

Clinical and Radiological Outcome Assessment following Coracoclavicular Reconstruction with Endobutton and Fibertape for Neer's Type II Lateral End Clavicle Fracture: A Prospective Study.

Nikhil Baran Dash¹, Suraj Kumar Jain¹, Tushar Ranjan Dalei¹, Pritam Kumar Panda¹, Braja Sundar Sahoo¹

Learning Point of the Article:

Endobutton fixation for Type 2 Neer Lateral end clavicle fracture is a valuable surgical technique, offering a minimally invasive approach with good clinical outcomes.

Abstract

Introduction: To evaluate the clinical and radiological outcomes following coracoclavicular (CC) reconstruction with the endobutton for Neer type 2 lateral end clavicle fracture. Clavicular fracture is one of the commonest injuries encountered routinely in orthopedic practice, with an incidence ranging from 44 to 66% of all fractures. Based on the location of fractures they may be in the middle third, being most common or the lateral and medial thirds being least common. Fractures of the lateral end of the clavicle are troublesome to manage given their instability and ligamentous disruption and with a wide array of treatment options including fixation by means of plates, screws, K-wires, tapes and buttons making the decision often difficult for the surgeon based on the apprehended pros and cons of individual fixation methods.

Materials and Methods: A prospective cohort study on 30 cases of adult Neer type 2 lateral end clavicle fractures was carried out, which were fixed with CC endobutton under fluoroscopic guidance. Postoperatively, patients were given an arm sling pouch for 2-weeks with graded physiotherapy and a range of exercises commencing after 2 weeks. Cases were followed up at 2-weeks, 6-weeks, 3-months, 6-months, and 1-year intervals each. Functional and radiological outcomes were observed and documented.

Results: All 30 patients were assessed with a mean follow-up 12 months. The mean age group under the study was 34.70 years. Most of the patients had a constant shoulder score above 90 with excellent disabilities of the arm, shoulder, and hand scores. Mean fracture union time was 15 weeks without any major complication such as infection, revision surgeries, implant migration and stress fractures.

Discussion and Conclusion: Endobutton technique for fixation of type 2 lateral end clavicle stands as a promising and effective option demonstrating significant improvements in terms of clinico-radiological perspective and patient satisfaction. The current method of treatment exhibits stronger biomechanics with good fixation with almost no implant-related complications. It also supports an early mobilization crucial for maintaining shoulder function and preventing stiffness.

Keywords: Lateral end clavicle fracture, coracoclavicular reconstruction, endobutton, fibertape.

Introduction

Clavicle fractures are common injuries in adults (2–5%) and

children (10–15%) and constitute 44–66% of all shoulder fractures [1, 2].

Author's Photo Gallery



Dr. Nikhil Baran Dash



Dr. Suraj Kumar Jain



Dr. Tushar Ranjan Dalei



Dr. Pritam Kumar Panda



Dr. Braja Sundar Sahoo

Access this article online

Website:
www.jocr.co.in

DOI:
<https://doi.org/10.13107/jocr.2025.v15.i10.6236>

¹Department of Orthopaedics, Veer Surendra Sai Institute of Medical Sciences and Research, Sambalpur, Odisha, India.

Address of Correspondence:

Dr. Tushar Ranjan Dalei,
Department of Orthopaedics, Veer Surendra Sai Institute of Medical Sciences and Research, Burla, Sambalpur, Odisha, India.
E-mail: tusharranjan3009@gmail.com

Submitted: 27/07/2025; Review: 04/08/2025; Accepted: September 2025; Published: October 2025

DOI: <https://doi.org/10.13107/jocr.2025.v15.i10.6236>

© The Author(s). 2025 Open Access. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted use, distribution, and non-commercial reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated.



