

## OUTCOME OF PRECONTOURED ANATOMICAL PLATE IN INTRAARTICULAR FRACTURES OF PROXIMAL TIBIA

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### ABSTRACT

*Intraarticular fractures involving the proximal tibia can be particularly difficult to manage because of the mechanical importance of the tibial plateau, and the anatomic challenge posed by this region of the knee. This cross-sectional study was done at Allama Iqbal Teaching Hospital to compare the results of the treatment of intraarticular comminuted fractures of the proximal tibia using precontoured anatomical locking compression plates (LCP). This enrollment involved 124 patients who satisfied the Schatzker's classification type V and VI fractures in this prospective study. Operative treatment was performed through an anterolateral approach with open reduction and internal fixation with anatomical precontoured LCPs with standard protocol rehabilitation post-operatively. Over the period of six months patients were observed for various sign, which included infection rates, signs of bony union, postoperative ROM as well as the degree of weight bearing allowed. The study findings showed that every patient achieved union with a mean time to union of 14 weeks. Superficial infections ranged at about 5%, and all the infected patients were successfully treated using antibiotics. All deep infections were not reported. Active joint flexion (0 to 130) was regained in 98% of the patients at the end of the follow-up period. Partial weight-bearing was started at 12 Weeks and became full from 16 Weeks in most of the patients. For, the study reveals that precontoured anatomical LCPs provide effective and stable internal fixation, good union; low infection complication, and favorable functional result in the management of the OTA-A3 type of complex intra-articular proximal tibial fractures. From these findings anatomical plating is recommended as the standard of care for such fractures because of better patient outcomes and reduction in immediate and long-term morbidities.*

**Keywords:** anatomical plate fixation intraarticular comminuted fracture of proximal tibia locking compression plate Schatzker classification.

### INTRODUCTION

Tibial shaft fractures especially those of proximal tibia involve important load transfer structures like tibial plateau, which have essential roles in managing knee joint load in addition to maintaining limb stability. The tibial plateau plays an integral role as the load-bearing area in the knee joint, and any injury to this region causes altered biomechanics and

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predisposes the patient to možné onseque: post-traumaticni artritida a chronická neschopnost [1].

High velocity traumas such as RTA has increased proximal tibial fractures and as such there is the need for efficient management [2].

Previously, management of tibial plateau fractures has posed some difficulty because the proximal tibia is subcutaneous, and this has raised concerns with respect to soft tissue reactions as well as surgery [3]. Both Schatzker types V and VI are intraarticular comminuted fractures, which makes them difficult and often mandate an accurate anatomical reduction and stable fixation to assure congruent joint reduction of the affected limb [21]. With the older techniques of unilateral plating, there has been secondary loss of reduction due to instability in the angular control [5]. Using dual plating systems, there is increased stability, but the complications in soft tissues are increased, including wound dehiscence and infections [6].

Current developments in locking compression plates (LCP) have made proximal tibial fracture fixation easier to manage because these plates provide angular stability and maintain the body environment around the fracture. LCPs act as internal fixators to give substantial stability that keeps off various deforming forces while allowing early mobilization [7]. However, there is still a lack of agreement about the best methods of the treatment of intraarticular comminuted proximal tibial fractures and hence the need for more research on this subject [8].

The purpose of this work is to assess the results of the use of anatomical precontoured lightweight Czerny plates (LCPs) in the management of intraarticular comminuted fractures of the proximal tibia. In order to determine the effectiveness of anatomical plating in enhancing limb reconstruction and patient rehabilitation, this study tries to evaluate factors including infection rates, bony unions and functional recovery.

## Methods

### Study Design and Setting

This prospective descriptive study was performed in the Department of Orthopaedics, Allama Iqbal Teaching Hospital, Dera Ghazi Khan, during two consecutive years from January 2022 to December 2023. The study was approved by the institutional review board of the hospital.

