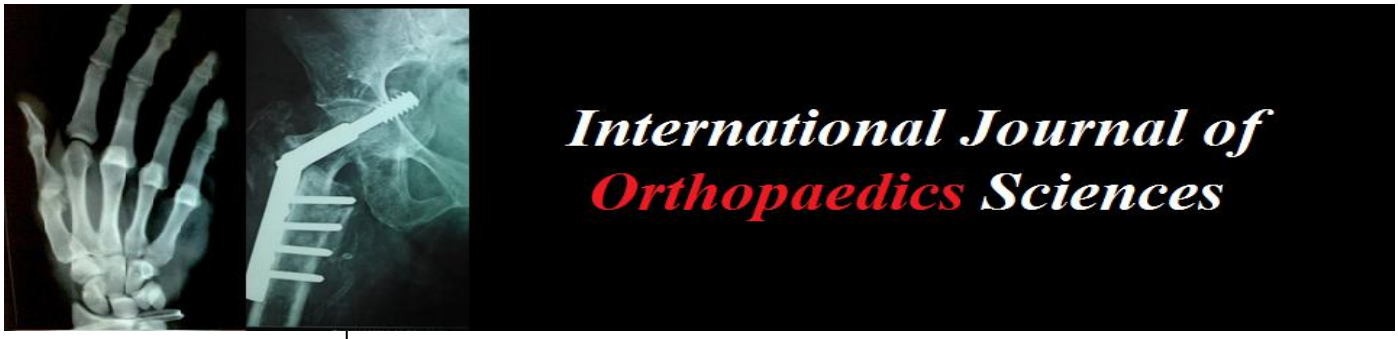

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To evaluate the functional outcome after use of Limited contact dynamic compression plate in treating diaphyseal fractures of both bones of forearm

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Abstract
Background: In this era of automobile explosion, forearm bone fractures were observed very frequently in the department of Orthopedics. Limited Contact Dynamic Compression Plate (LCDCP) is a product of different combinations of treatment modalities and is in line with the latest plating techniques which aims to achieve the smallest surgical incision, to preserve blood supply to the bone and to the adjacent soft tissues and gives greater stability at the fracture site. The present study was conducted to access the functional outcome after using Limited contact dynamic compression plate in fractures of forearm bone.
Materials and Methods: The present study is a cross sectional study conducted at department of Orthopedics, Gandhi Medical College and Hospital, Secunderabad, between august 2016 to October 2018. A total of 40 patients were included in the study with fracture both bones of forearm treated by open reduction and internal fixation with 3.5 mm Limited contact dynamic compression plate.
Results: Majority of fractures were located in the middle third of fore arm and the fracture pattern was of transverse/short oblique. After treatment 40(100%) Radius and 40(100%) ulna united within 6 months. The results were based on Anderson *et al*., scoring system which showed 34 (85%) patients had excellent results, 6 (15%) patients with satisfactory results. Only 2 cases of post OP complications were seen.
Conclusion: The 3.5mm Limited contact dynamic compression plate, if properly applied, is an excellent method for internal fixation of fractures of the forearm bone.

Keywords: Limited contact dynamic compression plate, fore arm, fractures, both bones, Telangana

Introduction
In this era of automobile explosion, forearm bone fractures were observed very frequently in the department of Orthopedics. Treatment modalities to deal with these both fractures of fore arm were changing from time to time and each of them had some edge over the previous one [1, 2, 3, 4]. Different studies has documented the functional outcome in terms of favourable fracture healing, post-operative mobilization [5, 6, 7]. Limited contact dynamic compression plate (LCDCP) is a product of different combinations of treatment modalities and is in line with the latest plating techniques which aims to achieve the smallest surgical incision, to preserve blood supply to the bone and to the adjacent soft tissues and gives greater stability at the fracture site [8, 9, 10]. LCDCP has got features of both DCP and a PC-Fix as it uses screw heads that are conically threaded on the under surface 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. The present study was conducted to access the use functional outcome after using LCDCPs in fractures of forearm bone.

Materials and Methods
The present study is a cross sectional study conducted at department of Orthopedics, Gandhi Medical College and Hospital, Secunderabad, between august 2016 to October 2018. A total of 72 patients were operated during the study period, from them 40 patients were included finally in the study with fracture both bones of forearm treated by open reduction and internal fixation with 3.5 mm LCDCP. The rest 22 had compound fractures and 10 others were not willing to sign the informed consent.

