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"Functional Outcome of Depressed Tibial Condyle Fracture Treated By Plating and Bone Grafting."

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Abstract:
Introduction
Tibia plateau fractures are a diverse group of fractures with a wide range of severity. Due to its location and subcutaneous nature for most of its length, tibial fractures are frequently open. Orthopaedic surgeons around the world have been battling infections and union issues associated with its fractures due to its fragile blood supply and limited soft tissue coverage. The aforesaid problems stand true even for fractures of proximal tibia and plateau fractures[1,2]. can be quite challenging to manage. They are notoriously difficult to reduce, align and stabilize, and are prone to develop compartment syndrome, wound complications and infections. Because these fractures affect a major joint that bears weight, they make it hard to function normally. To preserve normal knee function, it is mandatory to maintain joint congruity, preserve the normal mechanical axis, ensure joint stability and restore full range of motion especially in Indian culture where squatting and sitting cross legged is routine. This is a formidable task to accomplish with compromised soft tissues especially in open fractures, variable bone quality and associated co morbid conditions of the patients.
Methods
40 cases of tibial plateau fractures treated by various modalities were studied from June 2021 to October 2022 at our institution and followed for a minimum of 6 months post operative time.
Results
The selected patients evaluated thoroughly clinically and radiologically, after the relevant lab investigations were taken for surgery. The indicated fractures were classified as per the SCHATZKER'S[3,4] types. Majority of them(33) treated with MIPPOand remaining (7) underwent Open Reduction for fracture fixation.28 patients started weight bearing at 8-12 weeks of follow-up and 10 patients at 12-16 weeks. 2 patients required prolonged immobilization.
Conclusion
Excellent results were more commonly seen in closed fractures, type II Schatzker's and fractures treated by MIPPO.

Keywords
Depressed Tibial plateau fractures, Plating and Bone grafting

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I. Introduction

Tibia plateau fractures are a diverse group of fractures with a wide range of severity. They can be simple injuries with excellent outcomes after non-operative treatment, or they can be complex fracture patterns that challenge even the most experienced surgeons.Schatzker classification defined pathoanatomy and suggested treatment strategies and this classification remains central to the language of tibia plateau fractures even today Due to its location and subcutaneous nature for most of its length, tibial fractures are frequently open. Orthopaedic surgeons around the world have been battling infections and union issues associated with its fractures due to its fragile blood supply and limited soft tissue coverage. The aforesaid problems stand true even for fractures of proximal tibia and plateau fractures. However, fractures of the proximal tibia can be quite challenging to manage, notoriously difficult to reduce, align and stabilize, and are prone to develop compartment syndrome, wound complications and infections. Because these fractures affect a major joint that bears weight, they make it hard to function normally. To preserve normal knee function, it is mandatory to maintain joint congruity, preserve the normal mechanical axis, ensure joint stability and restore full range of motion especially in Indian culture where squatting and sitting cross legged is routine. To achieve functional rehabilitation of the limb, anatomic reduction, rigid internal fixation and early joint motion historically were stressed. Internal fixation, with the principle of compression was extremely useful for closed fractures. The indications of plating were performed and restricted. Plating in open fractures lead to operative insult to already wounded soft tissue, implant failures and non-unions. Its use in high velocity comminuted fracture and segmental fractures were questionable. Open reduction, drainage of fracture hematoma, poor soft tissue

coverage because of subcutaneous location decreased its popularity among orthopaedic surgeons around the globe for management of tibia plateau fractures. Minimally InvesivePerculaneous Plate techniques , which use conventional implants that are inserted through comparatively small incisions and subcutaneous or muscular tunnels. Compared to standard open exposures for internal fixation, cadaveric studies demonstrated that these minimally invasive techniques preserve periosteal vasculature more effectively. The use of plates that permit screws to lock into the plate to create a fixed angle structure has been gaining popularity as part of the continued development of biologically friendly plating and to facilitate minimally invasive plating techniques. These principles for treating fractures have been proven to be effective for treating fractures of the proximal tibia, which occur more frequently and earlier than any other bone in the body. Negligibly intrusive strategies are being given need even of the proximal tibia. Depending on the location of the fracture, a variety of surgical approaches—medial, lateral, and combined—have been described for tibia plateau fractures. Particularly, combined extensive approaches are linked to high rates of complications, possibly as a result of restricted soft tissue perfusion or extensive soft tissue stripping from bone fragments. Both open reduction and minimally invasive technique has been practised in our institute, SMIMER Medical College, Surat. In order to justify, criticize, document and compare our techniques and results the study was taken up by Dr. Utsav Patel, Resident doctor in orthopaedics under the guidance of Dr. Janak Rathod, Professor & Head, Orthopaedics Department.