### Sample Size and Selection

Sixty-nine of the patients were males, while 55 were females with a mean age of 43 years. The mean time of follow-up was 30 months. One hundred and twenty-four patients presenting with intraarticular comminuted fractures of the proximal tibia as described by Schatzker type V and VI were included. Entry criteria were patients aged 18-60 years with a closed fracture or grade I or II open fractures of the tibia according to the Gustilo-Anderson scale. Patients were excluded who had articular fractures (grade III open fractures), vascular or nerve injury, were prone to a pathological fracture, or had prior knee injuries or disorders.

### Surgical Technique

All the patients in this study received surgical management within 24 hours of the injury. In general, for spinal anesthesia, the patients were in a supine position with the injured limb in an operative position and adequately prepared and draped aseptically. An ordinary anterolateral surgical incision was made in order to gain access to the fracture site. The anatomy of the articular surface was reduced with the utmost precision by direct visualization and fluoroscopic control. An anatomically locking plate shaped to fit the planned reduction was chosen and applied below the fibular flange onwards to the tibial shaft fascia to capture enough of the lateral tibial shaft contour.

Screw fixation was done using locking screws to provide better angular control and to avoid second-phase displacement.

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## **Discharge and follow-up in trajectory of the patient with traumatic injuries**

After the operation, patients were recommended prophylactic antibiotics and analgesics according to the hospital standard. Range of movements of the knee and ankle joints were started on the second postoperative day by gentle active straight leg raising easily on the side opposite to the surgery and other movements possible depending with the pain of the patient. Superficial sutures were removed on day 15 of the operation. The limb was only weight-bearing in a protected capacity at 12 weeks, progressing to full weight-bearing only at 16 weeks postoperatively once X-ray changes were suggestive of union.

## **Outcome Measures**

Secondary outcome measures were identified as the infection rate of (superficial and deep) post and the time taken to achieve bony union (as per Hammer et al. criteria) and the ROM attained at the knee joint. Secondary endpoints included the time to the partial and full weight-bearing. Follow-up assessments were conducted at regular intervals: 2 weeks, 6 weeks, and between 3, 4, and 5 months, as well as 6 months postoperatively.

## **Statistical Analysis**

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Thus, a number of descriptive data were used to illustrate patients and fractures characteristics, as well as the outcomes. To analyze the results of infection rates, union rates, and ROM, frequencies and percentages were used. Time to union and weight-bearing milestones were documented as mean  $\pm$  standard deviation.

## **Results**

### **Patient Demographics**

Out of 124 patients, 90 (72.6%) were male and 34 (27.4%) were female, yielding a male-to-female ratio of approximately 3:1. The mean age of the cohort tended to be  $35.8 \pm 9.10$  years, and age extended throughout the range of 18 to 60 years. Therefore, 78 percent of global injuries occurred as a result of road traffic crashes, 15 percent from falls from great heights, and 7 percent due to other high-impact terminologies.

### **Infection Rates**

Nine patients had clinically positive findings of the wound—mostly participants of the superficial contamination group, although five patients who did not need any rough debridement developed folliculitis, manifesting as erythematous macules, edema and pus-like discharge within a week of surgery. These infections were effectively treated with oral antibiotics (linezolid 500 mg BID); there was no need for operation. No deep infections were identified over the following six months of follow-up.

### **Bony Union**

According to Hammer et al., all 124 patients got a radiological bony union with a mean time of  $14 \pm 3$  weeks. In their studies, they did not report any cases of nonunion or malunion.

### **Range of Motion**

At six months follow-up, 122 of the patients had a full range of knee joint movement (0–130 degrees). Two patients had mild flexion restrictions ( $120^\circ$ ) after surgery as postoperative stiffness with physiotherapy.

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## Weight-Bearing Status

Finally, partial weight-bearing was started in 112 patients (90.3%) at the third month after the surgery, while only 12 patients (9.7%) began partial weight-bearing at the fourth month. One hundred and twelve of the patients (90.3%) regained the ability to bear full weight by 16 weeks, and the rest of the patients, 12 (9.7%), by 20 weeks.

