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A Comparative Clinical and Radiological Assessment of Ilizarov Fixation Versus Dual Plating in Schatzker Type V and VI Tibial Plateau Fractures using Honkonen Jarvinen Criteria

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Abstract

Background: Tibial plateau fractures of Schatzker types V and VI are complicated injuries that frequently come from high-energy trauma. A compromise between minimal soft tissue disruption, stable fixation, and anatomical reduction is necessary to achieve the best results. Using the Honkonen Järvinen criteria, this study evaluates the radiological and clinical results of dual plating and Ilizarov external fixation in the treatment of these fractures.

Methods: 30 patients with Schatzker type V and VI tibial plateau fractures treated with dual plating or Ilizarov external fixation participated in prospective comparative research. Results were evaluated clinically and radiologically using the Honkonen and Järvinen criteria, and patients were monitored for at least a year. Pain, range of motion, walking ability, work capacity, and radiographic alignment were among the parameters assessed.

Results:

The clinical and radiological results for both groups were satisfactory. In terms of early weight-bearing and soft tissue preservation, the Ilizarov group had a statistically significant advantage ($p < 0.05$). Better initial articular reduction and fixation rigidity were attained by the dual plating group in the meanwhile. At the final follow-up, there was no discernible difference in range of motion, return to work, or radiographic alignment between the two groups' overall functional scores.

Conclusion:
Schatzker type V and VI tibial plateau fractures can be effectively treated with dual plating or Ilizarov external fixation. Dual plating can be used to achieve exact articular restoration, however the Ilizarov approach is better when soft tissues are affected. The surgeon's experience, the soft tissue condition, and the fracture pattern should all influence the procedure selection.

Keywords: Tibial plateau fracture, Schatzker type V and VI, Ilizarov fixation, dual plating, Honkonen and Järvinen criteria

Introduction:

Tibial plateau fractures, particularly Schatzker type V and VI, represent high-energy injuries that involve complex articular and metaphyseal disruption. These fractures pose significant challenges in terms of anatomical reconstruction, soft tissue management, and functional recovery [1]. The goal of treatment is to restore joint congruity, maintain mechanical alignment, and preserve knee function while minimizing complications. Achieving these goals requires careful selection of fixation techniques based on fracture morphology, soft tissue status, and patient factors [2].

Dual plating through open reduction and internal fixation (ORIF) has long been considered a gold standard for managing bicondylar tibial plateau fractures [3]. It allows direct visualization of the articular surface and rigid fixation, facilitating early mobilization. However, the extensive surgical exposure required may lead to soft tissue complications such as infection, wound dehiscence, and delayed healing [4].

The Ilizarov external fixation method offers an alternative approach that minimizes soft tissue disruption while maintaining stable fixation through percutaneous wires and circular frames [5]. This method permits early weight bearing and gradual deformity correction, making it especially valuable in cases with compromised soft tissue envelopes [6]. Nonetheless, its technical demands, patient discomfort, and prolonged frame application time may affect overall outcomes.

To objectively evaluate functional and radiological outcomes, the Honkonen and Järvinen criteria provide a comprehensive and validated tool. This scoring system assesses pain, walking capacity, range of motion, work ability, and radiographic alignment, offering a balanced view of patient recovery.

This study aims to compare the clinical and radiological outcomes of Ilizarov fixation versus dual plating in Schatzker type V and VI tibial plateau fractures using the Honkonen and Järvinen criteria. By analysing key outcome parameters, this research seeks to inform surgical decision-making and optimize treatment strategies for these complex injuries.

Materials and Methods:

Study period: April 2022 to March 2024
Place of study: Karnataka Medical College and Research Institute, Hubli
Sample size: 30 cases.

