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## INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/16806  
DOI URL: <http://dx.doi.org/10.21474/IJAR01/16806>



### RESEARCH ARTICLE

#### CLINICAL AND RADIOLOGICAL OUTCOME IN LATERAL END CLAVICLE FRACTURES FOLLOWING CLAVICLE LOCKING PLATE FIXATION

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#### Manuscript Info

##### Manuscript History

Received: 28 February 2023

Final Accepted: 31 March 2023

Published: April 2023

##### Key Words: -

Lateral End Clavicle, Precontoured  
Locking Plate, Quickdash

#### Abstract

**Aim:** The lateral end clavicle fractures comprise around 25% of all clavicle fractures. Various deforming forces acting over here render this fracture unstable. There are various treatment options of the lateral end of clavicle ranging from non-operative to operative methods like coracoclavicular screws, k wire fixation, tension band wiring, hook plates, non- locking and locking plates and coracoclavicular augmentation. In this study, we have evaluated the functional and radiological outcomes of the patients in whom a locking plate was used for fixation of the lateral end of clavicle fractures.

**Methods:** 15 patients with lateral end clavicle fractures underwent open reduction and internal fixation using a 3.5 mm pre-contoured superior locking plate under general anaesthesia or regional block. Regular post operative X-rays were done until radiological union was achieved. The postoperative pain was assessed using Visual Analogue Scale (VAS) on postoperative day 1 and at 2 weeks. The operated limb was supported by a sling for 3 weeks with intermittent passive and active assisted range of motion exercises. The functional outcome was assessed at the end of 1 month, 3 months and 6 months postoperatively with the help of QuickDASH scoring system.

**Results:** All the fractures achieved radiological union at an average duration of 12.1 weeks (range 9.8-13.4). The mean VAS score on post-operative day 1 was found to be 5 which decreased to 1 at two weeks postoperatively. The mean postoperative QuickDASH score was 52.23+/- 1.9 at the end of 1 month, 20.4+/- 1.9 at 3 months and then 1.3 +/-1.6 at the end of 6 months. There was one case of implant backout with hardware prominence and one case had superficial infection which responded to short course of oral antibiotics and dressings.

**Conclusion:** The precontoured superior clavicle locking plates may be a good method to fix the fractures of the lateral end clavicle, providing a stable fixation with good radiological and functional outcome, although larger comparative studies between the various surgical treatment methods need to be done to validate this method of treatment.

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#### Introduction:-

Lateral end of clavicle fractures accounts for upto 25% of all clavicle fractures.<sup>1</sup> It is often caused by either a direct blow or by a fall on the outstretched hand. Twenty-five percent of these fractures are unstable due to the displacing

forces acting on the fracture fragments: an inferior force on the lateral clavicle fracture fragment and an anterosuperior force on the medial clavicle.<sup>2</sup> The lateral fractured fragment is small and hence, it is difficult to get an anatomical reduction and poses problems in its fixation, which results in instability of the lateral clavicle fractures. Several treatment methods have been used for the management of such fractures. Conservative treatment is associated with high rates of non-union (22%-50%).<sup>3,4</sup> Various operative treatment options include coracoclavicular screws, Kirschner wires, tension band wiring, hook plates, nonlocked and locked plates.<sup>5-10</sup> The operative modalities are not without complications. These include non-united and malunited fractures, pin migration, impingement of the plate, the requirement of removal of the plate in all the fixation modalities.<sup>7,11</sup> In this study, we have evaluated the functional and radiological outcomes of the patients in whom a locking plate was used for fixation of the lateral end of clavicle fractures.

### Materials and Methods:-

The retrospective study was done in our department on 15 patients who underwent open reduction and internal fixation using a 3.5 mm pre-contoured superior locking with lateral end clavicle fractures. Our study included 15 patients within the age group of 18-60 years with displaced type 2 Neer's fracture lateral end clavicle fractures.<sup>12</sup> The exclusion criteria were the patients having associated acromio-clavicular joint dislocation, previous history of any fracture to the affected shoulder, polytrauma, associated neuro-vascular Injury and pathological/open fracture. The informed consent was taken from all patients for participating in the study. All the surgeries were performed by a single surgeon (the first author) under general anaesthesia or regional block and in the supine position with a roll of towel in between the scapula to retract the clavicle. A horizontal incision was given over the superior clavicle, centering the fracture. (Figure 1) This was followed by subcutaneous dissection taking care of the supraclavicular nerve. Division of platysma exposed the clavicle. The reduction was achieved and maintained by a temporary Kirchner wire fixation.(Figure 2) A precontoured locking compression plate (LCP, superior anterior clavicle plate with lateral extension) was used to fix the fracture, with the help of 3.5 mm locking and cortical screws on the medial side and 2.7 mm locking screws on the lateral side.(Figure 3a,b) The closure was done in layers and the arm was supported using an arm sling.Regular post operative X-rays were done until radiological union was achieved. The postoperative pain was assessed using Visual Analogue Scale (VAS) on postoperative day 1 and at 2 weeks. The operated limb was supported by a sling for 3 weeks with intermittent passive and active assisted range of motion exercises. The functional outcome was assessed at the end of 1 month,3 months and 6 months postoperatively with the help of QuickDASH scoring system.