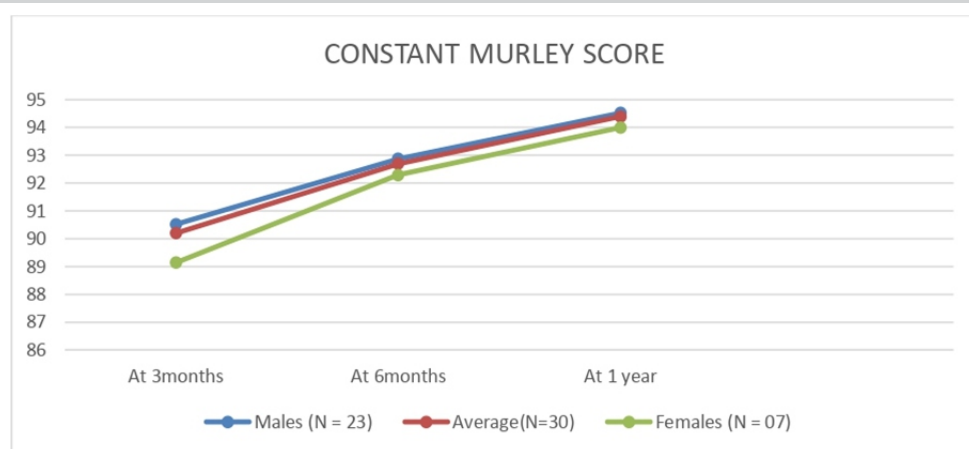


Figure 1: Graphical presentation of constant Murley score.

Allman classified clavicle fractures into three types based on anatomical location [3]. The most common type is the middle third fractures (group I) about 80% of cases, lateral clavicular fractures constitute group II, approximately 15–25%, and proximal third clavicular fractures (group III) are the least, about 5% only [4, 5, 6].

Neer further classified distal clavicle fractures into three groups based on the adhesion location of the coracoclavicular (CC) ligament [7]. Out of which, type 2 are the unstable ones, which have many controversies in their management. In Type 2 fractures, the distal clavicle fragment is subjected to the distal pull by the weight of the arm as well as a medial pull by the strong pectoral muscles and latissimus dorsi, while the proximal fragment is dragged posteriorly by the trapezius. These disturbing forces contribute to the fracture displacement and the unstable nature of Type 2 fractures.

Neer's type II fractures disrupt the integrity of the CC ligament and, therefore, are inherently unstable, requiring an extended

period of time to achieve bone union and are associated with a high rate of non- or malunion [8].

For the surgical treatment of unstable Neer type 2 distal clavicle fractures, several techniques have been introduced, such as Steinmann pin (S-pin) or Kirschner wire fixation from acromion to clavicle, anatomic locking plate fixation, hook plate fixation, CC screw fixation, which includes rigid fixation [9, 10]. Flexible fixation methods include CC sutures, tapes, wires, anchors, or cortical buttons with or without arthroscopic

assistance [10, 11, 12, 13].

The endobutton technique is a new and simple technique that has been proposed to overcome the complications of rigid fixation methods [14]. The advantages of CC button fixation result in greater strength than the traditional locking plate and lower hardware-related complications [15, 16].

Due to the unstable nature of fracture morphology and fixation with the endobutton generates a higher strength with minimal complications. This motivates us to perform a prospective study to evaluate the clinical and radiological outcomes following CC reconstruction with the endobutton for Neer's type II lateral end clavicle fracture in our institute between 2022 and 2024.