Inclusion Criteria: Patients with diaphyseal fractures of both bones of forearm Patients age between 20-50yrs Closed fractures to grade ii compound fractures

Exclusion Criteria: Grade iii fractures Pathological fractures Metaphyseal, epiphyseal and intra articular fractures Fracture with distal neurovascular deficit any other associated polytrauma

Follow-up

All the patients were followed up at monthly intervals for first 3 months.

Functional outcome:

Functional outcome is measured based on the duration of union and complications related to Limited contact dynamic Compression Plates. Functional outcome was certified using "Anderson *et al*., scoring system [11]. The variables taken into consideration were –a. Union of the fracture b. Range of elbow and wrist movements.

Operative Photographs

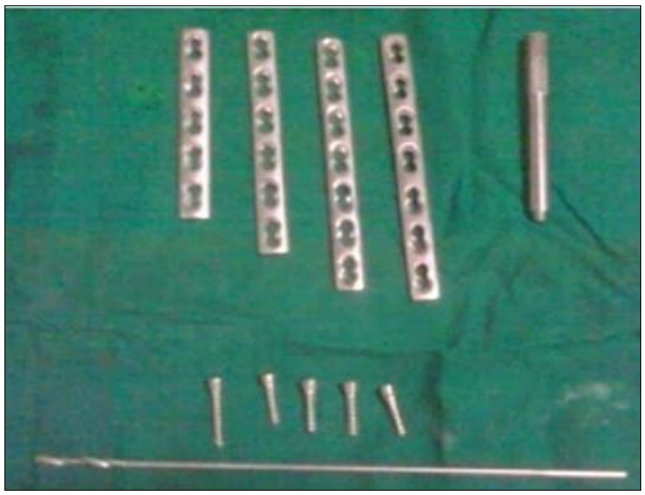

Fig 1: 3.5mm LCP, Drill Sleeve, Locking instruments

Fig 2: Volar approach for radius

Fig 3: Fracture fragments exposed

Fig 4: Fixed with 6 holed LCP

Fig 5: Subcutaneous approach for Ulna

Fig 6: Closure of wound

Results

The age of the patients ranged from 18-55 years with a mean age of 33.5 ±14 years with fracture being most common in 2nd and 3rd decade.

Table 1: Age Distribution

Distribution of Age	NO. Of. Patients	Percentage
18-20	4	10
21-30	16	40
31-40	12	30
41-50	6	15
51-60	2	5
Total	40	100

Male preponderance were observed i.e 28 patients (70%). Patients were presented with more number of left forearm fractures when compared to the right forearm fracture.

Table 2: Other Findings Related to Fractures

	No. of Patients (N)	Percentage (%)
Sex Distribution		
Male	28	70
Female	12	30
Side Affected		
Right forearm	16	40
Left forearm	24	60
Mode of Injury		
RTA	20	50
Fall	16	40
Assault	4	10
Level of Fracture		
Proximal third	6	15
Middle third	28	70
Distal third	6	15
Associated Injuries		
Closed head injury	2	5
Unilateral pubic bone fracture	2	5
Olecranon fracture	2	5
Fracture of both bones of leg	2	5
Ipsilateral fracture shaft humerus	2	5

In our study, there were 50% of patients with road traffic accidents, 40% patients with fall and only 10% of patients with assault. Majority of the fractures were seen in the mid diaphysis of both bones of forearm.28 (70%) patients had mid diaphyseal fractures. 10 (25%) of the patients had associated injuries.

Table 3: Type of the fracture vs Bone

	Radius	Ulna	Percentage
Transverse/short oblique	28	30	72.5
Comminuted	12	8	25
Segmental	-	2	2.5
Total	40	40	100

Majority (72.5%) of the fractures were transverse/short oblique. About 25% of fractures were comminuted and only 2.5% of segmental fractures were present.

Duration of Fracture Union

The fracture was considered as united when there were no subjective complaints, radiologically when the fracture line was not visible. Those fractures which healed after 6 months without an additional operative procedure was considered as delayed union. Fractures which did not unite after six months or that needed an additional operative procedure to unite was considered as non-union. All patients (100%) had sound union in less than 6 months, none of the patients had delayed union or non union.

