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ORIGINAL ARTICLE

Assessment of Rafting Screws versus Bone Grafts for Management of Depressed Tibial Plateau Fractures

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ABSTRACT

Background: Among the most common fractures in knee injuries, tibial plateau fractures have been demonstrated to heal better when treated with screws located closer to the joint. This study aimed for comparing the outcomes between the use of bone grafts versus using grafting screws in management of depressed tibial plateau fractures.
Subject & Methods: In our controlled study, a total number of 24 cases with depressed tibial plateau fractures were enrolled, group A: involved 12 cases who were managed using rafting screws and group B: involved 12 cases who were managed without using grafts. Follow up and X ray were done monthly for 2 months then every 2 months for till end of 2 years.
Results: The Visual Analogue Scale (VAS) on 1st day postoperatively showed less pain in group Athan group B with p<0.05.After 3 months, VAS returned to be higher in group A than group B with p-value= 0.02, the mean of the operative time was 93.33 minutes in group A (range; 60-180 mins) and 102.5 minutes (range; 90-180 mins) with P= 0.001,Group A had slightly less residual articular depression while group B had slightly higher residual condylar widening, three cases had complications, 1 case in group A and 2 cases in group B.
Conclusion: Mild to moderate depression (>1.5 cm) in the tibial plateau can be treated successfully with open reduction and internal fixation utilizing a large set buttress plate and screws or screws alone, without the need for bone graft or bone graft substitute.
Key Words: Rafting Screws, Bone Grafts, Tibial Plateau Fractures**.**

INTRODUCTION

Tibial plateau fractures, which account for about 1 percent of all body fractures, are extremely common in knee trauma and are typically caused by high-energy events such car accidents as well as falls [1-2].Type II lateral tibial plateau fractures are described by Schatzker as a combination of cleavage and compression of the lateral tibial plateau, while type III lateral tibial plateau fractures are characterized by pure compression.[3].

Tibial plateau fractures are intraarticular injuries that must be surgically treated with anatomical reduction and rigid internal fixation [4]. The popliteus tendon, the fibular head, common peroneal nerve as well as fibular collateral ligament all reside in the posterolateral area of the knee joint, making it difficult to surgically repair a Posterior Tibial Plateau Fracture [5].Pain, axial malalignment, knee joint instability, and posttraumatic arthritis can all be avoided with proper anatomical restoration of tibial plateau fractures [6].

For more than half of all tibial plateau fractures, reduction of the articular surface and secure fixation is the goal of surgery for depression fractures (Schatzker II-III) of the lateral tibial plateau [7]. Several problems, especially at the donor site, as

well as resorption of the graft with subsequent loss of reduction are linked with iliac bone graft, the method typically used to sustain the elevated articular surface after a metaphyseal subchondral defect has been repaired [8].

After tibial plateau fractures are fixed, there is currently no agreed-upon weight-bearing protocol to be followed. Weight-bearing restrictions can be recommended for 12-16 weeks, 6-8 weeks, as directed by a specialist, or immediate partial weight-bearing for all individuals [9].

For the treatment of split depressed tibial plateau fractures, Langhi et al. [10] recently proposed the use of the subchondral raft screws with plate fixation approach, employing small fragment screws 3.5-6.5mm without bone grafting. As a result, the fracture stability is maintained without the risk of infection or other complications from bone graft, the study done by Ye et al.[11] gave us the idea of our study to treat depressed tibial plateau fracture by using subchondral screws to elevate depression and to evaluate the results versus to elevate this depression by bone grafts.

The hypothesis of this work was that When it comes to depressed tibial plateau fractures, open reduction and internal fixation with rafting screws is a suitable alternative because it helps surgeons attain and preserve the anatomic joint line and normal mechanical axis, and it yields improved functional benefits in the short term.

This research was conducted to compare the outcomes between the use of bone grafts versus rafting screws in management of depressed tibial plateau fractures.

