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# Early Results of Unstable (Neer's Type II) Distal Clavicle Fractures Treated with Superior Anterior Locking Plate - A Prospective Study

**Aaron D'souza[1], Hijas Hameed[2]**

[1]Assistant Professor, M S Ortho, Department of Orthopaedics, Yenepoya University, Deralakatte, Karnataka, India

[2]Post Graduate Student, Department of Orthopaedics, Yenepoya University, Deralakatte, Karnataka

**Abstract:** ***Distal clavicle fractures account for approximately 21–28% of all fractures of the clavicle. They are associated with increased risk of non union (rate: 22-25 %) with conservative treatment. Superior anterior locking plate system is one of the newer surgical treatment option with certain advantages over other surgical implants. Aims and objectives: To evaluate functional results and outcome of unstable distal clavicle fracture using Anterior superior locking plate by open reduction technique. Materials & methods : 10 Adult patients with Neer classification type IIa and type IIb distal clavicle fractures treated at our hospital with anterior superior locking plate. They were followed up for functional outcome using Murley's constant score and radiological union till average of 14 months. Results: All fractures united well with an average time of 7.5 weeks. Constant score showed excellent result in 8 cases and good result in 2 cases. The average Constant score was 97.8 (range:95-99).Conclusion: Displaced distal clavicle fractures (Neer's type 2) treated with superior anterior locking plates achieved excellent results in terms of bony union and satisfactory functional outcome with rarely any early complications and demonstrates promising results with early plate fixation with this new technique.***

**Keywords:** Clavicle, Locking plate

## 1. Introduction

Distal clavicle fractures are very uncommon and account for approximately 21–28% of all fractures of the clavicle(second most common fracture type as per Allman's classification) [1]. The weight of the arm, pectoralis major, pectoralis minor, latissimusdorsi, trapezius, and scapular motions act on the fracture site to impair union in unstable Neer type II clavicle fractures.

Displaced fractures of lateral end of clavicle are associated with increased risk of non union (rate :22-25 %) with conservative treatment[2]. Distal clavicle fractures are always a challenge and as they are unstable, have high rate of non union, malunion and associated acromio-clavicular joint arthritis[3].

Available operative treatment options are- Kirschnerwires, tension band fixation, coracoclavicular fixation with screws, tapes,& suture anchors, distal clavicle excision, or osteosynthesis by hook plate or a locking plate fixation[4-10].

Superior anterior locking plate system has the following advantages –

1) Designed to combine advantages of greater stability with better anatomical form fit.
2) Multiple distal screw configuration allows better stability and functional outcome.
3) Contributes for plate fixation in particular and a lower incidence of implant loosening.
4) Antero-superior position of plate reduces the risk of vascular injuries due to screw fixation
5) Lessens plate prominence under skin and consequently reduce the high rate of implant extraction due to skin and scar irritation.
6) Compared to fracture fixed by K wires, it allows early mobilization and better functional outcome.

## 2. Review of Literature

Neer described this type of clavicle fracture as an unstable clavicle fracture requiring operative treatment due to the high rate of observed non union and the even higher rate of delayedunion. He explained this by the deforming forces around the fracture, causing displacement and interpositioning between the fracture fragments, with continuous motion at the fracture ends [11].Operative intervention is an indication for displacedType II distal clavicle fractures.

Konaet al.[12]reported 52.6% success rate with Krischner wires and reported complications like loosening of K-wires, migration, undue stress during active mobilization, back out, andbreakage.

In the last decade, the hook plate—originally developed by Balser to treat acromioclavicular dislocations—has been used as treatment for this difficult fracture[13].

Herrmann et al.[14] studied 8 people who underwent surgery by using locking T-plates and suture anchor stabilization for the treatment of unstable distal fracture. The results showed that the mean Constant score was 93.3 and the CC distance was successfully restored with a mean 1-mm side-to-side difference, and all patients reached an early clinical and radiographic outcome, with a mean follow-up time of only 8.3 months.

Johnston et al. [15] reported 6 patients with clinically unstable type II distal clavicle fractures undergoing treatment by using fracture-specific plate and coracoclavicular augmentation with a suture button, showing that patients had reliable union rates and excellent functional scores.


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## 3. Aims and Objectives

- To evaluate functional results and outcome of unstable distal clavicle fracture using Anterior superior locking plate by open reduction technique.
- Parameters to be evaluated-
- Age & Sex distribution
- Side Affected
- Mode of Injury
- Duration of Surgery
- Duration of Fracture Union
- Complications.

## 4. Materials & Methods

1) Adult patients with Neer classification type IIaand typeIIb distal clavicle fracturestreated at our hospital with anterior superior locking plate will be included in study.
2) Prospective study- Sample size :10 Patients

**Inclusion Criteria:**
- Age group above 18 years.
- Both male and female gender.
- Closed fractures.
- Radiological findings confirming fracture of lateral end clavicle, Neer classification type IIa& type IIb.

