

**A Prospective study of functional outcome of MIPO plating (Minimally invasive plate osteosynthesis) in extra articular proximal tibia fractures**

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**Conflicts of Interest:** Nil

**Abstract**

**Background:** Minimally Invasive Plate Osteosynthesis (MIPO) has become a widely accepted treatment modality for extra-articular proximal tibial fractures because it preserves the periosteal blood supply, minimizes soft tissue disruption, reduces postoperative pain, and facilitates early functional recovery. This study describes MIPO in the management of extra-articular proximal tibial fractures.

**Methods:** The technique was evaluated in 33 patients who sustained extra-articular comminuted proximal tibial fractures following motorcycle accidents and fall from height. Clinical and radiological outcomes,

operative duration, fracture union and complications were assessed.

**Results:** The mean operative time was 93 minutes. Radiological union was achieved in all patients within 21 weeks. Wound healing complications were observed in 3 patients

**Conclusion:** Locking anterolateral plating using the minimally invasive plate osteosynthesis (MIPO) technique is an effective treatment modality for tibial plateau fractures (AO/OTA types 41-A2 and 41-A3). It provides stable fracture fixation, facilitates satisfactory fracture healing, and results in favourable functional outcomes following surgery.

**Keywords:** Minimally Invasive Plate Osteosynthesis, Soft Tissue, ORIF, Fractures.

## Introduction

The ORIF and MIPO are surgical techniques are some of implant fixation techniques that provide better clinical outcomes in case of complex proximal tibia fracture.<sup>3</sup> In recent years, the minimally invasive plate osteosynthesis (MIPO) technique has gained widespread acceptance in the management of tibial plateau fractures because of its biological advantages. By preserving the periosteum and the surrounding soft tissue envelope, MIPO maintains the vascularity of the fracture fragments, thereby promoting fracture healing and reducing the risk of complications. Several studies have demonstrated superior functional outcomes with MIPO compared with conventional open plating, external fixation, and intramedullary fixation techniques.<sup>1</sup>

Conservative treatment can be result stiffness in the knee, non-union, and malunion. Surgical techniques use - implants that are locking compression plates for optimal clinical results, fracture union, and patient outcomes<sup>4</sup>

The MIPO technique minimizes soft tissue dissection through limited surgical exposure, reducing incision length, periosteal stripping, and muscle trauma, which in turn lowers the incidence of wound - related complications and infection. Furthermore, the use of locking compression plates provides angular stability, facilitates indirect fracture reduction, and offers a stable fixation construct while preserving the biological environment essential for bone healing.<sup>2</sup>

**Materials and methods** -The present study included 33 patients with extra-articular proximal tibial fractures classified as AO/OTA types 41-A2, 41-A3.

Patients with open tibial fractures, fractures associated with neurovascular injury, and displaced intra-articular tibial plateau fractures were excluded from the study.

AO/OTA fracture classification system was used.

24 patients (72.7%) were AO type 41-A2 whereas 9 patients (27.3%) were AO type 41-A3 fractures respectively.

The mean time taken between onset of injury and surgical intervention was 5.2 days. The average duration of surgery was 93 minutes. Bone grafting was not done in any case The patients were immobilised with an above knee slab for 4 weeks followed by physiotherapy including quadriceps strengthening exercises The average duration of the radiological union was 21 weeks, would dehiscence was seen in 3 cases (9 %)

## Surgical technique

All 33 patients underwent surgical intervention after obtaining written informed consent. Following admission, the affected limb was immobilised using a knee brace, and appropriate analgesia was administered. All procedures were performed under spinal anaesthesia with the patient positioned supine on a radiolucent operating table.

A bolster was placed beneath the ipsilateral gluteal region to maintain neutral rotation of the lower limb, and a pneumatic tourniquet was applied. After standard aseptic preparation and draping, the operative field was prepared to include the ipsilateral iliac crest for bone graft harvesting when required.

A curved anterolateral incision, approximately 5 cm in length, was made extending from Gerdy's tubercle towards the lateral aspect of the tibial tuberosity. A pre contoured proximal tibial locking compression plate (7-, 9-, or 11-hole) was then inserted sub muscularly using

the minimally invasive plate osteosynthesis (MIPO) technique.