SUBJECTS AND METHODS

This study was conducted in Zagazig University Hospitals, where the study involved 24 patients with depressed tibial plateau fractures with mean follow up of 2 years during the period from June 2021to June 2023.

Written informed consent was obtained from all participants and the study was approved by the research ethical committee of the Faculty of Medicine, Zagazig University, Institutional Research Board (IRB) number **(#9588/12-6-2022)** The Declaration of Helsinki, issued by the World Medical Association to ensure the protection of people participating in medical research, was strictly followed during this study.

Inclusion Criteria

All cases who had depressed tibial plateau fractures aged 18-60 years from both sexes with closed fractures of Schatzker type II or III. The fracture was classified using the Schatzker technique to determine its severity [12].

Exclusion Criteria

All patients with open orfractures type I, IV, V and VI (Schatzker)or who had other injuries to their legs that might prevent them from recovering from the tibial plateau fracture.

All subjects underwent the following:

Clinical evaluation: Full history including Patient complaint, present, past, and family history.

Patients were evaluated preoperative by a combination of interviews, physical exams, and imaging studies (X-ray and CT). The Schatzker classification system was used to determine the severity of the fracture. CT coronal slices were used to quantify the depth of the depression in millimetres. The volume of the remaining defect after the depression was raised was also estimated using pre-operative CT scans. Postoperative X-ray and CT scans were performed on all patients.

Operative procedure:

The indications of operative fixation included lateral plateau fractures type II and type III that have articular step-off greater than 5-10 mm. Reduction and fixation were done: All patients were supine position under spinal anesthesia. The reduction, K-wire placement, and articular surface screw tightening were all evaluated and monitored with fluoroscopy.

We made a curved anterolateral incision that began 3 cm proximally of the patella and ended 3 cm distally of the fracture's inferior edge. An inverted L-shaped incision was made to reveal the longitudinal fracture of the lateral condyle by removing the origin of the extensor muscles from

the anterolateral portion of the condyle. In type II fractures, the tibial condyle was accessed by a split in the lateral condyle (18 cases).

As an alternative, for patients with type III fractures, we created a cortical window below the depressed area to facilitate reduction of this fragment (6 cases). Then, we placed a bone elevator under the depressed articular fragments and carefully raised them while applying pressure to the cancellous bone surrounding them. When central depression of the condyle was the primary deformity and peripheral rim displacement was minor, an anterior cortical window was removed with its proximal edge about 1.3 cm distal to the articular surface.

When employing bone graft, cancellous bone was packed snugly using an inlay impactor into the tibial cavity below the raised pieces. The lateral tibial condylar fragment was then reinserted into its socket to secure the articular fragments. Under the femoral condyle, the lateral articular edge was cut down to provide stability. We used a series of small Kirschner wires to provide a temporary fastening while the pieces were being lifted and reduced. Following this, a contoured L-buttress plate was used to permanently secure the fracture. The anterolateral tibial condyle was reinforced with this plate, which was shaped to fit snugly over the condyle and the proximal metaphysis. After it was shaped correctly, cancellous screws long enough to engage the opposing medial cortex were used to fasten it to the condyle. The plate was fixed to the tibial shaft with 4.5-millimeter cortical screws.

Postoperative Follow up

1st day: Complete blood picture (CBC), postoperative X-ray and CT were done for all patients. The VAS which is a single-item scale was used in the study to assess postoperative pain for all patients in the day 1, day 2, after 2 weeks and after 3 months. Rasmussen score (94): used radiological results as an indicator of clinical success. Pain, flexion contracture, total range of motion, alignment, and stability were measured using the Knee Society Score (KSS) to determine the clinical result [12].

