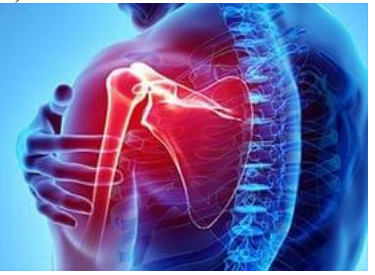


# International Journal of Orthopaedics and Traumatology



ISSN Print: 2664-8318  
ISSN Online: 2664-8326  
Impact Factor: RJIF 5.42  
IJOT 2024; 6(1): 32-39  
[www.orthopedicsjournal.in](http://www.orthopedicsjournal.in)  
Received: 06-05-2024  
Accepted: 11-06-2024

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## Dual plating versus lateral plate for closed distal femoral fractures a comparative study

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DOI: <https://doi.org/10.33545/26648318.2024.v6.i1a.43>

### Abstract

**Background:** Fractures of the distal femoral artery are categorized as A, B, or C per the AO classification. A type represents a straightforward extra-articular fracture, B type signifies a partial articular fracture, and C type denotes an entirely intra-articular fracture. This study aimed to assess the functional and radiological outcomes in Comminuted supracondylar fractures managed by either single or double plating.

**Methods:** Twenty cases were involved in this prospective, randomized clinical study of distal femoral fractures. Patients were separated into two groups of equal size: Group (I) including cases subject to a solitary lateral plate. Group (II) including cases subject to double plating.

**Results:** Knee society score was negatively correlated with partial weight bearing and full weight bearing when  $p < 0.05$  and  $r = -0.514, -0.535, \text{ and } -0.485$ , respectively. Age and Knee society score are positively correlated, the lower the age, the higher the Knee society score. Younger patients exhibited a considerably shorter time to complete radiological healing and a higher knee society score, indicating a positive correlation between age and both healing time and knee society score.

**Conclusion:** In instances involving distal femur fractures of types C2 and C3, both lateral and double plating fixation utilizing the dual technique are effective and safe methods of treatment. However, in the following circumstances-medial supracondylar bone loss, low transcondylar bicondylar fractures, medial Hoffa fracture, periprosthetic distal femur fractures, nonunion following failed fixation with a single lateral plate, compromised bone quality, and Comminuted distal femur fractures C3-double plating is recommended.

**Keywords:** Dual plating, lateral plate, distal femoral fractures, comparative study

### Introduction

Stabilization adequate to withstand dynamic muscular forces and static loading forces on bone can only be achieved surgically. Orthopedic treatment is infrequent; it is typically recommended for immobile patients or those with limited autonomy who have sustained fractures characterized by minimal or no displacement [1]. Fractures of the distal femoral artery are categorized as A, B, or C per the AO classification. A type fracture is a straightforward extra-articular fracture, B type fracture is partial articular, and C type fracture is completely intra-articular; based on the fracture pattern, each type is subdivided into 1, 2, or 3 [2].

When an extra-articular fracture occurs, minimally invasive surgery and all other treatment modalities are viable alternatives. When an intra-articular fracture occurs, it is recommended that open reduction and internal plate fixation be executed while the case is positioned on a standard operating table [3].

There are typically three primary issues identified in these fractures: Initially, it is arduous to obtain sufficient expose of the articular surface, specifically the medial femoral condyle and fractures in the coronal plane. Second, standard implants such as condylar nails that are utilized for other forms of distal femoral fractures are ineffective for articular surface reduction and fixation [4]. Furthermore, when medial comminution and a brief distal segment are present, there is a significant likelihood of varus collapse and loss of fixation [5].

Double plating: Support in performing preliminary K-wire fixation in all directions around the distal end of the femur to enable anatomical and complete reconstruction of these severe injuries; application of a medial plate that ensures comfort; optimal fixation of Hoffa

fractures occurring laterally and medially; grafting of bony defects at all locations with satisfactory impaction; management of internal knee derangement associated with the injury whenever feasible; and decreased occurrence of adhesion in the suprapatellar region <sup>[6]</sup>.

