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Surgical management of diaphyseal fractures of both bones forearm in adults by limited contact dynamic compression plate (LC-DCP)

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Abstract
This research discusses the surgical management of diaphyseal fracture applicable to two bones of the forearm by use of LC-DCP. The study assessed the patients to either of the two groups following block randomization alongside a random number table. Further, a clinicoradiological patients' follow-up for at least six months was conducted to obtain the outcomes. Lastly, the research established that LC plating is the operational treatment choice for both bones of forearm fractures as determined by sound application of doctrines of plating.

Keywords: Forearm fractures, locking compression plate (LCP), LC-DCP fixation, LCP fixation

1. Introduction
Forearm fractures characterize most injuries. Thus, effective management of forearm fractures requires an understanding of the anatomy as well as the function of the ulna, radius, interosseous membrane, distal and proximal radioulnar joints. To access ulnar and radius joints some of the reputable surgical methods such as dorsal Thompson, ulnar and anterior Henry are employed. Most fracture designs are acknowledged such as ulnar and isolated radius fractures, Monteggia fractures, Galeazzi fractures and combined fractures. So as to manage the fractures during surgery, a regular open reduction as well as internal plate fixation is required. Besides, screws are used with caution for a steady reduction of the distal radioulnar and proximal joints. Locking plate and intramedullary fixation technology are the new establishments in the forearm fracture management [1].

2. Methods
This research was carried out from May 2012 through to March 2015 in the Department of Orthopaedics, KVG Medical College and Hospital. A total of 36 patients diagnosed with fractures of the forearm on both bones was studied. Inclusion method consisted of 16 to 60 years of age. Besides, injury was less than 21 days Type I or compound diaphyseal fracture of forearm on both bones. Also, there was good vascular and neurological condition of the affected extremity and there was good elbow, shoulder, finger and wrist joints functioning. Lastly, there was no related contralateral or major ipsilateral injury of the limb affecting rehabilitation or treatment protocol. Excluded cases involved history of steroid usage, pathological fracture and clinically identifiable illness such as rheumatoid arthritis.

3. Study Design
There was random assignment of patients to either of the two groups following block randomization alongside a random number table. 70% comprised 25 males while 30% comprised 11 females. Their mean age was 30.5, that is, a range of 16 to 60 years. 14 (39%) of patients were diagnosed with high energy trauma being the causative injury. Other 22 (61%) were associated with a low-energy trauma history. Fractures were categorized according to the AO alpha-numeric categorization mechanism. One group, a representation of 18 incidents, had an open reduction as well as LCP fixation treatment. The other group, a representation of 18 incidents, had an LC-DCP treatment. For fixation, LC-DCP and 3.5 mm titanium were used.

8 Patients presented with Type I compound fractures when considering Anderson and Gustilo classification. Out of which four each were fixed with LC-DCP and LCP respectively.

Three skilled surgeons conducted the operations techniques as described in the AO/ASIF category. The plate was initially fixed with a screw after reducing the fracture in an LCP fixation to obtain axial compression. This was followed by another screw in the reverse section.

There was a clinicoradiological patients' follow-up for at least six months. At first, patients were examined each 3 to 4 weeks intervals up to the union of fractures, every six weeks subsequently for three months and eventually at three months intervals. The outcomes were assessed based on the union of fractures, movement range, grip or muscle strength as well as complications. Union was examined according to Anderson criteria. Fractures that took at least six months to heal were categorized as unions. Those that took more than six months to consolidate though lacking extra operative processes were categorized as delayed unions. Those that did not unite with the lack of extra operative procedures were categorized as non-unions.

The functional results were examined by use of Anderson *et al*. criteria. The fractures quality reduction was examined by use of Leung *et al*. Thus, anatomical reduction showed exact alignment with decreased wedge fragments as well as lag screws fixation. The major fragments are not compressed but adapted in a non-anatomical reduction. Thus, there is no achievement in an exact anatomical decrease in fragments. The complications were examined based on infections such as chronic or deep or superficial osteomyelitis; implant loosening, synostosis, non-union, minor loss of reduction, re-fracture, breakage of the implant, end-of-plate fracture, and compression hole fracture. There was testing of grip strength by use of dynamometer (hand-held). The latest follow-up values were used. The patient outcomes were examined after rating by use of the arm, hand and shoulder questionnaire disabilities. The questionnaire had 30 items to examine the symptoms and function of patients diagnosed with upper limb disorders.

4. Results

The duration needed for the fixation of LCP (average 93.05 minutes and a range of 75 to 180 minutes) was established to be more than that needed for LC-DCP (average 81.94 minutes and a range of 60 to 100 minutes). However, the time variation (0.09 minutes) was insignificant.