Statistical analysis

The statistical work was performed in SPSS 28(IBM Co., Armonk, NY, USA). Using the Shapiro-Wilk test, we checked if the data followed a normal distribution. Numbers and percentages were used to illustrate the patterns and trends in the qualitative data. In order to determine statistical significance between the qualitative variables, a Chi-square test and a Fisher exact test were employed. For parametric data, we used the mean SD (Standard Deviation), while for non-parametric data, we used the median and range. Parametric quantitative variables were analyzed using the Independent T test, and non-parametric ones were analyzed using the Mann Whitney test.

RESULTS

Twenty-one men and three women had closed lateral tibial plateau fractures, according to the data (18 type II & 6 type III). No other injuries were present in any of the patients besides the closed fractures. On average, patients waited 4.66 days before having surgery(Table 1).After open reduction of the fracture, fixation was done using plate and screws in the majority of cases; (80%) of cases in the group A, and (76.56 %) in group B. While screws alone were used in (20%) of cases in group A, and in (23.44%) in group B. Clinical outcomes at 1-year post-operative were compared between the two groups using the Rasmussen score and the knee society score with non-statistical significant difference between the both groups (Table 2).

Using a Visual Analog Scale to Evaluate Pain After Surgery Pain was significantly lower in group A (mean: 47) than in group B (mean: 51.18), as measured by a one-day postoperative score ($P<0.05$). On day two after surgery, group B continued to have a higher VAS average (mean: 40.93) than group A (mean: 39.47), ($P = .0.01$).The VAS average was higher in group B (mean; 34.18) than in group A two weeks after surgery (mean; 35.93).Three months after surgery, group A had a higher mean VAS score (7.45) than group B (18.27), ($p= 0.02$). The graft site was the primary painful area.(Table 3).

While group A had a mean radiological Rasmussen score of 16.5 (ranging from 14 to 18), group B had a score of 16.99 (ranging from 14 to 18). Group A had slightly less residual articular depression while group B had slightly higher residual condylar widening. Both groups showed no signs of residual angulation. Average union duration was 16.5 weeks (ranging from 11 to 19 weeks) in group A and 16.99 weeks (ranging from 11 to 19 weeks) in group B (ranging from 9 to 17 weeks).(Table 4).

Group A had an average operating time of 93.33 minutes (range: 60-180 mins), while group B's lasted 102.5 mins on average (range; 90-180 mins) Value of p = 0.001 (Table 5).

One patient in group A and two patients in group B experienced complications during our trial, however none of them required emergency care. One person in group A and one person in group B had contracted an infection. One person in group B sustained an injury to their Lateral Cutaneous nerve of the Thigh. Neuropraxia was the cause. The patient was given neurotonics. The pain stopped after two months (Table 6).

A male patient 46 years old, he was presented to emergency after an RTA by left type 2 tibial plateau fracture and operated 2 days after admission. We used 2 independent raft screws and supporting L plate, the patient was discharged 3 days postoperative. The follow up period was 2 years, the patient allowed for partial weight bearing when total radiological bone healing achieved at 2.5 months. The total flexion range was 132º, no flexion contracture or extension lag. The functional outcome was excellent according to the knee society score (KSS) = 100 with no recorded complications. (Figure 1).

A 33 years male self-employed patient with no past history of medical disease. He presented with right knee pain and inability to bear weight on the right lower limb following road traffic accident (motorcycle crash). X-ray for right knee (AP and Lateral views) was done for the patient revealing right lateral tibial plateau fracture type III. The depression was measured through coronal cuts, it was about 9 mm. Bone graft was used to elevate the depression. After 2 years the patient was fully weight bearing on the affected side with full range of motion without pain. He had excellent radiological and good clinical outcome; his Rasmussen radiological score was 18 (excellent) and Rasmussen clinical score was 25 (good). (Supplementary Figure 1).

