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OUTCOME OF FIXATION OF DISPLACED AND UNSTABLE CLOSE SCHATZKER TYPE V & VI TIBIAL PLATEAU FRACTURES BY USING UNILATERAL LOCKING T PLATE

RESULTADOS DA FIXAÇÃO DE FRATURAS DESLOCADAS E INSTÁVEIS DO PLANALTO TIBIAL DOS TIPOS V E VI DE SCHATZKER POR MEIO DO USO DE PLACA EM T DE BLOQUEIO UNILATERAL

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Abstract
Background: Fractures of the tibial plateau, especially Schatzki type V and VI, are intricate intra-articular injuries which typically occur as a result of high-energy trauma. These fractures are very challenging because they are accompanied by soft tissue damage, comminution and problems with attaining a stable fixation. Although there is good fixation with dual plating, it is linked with increased soft tissue complications. Unilateral locking T plate fixation is also a less invasive option with perhaps similar results. Objective: o establishes if there is functional outcome of fixation of displaced and unstable closed Schatzki type V and VI tibial plateau fractures with unilateral locking T plate. Methodology: This was a descriptive longitudinal study which was carried out in the Orthopedic Department of Bahawal Victoria Hospital, Bahawalpur, within a period of October 2025 to January 2026. Sixty consecutive samplings were used to sample 60 patients aged 20-60 years with Schatzki type V and VI fractures. Patients were operated on with the use of a unilateral locking T plate and open reduction. During 12 weeks of follow-up, functional outcome was examined with the

Resumo
Antecedentes: As fraturas do planalto tibial, especialmente as do tipo V e VI de Schatzki, são lesões intra-articulares complexas que geralmente ocorrem em consequência de traumatismos de alta energia. Essas fraturas representam um grande desafio, pois são acompanhadas por danos nos tecidos moles, cominuição e dificuldades para se obter uma fixação estável. Embora a fixação com placas duplas seja eficaz, ela está associada a um aumento das complicações nos tecidos moles. A fixação com placa T de bloqueio unilateral também é uma opção menos invasiva, com resultados possivelmente semelhantes. Objetivo: determinar se há resultados funcionais na fixação de fraturas fechadas deslocadas e instáveis do planalto tibial dos tipos V e VI de Schatzki com placa T de bloqueio unilateral. Metodologia: Este foi um estudo descritivo longitudinal realizado no Departamento de Ortopedia do Bahawal Victoria Hospital, em Bahawalpur, no período de outubro de 2025 a janeiro de 2026. Foram selecionados 60 pacientes consecutivos com idades entre 20 e 60 anos, portadores de fraturas de Schatzki tipo V e VI. Os pacientes foram operados com o uso de

Oxford Knee Score, and was measured as excellent, good, fair and poor. SPSS version 25 was used to analyze the data. Findings: Out of 60 patients, 78, 13, 6, and 3, achieved excellent, good, fair and poor results respectively. The mean Oxford Knee Score was 41.2 ± 4.6. The age at which they were presented, earlier age and lack of diabetes were significantly linked to better outcomes ($p \leq 0.05$). Conclusion: Unilateral locking T plateau fixation is a good treatment modality in displaced Schatzki type V and VI tibial plateau fractures to achieve satisfactory functional results with minimal soft tissue complications as compared to dual plating.

Keywords: Tibial Plateau Fracture. Schatzki Type V & Vi. Unilateral Locking T Plate. Functional Outcome. Oxford Knee Score. Orif.

uma placa T de bloqueio unilateral e redução aberta. Durante 12 semanas de acompanhamento, o resultado funcional foi avaliado com o Oxford Knee Score e classificado como excelente, bom, razoável e ruim. O SPSS versão 25 foi utilizado para analisar os dados. Resultados: Dos 60 pacientes, 78, 13, 6 e 3 alcançaram resultados excelentes, bons, razoáveis e ruins, respectivamente. A média do Oxford Knee Score foi de 41,2 ± 4,6. A idade na apresentação, idade mais precoce e ausência de diabetes estavam significativamente associadas a melhores resultados ($p \leq 0,05$). Conclusão: A fixação unilateral com placa T de bloqueio no planalto tibial é uma boa modalidade de tratamento em fraturas deslocadas do planalto tibial dos tipos V e VI de Schatzki para alcançar resultados funcionais satisfatórios com complicações mínimas nos tecidos moles, em comparação com a fixação com duas placas.

