



Effect of manual therapy and exercise on pain, range of motion and function in a patient with post-operative ankle fracture- A case report

Dr. Anushree Datar¹, Dr. Raturaj Shete²

¹ Department of Musculoskeletal Physiotherapy, TMV's Lokmanya Tilak College of Physiotherapy, Navi Mumbai, Maharashtra, India

² Associate Professor, Department of Musculoskeletal Physiotherapy at TMV's Lokmanya Tilak College of Physiotherapy, Navi Mumbai, Maharashtra, India

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Abstract

Background: Ankle Fractures, particularly bimalleolar fractures, are common lower-limb injuries that often require surgical fixation followed by structured rehabilitation to restore mobility, strength and functional independence. A significant delay in the recovery can occur if post-operative complications such as pain, edema, joint stiffness and altered gait patterns aren't addressed appropriately through physiotherapy.

Case Presentation: This case report describes the physiotherapy management of a 42-year old male carpenter who presented with chief complaints of pain, swelling, restricted Ankle Range of Motion, reduced strength and gait abnormalities following open reduction internal fixation (ORIF) for Left Bimalleolar Ankle Fracture with associated metatarsal fracture. The patient initiated his physiotherapy treatment 1.5 months post-surgery. The patient underwent a 6-week rehabilitation program which included Mulligan's Mobilization to improve Ankle Range of Motion, proprioceptive and balance training, progressive strengthening exercises, manual therapy and scar tissue mobilization. Later, task specific functional rehabilitation tailored to occupational demands were also incorporated into the rehabilitation program. Pain intensity, Ankle Range of motion, Muscle strength, gait parameters and Functional Disability were assessed pre and post intervention.

Conclusion: This case report highlights that a structured, multimodal physiotherapy rehabilitation program incorporating meaningful improvements in pain, ankle mobility, strength, and functional performance following surgery.

Keywords: Bimalleolar ankle fracture, physiotherapy rehabilitation, open reduction and internal fixation (ORIF), Mulligan's Mobilization

Introduction

Traumatic Musculoskeletal injuries are common problem and may result in short-term or long-term disability. Ankle Fractures are among the most common fractures in adults. They account for approximately 10% of all adult fractures. The Ankle a Talocrural Joint is a junction of the tibia, fibula and talus. The anterior talofibular ligament (ATFL), calcaneofibular ligament and posterior talofibular ligament provide static support to the joint laterally whereas the deltoid ligament provides medial support. The majority of the motion within the foot and ankle is produced by the twelve extrinsic muscles, which originate within the leg and insert within the foot. These muscles are contained into 4 compartments-anterior, lateral, posterior and deep posterior compartment [1]. The anterior compartment has the tibialis anterior, the extensor digitorum longus, the extensor hallucis longus and peroneus tertius. The lateral compartment is composed of the peroneus longus and peroneus tertius. The posterior compartment consists of the gastrocnemius, soleus, and the plantaris. The deep posterior compartment consists of tibialis posterior, the flexor digitorum longus, and flexor hallucis longus. The key movements of the ankle joint are Ankle Dorsiflexion and Ankle Plantarflexion occurring in sagittal plane. Inversion and eversion occur at the subtalar joint. Ankle Fractures are classically defined a malleolar injuries involving the distal lateral malleolus, medial malleolus or posterior distal tibia. A Bimalleolar Fracture is defined as as fracture of medial and lateral malleoli or posterior and lateral malleoli which is less

common. Associated involvement of the deltoid ligament medially or talofibular ligaments laterally may also be present [1, 2]. Management of Ankle Fractures depends on the stability of the injury. Stable fractures usually require minimal splinting, whereas unstable fractures often need open reduction and internal fixation (ORIF). Restoration of the ankle mortise is of critical importance for pain-free weight bearing across the ankle joint. Post-operative physiotherapy includes restoration of Joint Range of Motion, muscular strength, normalizing gait and enabling return pre-injury activity levels [2].