Table 1: The demographic data

		Rafting screws (A)	With graft (B)	p-value
		No.=12	No.=12	
Age	**Mean**	30.5±0.5	33.5±0.86	0.49
Sex	**Male**	11(91.66%)	10(83.3%)	0.167
	Female	1(8.3%)	2(16.66%)	
Schatzker type	**II**	9(75%)	9(75%)	0.1
	III	3(25%)	3(25%)	
Hospital stay (day)		6.25±0.8	6.3±0.8	0.83
period to have surgery (day)		4.67	4.67	1
Co-morbidities	**DM**	4(33.3%)	3(25%)	0.34
	HTN	2(16.6%)	1(8.3%)	0.02
Smoking		5(41.6%)	7(58.3%)	0.013
Mode of trauma	**RTA**	10(83.3%)	9(75%)	0.005*
	Fall from height	1(8.3%)	2(16.6%)	
	Twisting trauma	1(8.3%)	1(8.3%)	
Affected side	**RT**	8(66.6%)	9(75%)	1
	LT	4(33.3%)	3(25%)	
Discharge day		5.13	5.2	0.774
Period of follow up (months)		6±0.8	5.5±0.68	0.29

Table 2: The mean functional and knee society scores at 1 year.

The mean functional score		Rafting screws (A)	With graft (B)	P-value
		No.= 12	No.= 12	
Pain	Mean ± SD	4.66 ± 0.63	4.8 ± 0.52	0.558
	Range	4 – 6	5 – 6	
Walking	Mean ± SD	4.5 ± 1.3	5 ± 0.6	0.239
	Range	2 – 6	4 – 6	
Extension	Mean ± SD	4.9± 0.91	5 ± 0.32	0.722
	Range	4 – 6	4 – 6	
ROM	Mean ± SD	4.8 ± 0.55	4.9 ± 0.00	0.535
	Range	4 – 6	6 – 6	
Stability	Mean ± SD	5.1 ± 0.712	5.1± 0.341	1
	Range	4 – 6	4– 6	
Sum	Mean ± SD	23.96 ± 3.75	24.8 ± 1.88	0.495
	Range	18 – 30	25 – 30	
Outcome	Excellent	12(100%)	12 (100.0%)	0.589
	Good	0 (0.0%)	0 (0.0%)	
knee society score		**Rafting screws (A)**	**With graft (B)**	**P-value**
		No.= 12	**No.= 12**	
Total flexion range	Mean ± SD	120.66 ± 12.27	122± 13.90	0.804
Flexion contracture	No	11 (91.66 %)	11 (91.66%)	1
	1-5°	1 (83.3 %)	1 (83.3%)	
Extension lag	No	12 (100%)	12 (100%)	1
	1-5°	0	0	
Sum	Mean ± SD	92.58± 2.35	93.05 ± 2.6	0.646

Table 3: The MeanVAS Measurement at day1, day 2, day 14, and at day 90

VAS Measurement day1		Rafting screws (A)	With graft (B)	P Value
		No.=12	No.=12	
Score	Mean ±SD	47 ± 14.47	51.18 ± 12.09	0.01
	Range	30 – 75	40 – 90	
Severity	Mild	2 (16.6%)	3 (25%)	0.01
	Moderate	9 (75%)	8 (66.6%)	
	Sever	1 (8.33%)	1 (8.33%)	
VAS Measurement day 2		**Rafting screws (A)**	**With graft (B)**	**P Value**
		No.=12	**No.=12**	
Score	Mean ±SD	37.72±10.03	39.27±11.19	0.757
	Range	20–55	30–70	
Severity	Mild	10(83.3%)	3(25%)	0.738
	Moderate	2(16.66%)	9(75%)	
VAS Measurement Day 14		**Rafting screws (A)**	**With graft (B)**	**P Value**
		No.=12	**No.=12**	
Score	Mean ±SD	34.09± 12.72	35.18± 11.49	0.02

	Range	0 – 50	20 – 50	
Severity	Mild	10 (83.3%)	11 (91.6%)	0.746
	Moderate	1 (8.33%)	1 (8.33%)	
	No pain	1 (8.33%)	0 (0.0%)	
VAS Measurement day 90		**Rafting screws (A) No.=12**	**With graft (B) No.=12**	**P Value**
Score	Mean ± SD	7.45 ± 7.46	18.27 ± 7.5	0.02
	Range	0 – 30	0 – 40	
Severity	Mild	4(33.3%)	10 (83.3%)	0.03
	No pain	8 (66.6%)	2 (16.6%)	

Table 4: The mean of radiological score.