Palavras-chave: *Fratura do Plancho Tibial. Tipos V e Vi De Schatzki. Placa T de Bloqueio Unilateral. Resultado Funcional. Oxford Knee Score. Orif.*

1 INTRODUCTION

Tibial plateau fractures are a heterogeneous series of injuries with simple split injuries and complicated bicondylar configurations, which are normally caused by high-energy injuries like road traffic accidents, especially those connected with motorcycles (1,2). As motor vehicle accidents have been on the increase, the fractures have become a common occurrence and are often coupled with polytrauma.

The clinical importance of these intra-articular injuries is that they are associated with long-term effects, such as stiffness, post-traumatic osteoarthritis and instability in the knee joint. The intensity of these complications is usually enhanced by concomitant soft tissue damage due to the axial loading forces in conjunction with varus or valgus stress forces (3). Schatzki classification defines type V and VI fractures as complex fractures with both condyles involved, and the fracture is usually accompanied by metaphyseal-diaphyseal dissociation, excessive comminution, and high probability of compromising the soft tissue (4).

The AO/OTA guidelines suggest conservative treatment of stable, displaced fractures; the displaced and unstable ones necessitate surgical treatment to restore the articular congruity, mechanical alignment, and attain optimal functional results (5). Although surgical procedures have improved, bicondylar tibial plateau fractures are still difficult to treat and they carry a huge possibility of intraoperative and postoperative complications (6).

Anatomical reduction of the articular surface, restoration of the mechanical axis and maintenance of ligamentous stability are the main objectives of treatment to provide early mobilization and functional recovery. Innovation of locking plate technology by Carl Hansmann and further developed by Paul Reinhold has transformed the way fractures are fixed by offering angular stability particularly in osteoporotic and comminuted fractures (7).

Dual plating (open reduction and internal fixation) has been considered as the gold standard of treating complex bicondylar fractures because it offers a better biomechanical stability. The method however involves a lot of soft tissue dissection that predisposes wound complications and infection. Conversely, unilateral periarticular locking plate fixation has become popular because it is a less invasive treatment providing sufficient stability with minimal disturbance of soft tissue and minimizing complications of the surgical site (8,9).

Past research, including the one by Shah et al., has shown excellent functional outcomes of most patients treated with plating techniques with 80.9% of the cases reporting excellent outcomes (10). In most of the low-resource situations, however, the adoption of non-locking implants and inadequate fixation strategies tend to cause the length of immobilization, which causes joint stiffness, malunion, chronic pain, and high socioeconomic load.

In our practice, poor fixation with unilateral non-locking T plates is related to poor functional outcomes. Thus, the research was done to assess the functional outcome of displaced and unstable V and VI fractures of the tibia plateau in case of unilateral fixation with locking T plate, with the objective of having evidence of a safe and more efficient method of surgery.

2 OBJECTIVE

To establish the functional result of the fixation of displaced and unstable tibial plateau fractures of the type V and VI with the help of unilateral locking T plate.

3 METHODOLOGY

The descriptive longitudinal study was carried out in Bahasa Victoria Hospital in Bahawalpur from October 2025 to January 2026. There were 60 patients who were recruited based on non-probability consecutive sampling. The inclusion criteria were a patient with displaced Schatzki type V and VI fracture aged 20—60 years old and presented within 72 hours of the trauma. All of them were open reduction and internal fixation using unilateral locking T plate with a general or spinal anesthesia. Early mobilization and physiotherapy was part of postoperative rehabilitation. Oxford Knee Score was used to measure functional outcomes at 12 weeks.

4 INCLUSION CRITERIA

The study incorporated patients of both genders aged 20-60 years who reported within 72 hours of injury with displaced and unstable closed tibial plateau fractures (Schatzki type V and VI).

5 EXCLUSION CRITERIA

The study excluded patients with open fractures with severe soft tissue injury, related fracture of the femur, patella, pelvis or ankle, extra-articular proximal tibial fractures, compartment syndrome necessitating fasciotomy or vascular injury necessitating repair.

