

## ORIGINAL ARTICLE

### COMPARATIVE STUDY OF DYNAMIC COMPRESSION PLATE VERSUS LOCKING COMPRESSION PLATE IN THE MANAGEMENT OF DIAPHYSEAL FRACTURE OF BOTH BONES FOREARM

S. Hari Babu<sup>1</sup>, M. Rajesh<sup>2</sup>, G. Suresh Babu<sup>3</sup>, L. Anand<sup>4</sup>

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**ABSTRACT:** Fracture of forearm bones is one of the most common injuries seen in day to day practice. The forearm, in combination with the proximal and distal radioulnar joints, allows pronation and supination movements that are important to all of us in the usual activities of daily living. The forearm fractures constitute of 31% of upper extremity fractures. The present study was undertaken in a series of 24 cases (12 cases in each group) to analyse the comparative study of dynamic compression plating (DCP) and locking compression plating (LCP) in forearm bone fractures in patients more than 50 years. **AIMS AND OBJECTIVES OF THE STUDY:** To study the functional outcome of diaphyseal fractures of both bones forearm in adults surgically treated with Locking compression plate and Dynamic compression plate in the age group of more than 50 years. **SUMMARY:** In the present study 24 cases of diaphyseal both bones forearm fractures were treated with LCP and DCP, 12 in each group in the age group of more than 50 years. The mean age group of patients was 64.9 years for LCP and 64.25 years for DCP group. Road traffic accidents were the main cause of fractures. Fractures occurred predominantly in the male population. Surgery was performed within 2 to 10 days after injury. Radiological union was seen at an average of 13.83 weeks in LCP group and 15.33 weeks in DCP group. Overall functional results were almost same in both the groups. Excellent in 17 cases (9 in LCP, 8 in DCP), Good in 5 cases (2 in LCP, 3 in DCP), Fair in 2 cases (1 in each group).

**INTRODUCTION:** Fracture of forearm bones is one of the most common injuries seen in day to day practice. The forearm, in combination with the proximal and distal radioulnar joints, allows pronation and supination movements that are important to all of us in the usual activities of daily living. The forearm fractures constitute of 31% of upper extremity fractures.<sup>1</sup>

The forearm serves an important role in upper extremity function facilitating positioning the hand in space, thus helping to provide the upper extremity with its unique mobility. Exact and decisive management is required after fractures of the shafts of the radius and ulna if function is to be restored. Many chronically disabling disorders of the forearm can be prevented by the competent initial management of diaphyseal fractures of the radius and/or ulna.

Fracture of the forearm bones may result in severe loss of function unless adequately treated. Severe loss of function may result even though adequate healing of the fracture occurs. Hence a proper method of treatment is necessary to get back stability as well as normal range of function. It is difficult to achieve a satisfactory closed reduction of displaced fractures of the forearm bones and if achieved, it is hard to maintain.

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Fractures of both bones or a displaced isolated fracture of the radius or ulna should be treated by open reduction, plate fixation and cancellous bone grafting whenever there is bone loss. This treatment is carried out as a semi-elective procedure as soon as the patient's condition warrants, reduction is easiest when the fracture is treated within the first 48 hours. AO (Arbeitsgemeinschaft für Osteosynthesefragen)/ Association for the study of internal fixation (ASIF), dynamic and locking compression plate provides more secure fixation without cast protection. It produces sufficiently rigid fixation, impaction and compression of the fracture site. It can be inserted through a smaller incision than the standard plate because no external compression device is required.<sup>2</sup>

The dynamic compression plate (DCP) first described by Bagby and Denham and developed by the AO school has an intrinsic compression device making extensive dissection unnecessary. The plate depends upon the obliquity of cylindrical screw holes for compression which is produced as the screws are driven home. The most effective method of producing rigid internal fixation is by the use of compression plates developed by the AO School in Switzerland. The authors concluded that the use of ASIF compression plates for acute diaphyseal fractures of the forearm is a very successful method of obtaining union and restoring optimum functional use of the extremity.<sup>3</sup>