Radiological score		**Rafting screws A No.=12**	**With graft B No.=12**	**P-value**
Depression	Mean ± SD	5.17 ± 0.89	5.41 ± 0.86	0.341
	Range	4 – 6	4 – 6	
Condylar widening	Mean ± SD	5.33 ± 0.84	5.58± 0.75	0.43
	Range	4 – 6	4 – 6	
Angulation	Mean ± SD	6.00 ± 0.00	6.00 ± 0.00	NA
	Range	6 – 6	6 – 6	
Sum	Mean ± SD	16.5± 3.09	16.99 ± 1.61	0.88
	Range	14 – 18	14 – 18	

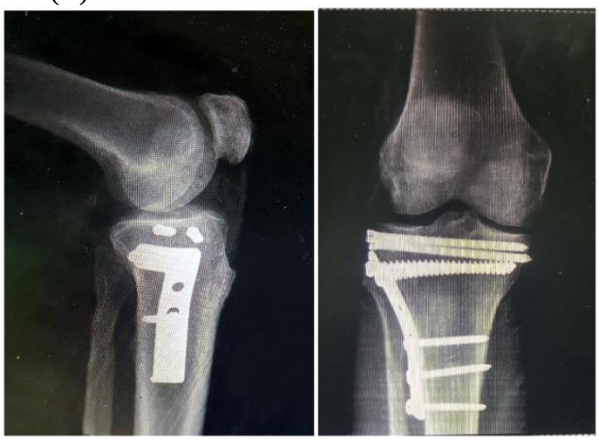
Table 5: The mean of operative time.

		Rafting screws A No.=12	**With graft B No.=12**	**P-value**
Operative Time (min)	Mean ±SD	93.33 ± 32.48	102.5 ± 29.75	**0.001**
	Range	60 – 180	100 – 180	

(A)

(B)

(C) (D)



(E)

Figure1: Case of raft screws: (A): -Preoperative x ray, (B): Preoperative CT scan, (C) :Immediate Postoperative X-Ray, (D): One-Month Follow up X-Ray, (D) :2 years Follow up X-Ray.

DISCUSSION

Type II (split depressed) fracture and type III (pure depression) fracture both are the commonly presented types of tibial plateau fractures. Patients are usually presented with painful swollen knee with inability to bear weight on the affected side. Evaluation of such patients is important and must include careful physical examination, radiological investigations including X-ray and CT [12].

Tibial plateau fractures that have a split depression have been controversial to treat. When to perform the final operation, the technique to use, and how to reduce the fracture all fall under this category. Indirect reduction and fixation of split and split depression fractures of the lateral tibial plateau were undertaken by Koval et al. [13].Postoperative pain lasting up to 2 years, inability to walk, hemorrhage, and infection at the donor site are only some of the complications that might arise from iliac crest autologous cancellous bone grafts. Also using bone graft substitute is considered expensive [14].

In our study, after open reduction of the fracture, fixation was done using plate and screws in the majority of cases; (80%) of cases in the group A, and (85 %) in group B. While screws alone were used in (20%) of cases in group A, and in (23.44%) in group B. Group A had a mean radiological union time of 16.3 weeks (range, 11-19 weeks), while group B's was 16.99 weeks (range, 8-17 weeks).Unfortunately, there were few articles and studies about treating depressed tibial plateau fractures without graft, most of them evaluate small set (3.5 ml) rafting screws for type II fractures.