Materials and Methodology

A patient of 42 year old male, carpenter by occupation was brought to hospital with chief complaints of pain, swelling in the Left Ankle Joint with difficulty in weight-bearing. The individual described trauma to the Left Ankle after a vertical fall from ladder while he was trying to descend downwards at his worksite. The patient was brought to the hospital casualty by his relatives and was conscious at that time. All the necessary investigations were carried out including X-ray of the left Ankle Joint which revealed Bimalleolar Fracture of the Left Ankle with 2nd, 3rd, and 4th metatarsal head fracture. After confirmatory diagnosis and clinical examination the patient was immobilized for 2 days to maintain stability at the fracture site. He was then operated with open reduction and internal fixation to achieve stability and restoration of alignment at the fracture site.

Clinical Findings

Before performing the physical examination, the patient's verbal and written consent was obtained. Dull aching pain on the operative site was 7/10 on walking, stair-ascending and descending on the left ankle and 0/10 on rest according to the Visual Analog Scale. Moderate swelling and grade 2 tenderness were present on palpation around the scar. A 6.5cm scar was present on the medial aspect of the left ankle and a 11cm scar was present on the lateral aspect close to the lateral malleolus. The scar appeared to be healed with absence of discharge or oozing. The scar along the medial aspect of the left ankle was adherent. The Active Range of motion was restricted and painful for the left Ankle and the

foot appeared to be in plantarflexed position. Gait assessment indicated antalgic gait pattern while ambulating with cane, characterized by a left pelvic hike, absence of heel strike on the left side, reduced knee flexion during swing phase, and decreased stance phase duration of the right limb. The spatiotemporal parameters revealed a step length of 21cm, stride length of 42cm, step width of 16cm, and cadence of 79 steps per minute.

Radiological Findings

Following are the Pre-operative and Post-Operative Radiographic Images of the patient's Left Ankle –



Fig 1: Pre-operative X-ray of Left Ankle joint which shows Bimalleolar Ankle Fracture



Fig 2: Post-operative Radiograph of Left Ankle Joint Showing ORIF

Post-operative radiological investigations were performed to assess the positioning and fixation of the implants.

1. The Lateral Malleoli fracture was o/w Locking Plate and Screws to maintain the alignment.
2. The Medial Malleoli fracture was o/w 2 parallel k-wires and Tension Band Wiring which converts tensile forces into compressive forces.
3. K-wires were used to stabilize the metatarsal head fractures.

Therapeutic Intervention

Before initiation of the treatment the patient was educated about his condition and explained the importance of physiotherapy treatment to reduce pain and swelling, improve the Range Of Motion and Strength and to make his ADLs easier. The patient was advised to follow the home exercise program regularly and explained the importance of

consumption of healthy diet rich in calcium and proteins in order to improve muscular strength.

The patient was given physiotherapy treatment for a duration of 6 weeks. Manual Therapy interventions were applied regularly during the initial phases of treatment. Swelling was present over the ankle which was treated with cryotherapy for a duration of 10mins and retrograde massage was utilized to facilitate the reduction of swelling. Distal to proximal strokes were applied to the popliteal fossa to facilitate reabsorption of oedema. Cross-friction massage was applied for 1-2 minutes, as per patient tolerance, to the scars present over the medial and lateral malleoli to improve scar tissue pliability.

Mobilization-with Movement-Mulligan Mobilization for Improving Ankle Dorsiflexion ROM-

Initially in a non-weight-bearing position-

Patient Position :	Supine, foot over plinth edge; knee slightly flexed; ankle near pain/limit
Therapist Position & Hand Placement :	Therapist at foot end; one hand on calcaneus, other on anterior talus; thigh supports foot
Application	AP glide of talus with calcaneal traction; patient active or passive dorsiflexion; repeat as pain-free range improves (= 6 reps, 3-5 sets)

Further Progressing into weight-bearing position-

Patient Position :	Step standing or kneeling with involved leg forward, close to the end of the treatment table. Treated body part: close to the limitation of ankle dorsiflexion.
Therapist Position and Hand Placement:	Facing the patient, in step standing, with knees slightly flexed. Hands/belt contact points: belt around the hips of the therapist and immediately above the ankle of the patient. Web-spaces of therapist's hands stabilise the talus anteriorly.
Application :	AP glide of talus with calcaneal traction; patient active or passive dorsiflexion; repeat as pain-free range improves (= 6 reps, 3-5 sets)

Therapeutic exercise primarily focused on increasing strength distally at the ankle dorsiflexors, plantarflexors, invertors and evertors. Strength training was also incorporated for the Hip Musculature proximally focusing on Hip Abductors and extensors in order to provide proximal control and promote greater hip strategy balance control. Exercises were prescribed to reduce pain and facilitate motor unit recruitment. The exercises were progressed from isometric to concentric to eccentric contractions through full of range of motion to promote graded loading. Progressive resisted exercises were implemented later using DeLorme's regimen of strength

training. Proprioceptive training was implemented to enhance controlled weight-shifts, step-up and step-down activities. Gait Training was conducted by using verbal and visual feedback with emphasis on achieving an appropriate heel strike at initial contact and adequate knee flexion during limb advancement.