The LCP (Locking compression plate) is a product which is in line with the latest plating techniques, the aim of which is to achieve the smallest surgical incision and to preserve blood supply to the bone and adjacent soft tissues and stability at the fracture site. LCP has got features of both LC-DCP (Limited contact dynamic compression plate) and a PC-Fix (Point contact fixator) as it uses screw heads that are conically threaded on the undersurface and create an angular stable plate screw device. This type of plate fixation relies on the threaded plate-screw interface to lock the bone fragments in position and do not require friction between the plate and bone as in conventional plating.<sup>4</sup>

There have been only a few studies till date in review of literature comparing both Locking compression plate and Dynamic compression plate. The present study was undertaken in a series of 24 cases (12 cases in each group) to analyse the comparative study of dynamic compression plating (DCP) and locking compression plating (LCP) in forearm bone fractures in patients more than 50 years.

**AIMS AND OBJECTIVES OF THE STUDY:** To study the functional outcome of diaphyseal fractures of both bones forearm in adults surgically treated with Locking compression plate and Dynamic compression plate in the age group of more than 50 years.

**METHODOLOGY:** Twenty four patients having diaphyseal fractures of forearm were treated by open reduction and internal fixation with stainless steel Locking compression plate and Dynamic compression plate during the period from November 2011 to July 2013, and followed up to October 2013 at Sri Venkateswara Ramnarayan Ruia Government General Hospital attached to Sri Venkateswara Medical College, Tirupathi. All the 24 patients (LCP-12, DCP-12) were available for the study and follow-up for minimum of 6 months and maximum duration is 18 months. The average period of follow up was 8 months.

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**Inclusion Criteria:** Age between 50 to 90 years as LCP is better indicated in them rather than DCP.

- Both sexes included in the study.
- Fresh cases of diaphyseal both bones forearm fractures which are of closed type.
- A3, B3 and type C fractures excluding single bone fractures.

**Exclusion Criteria:**

- Patients not medically fit for surgery.
- Open fractures.
- Single bone fractures of forearm.
- Pathological fractures.
- Associated neurovascular injuries.

All the patients were brought to casualty and careful history was elicited from the patient and/or attendants to reveal the mechanism of injury and the severity of trauma. Clinical assessment of skeletal and soft tissue injuries and general condition was done. The patients who had diaphyseal fractures of forearm clinically and confirmed by radiology were selected for the study.

Vital signs were recorded. Systemic examination was done. Local examination of the fractured limb in majority of cases revealed swelling at the fracture site, tenderness, abnormal mobility, crepitus. Distal neurovascular status was assessed by palpating the radial and ulnar artery and motor and sensory sensations of the palm and wrist done to evaluate the radial, median and ulnar nerve status. All the 24 patients were fresh fractures, and they presented to hospital within 0 to 5 days.

X-ray of the forearm with wrist and forearm with elbow AP and lateral views were taken. AO classification was used.

The injured limb of all the patients was immobilized by above elbow slab and injectable analgesics were given to relieve pain.

There were 17 men and 7 women with an average age of 63.5 years ranging from 50 to 75 years. The mode of injury was road traffic accident in 17 patients, fall in 7 patients. All these injuries were managed according to standard treatment protocol followed in our institution.

Once the general condition of the patient was stabilized, definitive treatment was planned. Pre operatively routine blood and urine examinations were done i.e. Haemoglobin percentage, Bleeding time, Clotting time, Random blood sugar, Serum Creatinine, blood urea, HIV, HBSAG, Blood grouping and typing, Urine for sugar, albumin and microscopy. ECG was done for all patients. Patients were shown to physician regarding fitness for surgery. Patient status for anaesthesia was assessed by anaesthetist one day before operation.

**After treatment:** Postoperatively a sterile dressing pads and bandage was applied over the affected forearm and arm pouch was given. The patient was instructed to keep the limb elevated and move their fingers and elbow joint. Suction drain was removed after 24-48 hours. Wound was inspected after 3-4 days postoperatively. Antibiotics and analgesics were given to the patient till the time of suture removal.