The average ranges for the elbow flexion, pronation, and wrist flexion joint movements among the LCP group recorded 146.9°, 100.7°, and 60° consecutively. In LC-DCP group the records were 141.4°, 96.55° and 55°. The two groups were insignificant with regard to the movement ranges (0.09, 0.14 as well as 0.66 consecutively, non-paired test). There were outstanding outcome among 32 (89%) patients, satisfactory results among 3 (8%) patients, and a lack of failure case in 1(3%) patient. The ranges reduction that existed was indicated in percentage. The statistical information given, are those that compare one out of the three movements for LC-DCP and LCP groups.

The strength of grip of the involved part extended from 80% to 100% of that of contralateral part of LCP group and from 60% to 100% in LC-DCP group. The two groups lacked a revelation of significant difference regarding the strength of grip (0.40 for non-paired test).

5. Discussion

The ulna and radius make up the two structures of the bone of the forearm, and they function mutually as a component. Thus, the bones movement and anatomy should be regarded as a sole flexible process other than two different bony structures [2] Distal radioulnar joint (DRUJ) is instrumental in connecting both bones; the interosseous membrane (IOM) and proximal radioulnar joint (PRUJ). IOM is a sheath composed of fibrous and separates the posterior and anterior sections. It is a minor limitation to the proximal shaft of the radius to the ulna. The sheath originates from the radius and enters ulna, is composed of the accessory band, central band, and a membranous portion [3]. The mean length of the sheath from radius to ulna is estimated to be 10.6 cm.

IOM's main purpose is to maintain the stability of the forearm at longitudinal level while serving as a ligament. IOM contributes an estimated 71 percent of the stiffness of forearm at the longitudinal level when excision of the radial head occurs. The radial head is responsible for restricting proximal shifting of the radius with the main IOM band as well as triangular fibrocartilage complex (TFCC) performing as subsidiary inhibitors. The structures simultaneously enhance stress evolution and allow motion of forearm to supination from pronation. The DRUJ, PRUJ, TFCC, IOM, ulnar and radius compose the arm ring. The ring performs in concert to let the forearm supination and pronation. Thus, disruption of the ring at a given site causes loss of normal motion of the forearm. The aim of management of fracture of the forearm is caring of the ring anatomically so as to keep movement as well as function [4].

Open reduction and plate fixation are the consistent typical treatment of adult diaphyseal forearm fracture. However, the most efficient type of plate fixation recommended for diaphyseal breakages of forearm bones has not been well documented. Locked plates such as internal-external fixators do not depend on the force of friction between the bone and the plate to attain firmness for providing stability [5]. Therefore, the blood supply below the plate should be preserved to allow for minimal complications and healing. It has been confirmed to be important in situations such as comminuted fractures, osteoporosis, complex intra-articular fractures, fractures in closer to the joints and fractures of upper extremities. Locking Compression Plate (LCP) is one of the considered methods as opposed to the conventional plating method in forearm fractures therapy [6]. However, there exists limited information regarding comparing LCP with the conventional plating.

Fixation of LCP was established to take more time, an average of 93.05 minutes when compared to the required time for fixation of LC-DCP which is 81.94 minutes. The difference in time was statistically insignificant. According to Marya *et al* their randomized control trial (RCT) compared LC-DCP with fixation of PC and established a 100 percent blending with an average duration of 17 and 18 weeks, correspondingly, for fractures that are closed [7]. In their other attempt of LCP, there was 100 percent blending rates in LCP and DCP groups. They as well established the union time in favor of DCP. Their study had consolidation rate of 100 percent, with a single delayed consolidation in the LC-DCP group as well as none in the LCP group. The average time of consolidation, that is, 14.16 weeks, ranging from 8 to 21 weeks in LCP group was determined to be lesser when compared to LC-DCP group. The efficiency of the two implants about the varied fracture morphologies was never compared because there was a feeling that the subgroups lacked sufficient numbers for the outcomes to be substantial.

In a non-anatomical reduction, the plate was employed to bridge the mode or conventional mode in the absence of compression, or in cases of small comminuted remains is not exactly adapted for avascularity fears. Since the formation of callus was established to be more in non-anatomically reduced forearms, then there is an agreement with Azboy *et al* [2]. That it is reduction quality and stability control in LCP that establish speed and type of healing. It backs Wagner's perception that the locked technique of internal fixator allows, though does not require exact reduction and offers priority to biology as opposed to mechanics.