That was the objective of this investigation as assess the functional and radiological results of 20 cases with Comminuted supracondylar fractures managed by either single or double plating.

### Patients and Methods

Twenty cases were enrolled in this prospective, randomized clinical trial with distal femoral fractures that managed at Banha University and El-Helal hospital, in the period between April 2023 to March 2024. After receiving approval from the Research Ethics Committee, Faculty of Medicine, Benha University, the investigation was conducted. An informed written consent was taken from the patients. Inclusion criteria were adults older than 18 years, both sexes with distal femoral fractures type A2 & A3 & C2 & C3. Exclusion criteria were associated vascular and nerve injury, open fractures, lower extremity trauma, pathological fractures, previous knee trauma or surgery and age group less than 18 years old.

### Grouping

Cases were randomly allocated into two equal groups: Group (I) including cases operated single lateral plate. Group (II) including cases operated double plating.

All studied cases were subjected to the following: Careful history taking, including [Personal data; age, gender of the patient as well as his/her address, occupation and telephone number, exact weigh.], Personal habits: smoking and substance abuse, History of the present trauma, Past history of DM and past surgical history.]. Full clinical examination: General examination including [Assessment of the case's general condition, examination for associated non-skeletal injuries, examination for associated skeletal injuries (Spine-Pelvis- Extremities).] Local examination [Skin condition (to determine Gustilo-Anderson and Tschernie classification), deformity, shortening of the limb, neurological and distal circulation examination. Routine laboratory investigations and preoperative medical evaluation [Complete blood count, Bleeding and clotting times, Urea and Creatinine levels as well as the fasting blood sugar levels. For patients above 40 years ECG and Chest A/P x-rays were added.]. Preoperative radiological workup [X-rays and computed tomography (CT) scan].

### CT scan

Two dimensions axial CT scan (2DCT) with 3D reconstruction was done routinely in the preoperative workup in intra-articular cases. In intra-articular cases, CT scan was ordered to define fracture lines in the articular segment, degrees of comminution and fragment displacement. The above images were reviewed, analysed and the following was determined whenever applicable: AO classification, angulation in coronal plane, angulation in sagittal plane, and nature of metaphyseal-diaphyseal junction (Simple or Comminuted). Bone scan was done to rule the stage of osteoporosis

**Surgical Technique:** Throughout each operation, spinal anesthesia was administered. The effect of antibiotics is

highly dependent on their administration timing. It is recommended to administer the initial dose prior to the procedure, ideally 30 minutes prior to the incision. Re-administration of the antibiotic at one to two half-lives is advised throughout the procedure.

**Patient position:** Supine on a radiolucent table:

### Group I: single lateral plate

This is achieved via lateral method and fixation is performed utilizing lateral locked distal femoral plate. Following anatomical reduction of the condyles with lag screws, the condyles were secured to the shaft via lateral approach with a lateral distal femoral fixed plate. Multiple factors contributed to the variation in the positioning of locked cancellous bone screws into the distal portion of the lateral locked plate, including the fracture pattern, the positioning of the lag-screws, and the sufficiency of the bone stock. Further screws were inserted into the condyles if technically practicable, with a minimum of three screws being inserted. Once the secured plate had been affixed to both the proximal and distal fragments, an intraoperative stability assessment was conducted.

### Group II: Double plating technique

A dual separate approach is utilized, and a lateral secured distal femoral plate and medial buttress plate are utilized for fixation. Following anatomical reduction of the condyles with lag screws, the condyles were secured to the shaft via lateral approach using a lateral distal femoral fixed plate. Multiple variables affected the variation in the location of locked cancellous bone screws into the distal portion of the lateral locked plate. These variables comprised the fracture pattern, the placement of the lag-screws, and the adequacy of the bone stock. Further screws were inserted into the condyles if technically practicable, with a minimum of three screws being inserted. Once the secured plate had been affixed to both the proximal and distal fragments, intraoperative stability testing was performed.

