

**Original article:**

## **Forearm Bone fractures: Dynamic Compression Plating Vs Locking compression plating – Randomised control study.**

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### **ABSTRACT:**

**BACKGROUND:** This article reports the efficacy of Dynamic compression plate versus Locking compression plate with regards to forearm bone fracture fixation, implant fixation, intra-operative & post-operative complications of the surgical intervention.

**SUBJECTS & METHODS:** 40 patients with a history of traumatic fracture of forearm bone were included in the study who reported in our Hospital.

**RESULTS:** In a study of 40 cases of forearm bone fractures, 20 (Group A) were treated with DCP and 20 ( Group B) were treated with Locking compression plate. All the 40 patients were followed up at 4-6 weeks , 11-14 weeks and 6 months for functional and radiological review.

**CONCLUSION:** The locking compression plating of diaphyseal bones produced excellent results, the advantages being early mobilization, early union and hence prevention of fracture disease. The only disadvantage is that it is more expensive than the Dynamic compression plate.

**KEYWORDS:** Dynamic compression plate, Locking compression plate, Both bone forearm

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### **Introduction:**

Fracture of forearm bone are one of the most common injuries seen in day to day practice. The forearm, in combination with the proximal & distal radioulnar joints, allows pronation and supination movements that are important to all of us in the usual activities of daily living. Forearm fractures can be regarded as articular fractures as slight deviations in the spatial orientation of the radius & ulna will significantly decrease the forearm's rotational amplitude & there by impair the positioning & function of the hand. Thus, the management of these fractures & their associated injuries deserve special attention as their treatment is not the same as the treatment of other diaphyseal fractures. Imperfect treatment of fractures of the radius & the ulna diaphysis leads to a loss of

motion as well as muscle imbalance & poor hand function. The most significant impact on the treatment of forearm fractures was the development of compression plate osteosynthesis. However, it is important to realize that the choice of implant is not the only parameter that governs the outcome. It is important to evaluate the patient & the type of surgery that is involved in the management of these fractures<sup>1</sup>.

### **Methodology:**

Data is collected from patients presenting with fracture of forearm bone advised to undergo open reduction and internal fixation with plates and screws at Sree Siddhartha Medical College, Tumkur. On an average 40 cases were operated for plating of forearm bones in one year. Sample size was taken as 40 with equal distribution of cases

(using randomization list) i.e, 20 cases with dynamic compression plating (DCP) (Group A) and 20 cases with locking compression plating (LCP) (Group B). Here prospective randomized clinical trial was done using the sealed envelope technique.

**Inclusion Criteria:**

1. All diaphyseal fractures of forearm bone.
2. Patients more than 18 years of age.
3. Closed fractures.

**Exclusion Criteria:**

1. Patients below 18 years of age.
2. Open fractures, segmental fractures and associated neurovascular injuries.

**Age and Sex Distribution:** of 40 cases there were 35 males and 5 females with equal distribution in both the groups. The average age was 36 years in Group A range (19- 58 years) and was 38.6 years in Group B range (18- 56 years).

**Distribution of Side, Site and Classification :**

The left side was involved in 19 patients & 21 had right side involvement with equal distribution in both the groups. A total of 72 bones were fixed in 40 patients of which 37 were ulna and 35 were radius. In Group A there were 15 both bone (75%), 3 isolated ulna (15%), 1 isolated radius (5%) and 1 galeazzi (5%) fracture. In Group B there were 17 both bone (85%), 2 isolated ulna (10%) and 1 isolated radius (5%) fractures.