Table 4: Duration of Fracture Union

Time of union	No. Of patients	Percentage
<4 months	32	80
4-6 months	08	20
6 months-1year	---	---
Non union	---	---
Total	40	100

Outcome

Table 5: Outcome based on "Anderson" *et al*. scoring system

Criteria				Results
Outcome	**Union**	**Flexion/Extension at elbow joint**	**Supination and pronation**	**N (%)**
Excellent	Present	<10 ^{0} loss	<25% loss	34(85)
Satisfactory	Present	<20 ^{0} loss	<50% loss	12(15)
Unsatisfactory	Present	>20^{0}loss	>50% loss	---
Failure		Non-union with or without loss of motion		-----

Using the Anderson *et al*. scoring system, 34(85%) patients had excellent results.

Complications

There were no cases of intraoperative complications. Postoperative complications one patient developed superficial infection which was later controlled with appropriate antibiotics after culture and sensitivity report. One patient developed transient posterior interosseous nerve injury. Patient was treated with static cock up splint which recovered in a span of about 1 and1/2 months.

Discussion

In our study, fracture was commoner in the second and third decade, with average age of 33.5 ±14 years (18-55 years) with male preponderance. Frankle Leung and Vishwanath C also observed similar results with third and fourth decade males accounting for high percentage [12, 13]. Goldfarb observed an average age of 41years [14]. Fractures are observed in the active age group and particularly in men as they work with heavy machinery and out door activities. RTA was the cause of fractures followed by falls. Similar observations has been observed by the studies conducted by Moed B. R. *et al*. [15]. Thomas Grace *et al*. [16]. H. N. Burwell and A. D. Charnley reported about 50% incidence of fracture both bones in right arm [17], in the present study about 60% incidence of fractures both bones in left extremity. Vishwanath C has observed 64% of fractures were in left extremity [13]. In our study. about 72.5% were transverse/short oblique and 27.5% of fractures as comminuted. The results were comparable to the previous studies conducted by Vishwanath C where 72.5% were transverse/short oblique, 22.5% of fractures as comminuted and 5% were segmental fractures. Our series had 70% of fractures in middle third, 15% in proximal third and 15% in

lower third, comparable to previous studies similar results were observed by study conducted by Vishwanath C had 64% of fracture in middle third, 26% proximal and 10% in lower third. Sarmiento Augusto 84.6% in the middle and 15.4% in the lower end [18].

Table 6: Union times from Different studies

Study	Union times (weeks)	Range (Weeks)	Union (%)
Frankie [19]	17	8 – 36	100
Mc Knee [20]	10.7	5-18	97.3
Vishwanath C [13]	17	8-28	100
Present study	11.85	8-20	100

Our results are comparable with the study by Mc Knee, in which he found the average time for union is 10.7 weeks. There is a discordant results with the other authors mentioned above. As the time for union varies according to age, general condition, rigidity of fixation and presence of infection.

Functional Outcome

Table 7: Comparison of functional outcome from different studies

Study	Excellent	Satisfactory	Unsatisfactory	Failure
Anderson [3] (1975)	50.9	34.9	11.3	2.9
Chapman [10] (1989)	86	7	12	5
Frankie [19] (2003)	98	2	-	-
Vishwanath[13] (2017)	90	8	-	2
Present study(2018)	85	15	-	-

The range of motion was determined and Anderson *et al*., scoring system was used as a measure for the functional outcome. Anderson *et al*. reported about 54 (50.9%) cases as excellent, 37 (34.9%) satisfactory, 12 (11.3%) unsatisfactory and 2 (2.9%) failure. Frankie Leung reported 98% cases as excellent and 2% satisfactory results. In our study we had 17 (85%) cases with excellent results, 3 (15%) satisfactory results. As the time progresses the functional outcome has increased from 51% to more than 85 % in the last three decades which was observed in studies conducted by Frankie, Chapman and Vishwanath.

With respect to complications in the present study common complications seen are Infection and Posterior interosseous nerve injury. In a study conducted by Vishwanath there were 3 case of superficial infection and 1 case of non-union of radius. Post-interosseous nerve injury is observed in study conducted by Kurt P i.e around 3.3%, Anderson, Chapman observed in 2% and 1.2% of cases respectively.

Conclusion

The 3.5mm LCDCP, properly applied, is an excellent method for internal fixation of fractures of the forearm bone. Use of tourniquet, separate incisions for radius and ulna and preservation of the natural curves of radius will lessen the rate of complications. Early fixation of fractures with a minimum of 6 cortices fixed on each fracture fragment is important to achieve good anatomical reduction and stable internal fixation for excellent functional outcome. LCDCP plating is an excellent procedure in treating diaphyseal fractures of both bones of forearm.

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