A distinct medial approach was utilized to apply a medial plate. For medial plate fixation, a minimum of two cancellous screws were employed distally, while two cortical screws were utilized proximally. A longitudinal incision ranging from ten to 15 cm in length was employed to perform the medial plating. This incision extended from a location five cm distal to the adductor tubercle and reached the medial aspect of the thigh. Through dissection of the plane anterior to the adductor magnus and posterior to the vastus medialis, the medial cortex of the femur was rendered visible. Upon identification, the geniculate arteries were ligated as required. Due to the dissection occurring anterior to the adductor canal and consistently extending distal to the mid-portion of the thigh, there was no exposure of the superficial femoral artery. The limb was secured in an above-knee brace with knee hinges following the operation. The range of motion commenced at 30 degrees and progressively increased throughout the day.

### Postoperative stage

In general, the case was observed, and vital signs were monitored. Patients were administered third-generation intravenous cephalo-sporin and continued at home after discharging from the hospital for seven days postoperatively, followed by oral antibiotics till the 14th day

postoperative while anticoagulant was started postoperative and continued till partial weight bearing was started. Patient controlled analgesia (Either oral or parenteral) was continued for the first 36-48 hours.

#### Methods of assessment of the results

The evaluation was conducted utilizing The Knee Society Score, a metric that assesses the clinical profile in terms of anteroposterior and mediolateral stability and range of motion, flexion deformities, contractures, and inadequate alignment.

**Statistical analysis:** The statistical analysis and presentation

of the current study were performed utilizing the mean and standard deviation. In order to compare quantitative data between the two groups, an unpaired student t-test was applied. For 2x2 tables containing qualitative data, the chi-square test was calculated, and SPSS V20 utilized the linear correlation coefficient [r] to identify correlations between two quantitative variables in a single group. A two-tailed P value less than 0.05 was deemed to indicate statistical significance.

#### Case presentation

Figure 1 shows the case presentation of x ray preoperative and B: x ray postoperative of group I.

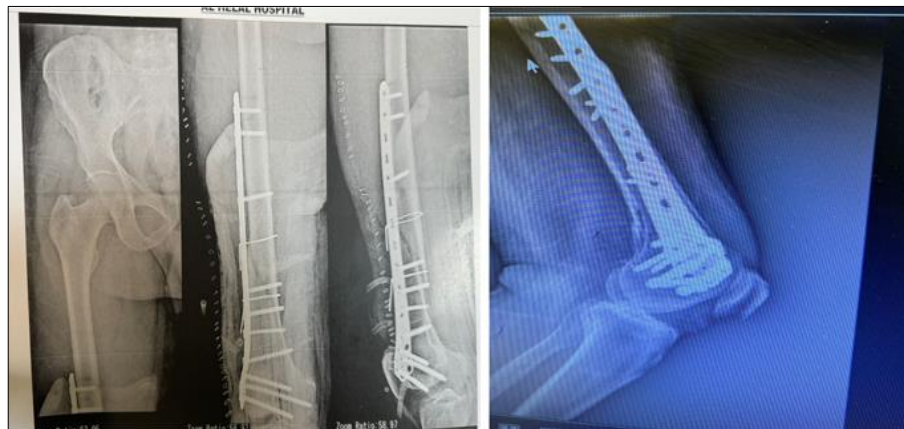


**Fig 1:** A: x ray preoperative and B: x ray Postoperative in Group I

Figure 2 shows the case presentation of x ray preoperative and B: x ray postoperative of group II.



(A)



(B)

**Fig 2:** A: x ray preoperative and B: x ray Postoperative in group II

**Results**

Demographic data, Smoking and associated conditions were insignificant difference between both groups. Table 1.

**Table 1:** Demographic data, Smoking and associated conditions of the studied groups

Demographic data	Group I		Group II		P-value
Age (Years)	40.70±14.06		40.90±16.05		0.792
<b>Sex</b>					
Male	3 (30%)		4 (40%)		0.639
Female	7 (70%)		6 (60%)		
<b>Smoking</b>					
Smokers	5	50%	6	60%	0.653
Nonsmokers	5	50%	4	40%	
<b>Associated Conditions</b>					
DM	1	10.0%	1	10.0%	0.721
FREE	7	70.0%	7	70.0%	
HTN	1	10.0%	2	20.0%	
HTN, DM	1	10.0%	0	0.0%	
Total	10	100.0%	10	100.0%	

Data present as Mean ± SD or frequency (%), DM: Diabetes mellitus, HTN: hypertension

There was insignificant difference between both groups as regard associated skeletal injuries and the type of fracture according to AO classification. Table 2.

