

## Research Article

# Functional outcome of displaced tibial plateau fracture treated by Illizarov fixator

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### ABSTRACT

**Background:** The tibial plateau fracture is a typical example of complex periarticular trauma, which has been and continues to be a considerable clinical challenge to the orthopaedician in terms of decision-making in management. Residual functional deficits in case of complex knee trauma treated with open reduction and internal fixation even when delayed till recovery of soft tissues were found to be significant. With this knowledge, we proposed to conduct a study on the effectiveness of the Illizarov technique in management of displaced tibial plateau fractures.

**Methods:** Prospective study of twenty two cases of complex tibial plateau fracture treated with Illizarov fixator done in Sri Ramachandra medical centre between June 2011-June 2013. The inclusion criteria were closed Schatzker type V & type VI tibial plateau fracture. The exclusion criteria were Schatzker Type I, II, III and IV tibial plateau fracture and any other associated lower limb fractures. The post op outcome was measured using the knee society score at each follow up and the final scoring was done at the final follow up.

**Results:** The average knee society knee score was 78.09 and the average function score was 93.5. We had 95% of excellent/good result.

**Conclusions:** Illizarov technique gives good to excellent results in high energy closed and open tibial condylar fractures. The Illizarov method offers significant advantage in the case of fracture blisters with impending compartment syndrome associated with closed high energy tibial plateau fractures. Illizarov technique provides the greatest advantage of ability to maintain the functional status of the extremity.

**Keywords:** Tibial plateau, Illizarov fixator, Schatzker classification

### INTRODUCTION

The tibial plateau fracture is a typical example of complex periarticular trauma, which has been and continues to be a considerable clinical challenge to the orthopaedician in terms of decision-making in management. Residual functional deficits in case of complex knee trauma treated with open reduction and internal fixation even when delayed till recovery of soft tissues were found to be significant.<sup>1</sup> Hence there is a need for further refinement of operative techniques and treatment protocols for improvement in results. The

Illizarov technique and other methods of external fixation circumvent this problem as only wires are used to achieve and maintain reduction of the fracture. Thus the insult to the soft tissue envelope is greatly reduced.

The Illizarov fixator can therefore also allows for early knee range of movements and weight bearing.

With this knowledge, we proposed to conduct a study on the effectiveness of the Illizarov technique in management of displaced tibial plateau fractures.

## METHODS

Prospective study of twenty two cases of complex tibial plateau fracture treated with Illizarov fixator done in Sri Ramachandra medical centre between June 2011-June 2013. The inclusion criteria were closed Schatzker Type V & Type VI tibial plateau fracture. The exclusion criteria were Schatzker type I, II, III and IV tibial plateau fracture<sup>2</sup> and any other associated lower limb fractures. Among the 22 patients included in our study there were 19 male and 3 female. The average age was 45 (30-63) years. All fractures were the result of road traffic accidents. Eighteen fractures were type VI Schatzker, five was type V. Standard antero posterior, lateral, right and left oblique roentgenograms of the affected knee were taken & fracture was classified according to Schatzker classification. The soft tissue injury was assessed using the Tschene grading in closed injuries. Fracture stabilized at the earliest with Illizarov ring fixator under 'C' arm guidance. The average waiting period before surgery was 21.4 hours (6-48 hours). The 3-ring Illizarov construct was used in all patients. Post operatively patients were mobilized by 24 hours with maximum weight bearing with walker support and daily pin tract cleaning was done. Apparatus was removed when the patient is able to perform one legged stance on the affected side. Patients were followed up at 6, 12 and 16 weeks and 1 year and 2 years. The minimum follow up was 6 months. The post op outcome was measured using the knee society score<sup>3</sup> at each follow up and the final scoring was done at the final follow up.

## RESULTS

The patients were on the fixator for 14 weeks in most cases except in one patient in whom the apparatus was removed due to bursitis and intolerance at 12 weeks and went in for malunion. The fixator was removed at an average of 14.96 weeks post trauma and weight bearing was started on the first post op day. At the final follow up the average knee range of motion was 0 to 110 degree and two patients had extension lag. Though few had some degree of thigh atrophy and six had mediolateral instability [4 had grade II varus laxity (5-10 mm) 2 patients had grade II valgus laxity] in knee flexion, no patient was troubled by symptoms pertaining to these findings. No anterior/posterior instability noticed. The average knee society score was 78.09 and the average function score was 93.5. Results as per knee society score were tabulated in Table 1.

**Table 1: Outcome based on knee society score.**

Result	Number of patients
Excellent	18 (81.9%)
Good	03 (13.6%)
Fair	01 (4.5%)
Poor	00

Six patient have pin tract infection which was treated by local dressings and oral antibiotics. One patient had deep infection which started from the pin tracts. The infection resolved with local debridement and systemic as well as local antibiotic. One patients developed intolerance to the apparatus due to bursitis. Since the apparatus was removed by 12weeks which later went for malunion.

## DISCUSSION

Bicondylar high energy fracture (Schatzker type V & VI) are associated with severe articular depression, separation of condyles, diaphyseal comminution and dissociation and loss of integrity of the soft tissue envelope. The most popular treatment has been reduction and internal fixation with double plating, but this is associated with many complications such as joint stiffness, malunion, skin loss which has been as high as 50% in some studies. The occurrence of post-operative skin infection and osteomyelitis has been reported as 42% and 33% respectively. To reduce the incidence of such problems minimal internal-external fixation through limited approached has been attempted with good results. An alternative method was proposed by Illizarov and we have adopted his techniques for treatment of fractures and nonunion. In this prospective study, we have used this method for management of high-energy fractures of tibial plateau.