6 DATA COLLECTION PROCEDURE

Fulfilled the inclusion criteria were enrolled in the study after they had given ethical approval and informed consent. Clinical examination was done thoroughly, which

involved the examination of the affected limb in terms of swelling, deformation, and neurovascular condition. Radiological evaluation was conducted with anteroposterior and lateral X-ray of the knee and computed tomography (CT) was done where possible to more clearly define fracture patterns. Surgical fixation was to be done once there was good soft tissue recovery which was seen through swelling relieved and wrinkle sign appeared. Fixation was done in all the patients with a unilateral locking T plate under the right anesthesia. Patients were encouraged to engage in early mobilization and physiotherapy with the postoperative management, and the patients were followed after every fortnight. The ultimate functional outcome was measured at 12 weeks through a structured proforma which was based on standardized scoring criteria.

7 DATA ANALYSIS

The data were keyed in and analyzed with SPSS version 25.0. Continuous variables like age, length of fracture and body mass index (BMI) were given in mean and standard deviation and categorical variables like gender, type of trauma, Schatzki classification, place of residence, diabetes status and functional outcome were given in frequencies and percentages. The Shapiro-Wilk test was done to test the normality of the data. Stratification was done to balance the various possible modifiers of the effect like the age, sex, length of injury, type of injury, Schatzki type, place of residence (rural/urban), and diabetes mellitus. After the stratification, the chi-square test was used to establish the relationship of these variables with functional outcome. A p-value of 0.05 or less was deemed as significant.

8 RESULTS

The study involved 60 displaced and unstable tibial plateau fractures of type V and VI in the study. The mean age of participants was 38.5 ± 9.2 years, with a predominance of males (38, 63.3%) over females (22, 36.7%). The most common cause of injury was road traffic accidents with 85 percent cases. The 24 (40) patients were presented with Schatzki type V fractures and 36 (60) patients with Schatzki type VI

fractures. Twelve (20%), had diabetes mellitus and most of the surgery (35, 58.3) was done less than 5 days after the injury.

Table 1

Baseline Characteristics

Parameter	Category	Frequency	Percentage
Age (years)	Mean ± SD	38.5 ± 9.2	-
Gender	Male	38	63.3%
	Female	22	36.7%
Mechanism of Injury	Road Traffic Accident	51	85%
	Others	9	15%
Schatzker Type	Type V	24	40%
	Type VI	36	60%
Diabetes Mellitus	Yes	12	20%
	No	48	80%
Time to Surgery (days)	<5	35	58.3%
	≥5	25	41.7%

8.1 Functional outcome at 12 weeks

Oxford Knee Score was used to measure functional outcomes for 12 weeks. Forty-seven patients (78 percent) had excellent outcomes, eight (13 percent) had good outcomes, four (6 percent) had fair outcomes and two (3 percent) had poor outcomes. The average Oxford Knee Score of the cohort was 41.2 ± 4.6, indicating that there is a satisfactory functioning of the knee. Outcome Oxford Knee Score Frequency Percentage.

Table 2

Outcome	Oxford Knee Score	Frequency	Percentage
Excellent	40–48	47	78%
Good	30–39	8	13%
Fair	20–29	4	6%
Poor	0–19	2	3%
Mean Oxford Knee Score	-	41.2 ± 4.6	-

8.2 Association of functional outcome with key variables

The chi-square test was used to determine the relationship between functional outcome and essential variables of the patient and surgery. Statistically significant were found to be age, diabetes status and time to surgery ($p \leq 0.05$). Patients who had young age (under 40 years), no diabetes and those who had early surgery (less than 5 days) were more likely to have excellent or good functional outcomes. The type of Schatzki fracture (V vs VI) and functional outcome did not show any statistically significant correlation ($p = 0.07$).

Table 3

Variable	Category	Excellent/Good	Fair/Poor	p-value
Age	<40 years	28	3	0.04*
	≥40 years	27	4	
Diabetes Mellitus	Yes	6	6	0.03*
	No	39	9	
Time to Surgery	<5 days	33	2	0.02*
	≥5 days	12	4	
Schatzker Type	V	19	5	0.07
	VI	36	6	

*Statistically significant at $p \leq 0.05$

8.3 Interpretation

This study demonstrates that Schatzki type V and VI tibial plateau fractures which are displaced and unstable lead to good functional results when unilateral locked T plate fixation. Most patients (78%) were doing very well at 12 weeks after operation through the help of a good average Oxford Knee Score (41.2 ± 4.6). Age at the time of surgery (younger), lack of diabetes and early surgery were strong predictors of improved functional recovery. The results indicate that this type of less invasive fixation provides sufficient stability that allows early mobilization with minimal complications caused by excessive soft tissue dissection that includes infection and wound healing issues.