**Table 2:** Associated fractures and classification

Associated injuries	Groups				P-value N
	Group I		Group II		
	N	%	N	%	
Clavicle	1	10.0%	0	0.0%	0.408
Colles	0	0.0%	1	10.0%	
Contral Femur Shaft	1	10.0%	0	0.0%	
Humerus	0	0.0%	1	10.0%	
Isolated	8	80.0%	7	70.0%	
Tibia	0	0.0%	1	10.0%	
Total	10	100.0%	10	100.0%	
Classifications					
A2	1	10.0%	0	0.0%	0.329
C2	8	80.0%	10	100.0%	
C3	1	10.0%	0	0.0%	

Data present as Mean ± SD or frequency (%)

The mean blood loss was an insignificantly different between both groups. Table 3.

**Table 3:** Blood loss during operation, Time till Partial and Full weight bearing, Time till radiological healing, and Total ROM

	Groups			P-value
	Group I	Group II		
Blood loss	600.00±115.47	675.00±237.17		0.380
Part weight bearing	8.00±2.31	8.00±1.63		0.962
Full weight bearing	14.00±3.65	15.00±2.16		0.466
Healing	15.60±2.46	13.80±1.93		0.291
Flexion Rom	98.20±4.94	104.50±6.77		0.217

Data present as Mean ± SD

There was insignificant difference between both groups as regard Pain, stability and alignment. Table 4.

**Table 4:** Pain, Alignment, AP stability and Medial lateral stability, Knee society score grading and other complication

Pain	Groups				P-value
	Group I		Group II		
	N	%	N	%	
Mild Walking and Stairs	1	10.0%	1	10.0%	0.682
Mild Occasional	5	50.0%	7	70.0%	
Mod Occasional	1	10.0%	0	0.0%	
None	3	30.0%	2	20.0%	
Alignment, A_P stability and Medial lateral stability.					
Flexion contracture					
5-10	8	80%	6	60%	0.329
10-15	2	20%	4	40%	
Extensor lag					
<10	7	70%	6	60%	0.639
10-20	3	30%	4	40%	
Alignment					
5=10	7	70.0%	8	80.0%	0.494
15 varus	1	10.0%	2	20.0%	
15 valgus	1	10.0%	0	0.0%	
5=20	1	10.0%	0	0.0%	
Ant. Posterior					
<5mm	10	100.0	10	100.0	1.000
5-10	0	0.00	0	0.00	
Medial lateral					
<5	10	100.0	10	100.0	1.000
10-14	0	0.00	0	0.00	
Knee society score					
Poor	0	0%	1	10%	0.315
Fair	2	20%	0	0%	
Good	4	40%	3	30%	
Excellent	4	40%	6	60%	

Data present as frequency (%)

There were 3 cases in each group (30%) of patients in group I had excellent results, 5(50%) had good results, 1(10%) had

poor results and 1(10%) had fair results. 7(7%) of cases had excellent results, 2(20%) had good results, 1(10%) had poor

results. There was insignificant difference between both groups. Table 5.

**Table 5:** Outcomes of the studied groups

Outcomes	Groups			
	Group I		Group II	
	N	%	N	%
Excellent	3	30.0%	7	70.0%
Good	5	50.0%	2	20.0%
Poor	1	10.0%	1	10.0%
Failure	1	10.0%	0	0.0%
Chi-square	X2	3.88		
	P-value	0.274		

Knee society score was negatively correlated with partial weight bearing and full weight bearing when p 0.05 and r = -0.514, -0.535, and -0.485, respectively. Age and Knee society score are positively correlated, the lower the age, the higher the Knee society score. Positive correlation between the Age and both healing time and knee society score, younger patients had significantly less time to full radiological healing and higher knee society score not significantly difference between female and male according to healing and knee society score in each group. Table 6.