When comparing the outcomes of the study group to those of the control group or those of past research, we find that they are very similar. Functional outcome, period of bony union, radiographic results, and complications were similar between patients treated with bone grafts and those who did not get them for depression of the lateral tibial plateau, types II and III (1.5 cm) [15].

The surgery can be completed more quickly and with less blood loss if graft is not used. Bone union and range of motion can be achieved more quickly with the help of a graft [16].

The outcomes of other research using a small set 3.5 mm raft construct were comparable to ours. This coincides with a retrospective study that was done by Cross et al. [14], on 105 patients of tibial plateau fractures, 51 patients of them were split depressed type II fracture. To treat them, we used a periarticular anatomic plate and 6.5 mm cancellous screws to achieve intercondylar reduction by the lag approach. No bone transplant or bone substitute was used in this procedure. Average age was 43.02 and patients were followed for a mean of 28.24(10-43) months. The average duration of a surgical procedure was 55 minutes (40 to 110). Results were deemed satisfactory, with no instances of implant loosening, joint depression, articular malalignment in the sagittal or coronal planes, or sagittal or coronal plane failure. Four patients developed a superficial infection as a result of the procedure. No late joint collapse was visible on x-rays taken at the most recent follow-up, regardless of the method of fixation[14].

Another study also came in line with our results, which was done by Singleton et al. [17] on 97 cases who had depressed tibial plateau fracture managed by open reduction and internal fixation with bone grafting of the resultant defect with a minimum follow up of 12 months. Just 41 patients completed the follow up. Of those 41 cases, there were 19 cases with type II and 2 patients with type III fractures. The mean age of all patients was 54 years, a median of 3.9 years of follow-up following fracture Thirty-five individuals had been treated surgically, whereas six had been treated conservatively [17]. Patients with depression of 2.5mm had a mean VAS score of 7.77, while those with depression of 2.5mm had a score of 6.50. 2.5-5 mm and >5 mm depression (6.56 mm), this was much lower than our findings. They concluded that differences in age or sex did not significantly affect the results. There was a correlation between the severity of the fracture and a decline in functional outcome scores and knee range of motion. One incidence of infected nonunion was found [17].

In our study, Group A had slightly less residual articular depression while group B had slightly higher residual condylar broadening. Both groups had no residual angulations. Group A couples took an average of 16.5 weeks (ranging from 11 to 19 weeks) to get married, while group B couples took an average of 16.99 weeks (ranging from 9 to 17 weeks).

In 2017, a study was done by Kayali et al.[18] The study included 60 cases of tibial plateau fractures, 13 cases of them were classified as Schatzker type II and 4 cases as type III. Open reduction and periarticular plate fixation was their treatment of choice. Supplementation with bone grafting was done for ten patients of them. They were followed for a full two years (2013 to 2015).The typical recovery time from surgery to beginning even light weight bearing was 8.74 weeks (8 to 13 weeks). Radiological union occurred on average after 12.85 weeks (range 12 to 16 weeks). There was a mean delay of 13.15 weeks before patients could bear their full weight. More over half of the patients (60%) showed knee flexion of 120 degrees or more. Normal motion was 112.8 degrees [18].

When comparing the outcomes of the study group to those of the control group or those of past research, we find that they are very similar. When treating a depressed lateral tibial plateau of type II or type III (depression 1.5 cm), there was little difference between utilising a bone transplant and not using one in terms of functional outcome, time to bony union, radiological outcomes, or comorbidities. Avoiding the need for graft means the procedure can

be completed more quickly and with less blood loss than if graft were used. Grafting, on the other hand, allows for early mobility and faster bone union. Studies using smaller sets of rafts (3.5 mm) have yielded results that are comparable to ours. The researchers concluded that while grafting improves functional and radiological outcomes, it is preferable to perform the procedure without the graft since it eliminates the risk of donor site problems, reduces blood loss, and shortens the duration of the operation.