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Sutures removed on 10th postoperative day and check X-ray in anteroposterior and lateral views were obtained. Later patients were discharged after suture removal with the forearm in arm pouch and advised to perform shoulder, elbow, wrist and finger movements. Patients were advised not to lift heavy weight or exert the affected forearm.

Patients were advised regular physiotherapy regarding wrist and elbow mobilization.

**Follow-up:** All the 24 patients were followed up at 4-6 weeks, 10-14 weeks, 6 months, 10 months for functional and radiological review. The average period of follow up was 8 months.

**Criteria for Evaluation of Radiological and Clinical Results:** Anderson et al (1975) criteria were used to evaluate radiological and functional results.

**Radiological Criteria:** A fracture was designated healed radiologically when there was presence of Periosteal callus bridging the fracture site or trabaculation extending across it and when there was obliteration of fracture when rigidly compressed.

### Functional Results:

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	Non union	With or Without Loss of Motion	

**OBSERVATIONS AND RESULTS:** This series consists of 24 cases of both bones forearm fracture between the age group of 50 years to 90 years, which includes 17 males and 7 females treated surgically by LCP and DCP, 12 each, between November 2011 to July 2013 and followed up to October 2013. The average period of follow up was 8 months.

**Age Distribution:** The average age was 64.9 years for (LCP) and 63.25 years for (DCP).

**Sex Distribution:** In both the groups there was almost equal distribution.

**MODE OF INJURY:** Most of the cases were due to Road traffic accidents. Seven were due to fall.

Mechanism of Injury	LCP group NO of cases	%	DCP group NO of cases	%
RTA	8	66.67	9	75
FALL	4	33.34	3	25
	12	100	12	100

Table 1

Fisher exact P value: 0.50 (Nil Significant).

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**SIDE AFFECTED:** Left side was involved in 9 cases and right side was involved in 15 cases.

Side of Fracture	LCP group NO of cases	%	DCP group NO of cases	%
Right	6	50	9	75
Left	6	50	3	25
	12	100	12	100

Table 2

Fisher exact P value: 0.20 (Nil Significant).

### TIME OF ADMISSION:

- 16 Patients have presented on the same day of injury.
- 8 Patients have presented between 1 to 5 days.

**Fracture Classification:** Single bone fractures of forearm were not included in the study. A3, B3 and Type C fractures included. C1 and C2 fractures were Nil. No. Of patients in each fracture group.

Type of Fracture	LCP group NO of cases	%	DCP group NO of cases	%
A3	9	75	8	66.67
B3	2	16.67	3	25
C3	1	8.34	1	8.34
	12	100	12	100

Table 3

$\chi^2 = 0.26$ ;  $P=0.87$  (Nil Significant)

**Level of Fracture:** Majority of cases were in the middle third.

Level of Fracture	LCP group NO of cases	%	DCP group NO of cases	%
U/3 <sup>rd</sup>	2	16.67	3	25
M/3 <sup>rd</sup>	8	66.67	7	58.34
L/3 <sup>rd</sup>	2	16.67	2	16.67
	12	100	12	100

Table 4

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**Associated Injuries:** Lcp group had 16.68% cases of associated injuries and DCP group had 25% cases.

Injury	LCP group NO of cases	%	DCP group NO of cases	%
Head Injury	1	8.34	-	-
Both bones leg fracture	-	-	1	8.34
Blunt injury abdomen	-	-	1	8.34
Pubic rami fracture	1	8.34	1	8.34
	2	16.68%	3	25%

Table 5

**Statistics of Surgery:** General anaesthesia was used in 6 cases and brachial plexus block was used in 18 cases. Surgery was done 2 days to 10 days after admission at an average of 5 days. Average duration of surgery was 65 minutes for LCP group and 72 minutes for DCP group.

### Complications:

**Intra Operative:** No complications occurred intra operatively.

**Post-Operative:** There was one case in each group with superficial infection and it was controlled by higher antibiotics and regular dressings. The infection healed in 10 days in both the cases.