**Table 6:** Correlation between Knee society score and other items, Correlation between age and sex with healing and knee society score

		Knee society score			
		R		P-value	
Age		-0.205		0.186	
Partial weight bearing		-0.514		<0.001**	
Healing		-0.535		<0.001**	
Full weight bearing		-0.485		0.006*	
		Age			
		Group I		Group II	
		R	P-value	r	P-value
Healing		0.093	0.877	0.358	0.123
Knee society score		-0.160	0.463	-0.247	0.282
Groups		Sex			
		Female		Male	
		Mean	SD	Mean	SD
Group I	Healing	20.0	0.0	15.11	2.03
	Knee society score	67.0	0.0	76.89	5.51
Group II	Healing	14.0	1.63	12.00	1.79
	Knee society score	74.75	15.20	81.50	6.69

Case number seven (5%) of group I required revision three months later due to plate failure resulting from fastener pull-out. Possible explanation: medial metaphyseal communication. The revision process involved the use of the double plating technique.

**Discussion**

The absence of severe complications in both groups and the overall satisfactory result of both techniques constituted the most significant finding of this study.

Four cases (40%) in group I yielded excellent results, four cases (40%) yielded good results, two cases (20%) yielded acceptable results, and none of the cases (0%) produced poor results. Six cases (60%) in group II yielded outstanding results, three patients (30%) yielded good results, zero cases (0%) yielded fair outcomes, and one patient (10%) produced poor results. There was an insignificant difference observed in the aggregate knee society score between the two groups.

The average follow-up duration for the cases is 14.56±4.85 weeks, with a range of 8-24 weeks. From the demographic data, Age, Gender and Mode of trauma showed insignificantly different between the two compared groups. Blood loss during operation was insignificantly different between both groups: Group I population with an average blood loss of 600±115.47 ml in comparison with a mean of 675±237.17 ml in group II. This is an accepted and logic observation as group II were managed by double plating using open reduction through dual incisions while group, I were managed through one approach.

Partial and full weight bearing could be started earlier when we used double plating for management with the mean time of 8.00±1.63 w ranging from 6w to 14w for partial weight bearing and 15.00±2.16 w ranging from 12w to 18w till full weight bearing compared to single plating group with the average was 8.00±2.31 w ranged from 6w to 14w and 14.00±3.65 w ranged from 12w to 18w for partial and full weight bearing respectively. The average time in weeks until radiological recovery for group I was 15.60±2.64 days, with a range of 12 days to 20 days, In contrast, the mean for group II was 13.80±1.93, encompassing a range of 10w to 16w. A shorter time to union was observed in patients who were treated with double plating.

The ROM was insignificant difference between two groups. Group I had an average total ROM of 98.20±4.94, whereas group II had an average of 104.50±6.77.

Alignment and stability were no substantial distinction was found between the two groups. Both groups showed good results.

One patient (10%) in group II induced erythema and serous discharge one week postoperatively, indicating a superficial lateral wound infection. Treatment entailed daily dressings containing antibiotics. Despite taking a prophylactic anticoagulant, one case in group II and group I (10%) developed DVT. Following a vascular consultation, the therapeutic anticoagulant dose was initiated. Three weeks after the operation, one patient (10%) in group II induced medial plate infection and incision dehiscence. The T-shaped buttress plate was utilized, but due to the patient's extremely low body mass, a reconstruction plate was utilized to revise the medial plate one case (10%) in group I necessitated revision after a period of three months owing to plate failure induced by screw pull-out. This may have occurred as a result of a technical error involving the lateral plate being positioned too low during the operation, leading to medial metaphyseal communication. The revision procedure entailed the implementation of the double plating method. The overall rate of complications in group I was 20%, whereas in group II it was 30%. Based on the derived P-value of 0.547, it can be concluded that the complication rates of the two groups do not differ significantly.

Several factors can cause these complications. Occasional mild discomfort was reported by 60% of patients following union and throughout the follow-up period. Proximal injury to the cutaneous nerves, the formation of scar tissue, or an exacerbation of underlying arthritis are all potential causes of chronic pain.

