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PROXIMAL TIBIAL FRACTURES: OUTCOME OF INTERNAL FIXATION WITH LOCKING PLATES

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Abstract:

Objective: In this study, we evaluated Functional and radiological outcome of locking plates in proximal tibia plateau fractures.

Methods: Thirty-eight cases of tibial plateau fractures were treated locking plates. 16 Cases were treated with low profile pre contoured locking plates from lateral side, 22 cases needed another butteres plate from medial side or posteromedial side.

Results: All Fractures were united with mean time of 15.2 weeks, and the mean time of full weight-bearing was 16 weeks. At the final follow-up visit, no patients showed knee instability; the mean range of motion was 119°. Amongst all patients 19 patients had excellent results, 3 with good results, 2 with fair results and 2 had poor result

Conclusion: locking plate fixation can be a preferred treatment option for complex tibial plateau fractures with excellent radiological and function outcome but some patient requires double plate for optimal stability.

Keywords: Proximal tibial fractures, locking plates, internal fixation

Objective

High-energy tibial plateau fractures remain challenge to the orthopaedic surgeon and treatment for these fractures remains controversial.¹ In this study, we evaluated the outcome of locking plates in proximal tibia plateau fractures. If isolated lateral locked plating does not provide sufficient fixation to provide support of the medial condyle, axial alignment of the limb may be lost, producing varus deformity and hampering the long-term outcome, though the lateral fixed angle device are effective at controlling medial condylar displacement if applied properly.²

There are clinical data³ to suggest that unilateral locked plating of bicondylar tibial plateau fractures may lead to significant malreduction and loss of reduction, good fixation in anatomical reduction reduces these complications. Articular depression, malalignment increases risk of posttraumatic osteoarthritis.⁴

Early technique of osteosynthesis emphasized anatomical reduction and rigid fixation of fractures. Surgical approaches often add to the soft tissue damage already present from the injury.

There has been a recent trend toward surgical fixation of high energy tibial plateau fractures utilizing the minimal invasive technique. These techniques gives better outcome with minimal soft tissue damage and optimal bone to implant contact.⁵

Methods

Thirty-eight cases of tibial plateau fractures were treated locking plates. Tibia plateau fractures with age more than 18 years, closed fractures and open cases of Gustilo Anderson type I type were included in this study. 16 Cases were treated with low profile

pre contoured locking plates from lateral side, 22 cases needed another butterfly plate from medial side or posteromedial side.

On admission, all the patients were assessed for other injuries and underwent routine investigations for fitness. Meanwhile, limb was kept elevated and active movements of the toes were encouraged and ice fomentation was advised. Surgery was delayed till wrinkles appeared on the skin in the patients with swelling.

After operation limb was kept elevated and 1st post operative check dressing was done after 48 hours and knee physiotherapy was started from next day of operation. Post operative x-ray was done after 48 hours and then on 1st week, 1st month and then every monthly till union. All were followed up for a period ranging from 14 to 40 weeks. Functional outcome was evaluated using Knee Society Score and radiological outcome was evaluated by comparing immediate postoperative and 6th month follow-up X-rays and evaluated by modified rosenmuller radiological assessment score. According to Paley et al. An increase of 5° malalignment or in articular depression of 2 mm compared with the first postoperative radiograph was defined as secondary loss of reduction.⁶

Approach

Standard lateral approach was used for lateral plating using curved incision over anterolateral aspect of upper tibia starting from lateral aspect of tibia tuberosity towards upwards. Then submuscular plane developed and plate was slid through it. Then satisfactory reduction achieved and correct position of plate checked in ap and lateral c arm image and plate position fixed with k wires. K wires

were used to achieve reduction and elevate depressed lateral fragment and pointed reduction clamp was used to compress both condyles. Plate was fixed in standard manner. In few cases additional medial or posteromedial required to butterfly medial or posteromedial fragment which couldn't be addressed with lateral-plate.

Results

All Fractures were united with mean time of 15.2 weeks, and the mean time of full weight-bearing was 13 weeks. At the final follow-up visit, no patients showed knee instability; the mean range of motion was 119°. Amongst all patients 30 patients had excellent results, 4 with good results, 2 with fair results and 2 had poor result. There was change in the radiological findings between their immediate postoperative and final follow-up X-rays in one patient who had 10° of varus angulation. All the patient had good reduction (articular step <2mm) except one patient with double plates, in whom there was 4 mm articular step.