The AO classification was used to know the type of fracture in both the groups. In Group A there were 12 C3, 3 B3, 3 B1, 1A3 and 1 A2. In Group B there were 12 C3, 5B3,2C1 and 1 C2 fractures. Type of anaesthesia used in both groups were as follows : Brachial block was used in 19 patients (Group A- 7, Group B- 12) and general anaesthesia was used in 21 patients (Group A- 13, Group B – 8). All the 37 ulnas were approached directly through the subcutaneous approach. The radius was approached by Henry's anterior approach in 25 patients (Group

A-13, Group B-12) & Thompson's posterior approach in 9 patients (Group A- 4, Group B- 5). The average duration of surgery was 78.4 minutes in Group A range (40-145 minutes) and 58.9 minutes in Group B range (30-150 minutes). An x-ray in Anterio-Posterior and lateral view with both the elbow and wrist joints were taken. The patients was then given a posterior slab. All patients were given injectable analgesics on arrival and continued on oral analgesics and intravenous antibiotics was given one night prior to the operation and continued for 4 days postoperative. Routine blood and urine investigation were done.

**RESULTS:**

In a study of 40 cases of forearm bone fractures, 20 (Group A) were treated with DCP and 20 (Group B) were treated with LCP. In the present study, the average age was 36 years (19-58 years) in group A and in Group B it was 38.6 years (18-56 years). In both the groups, 87.5% of cases in our study were males and 12.5% were females. The left side was involved in 45% of cases in our study, where as there was 55% involvement of right side. The average duration of hospital stay in our study was 14 days in Group A and majority being in 7-32 days and was 11 days in Group B and majority of it being in 5- 30 days.

All the 40 patients were followed up at 4-6 weeks, 11-14 weeks and 6 months for functional and radiological review.

In Group A the average follow up was 12.8 months range (6-20 months).

Group B the average follow up was 13.1 months range (6-18 months).

Criteria for Evaluation of results Radiological and clinical were as follows,

**Radiological Criteria:**

Using the criteria of Anderson et.al (1975). A fracture was considered healed radiologically when there was presence of Periosteal callus bridging the fracture site or when there was obliteration of fracture gap , in rigidly compressed fractures.

**Determination of union:**

Using the Criteria of Anderson et al <sup>2</sup>

1. Fractures which healed in less than 6 months were classified as unions.
2. Those, which required more than 6 months to unite and had no additional operative procedures, were classified as delayed unions.
3. Those, which failed to unite without another operative procedures were classified as non-unions.

**Functional Results:**

Using the criteria of Anderson et al (1975) the results were graded as -

RESULTS	UNION	FLEXION/EXTENSION AT ELBOW JT	SUPINATION AND PRONATION
EXCELLENT	PRESENT	< 10° LOSS	< 25° LOSS
GOOD	PRESENT	< 20° LOSS	< 50° LOSS
FAIR	PRESENT	> 20° LOSS	>50°LOSS
POOR	NONUNION	WITH OR WITHOUT LOSS OF MOTION	

Using the above criteria for radiological union. In group A the average time for radiological union was 9.1 weeks ( 6- 22 weeks) and in Group B the average time was 6.4 weeks ( 4- 12 weeks).

RESULTS	Group A		Group B	
	No of Cases	%	No of cases	%
EXCELLENT	15	75	18	90
GOOD	2	10	1	5
FAIR	2	10	1	5
POOR	1	5	-	-

From the above study, Chi-square value is found to be 0.275 at degree of freedom 1, so p value is more than 0.5 which signifies that there is not much difference in functional results in both the study groups.

**Complications:**

COMPLICATION	Group A		Group B	
	No of Cases	%	No of cases	%
Non union	2	10	-	-
Superficial infection	1	5	1	5
Loss of Movement	1	5	-	-
Post. Int.N.Palsy	1	5	1	5
Synostosis	-	-	1	5
	5	25	3	15

1) Non union:- There were 2 non-unions in Group A with overall rate of 10%. The non-union was due to type of fracture. In the first case it was type C3 comminuted fracture according to the AO classification, was fixed with 6 holed plate for both radius and ulna. After 6 months of radiological review, the fracture did not show signs of union. So after 8 months bone grafting was done and union was attained at 4 months. In the second case there was distal radius fracture, the lower fracture was fixed with T-plate. The lower fracture did not show signs of union radiologically after 8 months. So bone grafting was done and after 3 months fracture showed signs of union.