The results of open reduction and internal fixation for split-depression (>5 mm) tibial plateau fractures were analysed by Molenaars et al. [19]. Without using any bone grafting, a periarticular raft construct was created using a locking plate. There was not a single case of infection during surgery, implant failure, implant breakage, or screw backout. For split-depression proximal tibial plateau fractures, they suggested a periarticular raft build through a locking plate as an alternative to bone grafting or bone substitutes.

According to Cross et al. [14], there was no failure of fixation, joint depression, articular malalignment in the sagittal or coronal plane, or implant loosening, all of which were considered acceptable results. Regardless of the method of fixation, no late joint collapse was visible on the most recent x-ray follow-up. To avoid the need for a bone graft or bone substitute, it has been proposed that adding 6.5 cancellous lag screws to periarticular plates is an effective method in the treatment of depressed proximal fractures.

Patients with less residual articular depression at 3.9 years experienced significantly less loss of knee range of motion, as demonstrated by the research of Singleton et al. [17]. The average range of motion of the unaffected knee was 0-131 degrees across all groups, while the range of motion of the damaged knee was 4-119 degrees. Patients with lower levels of residual articular depression also reported greater improvements in both their functional capacity and their level of discomfort. They found significantly lower VAS scores than we did, with mean VAS scores of 7.77 in patients with depression 2.5 mm, 6.50 in patients with depression 2.5-5 mm, and 6.56 in patients with depression > 5 mm. This discrepancy may be attributable to the different patient population and method used in this study. They concluded that differences in age or sex did not significantly affect the results. Functional outcome scores and knee range of motion tended to decline with increasing fracture severity.

We were also in agreement with Kayali et al.[18] who reported an average of 8.74 weeks between surgery and the ability to bear partial weight (8 to 13 weeks). Radiological union occurred on average after 12.85 weeks (range 12 to 16 weeks). There was a mean delay of 13.15 weeks before patients could bear their full weight. Moreover half of the patients (60%) showed knee flexion of 120 degrees or more. Typically, people have a 114 degrees range of motion.

In a study by Karunakar et al. [20], they found that when treating a split type lateral plateau fracture, the raft plate fixation allowed much less movement under axial loading than the buttress plate construct, which is often used for big fragment fixation (2,954 versus 968 newtons per millimeter). They theorized that the articular surface could benefit from a multitude of screws [20]. Locally depressed articular fragments were not investigated in their study.

Recent research by Hubbard et al. [21] in a split depression model examined the usefulness of the tiny piece construct. In this investigation, a large fragment plate construct and a small fragment t-plate construct were contrasted and compared. They discovered no statistically significant difference in the intensity of fixation between the two groups. The split depression fracture model was used, but the issue of local depression stiffness was not. In this and a previous work by Hubbard et al. [21], the overall stiffness of the split component was not significantly different between the various fixation designs.

The current research also demonstrates that a subchondral raft of screws may offer better

resistance to local depression loads than conventional fixation structures. Although the stiffness of the large fragment constructions was improved by the incorporation of bone graft, this improvement was not statistically significant. Greater resistance to local depression stresses was achieved with smaller screws placed closer to the subchondral bone without sacrificing overall construct stiffness. This study provides one of the novel researches that highlighted comparing the use of the rafting screws versus bone grafts in management of depressed tibial plateau fractures.

Our study had several limitations including a lack of long-term follow-up, a small sample size, and stringent inclusion criteria. Another limitation is lack of prior research studies on the topic.

Indications for using rafting screw could be summarized in the following conditions: Depression of lateral tibial plateau up to 1.5 cm, young age with good bone quality. Indication for using bone graft could be summarized in the following conditions: Depression of lateral tibial plateau more than 1.5 cm and old age with osteoporotic bone.

We recommend the use of rafting screws in mild to moderate depressed tibial plateau fractures <1.5 cm to avoid complications of harvesting iliac bone graft such as donor site infection ,nerve injury , chronic pain ,avulsion fracture of anterior superior iliac spine and resorption of the graft.