**Time of Discharge:** Most of the patients were discharged after 10 days of operation. Two patients with superficial infection one in LCP group was discharged after 24 days and the other in DCP group were discharged after 26 days. After suture removal they were advised active range of movements that is flexion and extension of forearm at elbow and to come for follow up after 6 weeks.

**RADIOLOGICAL UNION:** Using the criteria of Anderson et al (1975)<sup>5</sup>, 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. The average time of healing was

In LCP group 13.83 weeks.

In DCP group 15.33 weeks.

### Healing Time in Weeks:

Group	Mean	SD
LCP	13.83	1.33
DCP	15.33	1.77

Table 6

t=2.34; P=0.02 (Significant).

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The average healing time is found to be lower in LCP group (13.83 weeks) compared to that of DCP group (15.33 weeks) and the difference is also statistically significant (P=0.02; Significant).

### FUNCTIONAL RESULTS:

Results	LCP group NO of cases	%	DCP group NO of cases	%
Excellent	9	75	8	66.67
Good	2	16.67	3	25
Fair	1	8.34	1	8.34
Poor	-	0	-	0
	12	100	12	100

Table 7

$\chi^2 = 0.26$ ; P=0.87 (Nil Significant).

The functional results were almost same in both the groups, inspite of different rates of radiological union.

### CONCLUSION:

- The study was conducted to assess the functional outcome and complications of LCP and DCP plating in the treatment of diaphyseal both bones forearm fractures in the age group of 50 to 90 years.
- In our study though there was no definitive criteria for using DCP and LCP, age groups are comparable and DCP and LCP were applied randomly.
- Fractures of both bones of forearm in adults in more than 50 years are common between 50 to 70 years. Males predominant in the high incidence of fractures due to manual working and outdoor activities.
- Majority of the fractures were transverse/short oblique in the middle shafts of both bones forearm and were due to vehicle accidents/fall.
- Radiological union of fracture was quicker in LCP group compared to DCP group by 1.50 weeks.
- Although there is no marked difference with regards to functional results in the use of LCP as compared to DCP, LCP has a slight edge over DCP.
- LCP is a stronger construct and by preventing primary and secondary loss of reduction it does not alter the natural course of healing of fracture, which is not possible with the use of DCP.
- Being a rigid construct, it allows early rehabilitation and thereby preventing secondary complications like elbow and wrist stiffness.
- LCP does not involve stripping of periosteum and cause minimal damage to soft tissues around fracture and thus by minimal disturbance of local biology of fracture it allows fracture healing to proceed its natural course. Also minimal soft tissue stripping decreases the incidence of infection.

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- As radiological union is quicker in LCP group than in DCP group, LCP is better indicated than DCP in the age group of above 50 years.

### SUMMARY:

- In the present study 24 cases of diaphyseal both bones forearm fractures were treated with LCP and DCP, 12 in each group in the age group of more than 50 years.
- The mean age group of patients was 64.9 years for LCP and 64.25 years for DCP group.
- Road traffic accidents were the main cause of fractures.
- Fractures occurred predominantly in the male population.
- Surgery was performed within 2 to 10 days after injury.
- Radiological union was seen at an average of 13.83 weeks in LCP group and 15.33 weeks in DCP group.
- Overall functional results were almost same in both the groups. Excellent in 17 cases (9 in LCP, 8 in DCP), Good in 5 cases (2 in LCP, 3 in DCP), Fair in 2 cases (1 in each group).

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#### AUTHORS:

1. S. Hari Babu
2. M. Rajesh
3. G. Suresh Babu
4. L. Anand

#### PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Orthopedics, S. V. Medical College.
2. Assistant Professor, Department of Orthopedics, S. V. Medical College.
3. Resident, Department of Orthopedics, S. V. Medical College.

4. Civil Assistant Surgeon, Department of Orthopedics, S. V. Medical College.

#### NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. G. Suresh Babu,  
Department of Orthopedics,  
S. V. Medical College, Tirupati.  
E-mail: gangisb@gmail.com

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