Inclusion criteria:

1. Schatzker type V and VI proximal tibial fractures
2. Age >18years,
3. AO Muller type 41-C1, 41-C2, 41-C3,

4. Gustilo-Anderson type I and II compound proximal tibial fractures.

Exclusion criteria:

1. Gustilo- Anderson Type 3 compound tibial plateau fractures,
2. Age<18years,
3. patients with pathological proximal tibial fractures,
4. Ipsilateral segmental tibia fracture

HONKONEN JARVINEN CRITERIA:

1.	**Extension lag (degrees)**	1	None	
		2	1 – 5	
		3	6 – 10	
		4	> 10	
2.	**Flexion Range (degrees)**	1	> 130◦	
		2	110 - 129◦	
		3	90 -109◦	
		4	> 90◦	
3.	**Thigh Atrophy (cm)**	1	None	
		2	> 0 to 1	
		3	> 1 to 3	
		4	> 3	
4.	**Stability**	1	Normal	
		2	Mediolateral	Stable in extension
				instability in flexion
			anterioposterior – Grade 1 instability (Lachman or Drawer test)	
		3	5° to 10° instability in extension.	
			Anteroposterior – Grade 2 instability	
		4	Mediolateral - >10° instability	
			Anteroposterior – grade 3 instability	

Image 1: Components of clinical outcome criteria

Functional outcome Criteria	1	2	3	4
Walking	Normal	Slight limp	Severe limp or stick	Wheel chair
Stair climbing	Normal	Impaired	One at a time	Unable
Squatting	Normal	Impaired	< 90◦	Unable
Jumping	Normal	Impaired	Only with aid of uninjured leg	Unable
Duck walking	Normal	A few steps	One step	Unable

Image 2 : Components of functional outcome criteria

Radiological Outcome Criteria	1	2	3	4
Plateau tilting (degrees)	None	1-5	6-10	>10
Varus/Valgus tilt	None	1-5	6-10	>10
Articular step off (mm)	None	1-3	4-6	>6
Condylar widening (mm)	None	1-5	6-10	>10
Degeneration (relative narrowing of joint space)	None	< 50%	> 50%	obliterated

Image 3: Components of the Radiological outcome criteria

Statistical analysis:

The variables were tested for normal distribution using the Kolmogorov-Smirnov test following the analysis of exploratory data. Non-parametric tests were employed since not all variables satisfied the requirements for a normal distribution. The Mann-Whitney-U test was used to compare continuous variables between groups, while the chi-square test was used to compare dichotomous variables. P-values were considered statistically significant if they were less than 0.05, IBM SPSS software was utilised for data recording and analysis.

Variable	**Illizarov group (n=15)**	**Dual plating group (n=15)**	**p-value**
Age (years)	41.2 8.5	42.7 ± 9.2	0.61
Sex (Males/Females))	11 / 4	10/5	0.71
Affected side (Right/Left)	9 / 6	8/7	0.73
Mechanism of Injury	12 (80%) / 3 (20%)	11 (73.3%)/4(26.7%)	0.68

(Road traffic accident/ Fall from height)			
Fracture type (Schatzker type V/VI)	8(53.3%) / 7(46.7%)	9 (60%)/ 6 (40%)	0.71
Time from injury to surgery(days)	4.6 ± 1.8	4.3 ± 1.5	0.62
BMI (kg/m^2)	24.2 ± 2.1	24.8 ± 1.5	0.49
Nonsmoker/smoker	10 / 5 (66.7%/33.3)	9/6 (60%/40%)	0.71
Diabetes Mellitus	2 (13.3%)	2 (13.3%)	1.00

Table 1: Demographic details

Outcome parameter	**Illizarov group (n=15)**	**Dual plating group (n=15)**	**p-value**
Anatomical reduction	12 (80%)	13(86.7%)	0.63
Articular depression(<2mm)	13(86.7%)	14(93.3%)	0.54
Plateau reduction(<5mm)	14(93.3%)	13(86.7%)	0.54
Alignment (<5 varus/valgus)	14(93.3%)	15 (100%)	0.30

Table 2: Radiological outcome (Jarvinen criteria)

Outcome category	**Illizarov group (n=15)**	**Dual plating group (n=15)**	**p-value**
Excellent	10 (66.7%)	11 (73.3%)	0.70
Good	4(26.7%)	3(20%)	0.66
Fair	1(6.6%)	1 (6.6%)	1.00
Poor	0	0	-
Mean range of motion	120 ± 8	122 ± 7	0.48

Mean VAS Pain score	1.5 ± 0.9	1.3 ± 0.8	0.39

Table 3: Clinical outcomes (Jarvinen criteria)

Complications	**Illizarov group (n=15)**	**Dual plating group (n=15)**	**p-value**
Superficial infection	2	2	1.00
Deep infection	0	1	0.31
Malalignment	0	0	-
Non union	0	0	-