Longitudinal traction was applied to achieve indirect reduction of the diaphyseal component, and the plate was provisionally secured with Kirschner wires.

Reduction quality was assessed intra operatively, with acceptable alignment defined as less than 5° of varus/valgus angulation, less than 5° of coronal plane malalignment, and less than 10° of rotational deformity. Plate position and fracture reduction were confirmed using fluoroscopy in both antero posterior and lateral projections.

Following satisfactory reduction, the plate was fixed proximally using multiple 4.9-mm bicortical locking screws, while distal fixation was achieved through separate stab incisions using cortical and locking screws. Postoperatively, intravenous antibiotics were administered for three days. Standard antero posterior and lateral radiographs were obtained to document fracture reduction and implant position. Quadriceps strengthening exercises depending on patient tolerance. Toe-touch partial weight bearing was permitted after four weeks, and progressive weight bearing was allowed based on clinical assessment and radiographic evidence of callus formation during follow-up. Patients were reviewed regularly in the outpatient clinic for clinical and radiological assessment until 12 months postoperatively.

Follow-up evaluation included assessment of fracture union, alignment, infection, delayed union, non-union, implant failure, limb shortening, and angular deformity. Functional outcomes were assessed using VAS (Visual analogue scale) scoring system

## Results

Fractures were classified according to the AO/OTA classification system. Of the 33 patients included in the study, 24 (72.7%) had AO/OTA type 41-A2 fractures, while 9 (27.3%) had AO/OTA type 41-A3 fractures.

The mean age was 42 years and included 21 females and 12 males the most common mechanism of injury was road traffic accident The mean interval between injury and definitive surgical intervention was 5.2 days. The average operative time was 93 minutes. Bone grafting was not required in any patient.

Postoperatively, all patients were immobilized in an above-knee slab for four weeks, followed by a structured physiotherapy program that included quadriceps strengthening and progressive knee range-of-motion exercises.

The mean time to radiological union was 21 weeks. Wound dehiscence occurred in three patients (9%), all of whom were managed successfully with appropriate wound care without compromising fracture union.

Acceptable ROM (Range of Motion) of the knee > 120 degrees was seen in all the patients and mean VAS score was 1 during the last follow up Varus malalignment (< 5 degrees) was within acceptable limits.



Figure 1



Figure 1

### Discussion

Minimally invasive plate osteosynthesis (MIPO) technique maintains a biologically favourable environment for fracture healing.

Visualization of fracture fragment and direct reduction is difficult with small incisions and learning curve of MIPO technique with fluoroscopy-guided reduction is quite takes long<sup>8</sup>

Open proximal tibial fractures require emergency management with prompt wound debridement, appropriate soft tissue care, and temporary stabilization using an external fixator.<sup>5</sup> Definitive fixation is typically performed in a staged manner, with minimally invasive plate osteosynthesis (MIPO) undertaken after adequate soft tissue recovery and wound healing. The staged use of the MIPO technique has been shown to provide stable fracture fixation while preserving the biological environment, resulting in faster fracture union, reduced soft tissue trauma, improved functional recovery, and a lower incidence of complications such as delayed union, non-union, and malunion.<sup>6,7</sup>

### Conclusion

The incidence of proximal tibial fractures has increased over recent years, presenting significant challenges because of their association with impaired mobility, functional limitations, and reduced quality of life. These injuries are frequently accompanied by substantial soft tissue damage, which increases the risk of postoperative wound complications and infection. The primary objectives of treatment are to achieve anatomical reduction of the articular surface, restore axial alignment, and provide stable fixation to facilitate early mobilization and optimize functional recovery of the knee joint.

Minimally invasive plate osteosynthesis (MIPO) using a proximal tibial locking compression plate has emerged as an effective treatment modality for these fractures. The technique minimizes soft tissue dissection and preserves the periosteal blood supply while providing a stable, fixed-angle construct. Consequently, MIPO promotes biological fracture healing, enables earlier rehabilitation, reduces the risk of infection and postoperative knee stiffness, and results in favorable functional outcomes.

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