Table: 1 Patient Demography

Mean Age	33
M: F Ratio	24:14
Rt: Lt Ratio	22: 16
Mean Plate Length	6 holes
Mean Union Time	15.2 week
Mean time for full weight bearing	13 week
Mean Range of Motion	119°
Mean Knee Society Score	83

Table: 2 Knee severity score

Knee Score Results	Single Plate	Double Plate	Chi-Square Test	
Excellent	12	18	X2 = 8.2878	X2 = 2.82
Good	2	2	P = 0.0404	P = 0.4202
Fair	1	1	Significant At 95% of LOS	Not Significant At 95% of LOS
Poor	1	1		

Table 3: Complications

Complication	Single Plate group	Double Plate group
Infection	1	2
Hardware prominence	1	1
Non Union	0	0
Osteoarthritis	0	0
Secondary loss of reduction	1	0

Table :4 Radiological outcome compression

Results	modified rosenmuller radiological assessment score			
	Single Plate Group		Double Plate Group	
	Just Post Op	At 6th month	Just Post Op	At 6th month
Excellent	15	14	20	20
Good	1	2	1	1
Fair	0	0	1	1
Poor	0	0	0	0

Figure: 1 35 year old male patient with schatzker type 6 fracture treated with dual plates. (A) Pre op X-ray (B) Post OP X-Ray (C) 4 week follow up (D) 15th week follow up X-Ray (E,F,G) Clinical Images

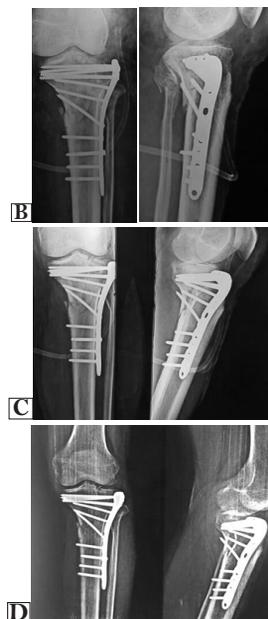
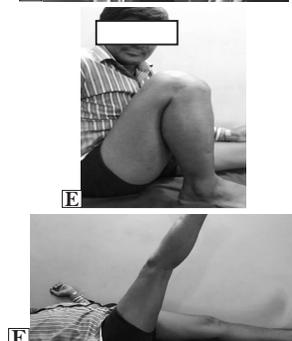


Figure 2: 32 year old male patient with schatzker type VI fracture treated with dual plates. (A) Pre op X-ray (B) Posr OP X-Ray (C) 4 week follow up (D) 13thh week follow up X-Ray (E,F) Clinical Images



Discussion

To preserve normal knee function, treatment must aim to re-establish joint stability, alignment, and articular congruity to ensure a full range of motion. In complex tibial plateau fractures, it is mandatory to anatomically reduce the articular part of the fracture in order to prevent the secondary arthritis and achieve a stable articular and metaphyseal fixation to facilitate the fracture healing regardless which treatment option is selected.⁷ Moreover, soft tissue complications can be largely minimized by staging the treatment of the patient. The LCP system a new concept in plate osteosynthesis that attempts to combine the advantages of minimally invasive surgical approaches utilizing anatomically pre-shaped plates that with screws that lock into the plate forming the fixed angle device. The LISS combined with indirect reduction technique limits the surgical trauma inflicted while stabilizing the fracture. The locking screws provide a fixed angle device at each screw plate interface. Studies have shown that a lateral locking plate is not always sufficient to protect the fracture from collapse, and an additional medial plate is necessary to further stabilize the fracture⁸ but dual plate has its own higher complication rates as compared to single plates like infection and hardware related complications and compartment syndrome. Single plate has less complication rates except varus collapse of fracture as occurred in one patient which is not common with dual plate.

David Barei et. al. treated forty one Bicondylar Tibial Plateau Fractures Treated with Dual Incisions and Medial and Lateral Plates and found that accurate reduction could be achieved in half of the patients.⁹ In our

study out of 38 patients in 37 patients good reduction was achieved.