The two groups were established to vary substantially concerning the formation of callus, which clearly shows the biologic context of LCP plating. Locked plates serve as internal fixators in fractures associated with a wider gap. They strain at below 10 percent to offer adequate stability favorable for the healing of for secondary bone through enchondral ossification [8]. There was only a single case of osteomyelitis occurring with a 22-C2. 2 fracture. Though there was severe lysis of the main bone below the plate, it lacked signs of plate loosening or screw back-out. Healing occurred by the 21st week with modest callus formation in the absence of any implant breakage, loosening, fracture or synostosis, non-delayed union and need for a procedure of secondary surgery [9].

Angular and axial stability is assured by locking screw into the plate. Thus, it disregards the probability for the screw to toggle, dislodge or slide. Therefore, it decreases the vulnerability of post-operative cost of decline [10, 11]. The outcomes of this study can be compared with the described literature based on functional results and rates of complication. The outcomes are as well established to be better regarding consolidation rates. The vulnerability to fracture due to the removal of the plate is reported to range from 4% to 25% [6]. According to Marya *et al*. (2003), there had only been one re-fracture in both groups after removal of the implant in his RCT when comparing LC-DCP with PC fixation. The researchers as well reported two re-fractures in LCP, where the removal of plates was done after 12 months. They, therefore, advised that plates should not be removed until after 18 months of fixation.

6. Conclusion and Recommendation

LC plating is the operational treatment choice for both bones of forearm fractures. The results are established using sound doctrines of plating. The current study thus could not provide better standards than LC-DCP since the two methods of fixation provide similar outcomes on patient satisfaction in managing forearm fractures and functional healing. Thus, it is the effective implementation of the doctrines of plating irrespective of the type of plate that decides the results. Moreover, a multi-centric long-term research is needed to confirm implant behaviors.

7. References

1. Ali A, urRehman H, Anjum MP. Outcome of Forearm Shaft Fractures in Adults Treated by Dynamic Compression Plate (DCP). Journal of Pakistan Orthopaedic Association. 2014; 26(2):1-4.
2. Patil RB, Ravindragouda BP, Ronald IK, Sharad MA. A follow up study to evaluate the management of fractures of both bones of forearm in adults using locking compression plate. International Journal of Orthopaedics Traumatology & Surgical Sciences. 2016; 1(2):119-123.
3. Azboy I, Demirtas A, Uçar BY, Bulut M, Alemdar C, Ozkul E. Effectiveness of locking versus dynamic compression plates for diaphyseal forearm fractures. Orthopedics. 2013; 36(7):e917-22. doi: 10.3928/01477447-20130624-23.
4. Saka G, Saglam N, Kurtulmus T, Bakir U, Avci CC, Akpinar F *et al*. Treatment of isolated diaphyseal fractures of the radius with an intramedullary nail in adults. European Journal of Orthopaedic Surgery & Traumatology. 2014; 24(7):1085-1093.
5. Babu SH, Rajesh M, Babu GS, Anand L. Comparative study of dynamic compression plate versus locking compression plate in the management of diaphyseal fracture of both bones forearm. Journal of Evidence based Medicine and Healthcare. 2015; 2(40):6717-6724.
6. Leung F, Chow SP. Locking compression plate in the treatment of forearm fractures: a prospective study. Journal of Orthopaedic Surgery. 2006; 14(3):291.
7. Marya KM, Devgan A, Siwach RC, Yadav V. Limited contact dynamic compression plate for adult forearm fracture. J OrthopSurg (Hong Kong). 2003; *7:*19-24
8. Meena RK, Singh AM, Langshong R, Waikhom S, Singh AK, Chishti SN. Internal fixation of adult diaphyseal both bone forearm fractures using locking compression plate. Journal of Medical Society. 2014; 28(3):171.
9. Stevens CT, Ten Duis HJ. Plate osteosynthesis of simple forearm fractures: LCP versus DC plates. Acta orthopaedica Belgica. 2008; 74(2):180-183.
10. Ozkaya U, Kilic A, Ozdoğan U, Beng K, Kabukçuoğlu Y. [Comparison between locked intramedullary nailing and plate osteosynthesis in the management of adult forearm fractures]. Acta orthopaedica et traumatologica turcica. 2008; 43(1):14-20.
11. Raval H, Panse JB, Amin P, Pandit J. Unilateral, Multifocal Fracture of Radial with Ipsilateral Midshaft Ulna Fracture–Two Such Unusual and Rarely Reported Cases. Journal of Orthopaedic Case Reports. 2015; *5*(3):22-24.
12. Saikia KC, Bhuyan SK, Bhattacharya TD, Borgohain M, Jitesh P, Ahmed F. Internal fixation of fractures of both bones forearm: Comparison of locked compression and limited contact dynamic compression plate. Indian journal of orthopaedics. 2011; 45(5):417.