Materials and Methods

A hospital-based prospective cohort study was undertaken

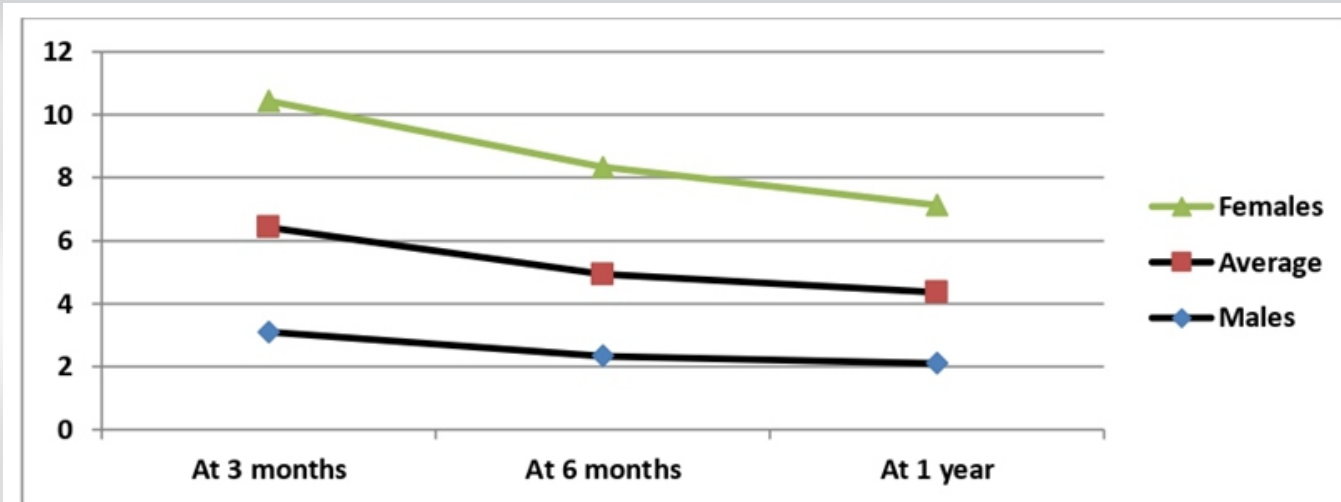


Figure 2: Graphical presentation of mean disabilities of the arm, shoulder, and hand score.



Figure 3: (a) X-ray showing Neer's type 2 lateral end clavicle fracture. (b) X-ray showing 2 month post endobutton fixation. (c) X-ray showing 6-month post endobutton fixation.

following Institutional Ethical Committee approval bearing IRB no.058-2022/I-S-T/083/DT March 01, 2023 taking around 30 adult patients with acute unilateral closed Neer's type 2 distal clavicle fractures. A convenient sampling technique was used. Multiple injuries, open fractures, and age group <18 years were excluded from the study.

All the surgeries were performed either under general anesthesia or inter-scalene block. The surgical technique is a modification of the double endobutton technique described by Steven [17]. The patient was positioned in the supine position with a bolster underneath the interscapular areas and a vertical 6-cm bra-strap incision centered over the coracoid and extending upwards to the clavicle was made. Medial and lateral skin flaps were developed, and after the separation of the delto-trapezial fascia, the coracoid was exposed and cleared off all the way to the base. The medial and lateral edges of the coracoid at the base are clearly identified. A vertical tunnel was made in the coracoid in a cephalocaudal direction with a 3.2 mm drill-bit over a guide wire. The drill hole was directly over the base of the coracoid, and the drill was aimed slightly anteriorly. An endobutton with a fiberWire loop was passed through this

tunnel and manually flipped to hook the endobutton beneath the coracoid. The lateral portion of the clavicle was exposed. The clavicle is manually reduced, and while the reduction is being held with a 2.0 mm K-wire, another drill hole of size 3.2 mm was made in the medial fragment of the clavicle midway between the anterior and posterior borders of the clavicle. Another endo-button from the same fiber-wire loop was passed through the clavicular tunnel in an upward direction and flipped to rest over the superior surface of the clavicle. The achieved reduction was secured after tying the knot of the fiber-wire over the clavicle endobutton. Intra-operative reduction was confirmed fluoroscopically before wound closure. An arm pouch sling was used for support of the clavicle in the immediate post-operative period till the suture removal at 2 weeks. Pendulum exercise was started 2 weeks after surgery when pain had subsided. The arc of the pendulum swing was gradually increased to 90° up to 4 weeks after surgery, after which abduction of the shoulder was allowed and active range of shoulder motion was started to achieve normal shoulder motion within 3 months. Patients were followed up in the outpatient department at 2nd week (stitch removal), 6 weeks,