II. Methodology

(1) Study design, sample size and Period:
This study was carried out at Department of Orthopaedics, Medical college and SMIMER Hospital, Surat from June 2021 to October 2022, inclusive of both. During this period, 58 patients with proximal depressed tibial plateue fractures were identified of which 48 patients were enrolled in the study based on the inclusion and exclusion criteria. With 8 patients being lost to follow-up during the course of study before completing at least 6 months of follow-up, we had 40 patients remaining to study.
This study was mainly an observational prospective study. However, data for some patients was collected retrospectively from available medical records. Such patients were followed up prospectively for a minimum of six months post operative time.

(2)Inclusion Criteria:
 All the fractures of the tibia plateau with intra articular extension, with recent (<4 weeks) history of trauma.
 All the patients between 18 to 75 years of age were included who were willing to give informed consent for participation in study.
 Closed fractures, open grade I and open grade II fractures were included.

(3)Exclusion Criteria:
 Pathological fractures
 Fractures in children (< 18 years) ,which were skeletally immature.
 Old neglected fractures
 Pregnant females
 Patients with significant coexisting comorbidities
 Crush injuries
 Previously operated Fractures
 Fractures with existing or impending compartment syndrome
 Neurological problems (local or general) which could affect the functional outcome assessment
 All open grade III fracture

III. Results:

Results with Age

Agein years	Excellent	Good	Fair	Poor	Pati-ents
18-20	1(50%)	1(50%)	0	0	2
21-30	4(80%)	0	0	1(20%)	5
31-40	3(30%)	5(50%)	2(20%)	0	10
41-50	5(35.72%)	7(50%)	2(14.29%)	2(14.29%)	16
>50	2(28.57%)	3(42.86%)	2(28.57%)	0	7
Total	**15(37.5%)**	**19(47.5%)**	**6(15%)**	**3(7.5%)**	**40**

- Out of results, 6 patients in age group of 31-40 (56%) showed excellent outcome.

 No age group seems to be immune to fair and poor results.

 Factors other than age seem to influence the fractures more in functional outcome.

Results with Type of Injury

Injury	Excellent	Good	Fair	Poor	Patients
Closed	14(37.84%)	14(37.84%)	6(16.21%)	3(8.11%)	37
OG-I	0	1(100%)	0	0	1
OG-II	1(50%)	1(50%)	0	0	2
Total	**15**	**16**	**6**	**3**	**40**

- Although we had more of closed fractures in our sample, even closed fractures showed less than optimum functional results [although less{24.32%} fair & poor than {75.68%} good and excellent].

 Only one of the open fracture gave excellent results.

Results with Classification:

Schatzkar'sClassification Type	Excellent	Good	Fair	Poor	Patients
I	0	4(100%)	0	0	4
II	10(50%)	7(35%)	3(15%)	0	20
III	3(33.33%)	3(33.33%)	1(11.11%)	2(22.22%)	9
IV&V	2(28.57%)	2(28.57%)	2(28.57%)	1(14.28%)	7
Total	**15**	**16**	**6**	**3**	**40**

- Type II fracture showed maximum (50) excellent results.
- Type V & VI fracture showed maximum Fair & Good results.
- None of type V & VI fracture showed excellent results probably due to highly communited and depressed fractures.

Results with Surgical method:

Method	Excellent	Good	Fair	Poor	Patients
Open	1(14.28%)	2(28.56%)	3(42.85%)	1(14.28%)	7
MIPPO	14(42.42%)	14(42.42%)	3(9.1%)	2(6.06%)	33
Total	**15**	**16**	**6**	**3**	**40**

➢ More excellent & good results are obtained by MIPPO technique probably due to less invasive and less soft tissue damage.

