/10; Movement: 7/10	Rest: 1/10; Movement: 3/10
2	Joint Range of Motion	Knee and ankle movement limited due to pain and fixator	Mobility improved with pain-free and functional range restored
3	Muscle Strength (MMT)	Hip and knee: grade 3/5; Ankle dorsiflexors and toe extensors: grade 2/5	Hip and knee: grade 4+/5; Ankle dorsiflexors and toe extensors: grade 3+/5
4	Sensory Testing	Loss of light touch and vibration over dorsum of foot and first web space	Partial return of light touch and vibration sensations
5	Functional Independence (FIM)	Required assistance for transfers and non-ambulatory	Independent in bed mobility and transfers; able to walk with AFO and support

7. Discussion:

High-energy injuries such as proximal tibial fractures, particularly bicondylar fractures (Schatzker type V), often lead to significant soft tissue damage and neurovascular problems. Axial loading combined with varus or valgus stress usually causes articular depression and condylar disruption. In our patient, the injury was worsened by a Grade II open wound, a proximal fibula fracture, a midshaft tibia fracture, and common peroneal nerve (CPN) palsy. Previous studies show that the occurrence of CPN palsy, a known result of tibial plateau and shaft fractures, ranges from 3 to 12%(16).

The neurological results in this case stem from the nerve's physical weakness at the fibular neck. This makes it vulnerable to traction or compression from displaced fragments or swelling. The outlook depends on identifying CPN involvement early. Standard recommendations stress the importance of a thorough neurological exam upon admission and nerve conduction testing for follow-up when problems persist. According to the literature, a partial recovery of CPN function is expected during the first three to six months. However, if problems persist, surgical procedures like tendon transfers or nerve grafting may be needed. Published data shows that physical treatment improved both motor strength and sensory function in this case.(7). Immediate surgical debridement, along with prompt stabilization, reduces the risk of infection and promotes better healing outcomes in open fractures (17).

Additionally, guidelines suggest fixing high-energy tibial plateau fractures in stages. Definitive fixation should happen when the soft tissue is ready, following interim external fixation. This approach helps reduce problems such as infection and non-union. Rehabilitation is equally important. Gait training, progressive strengthening, joint mobilization within pain-free limits, and orthotic support, such as an ankle-foot orthosis to control foot drop, are the main focuses of physiotherapy techniques. Furthermore, studies show that in cases of peroneal nerve palsy, functional electrical stimulation (FES) can restore muscle activation and functional movement(18).

To achieve the best results in complex tibial fractures with CPN palsy, this case highlights the importance of early fracture stabilization, thorough physical therapy, and careful neurological monitoring.

8. Learning Points/ Take Home Message:

When examining fractures of the tibia and fibula, always check for nerve damage.
Complications from open fractures decrease with staged fixation.
The key to a successful recovery is early physiotherapy.
Regularly monitor nerve recovery to guide treatment.
Physiotherapists and physicians working together improves results.

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10. Images

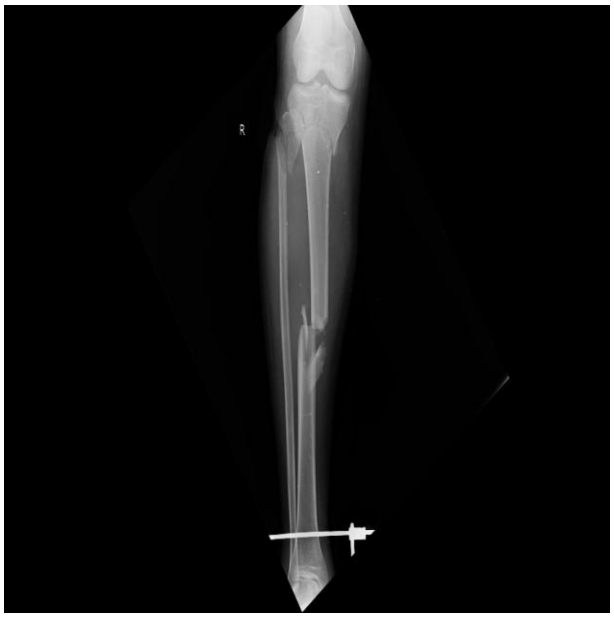

Figure 1: X- ray AP view Right leg pre operative

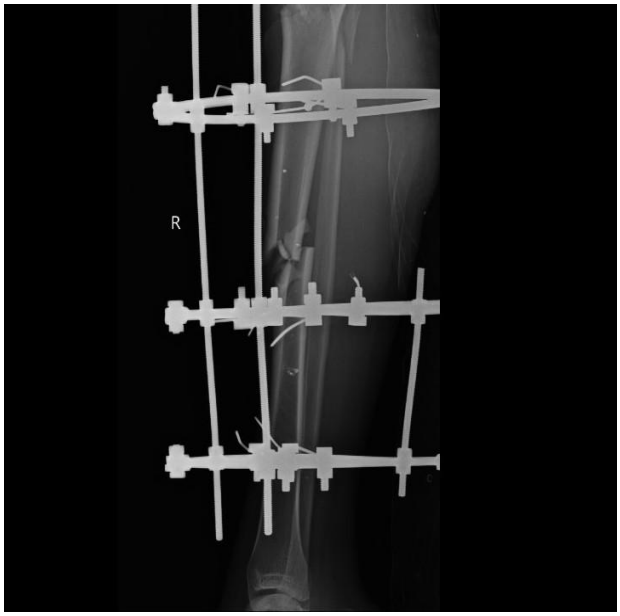

Figure 2: AP view of leg post operatively

Figure 3: Therapist Guiding Patient with exercises

11. Patient Perspective:

"When I first had the accident, I was in terrible pain and could not move my leg or lift my foot. I was very worried about whether I would be able to walk again. After the surgery and regular physiotherapy, I slowly regained movement, strength, and some sensation in my foot. The recovery was difficult, but with exercises and support, I am now able to walk with assistance and feel much more independent."

— Written by the patient (edited for clarity)

12.