### Results:-

In our study of 15 patients, 11 patients were male and 4 patients were females with an average age of 34.2 years (range 22-56). The dominant side was involved in 9 patients. The mode of trauma was road traffic accident in, fall from height in and street fall in. All the fractures achieved radiological union at an average duration of 12.1 weeks (range 9.8-13.4). (Figure 4,5) The mean VAS score on post-operative day 1 was found to be 5 which decreased to 1 at two weeks postoperatively. The mean postoperative QuickDASH score was 52.23+/- 1.9 at the end of 1 month,20.4+/- 1.9 at 3 months and then 1.3 +/-1.6 at the end of 6 months. (Table 1) There was one case of implant backout with hardware prominence in one patient and one case had superficial infection which responded to short course of oral antibiotics and dressings. (Figure 6)

### Discussion:-

The lateral end clavicle fractures where the small distal fractured fragment is acted upon by various deforming forces makes it an unstable fracture with increased risk of malunion and non-union, which leads to functional disabilities.<sup>13,14</sup> Hence, the need for surgical management in the form of stable fixation is necessary. Various surgical procedures for lateral clavicle fractures have been used like K-wire fixation, screw fixation, tension band wiring, hook plates, non-locking and locking plates with or without coracoclavicular sling augmentation. We have used 3.5 mm pre-contoured superior locking plate with lateral extension, which provided a stable fixation to the fractured fragments and allowed early mobilization of the shoulder. This plate is anatomical and fits well to the contour of the lateral end of the clavicle. It also allows screw fixation in different planes in the lateral end of the clavicle and hence provides a multi-planar fixation of the distal fragment of the fracture and greater stability to the small unstable fragment.<sup>15</sup> This implant not only neutralizes the forces acting upon the fracture fragments but also gives better hold in osteoporotic bones. We believe that all these factors contribute to a successful union of the clavicle fracture along with good functional outcomes. Kalamaras et al were the first to report the concept of locking plate in distal clavicle fracture in their study where distal radius locking plate was used and finally concluded that the use of the locking

plate gave good results and was promising for the management of the lateral clavicle fracture as it showed to have a better control on the distal fracture fragment.<sup>16</sup> Anderson et al reported 13 cases of lateral clavicular fractures fixed with the locking LCP plate and concluded that superior locking plates provided high union rates along with good functions and low complications rates. In our series of 15 patients, we achieved radiological union in all the patients at an average duration of 12.1 weeks. Rieser et al analysed the biomechanical analysis of the lateral clavicle fracture treated with the help of various treatment modalities and reported that locking plate fixation provided a stable fixation biomechanically and the clinical outcome was also satisfactory.<sup>18</sup> There was one case of implant backout with hardware prominence in one patient and one case had superficial infection which responded to short course of oral antibiotics and dressings. In our case series we achieved a significant increase in clinical outcome using QuickDASH Score. In a comparative study done by Chunlin et al the LCP plate was compared with the hook plate and in 66 patients (30 done by hook plate and 36 done by locking plate) it was seen that the clinical outcome was better in locking plate as compared to hook plate.<sup>19</sup>

#### Figures and Tables



**Figure 1:-** Incision site over Clavicle.



**Figure 2:-** Reduction of the fracture and preliminary Stabilization using k wires and plate application.



**Figure 3:-** Precontoured Clavicle locking plate (a) Side View (b) Top View.



**Figure 4:-** Pre-operative image of Fracture Clavicle.



**Figure 5:-** Post Operative Image.



**Figure 6:-** United Fracture with implant backout.

**Table 1:-** Clinical Scoring (Quick DASH Score).

| Post Op Duration | Operated Limb    | Non Operated Limb | P Value     |
|------------------|------------------|-------------------|-------------|
| 1 Day            | 52.23 ± 1.9      | -                 |             |
| 3 Months         | 20.4 ± 1.7       | -                 |             |
| <b>12 Months</b> | <b>2.7 ± 1.5</b> | <b>2.6 ± 1.9</b>  | <b>0.37</b> |

### Conclusion:-

The precontoured clavicle locking plate with lateral extension provides a stable fixation for the displaced lateral end clavicle fractures and are not associated with any major complications. This low-profile implant is easy to use and fits well to the contour of the lateral end of the clavicle and offers multi-planar screw fixation in this small fragment providing stability. Although, larger comparative studies between the various surgical treatment methods are required to confirm the same.

### Conflict Of Interest:

The authors declare no conflict of interest.

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