**Exclusion criteria:**
- Type I & Type III fractures
- Open fractures
- Patients with head injury and vascular injury
- Age <18 years or skeletal immaturity
- Patients not fit for surgical intervention
- Nonunion
- Fractures presenting after 10 days of injury.

Preoperative assessment was done with Xrays (both AP and Zanca's view)

.



**Figure 1:** Preoperative xray AP view of clavicle showing lateral third fracture

All procedures were performed under general anaesthesia. Open reduction performed using antero-superior approach to the clavicle and length of the clavicle restored and initially fixation maintained with kwires and then final fixation with superior anterior plate and confirmed with image intensifier.

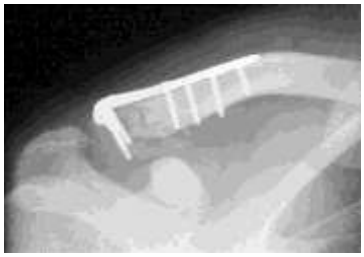


**Figure 2:** Immediate post operative xray

## 5. Post-op management

Weeks 1-2:
- Sling: for comfort
- Motion: Pendulum ROM exercises, No overhead motion
- No resistive exercises/actvities

Weeks 2-6:
- Sling: for comfort
- Motion: Pendulum ROM exercises,

Begin gentle PROM above shoulder level,
Begin AROM, AAROM in all planes to pain tolerance
Strengthening: Begin gentle teraband resistive exercises

Weeks 6-12:
- Sling: Discontinue sling
- Motion: full motion by week 12
- Strengthening: Progress to higher weights and sports specific training at week 10
- Return to sports 3-6 months from surgery

Follow-up Protocol:
- Patient discharged 4th-7thday of surgery, suture removal done on 12th day.
- Patient regularly reviewed every 15 days till 3rd month.
- Usually most fracture unite by 3rd month

a) If fracture united , then patient asked to come once in 6month,9month,12$^{th}$ month.
b) fracture not united then patient asked to continue follow up every month till fracture unite.

Follow up assessment by –
- Pain
- Tenderness
- Scar healing
- Radiological assessment
- Fracture union duration
- ROM shoulder(assessed by constant murley score)

**Constant murley score-** It has a subjective patient-based component ( pain and functional outcomes) and an objective evaluator-based component ( range of movements and strength measures) they contribute a maximum of 100 points in total: pain (15 points), activities of daily living (20 points),range of motion (40 points), and strength (25 points). The score was also compared with the contralateral shoulder. These scores were graded as excellent (90–100 points),good (80–89 points), fair (70–79 points), or poor (70 points)[16].


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## 6. Results

- All ten patients returned for clinical & radiological follow up.
- Average clinical follow up was 14months(12-18months).

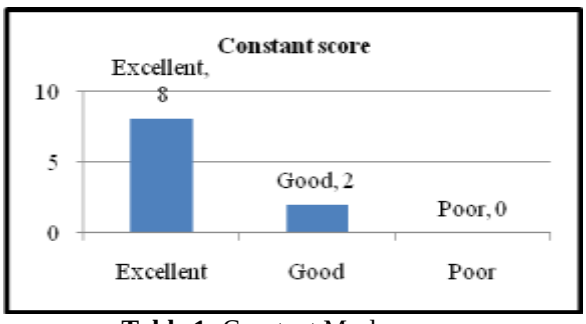



**Table 1:** Constant Murley score



**Figure 3:** Preop

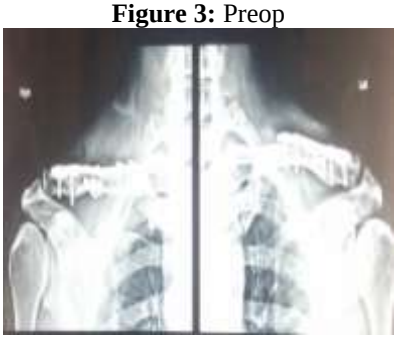


**Figure 4:** Immediate postop



**Figure 5:** 6 month post-op



**Figure 6:** Final follow-up – good functional outcome

**Case 2**



**Figure 6:** Preop



**Figure 7:** Immediate postop

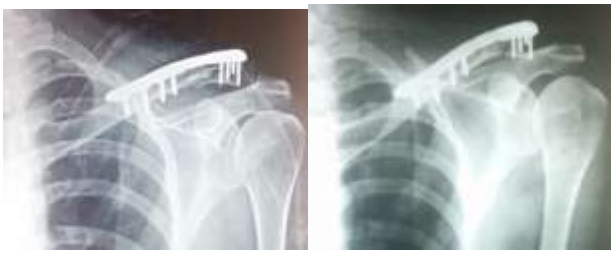


**Figure 8:** 7months postop- adequate union



**Figure 9:** Excellent functional outcome

This study included a total of 10 cases comprising of 7 males and 3 femalesages ranged from 24 to 56 years (mean 40.20 years). Three fractures occurred on the right side and 7 occurred on the left side. Two injuries were caused by vehi-cle accident and the 8 left fractures were caused by falls from a height. One of the patients also had an ipsilateral scapula fracture. Time from injury to surgery ranged from 3 to 10 days (mean 6.20 days).