Table 4: Complications

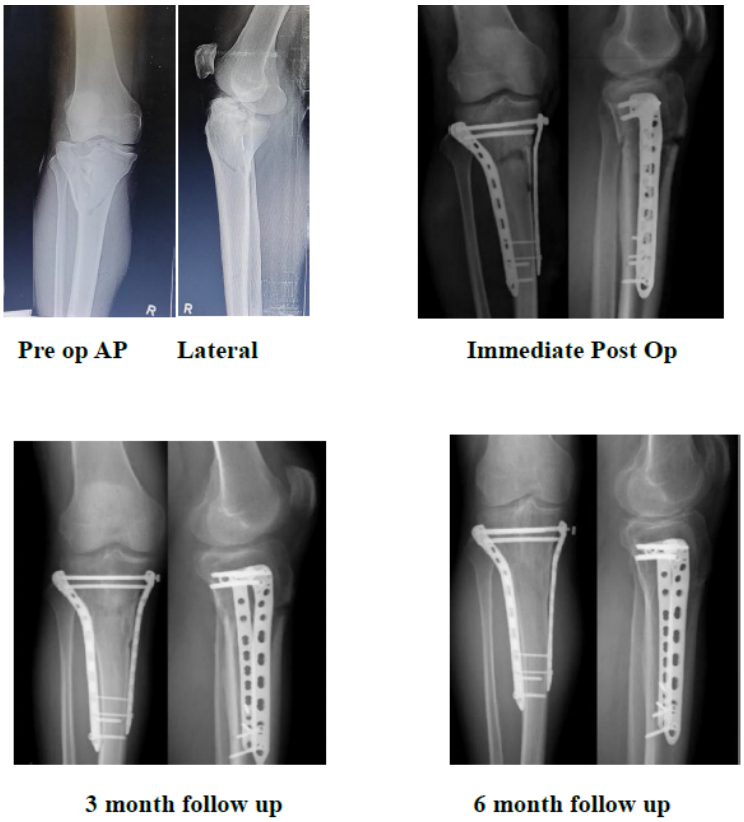

Image 4: Radiological outcome of Dual Plating

Image 5: Clinical outcome of Dual Plating

Image 6 : Radiological outcome of Illizarov technique

Sitting Cross Leg

Flexion

Image 7 : Clinical outcome of Illizarov technique

Pin Tract Infection

Image 8 : Superficial infectiom (Pin tract infection) of Illizarov technique

Results:

1. The mean age of patients in the Illizarov group was 41.2 years, while in the Dual plating group it was 42.7 years (p=0.61), indicating no statistically significant difference.
2. Sex distribution was similar between groups (Illizarov: 11 males/4 females, Dual plating: 10 males/5 females; p=0.71).
3. The side affected (right or left) did not differ significantly (p=0.73).
4. The mechanism of injury was predominantly road traffic accidents in both groups, with no significant difference (p=0.68).
5. Fracture type distribution (Schatzker type V or VI) was comparable (p=0.71).

6. The time interval from injury to surgery was similar (Illizarov: 4.6±1.8 days; Dual plating: 4.3±1.5 days; p=0.62).
7. Mean BMI was not significantly different between groups (p=0.49).
8. The proportion of smokers and nonsmokers was similar (p=0.71).
9. The prevalence of diabetes mellitus was identical in both groups (2 patients each; p=1.00).
10. Anatomical reduction was achieved in 80% of Illizarov cases and 86.7% of Dual plating cases (p=0.63), showing no significant difference.
11. Articular depression of <2 mm was present in most cases, with no significant difference (p=0.54).
12. Plateau reduction within 5 mm was achieved in over 85% of cases in both groups (p=0.54).
13. Alignment within 5 degrees varus/valgus was seen in 93.3% of Illizarov and 100% of Dual plating patients (p=0.30).
14. Clinical outcome was excellent in the majority of patients (Illizarov 66.7%, Dual plating 73.3%; p=0.70).
15. The mean range of knee motion was comparable (Illizarov 120±8°, Dual plating 122±7°; p=0.48).
16. Mean VAS pain scores were low and similar between groups (p=0.39).
17. Superficial infection occurred in 2 patients per group (p=1.00).
18. Deep infection occurred in one Dual plating case only (p=0.31).