2) Superficial Infection:-There was 1 superficial infection both in group A and group B, each with overall rate of 10%. In group A one case had mild superficial infection for which 2 sutures were cut off on 5<sup>th</sup> day and after controlling the infection on appropriate antibiotic cover, the wound was secondarily closed on 17<sup>th</sup> day.

The fracture healed at 10<sup>th</sup> week radiologically and had excellent result functionally. In Group B, there was a similar problem and treated amicably under antibiotic cover and had radiological union at 7 weeks and had excellent functional results.

3) Posterior Interosseous Nerve Palsy:-Two patients had isolated posterior interosseous nerve palsy in both group A and group B respectively, following brachial block or secondary to traction while reducing. The patients had weak wrist extension and had weak abduction of thumb and weak metacarpophalangeal extension. Both the patients improved after physiotherapy after 4 months and had more than 50% return of function.

4)Loss of Movement:-It accounted for 5% in 1 case of group A. The patient had loss of more than 30° flexion-extension and more than 50° pronation-

supination due to prolonged immobilization by the patient himself.

5)Radioulnar Synostosis:- 1 patient in group B had Synostosis due to fracture comminution, was detected on radiologically and he had restriction of pronation- supination movements. He was operated after 6 weeks and had excellent result at 6 months functionally.

#### **Discussion:**

The forearm serves as an important role in upper extremity function, facilitating positioning the hand in space, thus helping to provide the upper extremity with its unique mobility. The competent initial management of diaphyseal fractures of the radius and ulna can prevent many chronically disabling disorders of the forearm. At a minimum, there must be 6 screws engaging three cortices above and below the fracture site. The use of 3.5 mm plate systems has nearly eliminated the problem of re-fracture after plate removal. Six to eight hole plates are used most often. Cancellous bone grafting of these fractures, in addition to plate fixation should be considered, as the union rate using this method of treatment has been nearly 100%.

The arm is immobilized in a long-arm plaster cast until there is roentgenographic evidence of union. Reliable patients may be placed in a removable splint and early motion started as soon as wound healing is complete<sup>3</sup>.Plaster of Paris has been used extensively in the treatment of fractures for well over 100 years, there is no unanimity of opinion as to the best technique for application. It can be safely concluded that even the tightest of skintight casts allows some motion at the fracture site<sup>4</sup>. **Goyal S and Iraqi et al (1997)** mentioned it is difficult to achieve & maintain closed reduction after diaphyseal fractures of forearm bones in adults.<sup>5</sup> **Charnley. J (1961)** has

stated, "If a fracture slips in a well applied plaster, then the fracture was mechanically unsuitable for treatment by plaster and another mechanical principle should have been chosen." & maintain closed reduction after diaphyseal fracture of forearm bones in adults.<sup>6</sup>

**Watson-Jones (1982)** said "Internal fixation is nothing more than a bone suture", stressing the importance of immobilization after internal fixation. "Internal fixation of the fractures of the forearm with metal can allow unrestricted activities", probably rightly as the internal fixation devices used in those days did not give rigidity or compression.<sup>7</sup>With the unacceptable results of closed methods and with the less than excellent results of a variety of intramedullary appliances, numerous investigators, including Eggers, Burwell, Charnley, and others sought more rigid fixation by means of plates and screws.<sup>8</sup>

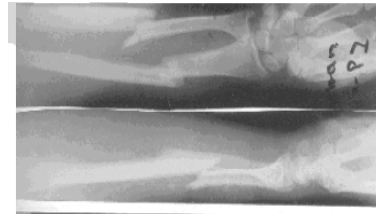
The AO group in Switzerland reported success using the compression plate in the treatment of forearm fractures in the late 1950s and early 1960s.<sup>8</sup> With compression plate fixation, early active motion is possible. This helps prevent muscle atrophy and joint stiffness, which often are responsible for unsatisfactory results.<sup>10</sup>