Results with Injury surgery interval:

Injury Surgery Interval	Excellent	Good	Fair	Poor	Patients
<1 week	12(38.71%)	12(38.71%)	5(16.13%)	2(6.45%)	31
=/> 1 week	3(33.33%)	4(44.44%)	1(11.11%)	1(11.11%)	9
Total	**15**	**16**	**6**	**3**	**40**

➢ As seen from previously, knee range of motion was affected by delay in surgery. Similarly, excellent results were seen in cases delayed for as long as 3 weeks.

➢ Majority of patients were treated in first week of injury out of which 38.71% had excellent results and 38.71%had good results.

➢ Of the 9 patients treated after1 week of injury, 3(33.33%) showed excellent results, and 4(44.44%) showed good results

Comparison of clinical and radiological results:

Results according to Rasmussen's Scoring system					
Clinical / Radio-logical	Excellent	Good	Fair	Poor	Total
Excellent	15	2	0	0	**17**
Good	0	14	3	1	**18**
Fair	0	0	3	2	**5**
Poor	0	0	0	0	**0**
Total	**15**	**16**	**6**	**3**	**40**

Interpretation:
The clinical and radiological result difference in seen in our study was not just due to chance. So, clinical and radiological results may vary in patients treated for Tibial Plateau Fractures.

IV. DISCUSSION

Vast majority of cases were fixed using stable angle plating via MIPPO techniques and others by open reduction[5]. Both techniques provided reasonable method of fracture reduction and stabilization using the lateral locking plate. Closed reduction results in fewer and less serious complications, marginally faster union time and superior clinical outcome.

Our study consisted of 7 patients with a bicondylar Schatzker type –IV & V tibia plateau fracture. Of these 2 required a medial locking plate. Schatzker classification defined pathoanatomy and suggested treatment strategies and this classification remains central to the language of tibia plateau fractures even today. All these cases would have required a bilateral conventional double, plate osteosynthesis, if treated without locking plate & screws. No loss of reduction, especially of the contralateral tibia plateau, occurred.

High energy, complex bicondylar tibia plateau fractures[2,5,6,7]), typically present with an associated severe soft-tissue injury. Extensive dissection through this tenuous soft-tissue envelope to achieve reduction and apply of conventional stabilizing implants, particularly through a midline incision, may significantly increase postoperative infection rates and implant failure leading to loss of fracture reduction hindering long-term successful outcome.

The implementation of contemporary reduction techniques and novel implants allow the surgeon to attain stable fixation without compromising the surrounding soft tissues. In our study group as well as in other

similar studies minimal invasive percutaneous techniques with application of locking plating systems offered the ideal combinations in terms of bone fixation and soft tissue sparing. The advantage of MIPPO plating include biological fixation without extensive soft tissue stripping, earlier mobilization and shorter duration of hospital stay.

We had no case of non-union in our series. Non-union is rare after low energy fracture, owing to the predominance of cancellous bone and its rich blood supply. It is mostly seen in Schatzker VI at metaphyseal-diaphyseal junction. In our study, analysis showed that time to union was dependent on the surgical method used. The average time to union (13.85 weeks) in our study corresponds to published studies in the Indian scenario. Incidence of infection/ wound dehiscence/ malunion/ early arthritis up to 20-50% esp. in high energy cases have been reported. In this series the accumulative rate of local and systemic post- operative complications was 17.5% (7/40 cases). Infection was observed in 7.5% cases (n=3). The low incidence of infection in our study can be attributed to the fact that due care was taken to delay surgery in excessive soft tissue swelling, judicious use of MIPPO and avoiding medial incisions.

Around 20% of our cases had more than 2 mm of depression(8,9,10). Despite this fact functional outcomes were not affected. Using the ANOVA test we could prove beyond doubt that articular depression did not affect the final knee range of motion. A rigid fixation and early physiotherapy reduces post traumatic Osteo-Arthritis. Early ROM physiotherapy shows good results in the form of functional arc of motion.