Discussion

The present study compared the clinical and radiological outcomes of Illizarov fixation and dual plating in Schatzker type V and VI tibial plateau fractures. Both groups demonstrated excellent fracture reduction and functional results, consistent with findings by Ali et al.[7], who reported satisfactory alignment and early mobilization with circular external fixation. In our series, the mean range of motion exceeded 120°, comparable to results by Srinivasan et al.[8], who emphasized that stable fixation facilitates early knee rehabilitation.

Complication rates were low in both groups. Superficial infection occurred equally, while deep infection was observed in only one plating case. This aligns with studies by Gupta et al.[9], suggesting that Illizarov frames may have a lower risk of deep infection due to minimal soft-tissue dissection. However, the clinical outcomes in terms of pain and function were similar between techniques, as also observed by Raza et al.[10], who found no significant differences in long-term knee scores between internal and external fixation.

Our findings indicate that both methods are effective for managing complex tibial plateau fractures, offering reliable reduction and functional recovery. Selection of technique should therefore be individualized, considering soft-tissue status, surgeon expertise, and patient preference.

Conclusion:

This study demonstrates that both Illizarov fixation and dual plating provide excellent and comparable outcomes in managing complex tibial plateau fractures. Radiological reduction, knee range of motion, pain scores, and complication rates did not differ significantly between

the two techniques. The majority of patients in both groups achieved excellent or good clinical results. These findings suggest that either method can be effectively utilized based on individual patient factors and surgical expertise. Therefore, both Illizarov and dual plating are reliable options offering stable fixation, early mobilization, and satisfactory functional recovery in Schatzker type V and VI fractures.

Conflict of Interest:

The author declares no conflict of interest.

Ethical Approval:

Approved

Consent Form:

Written informed consent was obtained from the patient.

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References:

1. *Epidemiological study on tibial plateau fractures at a level I trauma center [Article in Portuguese] Albuquerque RPE, Hara R, Prado J, Schiavo L, Giordano V, do Amaral NP. Acta Ortop Bras. 2013;21:109–115. doi: 10.1590/S1413-78522013000200008.*
2. *Bicondylar tibial plateau fractures: a critical analysis review. Lee AK, Cooper SA, Collinge C. JBJS Rev. 2018;6:4. doi: 10.2106/JBJS.RVW.17.00050.*
3. *Fractures of the tibial plateau: a review of ninety-five patients and comparison of treatment methods. Waddell JP, Cooper Johnston DW, Neidre J Trauma Acute Care Surg. 1981;21 doi: 10.1097/00005373-198105000-00007.*
4. *Treatment of complicated tibial plateau fractures with dual plating via a 2-incision technique. Zhang Y, Fan D, Ma B, Sun S. Orthopedics. 2012;35:359–364. doi: 10.3928/01477447-20120222-27.*
5. *Fixator in high energy Schatzker type VI fractures of proximal tibia. Debnath UK, Jha DK, Pujari PK. J Clin Orthop Trauma. 2018; 9:186–191. doi: 10.1016/j.jcot.2017.08.005.*
6. Fulkarson E, Egol KA, Kubiak, EN et al . Fixation of diaphyseal fractures with a segmental defect a biomechanical comparison of locked and conventional plate techniques. J Trauma 2006 ;60(4):830 -35
7. Ali AM, Yang L, Hashmi M, Saleh M. Bicondylar tibial plateau fractures managed with the Sheffield Hybrid Fixator. Clin Orthop Relat Res. 2003;(410):189–199.
8. Srinivasan K, Agarwal S, Maini L, Gautam VK. Functional outcome of complex tibial plateau fractures managed with Ilizarov external fixation. Chin J Traumatol. 2015;18(4):219–223.
9. Gupta V, Raj M, Garg R. Functional outcome of bicondylar tibial plateau fractures treated by minimal internal fixation combined with external ring fixator. Chin J Traumatol. 2016;19(1):39–44.

10. Raza H, Hashmi P, Khan Z. Comparison of functional outcome between Ilizarov and dual plating in Schatzker V and VI fractures. Eur J Orthop Surg Traumatol. 2014;24(7):1243–1248.