| Gender | Male 23 (76.7%) | Female 07 (23.3%) | Total 30 (100%) |
|-------------------------------|-------------------------|-------------------------|---------------------------|
| Age in years (mean \pm -SD) | Male (33.7 \pm -7.98) | Female (38 \pm -8.34) | Total (34.70 \pm -8.13) |
| Side | Right 56.7% | Left 43.3% | Total 100% |
| Mode of injury | RTA (66.7%) | Fall (33.3%) | Total 100% |
| Time of union (in weeks) | 8 to 12 weeks (33.3%) | 12 to 16 weeks (40%) | = 16 weeks (27.7%) |

Table : Demographic characteristics of the patients.

| | | At 3 months | At 6 months | At 1 year | |
|---------------------|--------|------------------|------------------|------------------|---------|
| Mean constant score | Male | 90.52 \pm 3.87 | 92.87 \pm 3.84 | 94.52 \pm 2.64 | |
| | Female | 89.14 \pm 6.20 | 92.29 \pm 5.35 | 94 \pm 4.76 | |
| | Total | 90.20 \pm 4.44 | 92.7 \pm 3.73 | 94.4 \pm 3.17 | |
| Mean DASH score | Male | 3.10 \pm 1.16 | 2.34 \pm 1.14 | 2.1 \pm 1.07 | MDC 32% |
| | Female | 4.02 \pm 1.85 | 3.40 \pm 1.78 | 2.77 \pm 1.22 | MDC 31% |
| | total | 3.32 \pm 1.37 | 2.59 \pm 1.36 | 2.26 \pm 1.13 | |

Table 2: Mean scoring system.

3rd month, 6th month and 1 year. In each visit, a radiograph with an anteroposterior view of the shoulder joint was taken to evaluate fracture union. Functional outcomes were assessed based on Constant–Murley [18, 19] and disabilities of the arm, shoulder, and hand (DASH) score [20].

Statistical analysis

Data were collected and graphics were designed using Microsoft Office Excel 2019. The data were analyzed with Statistical Package for the Social Sciences (IBM, Armonk, NY, USA) version 23.0 for Windows. The categorical and continuous variables are represented as frequency (percentage) and mean \pm standard deviation respectively.

Results

All 30 patients (23 males and 7 females, most of them aged below 40 years) were studied between August 2022 and July 2024. All patients had a mean of approximately 12 months of follow-up. Demographic characteristics of the patients are reported in Table 1. The mean age of the patient was 34.70 ± 8.13 years (range 16–54). The highest proportion of cases was seen in the 31–35 age group.

Mean functional outcome scores are analysed by the Constant–Murley score and DASH score. Constant scores lying between 86 and 100 points are designated as “very good,” 71 and 85 points as “good,” 56–70 points as “fair,” and less than 56 points as “poor.” Similarly, a DASH score with a minimal detectable change (MCD) of more than 10% is taken to be significant. MCD is the smallest amount of change that has to occur before the change can be considered a true change and not an error [20]. Outcome scores are reported in Table 2 and Fig. 1 and 2.

All patients were satisfied with the results and had excellent results at the final follow-up. Most of the patients had a constant shoulder score above 90 with an excellent grade, except for two patients. Of these, one had a superficial surgical site infection, which resolved with local wound care. Another patient was an old lady who developed shoulder stiffness due to improper physiotherapy following surgical fixation. Three patients post-surgery developed paraesthesia around the surgical site, which improved in due course of time.

All patients had fracture union in a mean of 15 weeks (Fig. 3a, b, c). There were no hardware-related complications, such as implant migration or stress fracture, detected on final follow-up radiographs. No patients complained of hardware irritation or prominence. There were no cases of reoperation or revision.