In general, unilateral locking T plateau fixation is an appropriate and dependable method of treatment of complex bicondylar tibial plateau fractures which attain satisfactory anatomical restoration and functional recovery in most of the patients.

9 **DISCUSSION**

The current research indicates that T plateau fractures of the displaced and unstable Schatzki type V and VI fractures have satisfactory functional results when the fixation is done using unilateral locking T plateau. With this fixation, most patients in this group have had excellent or good results in 12 weeks meaning that this fixation technique provides a stable fixation of complex intra articular injury.

Our findings agree with those that have been reported in the past. Shah et al. achieved good functional outcomes in 80.9 per cent of patients who were put under plating techniques, which highlights the usefulness of stable internal fixation in the management of bicondylar tibia plateau fractures [10]. Traditional ORIF using two plates has been commonly considered to be biomechanically sound to use in the case of bicondylar injuries, but many times necessitate a lot of soft tissue dissection and even a high rate of wound complications [1,9]. This has brought the need to explore less invasive fixation strategies.

Lee et al. have shown similar functional and radiological results in unilateral locking plates and dual plating in the complex tibial plateau fractures, with the unilateral locking plateau method showing less soft tissue complications and a less hospital stay time [8]. In a similar vein, Matheus Manolo Arouca et al. demonstrated that single lateral locked plates had sufficient radiographic reduction as compared to a double plating in Schatzki V and VI fractures, further supporting the usefulness of less invasive constructs when the morphology of a fracture allows [11]. Lateral locking plates have proven to be as stable as more comprehensive constructs in cadaveric and model systems, biomechanically. Vélez et al. discovered that in non-comminuted and comminuted fracture models, lateral locked plates could be a potential solution to fixation and medial comminution may not require dual plating to be stable enough [12]. This justifies the unilateral fixation in certain fracture patterns which retain medial column integrity.

There is also clinical evidence showing positive results of isolated lateral plating. Mandip Singh et al. reported good functional outcomes with isolated lateral plating but emphasize that proper patient selection, depending on the fracture shape is crucial to prevent malediction or loss of alignment [13]. Lateral locked plate studies have demonstrated comparable functional and radiological results and comparable

complication rates with dual plating methods in bicondylar fractures where large posteromedial fragments (absent) [16] and with similar complication rates in dual plating techniques [17]. Also, single lateral locked plate fixation has the same outcome as dual locked plating in bicondylar fractures, which suggests that simplified constructions could be suitable in cases where the morphology of the fracture allows it [19].

In spite of these benefits, other authors have observed shortcomings of lateral fixation in very comminuted patterns, in which dual plating or buttress augmentation can be required to preclude a second loss of reduction or varus collapse. Additional posterior or medial support plating has demonstrated good functional results to accompany anterolateral fixation in complex tibial plateau fractures [15]. These results indicate the significance of examining the fracture patterns and indicate that though unilateral locking plates would be effective in most situations, intricate fracture morphology could still be supported with augmented fixation techniques.

Literature on biomechanical and clinical findings indicates that lateral locked plating can obtain the same results as dual plating provided posteromedial fragments are not present or minimal [16]. Fractures with large medial fragmentation, however, are considered dangerous to fracture with isolated lateral fixation, this may not be strong enough to counter forces acting on complicated fracture patterns, changes in alignment may occur or fixation may fail [18].

In general, our results contribute to the mounting evidence that unilateral locking T plates have good functional and radiological results and less soft tissue morbidity. The method enables premature knee mobilization and reduces the difficulties related to two incisions. Intelligent preoperative planning, with preoperative imaging, to consider fracture nature, is necessary to maximize the fixation strategy and clinical outcome.

10 CONCLUSION

Unilateral locking T plateau fixation is a good and stable treatment system of displaced and unstable Schatzki type V and VI fractures of the tibial plateau. It has acceptable functional results since there were high rates of excellent and good results according to the Oxford Knee Score. The method has the added benefit of less soft tissue dissection thus minimizing post-operative complications like infection and wound

breakdown. Early surgery after sufficient recovery of the soft tissue with appropriate rehabilitation is very important in order to have optimal results. Even though dual plating is a conventional method of fixing complex fractures, it is possible to discuss the unilateral locking T plate fixation as an appropriate option in a group of patients with the primary emphasis on the soft tissue preservation. More multicentric studies with lasting follow-ups are advisable to confirm these results and come up with standard treatment guidelines.

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Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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