Jiang et. al¹⁰ Treated 43 patients of bicondylar tibia with dual plates and 41 patients with 41 LISS plates. There were no statistically significant differences in adequate reduction rates of the articular surface, union rate or radiographic healing time, infection, between the Dual Plate (DP) group and the LISS group. Six cases (14.6%) of malalignment of the proximal tibia occurred in the LISS group, most frequently involving deformity in the sagittal plane. This was significantly higher than that (2.3%) in the DP group ($P=0.041$). During healing, loss of reduction occurred in two patients (4.7%) from the DP group, and one patient (2.3%) from the LISS group ($P=1.000$, statistical power: 8.9%). Loss of alignment into varus occurred in one patient (2.3%) from the DP group. Meanwhile, two cases (4.7%) of loss of alignment into varus were found in the LISS group (Fig. 3); these differences were not statistically significant when compared with the DP group ($P=0.966$, statistical power: 9.4%). In our study, there was loss of reduction in 1 patient in single plate group.

Gosling T et. al.³ treated 62 tibial Plateau fractures with single LISS. Out of 62, 16 patients have substantial loss of reduction. In our study out of 16 patients, one had secondary loss of reduction while in double plate group no patient had secondary loss of reduction.

Z Yu, L Zheng et. al.¹¹ treated 62 patients of tibial plateau fractures with double plates. At the final follow-up visit, no patients showed knee instability, For all patients, no statistically significant difference in the functional outcomes was observed between their 6-months and final

follow-up visits; or in the radiological findings between their immediate postoperative and final follow-up examinations in terms of change in the tibial plateau angle (TPA), the femorotibial angle (FTA) and the medial posterior slope angle (PA).

Conclusion

Locking plate can be proffered treatment for fractures of proximal tibia. Locking the screw in the plate gives better angular and axial stability, and reduces the risk of toggling of screws and loss of reduction. Simple non comminuted fractures of proximal tibia can be treated with single pre contoured locking plate. Comminuted fractures require another buttress plate from medial side to prevent angular collapse and to maintain reduction. We concluded that locking plates gives better stability and early union with good range of motion and less post operative complication.

References

1. Blokker CP, Rorabeck CH, Bourne RB (1983) Tibial plateau fractures. An analysis of the results of treatment in 60 patients. *Clin Orthop* 182:193–199.
2. Mueller KL, Karunakar MA, Frankenburg EP, Scott DS. Bicondylar tibial plateau fractures: a biomechanical study. *Clin Orthop*. 2003 Jul;(412):189–95.
3. Gosling T, Schandelmaier P, Muller M, Hankemeier S, Wagner M, Krettek C. Single lateral locked screw plating of bicondylar tibial plateau fractures. *Clin Orthop*. 2005 Oct;439:207–14.
4. Honkonen SE (1995) Degenerative arthritis after tibial plateau fractures. *J Orthop Trauma* 9:273–277.
5. Lee JA, Papadakis SA, Moon C,

Zalavras CG. Tibial plateau fractures treated with the less invasive stabilisation system. *Int Orthop*. 2007 Jun;31(3):415–8.

6. Paley D, Herzenberg JE, Tetsworth K, McKie J, Bhav A. Deformity planning for frontal and sagittal plane corrective osteotomies. *Orthop Clin North Am*. 1994 Jul;25(3):425–65.
7. Kiene J, Schulz A, Hillbricht S, Jürgens C, Paech A. Clinical results of resection arthrodesis by triangular external fixation for posttraumatic arthrosis of the ankle joint in 89 cases. *Eur J Med Res*. 2009 Jan 28;14(1):25–9.
8. Higgins TF, Klatt J, Bachus KN. Biomechanical analysis of bicondylar tibial plateau fixation: how does lateral locking plate fixation compare to dual plate fixation? *J Orthop Trauma*. 2007 May;21(5):301–6.
9. Barei DP, Nork SE, Mills WJ, Coles CP, Henley MB, Benirschke SK. Functional outcomes of severe bicondylar tibial plateau fractures treated with dual incisions and medial and lateral plates. *J Bone Joint Surg Am*. 2006 Aug;88(8):1713–21.
10. Jiang R, Luo C-F, Wang M-C, Yang T-Y, Zeng B-F. A comparative study of Less Invasive Stabilization System (LISS) fixation and two-incision double plating for the treatment of bicondylar tibial plateau fractures. *The Knee*. 2008 Mar;15(2):139–43.
11. Yu Z, Zheng L, Zhang Y, Li J, Ma B 'an. Functional and radiological evaluations of high-energy tibial plateau fractures treated with double-buttress plate fixation. *Eur J Med Res*. 2009 May 14;14(5):200–5.