## Tables and Graphs

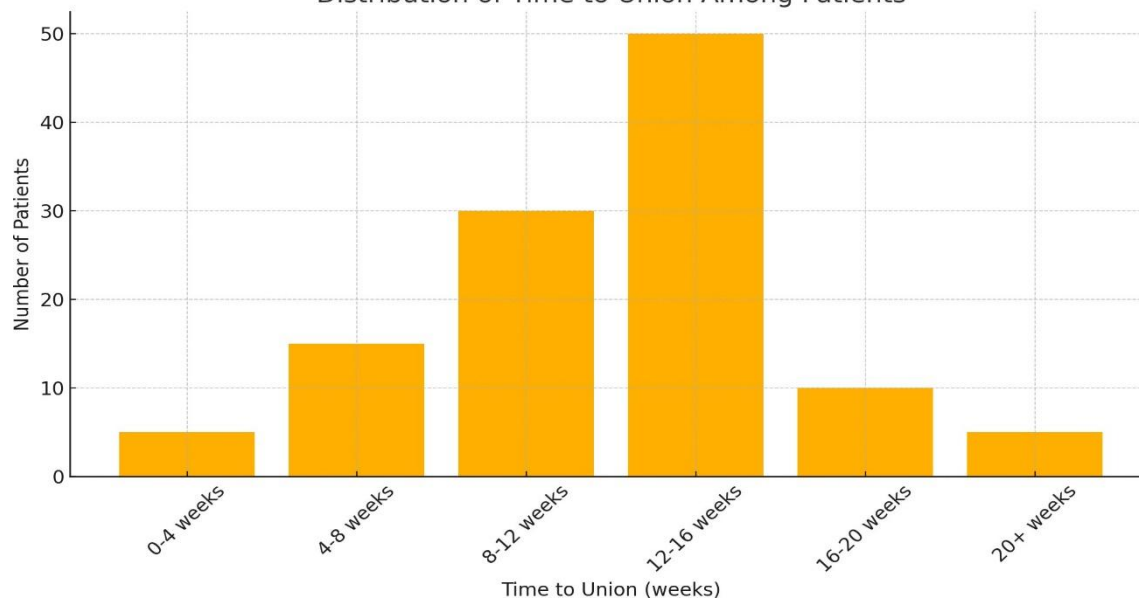
**Table 1: Demographic Characteristics of Patients**

Parameter	Value
Total Patients	124
Age (mean $\pm$ SD)	35.8 $\pm$ 9.10 yr
Male	90 (72.6%)
Female	34 (27.4%)
Mechanism of Injury	RTA (78%), Falls (15%), Others (7%)

**Table 2: Infection Rates**

Type of Infection	Number of Patients	Percentage (%)
Superficial	6	4.8
Deep	0	0

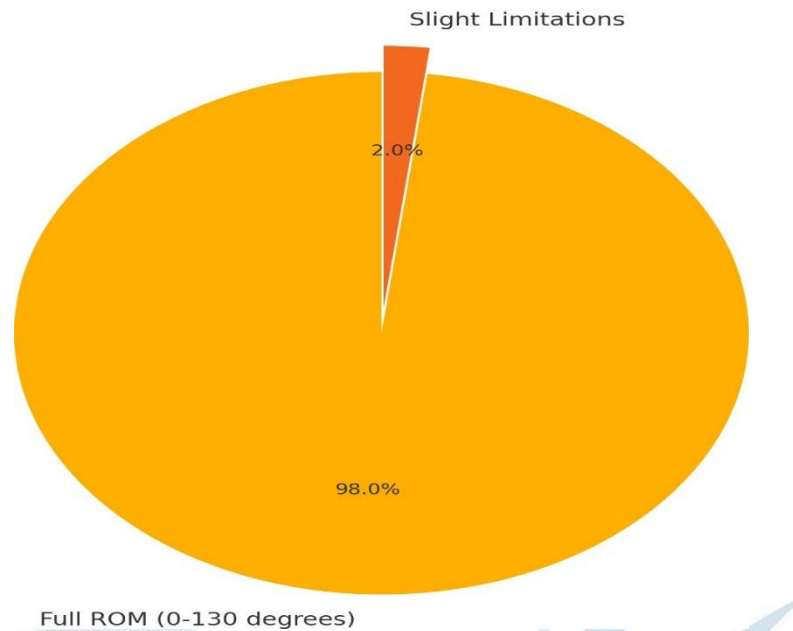
**Figure 1: Time to Bony Union (Weeks)**  
Distribution of Time to Union Among Patients