V. Conclusion:

The outcome of tibia plateau fractures is governed by multiple factors. Based on our study and with support of literature we recommend a staged approach, minimal invasive percutaneous techniques, use of fixed angle construct and use of bone graft to fill the void, that allows early range of motion and restoration of articular congruity for improving the outcome of this fracture.

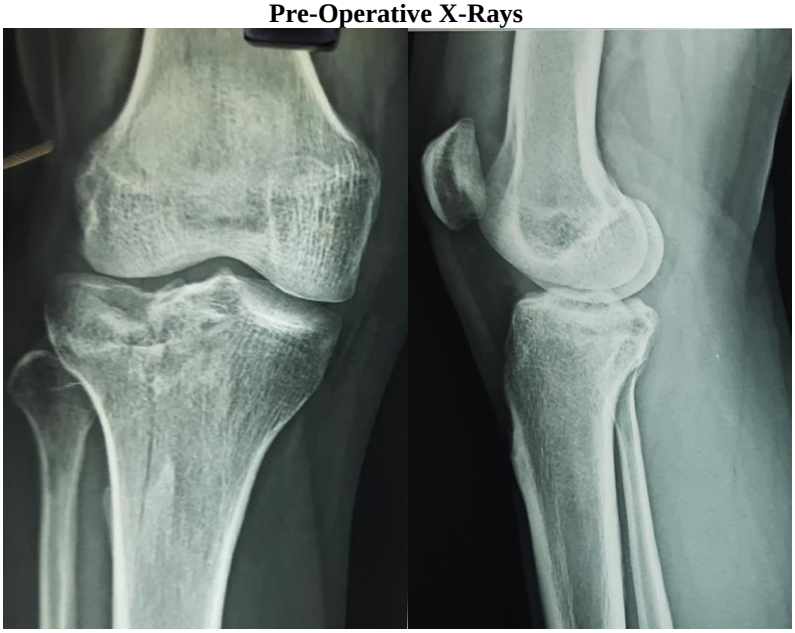
Case:

Excellent Result

Caseno:27
Age/sex:45/Male
Diagnosis:AcaseofclosefractureLateral Tibial Plateau Depression Right side without neurovasculardeficit.
Schatzker Type: Type II
Operativeprocedure:MIPPO

Cross Leg PositionSitting with Fully Flexed KneeSquatting Position

Pre-Operative X-Rays

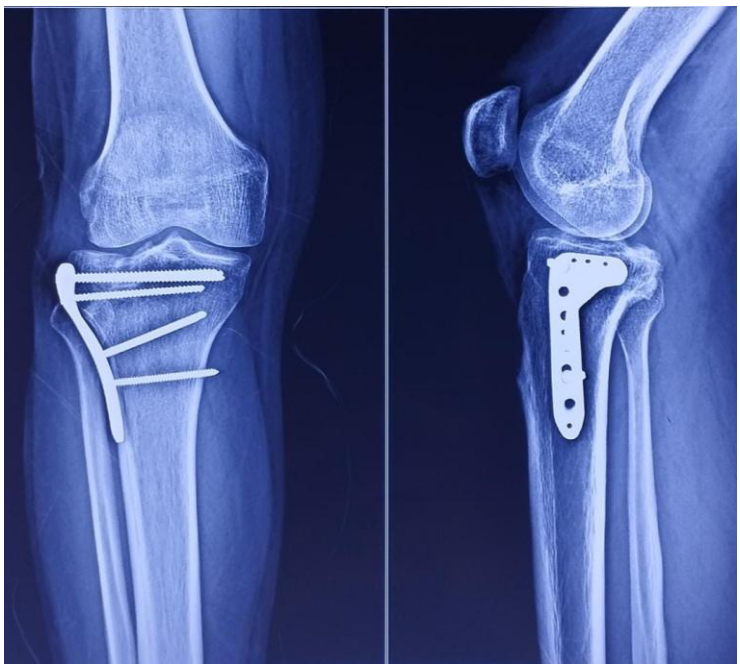


AP **Lateral**

Post-Operative X-Rays

AP **Lateral**

Follow up X-Rays at 7 Months



AP **Lateral**

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