Illizarov methodology has been accepted as one of the modalities in treating open fractures, infective non-union, lengthening procedures, deformity correction of the osteoporotic fractures. Illizarov fixator has been used because of the structure of the apparatus which gives stability and rigidity. Stability is the ability of the fixator to maintain the necessary mechanical configuration during treatment. Rigidity is a measure of the mechanical response of the fixator, which has importance in the healing response. The non-linear behavior of Illizarov frame is less stiff in bending, particularly in lateral medial direction, but its values for lateral medial and antero-posterior bending are similar. In torsion, the Illizarov frames are less stiff. The unique wire-ring combinations in the Illizarov apparatus produces a much lower axial stiffness and axial loading force, which distributes load to all parts of the frame, than do the uni-planar fixator that use much heavier pins. At the same time it shows higher axial stiffness against loading from bending forces.

In our study patients were taken up for surgery at an average of 21.4 hours post trauma (6 to 48 hours). The fixator was removed at an average of 14.96 weeks post trauma and weight bearing was started on the first post op day. At the final follow up the average knee ROM was 0 to 110 degree and 2 patients had extension lag. Though all had some degree of thigh atrophy and 4 had mediolateral instability in knee flexion, no patient was troubled by symptoms pertaining to these findings. One

patient had debilitating knee pain and flexion contracture and only one patient was using a cane at the last follow up. Day to day activities such as walking, stair case climbing and squatting could be performed satisfactorily by a majority of the patients. The average knee society knee score was 78.09 and the average function score was 93.5. There were eighteen (81.9%) excellent, three good (13.6%), one fair result (4.5%) and no poor results. The most common complication was pin tract infection. One fracture went into mal union due to early removal of the fixator.

The most common treatment of displaced fractures of tibial plateau has been open reduction with restoration of articular surface to as near to the anatomical position as possible and internal fixation to maintain the reduction which early motion of the joint is begun. However some data<sup>4-6</sup> have suggested that the long-term outcome depends less on the reduction that is obtained and more on the stability of the knee and that less extensive operation may lead to satisfactory results.<sup>7</sup>

Many studies have documented the high incidence of pin tract infection especially with small tensioned wires that tether the proximal medial gastrocnemius tendons or lateral fibular head<sup>8</sup> to place the wires more posterior in the popliteal crease would risk not only a higher potential rate of infection, but also would be risky regarding neurovascular embarrassment. In our study 4% of patients developed pin tract infection which was treated by local dressing and oral antibiotics. Pin tract was followed by deep infection in same patients. The infection resolved with local debridement and systemic as well as local antibiotics. 4.5% patients developed intolerance to apparatus due to bursitis. Since the apparatus was removed by 12 week later went in for non-union. Besides these complications the results were 81.9% excellent, 13.6% good and 4.5% fair these fair results included the pin tract infection. The average duration of fixator was 16.5% week and average range of movement achieved on final follow up 104 degrees. The average follow up period was 19.2 months average healing time 16 weeks. 11 patients showed good results.

The potential disadvantage of indirect reduction (under the control of image intensifier) and ring fixation (external fixation) is decreased accuracy of reduction of articular surface compared with that obtained with open reduction. Koval et al.<sup>7</sup> demonstrated the difficulty in obtaining and assessing reduction of depressed fragments with indirect techniques. No meniscal or ligamentous injuries were treated operatively. Though 6 of our patients had mediolateral instability 4 had grade II laxity (5-10 mm) 2 patients had grade II valgus laxity in knee flexion, no patients was troubled by symptoms pertaining to these finding. No antero-posterior instability noticed.

Illizarov ring fixator allows both early movement and early weight bearing. The value of early movement has been well established in literature.<sup>9</sup> Early weight bearing

stimulates bone healing and allows retention of muscular strength.<sup>10-12</sup> The Illizarov frame allows adequate initial weight bearing our study emphasized the low morbidity associated with the Illizarov method. No patients developed osteomyelitis or septic arthritis. The technique is well suited to management of complex fractures of tibial plateau when extensive dissection and internal fixation are contraindicated due to comminution at the fracture site and compromise of the soft tissue.

The Illizarov technique though it is an effective method of dealing with high energy complicated fracture of tibial plateau and has the advantages of preserving soft tissue integrity, facilitating early knee ROM in addition to providing stable fixation of the fracture. Our original reason for considering Illizarov ring fixation for complex fracture of tibial plateau as to limit the soft tissue and wound complication that have been reported after the wide exposures required for internal fixation. We had mixed results in achieving this goal. There were no wound breakdowns and early infections at fracture site.

## CONCLUSION

Illizarov method is a procedure in the treatment of complex tibial plateau fractures with severe soft tissue complications, where internal fixation could not be contemplated. Illizarov technique gives good to excellent results in high energy closed and open tibial condylar fractures. We had a good functional range of motion, averaging 110degree with an average healing time of 14.96 week. In this technique no bone grafting is required. The Illizarov method offers significant advantage in the case of fracture blisters with impending compartment syndrome associated with closed high energy tibial plateau fractures.

Illizarov ring fixator gives stability, rigidity and prevents secondary displacement of the fracture fragments by using multiple K-wires and strategic placement of the olive wires that facilitates reduction of fracture, correction of angular deformity and translation of fracture fragment. Illizarov technique provides the greatest advantage of ability to maintain the functional status of the extremity. This accomplished by allowing and indeed encouraging, full weight bearing on the injured limb at the first post-operative day. Ambulating with full weight bearing stimulates bone healing and preserves range of motion of the adjacent joints. Through our data in this study, with an excellent and good functional outcome of 95.5% (based on knee society score), we conclude that Illizarov ring fixator is an useful armamentarium and effective alternative to conventional fixation in the management of type V and type VI tibial plateau fractures.

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