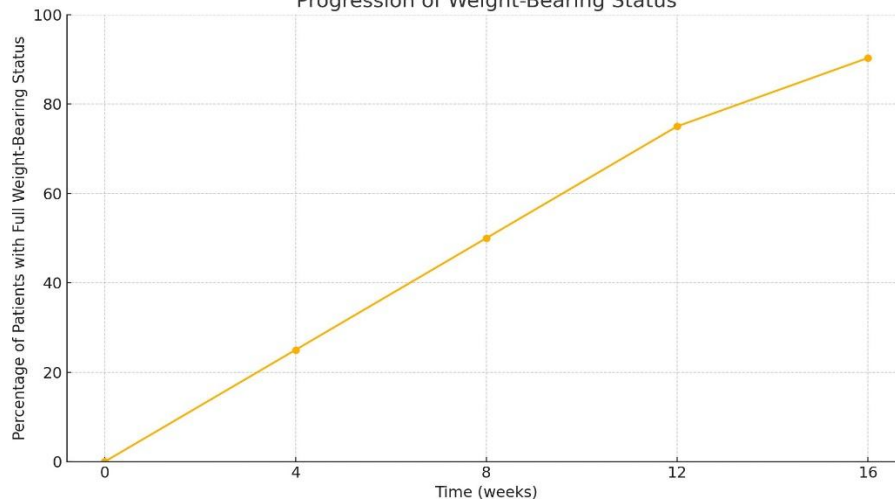
**Figure 2: Range of Motion Achieved**

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Distribution of Patients Achieving Full ROM



**Figure 3: Weight-Bearing Milestones**  
Progression of Weight-Bearing Status



## Discussion

Further, Schatzker type V and VI tibial fractures are intraarticular injuries which require accurate restoration of the anatomy and rigid internal submission to ensure satisfactory limb function and avoid several complications in the future [10]. The outcome of the present study show when anatomical LCP are used, we get fairly good results with respect to bony union, low incidence of infection and good functional outcome.

Such 100% union rate detected is in consonance with other works pointing at strong efficiency of LCP in offering the most favourable biomechanical stability for reparative bone healing [11]. The mean time to union of 14 weeks is within the range found in previous researches; thus, anatomical plating does not delay the healing [12].

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Bacteria have always being a huge problem in the management of proximal tibial fractures. The overall infection rate of 4.8% in this study is on the par or slightly higher than other series using LCPs reported to be between 2-7% [13]. Interestingly, there were no presentations of deep infections suggesting that surgical approaches especially during the peri-operative period have significantly reduced incidences of severe complications.

Regarding the functionality of the patients depending on the range of motion the patients operated with InSur implant had extremely satisfactory values; 98% of the patients recovered the full ROM. The reason for such a high level of functional outcome is the stable fixation that can be ensured by LCPs , thereby the early mobilization can be recommended to prevent joint stiffness [14].

Thus, one has to stress that even slight limitations in a minority of patients are controllable with physiotherapy, which emphasizes the necessity of postoperative rehabilitation.

This study thus also underscores weight-bearing progression as essential throughout rehabilitation and most of the participants got to full weight-bearing by 16 weeks. This is in line with the biomechanical stability afforded by the LCPs aiding in incremental load bearing without jeopardizing the construct stability [15]. Early weight-bearing has benefits which include gain of functional independence and the patients' general satisfaction.

In contrast, other fixation techniques like dual plating or using external fixators have been shown to be complicated and do not provide the same good results [16]. The described technique of applying a single precontoured anatomical plate leads to decreased operative time and less tissue damage, thus leading to lower surgical morbidity [17].

## Conclusion

Precontoured anatomical locking compression plates are highly effective in the management of intraarticular comminuted fractures of the proximal tibia (Schatzker type V and VI). The study demonstrates a 100% union rate, low superficial infection incidence, and excellent functional outcomes in terms of range of motion and weight-bearing capacity. These findings advocate for the adoption of anatomical plating as a preferred fixation method, offering reliable stability and facilitating optimal recovery in patients with complex proximal tibial fractures.

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