Transverse and short oblique fractures cannot be stabilized with lag screws but can be brought under compression with a plate. The plate acts as a static compression plate and exerts compression in the direction of the long axis of the bone.<sup>11</sup>**Schenk RK and Willenegger HR (1977)** have done studies of bone healing under rigid fixation. They have shown that where bone is under compression such that no fracture gap is present, dead bone is resorbed, resorption cavities produced by cutting cones of osteoclasts, traverse the fracture plane. Blood vessels accompanied by mesenchymal cells and

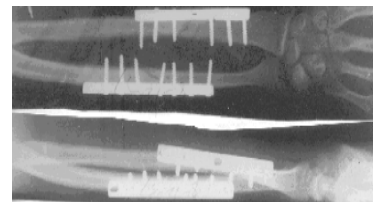
osteoblast precursors soon follow to reconstitute the Haversian systems.<sup>12</sup>

#### **Conclusion:**

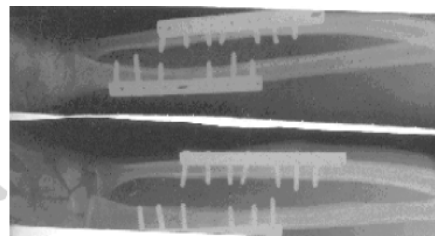
Forearm fractures commonly occur due to road traffic accidents in young adults. Open reduction & internal fixation is the treatment of choice as closed methods invariably fail. The fracture fragments should be fixed as early as possible to ease the surgery and it is also important to achieve accurate anatomical reduction with rigid internal fixation. The quality of fixation has a definitive bearing on the functional recovery. The conclusion of our study is that locking compression plate (LCP) has a definite advantage over dynamic compression plating (DCP) with respect to the time of union and screw placement in comminuted fractures, but the complications, duration of surgery and surgical technique virtually remains unchanged.



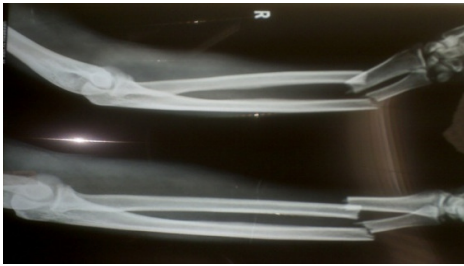
**PREOPERATIVE X-RAY**



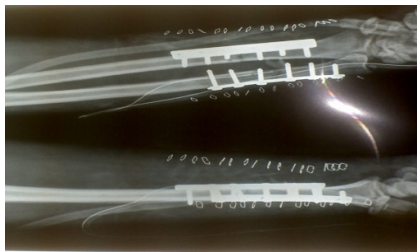
**POSTOPERATIVE X-RAY**



**FOLLOW UP X-RAY**



**PREOPERATIVE X-RAY**



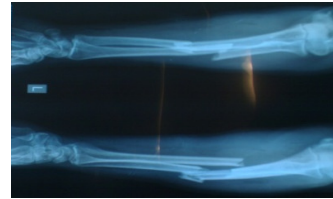
**POSTOPERATIVE X-RAY**



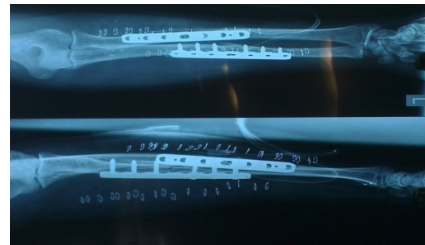
**FOLLOWUP X-RAY**

**LCP TREATED GROUP**

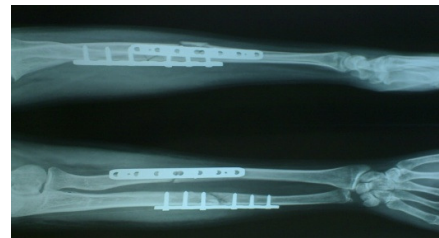
**1.EXCELLENT RESULT:-**



**PREOPERATIVE X-RAY**



**POSTOPERATIVE X-RAY**



**FOLLOW UP X-RAY**

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