Steinberg *et al.* [3] studied the double plating method to distal femur fractures. The investigation comprised 32 patients, 6 males and 26 females). Two patients were managed for a non-union, while eight patients experienced peri-prosthetic stable implant fractures. Due to a re-fracture of the femur at the location of the most proximal screw, one

patient required fixation exchange and another required bone grafting to address delayed union. Due to a profound infection, one case needed medial plate elimination following union, while two patients developed superficial wound infections. In order to manage supracondylar femur fractures, they suggested that consider incorporating the double-plating technique into the surgeon's toolbox., especially in cases with compromised bone quality, Comminuted fractures, and extremely low peri-prosthetic fractures. With the exception of one that required bone grafting and one refracture, every fracture healed within twelve weeks. This finding aligns with our research, as the repair time of our double plating population was  $12.67 \pm 2.89$  minutes.

Ziran *et al.* [7] studied anterior approach therapy of intra-articular distal femoral fractures involving lateral and anterior plating. A lateral peripatellar arthrotomy and lateral dissection of the vastus lateralis and a portion of the intermedius from the femur comprise the anterior approach. The extent of the anterior dissection was restricted in order to prevent any additional medial dissection that the injury might cause. Retractors of the Hohman and Bennett varieties were forbidden. A lateral plate and an anterior plate were positioned subsequent to the attainment of articular reduction. Utilizing this method, 35 cases with 36 fractures were handled. In this study, 21 male and 14 female participated, with a mean follow-up of 7.7 months. The AO classification identified sixteen C2 fractures and nineteen C3 fractures. Twenty-one cases suffered associated extremity injuries.

With the exception of three patients, declines were nearly anatomic. By the sixteenth week, healing was uneventful in 24 of 36 fractures. Three entities were not unionized. Long reconstruction plates were employed for the anterior plates of two patients who presented with non-union and had fracture spans exceeding 350 pounds each. Both patients recovered following a subsequent procedure. Subsequently, only 1.8-mm DC plates have been employed as the antecedent plate, particularly in cases involving extensive fracture spans. The average angle of motion spanned from 10 to 102°. In our investigation, the ROM for the double plating population was 114°, which is an improvement. This can be ascribed to the early implementation of ROM that we undertook [7].

Khalil *et al.* [4] utilized a modified Olerud extensile technique to double plate a distal femur fracture of the C3 type, which was extremely unstable and complex. The extensile methodology suggested by Olerud was implemented in every instance; however, certain adjustments were made to the methodology. To begin, the Y-shaped skin incision was substituted for a V-shaped incision, which was precisely 1 cm below the tibial tuberosity at its apex.

Second, the tibial tuberosity was perforated in two predetermined locations to facilitate the insertion of two washered 6.5mm cancellous screws for closure at the conclusion of the operation. Third, Electrocautery was utilized to mark the tibial tuberosity, and a pointed osteotome was utilized to complete the osteotomy, which was initiated with an electric saw. Fourth, the suprapatellar pouch was maintained in the reflected extensor mechanism's subsurface to the greatest extent feasible. As the fifth, To improve fixation, tension band wiring was affixed over the head of the proximal screw and a transverse tunnel was