CONCLUSION

Mild to moderate depression (>1.5 cm) in the tibial plateau can be treated successfully with open reduction and internal fixation utilizing a large set buttress plate and screws or screws alone, without the need for bone graft or bone graft substitute. Although Results in terms of function and imaging are slightly inferior when a graft is not employed, but donor site problems are avoided, blood loss is reduced, and operating time is shortened in addition to chronic pain in iliac bone after taking the graft.

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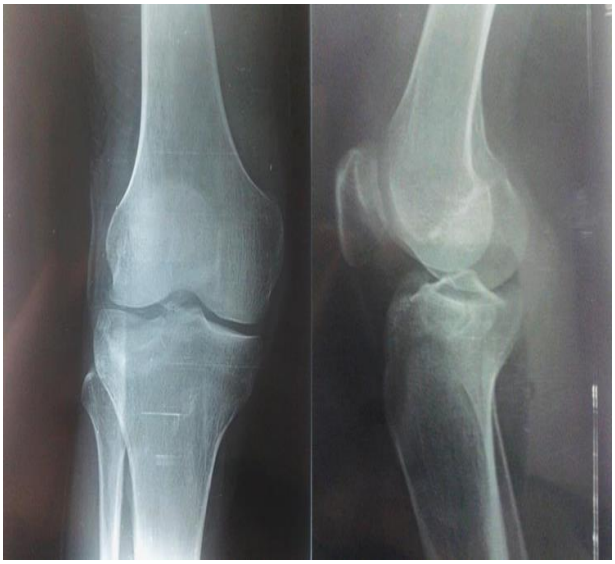
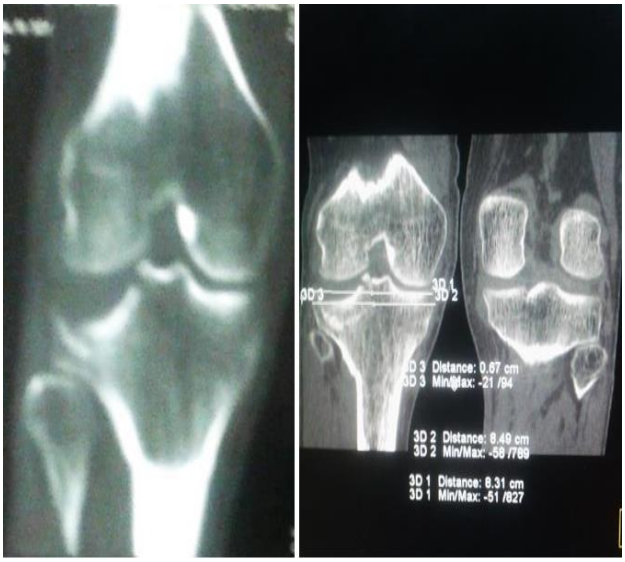
Supplementary Figure1 : Case of Bone graft: (A): -Preoperative x ray, (B): Preoperative CT scan, (C): Intraoperative image taken by C arm, (D): Postoperative X-ray, (D) : 2 years Follow up X-Ray.

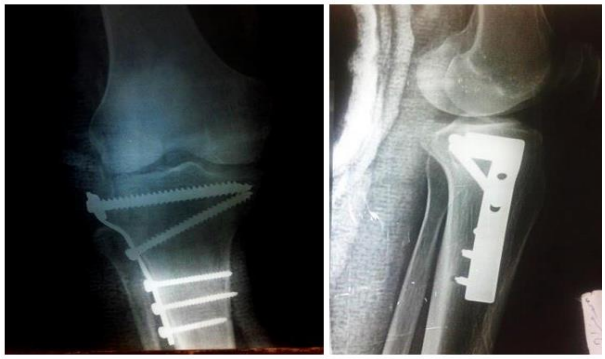


(A)



(B)

(C)



(D)

(E)