The patient was also trained for return to Functional Activities and Job Simulation.

Occupation of the patient- Carpenter

Goal of the Rehabilitation- Return to full functional capacity for Carpentry Work

Activity	Task	Purpose
1. Weight shifting	Side to side standing balance	Retrain Ankle Proprioception
2. Squatting Drills	Performing Mini-squats holding a Mock Tool Belt	Prepares for low-weight carpentry tasks
3. Standing Hammering	Hit nails/screws into a soft wooden block while standing	Task Specific Retraining
4. Ladder Climbing	Ascend/descend 4-5 steps repeatedly	Climbing Simulation
5. Uneven surface walking	Walking on sandbags or wooden planks	Site terrain adaptation

The before and after treatment values of different outcomes:

OUTCOME MEASURES	Left Leg- Day 1			Left Leg- Day 21 st		
Pain (NPRS) On Activity	7/10			4/10		
Range of Motion- Ankle Dorsiflexion- Ankle Plantarflexion- Ankle Inversion- Ankle Eversion-	AROM	PROM	End-feel	AROM	PROM	End-feel
	0-18	0-20	empty	0-25	0-25	firm
	0-20	0-30	firm	0-30	0-40	firm
	0-7	0-9	empty	0-18	0-25	firm
	0-5	0-10	empty	0-15	0-20	firm
Manual Muscle Testing-						
Hip Flexors-	4/5			5/5		
Hip Extensors-	4/5			5/5		
Hip Abductors-	3+/5			4/5		
Hip Adductors-	4/5			5/5		
Hip Medial Rotators-	4/5			5/5		
Hip Lateral Rotators-	4/5			5/5		
Knee Flexors-	5/5			5/5		
Ankle Dorsiflexors-	2/5			4/5		
Ankle Plantarflexors-	3/5			4/5		
Invertors-	2/5			4/5		
Evertors-	2/5			4/5		
Tenderness around the scar	Grade 2			Grade 1		
Step Length	21cm			24cm		
Step Length	42cm			53cm		
Stride Width	16cm			19cm		
Cadence	79 steps			86steps		
Lower Extremity Functional Scale (% of disability)	50%			70%		

Discussion

Yi Rao *et al* (2023) highlights the importance of Ankle Dorsiflexion in gait propulsion. Adequate ankle dorsiflexion range of motion is required for various ADLs as walking, landing, and walking up and down stairs. Ankle dorsiflexion during walking causes the tibia to roll forward relative to the foot to achieve forward propulsion. Restricted ankle dorsiflexion can alter the lower extremity movement patterns due to abnormalities in kinematics that occurs at the pelvis, hip, knee, and foot.

In 2019, Marouvo *et al* investigated the effectiveness of Mulligan MWM to increase ankle dorsiflexion in adults with dorsiflexion movement limitation.

Our case study was of a 42-year-old male, carpenter by occupation, who was diagnosed with a bimalleolar ankle fracture with 2nd, 3rd, and 4th metatarsal fractures and was operated on with open reduction internal fixation for the

same. The physiotherapy rehabilitation was focused on reducing pain, improving muscle strength, returning to ADLs, and work. The physiotherapy rehabilitation program consisted of MWM- Mobilization with movement to improve ankle dorsiflexion ROM, progressive resisted exercises, proprioceptive and balance training, and job simulation training to return to work. This study aimed to evaluate the effect of manual therapy and exercise interventions in patients operated for complex ankle fractures.

Conclusion -

The case report describes a 6-week physiotherapy and rehabilitation intervention for the management of postoperative complex ankle fracture. There was a significant improvement in the patient's ankle range of motion, muscular strength, and successful restoration of normal movement patterns during gait propulsion. This

report clearly highlights the importance of structured physiotherapy and rehabilitation program in patients with surgically managed ankle fractures.

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