created distal to the osteotomy site. Following a comprehensive examination, detritus removal, and fracture fragment assemblage, initial Kirschner wires (K-wires) were skilfully inserted from all sides in the area surrounding the exposed distal end of the femur. Utilizing countersunk cannulated cancellous screws, including those designed for Hoffa fractures, definitive fixation was initiated. Following that, a lateral locked distal femur plate was introduced, followed by the application of a contoured medial plate (reconstruction plate in eight cases, semitubular plate in four cases). Autogenous iliac bone grafting was utilized to fill in all bony defects, ensuring superior impaction, especially in the medial and anterior regions. Following that, the incision was carefully closed. A total of twelve patients, eight of whom were male, presented with confined C3-type injuries. The average age of the patients was 33.5 years, with a range of 22 to 44 years. Nine patients sustained injuries as a result of road traffic accidents (RTAs), whereas falls from heights accounted for the remaining three cases. The mean follow-up period spanned 13.7 months, falling within the interval of 11-18 months. As a consequence, the radiological recovery period was found to be 18.3 weeks on average (Range: 12-28 weeks), with no instances of nonunion or malunion observed. Outstanding clinical outcomes were observed in two cases (16.7%), whereas good results were produced in five cases (41.7%), middling results were obtained in three cases (25%) only, and poor results were observed in two cases (16.7%). There were no instances of skin necrosis, severe infection, bone collapse, or implant failure reported in any of the cases. Two patients (16.7%) exhibited knee flexion limitation to a degree of 90 degrees, which required subsequent quadriceps plasty. Our research yielded superior results in terms of recovery time, functional outcome, and range of motion. The observed result can be attributed to the aggressive strategy, tibial osteotomy, and fixation utilized in the study [4].

Imam *et al.* [5] used the anterior method for Distal femoral fractures of the intraarticular multifragmentary C3 type are double-plated. For the treatment of distal femoral fractures of type C3, they utilized a lateral distal femoral locked plate in conjunction with a low contact locked medial plate and bone graft inserted via an extended medial parapatellar anterior approach. A total of sixteen individuals (11 males and 5 females) with supracondylar femoral fracture type C3 participated in the investigation. In the population under study, the average duration of complete radiological union was  $6.0 \pm 3.5$  months, spanning a range of 3 to 14 months. In the follow-up, neither a varus nor valgus deformity was observed postoperatively. During follow-up, a substantial plurality (68.75%) of the patients who were examined exhibited a notable enhancement in their range of motion (90°-120°). Sixty-eight patients (68.75 percent) exhibited a satisfactory to outstanding functional outcome. A negative outcome was documented in a mere two patients, accounting for 12.50% of the total. While the fixation in this study was accomplished using double-locked plates as opposed to our lateral-locked plate and medial non-locked plate approach, their functional outcome and range of motion (ROM) results are comparable to ours.

Sanders *et al.* [8] treated fragmented, unstable distal femoral fractures with double plating. A review was conducted on the cases of nine patients who presented with a complex fracture affecting the distal portion of the femur and a deficient medial-cortical buttress. Five fractures were of

type C3, while four were type C2. A combined approach was employed, utilizing two buttress plates. Stable fixation achieved exclusively through the use of a lateral plate was insufficient. The authors observed the varus angulation-induced collapse of the distal fragment intraoperatively. A medial plate containing a bone implant was utilized in every instance to provide additional stability. The functional outcome evaluation yielded five satisfactory results and four average ones. Three patients exhibited knee flexion of less than 90 degrees, while six patients had knee flexion restricted to an angle of 90 to 100 degrees. In addition, four patients exhibited a five-degree extensor latency. Based on these findings, double plating is recommended for the treatment of patients with difficult fractures in whom stable fixation of the distal portion of the femur with a condylar buttress plate is not possible due to medial cortical comminution, loss of metaphyseal bone, or a short distal condylar fragment.

This study is limited by the fact that it was conducted retrospectively and on a relatively small sample of patients. We eagerly await the results of additional, more extensive research examining this form of fixation with a specific focus on the fragility of the bone and the characteristics of the supracondylar femur fractures.

### Conclusions

While lateral and double plating fixation utilizing the dual approach are both effective and safe methods of managing distal femoral fractures of types C2 and C3, double plating is advised in the following circumstances: Medial supracondylar bone loss, low transcondylar bicondylar fractures, medial Hoffa fracture, periprosthetic distal femur fractures, non-union following failed fixation with a single lateral plate, compromised bone quality, and comminuted distal femur fractures C3.

**Acknowledgments:** There is none to be declared.

**Financial support and sponsorship:** Nil

**Conflict of Interest:** Nil

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#### How to Cite This Article

Khamis AR, Elshamely IF, Alzahhar MS, Monib SM. Dual plating versus lateral plate for closed distal femoral fractures a comparative study. *International Journal of Orthopaedics and Traumatology*. 2024;6(1):32-39.

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