All fractures united well with an average time of 7.5 weeks.

- Constant score showed excellent result in 8 cases and good result in 2 cases.
- The average Constant score was 97.8(range,95-99).

**Complications**

One case had superficial infection which got settled with antibiotics.

## 7. Discussion

Anatomical locking plate for distal clavicle is reported to achieve firm and stable fixation with multiple screw placement in the distal fragment [17]. The multiple, divergent,


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fixed-angled screws in the distal fragment seem to increase pullout strength because the stability provided by the locking plate and screws does not solely depend on the friction between the bone and plate. Moreover, the angular stability of the locking plate and screws can provide better resistance against bending and torsion forces than use of the traditional compressive plate. Since the anatomical locking plate does not violate the subacromial space and AC joint[18], complications such as AC joint osteoarthritis, subacromial shoulder impingement, fixation failure, and subacromial bursitis can be reduced.

## 8. Conclusion

Displaced distal clavicle fractures ( neer's type 2)treated with superior anterior locking plates achieved excellent results in terms of bony union and satisfactory functional outcome with rarely any early complications and demonstrates promising results with early plate fixation with this new technique.

## References

[1] Sambandam B, Gupta R, Kumar S, Maini L: Fracture of distal end clavicle: A review. J ClinOrthop Trauma, 2014; 5(2): 65–73
[2] Edwards DJ, Kavanagh TG, Flannery MC: Fractures of the distal clavicle: A case for fixation. Injury, 1992; 23(1): 44–46
[3] Bisbinas I, Mikalef P, Gigis I et al: Management of distal clavicle fractures. ActaOrthopBelg, 2010; 76(2): 145–49
[4] Wang SJ, Wong CS: Extra-articular knowles pin fixation for unstable distal clavicle fractures. J Trauma, 2008; 64(6): 1522–27
[5] Neer CS 2nd: Fractures of the distal third of the clavicle. ClinOrthopRelat Res, 1968; 58: 43–50
[6] Kao FC, Chao EK, Chen CH et al: Treatment of distal clavicle fracture using Kirschner wires and tension-band wires. J Trauma, 2001; 51(3): 522–25
[7] Macheras G, Kateros KT, Savvidou OD et al: Coracoclavicular screw fixation for unstable distal clavicle fractures. Orthopedics, 2005; 28(7): 693–96
[8] Daglar B, Delialioglu OM, Minareci E et al: [An alternative fixation method for the treatment of unstable distal clavicle fractures: Locked distal radius plate]. ActaOrthopTraumatolTurc, 2009; 43(4): 324–30 [in Turkich]
[9] Lee YS, Lau MJ, Tseng YC et al: Comparison of the efficacy of hook plate versus tension band wire in the treatment of unstable fractures of the distal clavicle. IntOrthop, 2009; 33(5): 1401–5
[10] Shin SJ, Ko YW, Lee J, Park MG: Use of plate fixation without coracoclavicular ligament augmentation for unstable distal clavicle fractures. J Shoulder Elbow Surg, 2016; 25(6): 942–48
[11] Neer CS 2nd. Fractures of the distal third of the clavicle.ClinOrthopRelat Res. 1968;58:43–50.4. Rockwood CA Jr. Fractures of the outer clavicle in childrenand adults. J Bone Joint Surg Br. 1982;64:642.
[12] Kona J, Bosse MJ, Staeheli JW, Rosseau RL. Type II distalclavicle fractures: a retrospective review of surgicaltreatment.J Orthop Trauma. 1990;4(2):115–20.
[13] Eberle C, Fodor P, Metzger U (1992) Hook plate (so-called Balser plate) or tension banding with the Bosworth screw in complete acromioclavicular dislocation and
[14] Herrmann S, Schmidmaier G, Greiner S: Stabilisation of vertical unstable distal clavicular fractures (Neer 2b) using locking T-plates and suture anchors. Injury, 2009; 40(3): 236–39
[15] Johnston PS, Sears BW, Lazarus MR, Frieman BG: Fixation of unstable type II clavicle fractures with distal clavicle plate and suture button. J Orthop Trauma, 2014; 28(11): e269–72
[16] Constant CR, Murley AH (1987) A clinical method of functional assessment of the shoulder. ClinOrthopRelat Res 214:160–164
[17] Lee SK, Lee JW, Song DG, Choy WS: Precontoured locking plate fixation for displaced lateral clavicle fractures. Orthopedics, 2013; 36(6): 801–17
[18] Klein SM, Badman BL, Keating CJ et al: Results of surgical treatment for unstable distal clavicular fractures. J Shoulder Elbow Surg, 2010; 19(7): 1049–55


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