Discussion

It is quite difficult to achieve stable fixation and early mobilization with previously proposed treatment methods in cases of fractures of the lateral third of the clavicle, where the distal fragment is small and deforming forces are great [21]. No consensus has been established regarding the optimal operative treatment for these fractures [22]. According to the literature, the incidence of failure of conservative treatment of clavicle fractures ranges from 4.4% to 31% in terms of pain, loss of force, rapid fatigue, paraesthesia, pain when lying on the affected shoulder, and aesthetic defects [23, 24, 25]. De Giorgi et al., in their case series, observed these symptoms in 21 patients (29.6%) out of 71 cases studied [26]. Similarly, Robinson and Cairns, in their cohort study of 127 patients with displaced lateral end clavicle fractures, found that 7 patients underwent immediate surgical fixation and 14 patients underwent delayed surgery due to severe symptoms, and of the remaining 87 patients who were managed conservatively, 21 of them (21% of the whole cohort) had a non-union of the clavicular fracture [27].

Various methods of surgical treatment are available at present, such as K-wire fixation, tension band wiring (TBW), screw fixation, locking and non-locking plates, and flexible fixation methods such as CC stabilization using non-absorbable sutures or endobutton and fibre tape fixation. Patients managed by TBW complications like K-wire migration, loss of reduction, superficial infection, asymptomatic non-union, and wire breakage were observed, and all patients needed implant removal [28].

Patients managed with precontoured locking plates have complications like fracture at the medial end of the plate and deep and superficial infection, which leads to symptomatic non-union, and hardware symptoms requiring repeat surgery for plate removal have been noticed [29, 30, 31]. In patients managed with hook-plate fixation, although shoulder functions range from good to excellent, they are associated with major complications such as dislocation of the hook, fracture of the medial end of the clavicle, symptomatic non-union, severe acromioclavicular (AC) joint arthrosis, rotator cuff tear, acromion fracture, acromial osteolysis, hypertrophic scar, and frozen shoulder. Furthermore, most of the patients have to remove their plates by a second surgery [32, 33, 34].

In patients managed with a CC screw, all patients require screw removal. Complications such as superficial infection, screw back-out, and implant failure are also noticed [35, 36]. In studies with flexible CC fixation, nearly all patients have excellent results. A few minor complications are observed in the form of frozen shoulder, asymptomatic non-union, minor infections, titanium wire breakage, and uncomfortable subcutaneous

tenting of the Mersilene tape [37,38,39].

In our study, we prospectively evaluate the clinical and radiological outcomes of CC reconstruction using the endobutton system, a technique that may gain popularity due to its minimally invasive nature and promising results. It provides stable fixation of a small-sized lateral fragment, allowing early mobilization and hence secured bony union. Stable fixation and immediate postoperative shoulder motion can be achieved even in osteoporotic bone without impinging the AC joint or subacromial space. The clinical outcomes in this study are assessed using standard metrics such as the Constant–Murley score and the DASH score. The results demonstrate significant improvements in shoulder function and patient satisfaction postoperatively. Patients typically report marked improvements in pain relief, range of motion, and overall shoulder function within the first 3–6 months post-surgery. The use of the endobutton system allows early mobilization, which is crucial in maintaining shoulder function and preventing stiffness.

The complication rate in this study is relatively low, with no cases of hardware irritation. No major complications that necessitate revision surgery occurred in our study. Some minor complications, like one case with superficial infection, which was not associated with any loss of reduction and subsequently led to bony union; one case of transient stiffness of the shoulder treated by physiotherapy; and three cases of paraesthesia observed over the shoulder, which improved in due course of time. Importantly, there are no reports of coracoid fracture, a potential complication when using other methods of CC ligament reconstruction [40, 41]. There are no cases with malunion or non-union in our study.

The majority of the fractures in our study have achieved radiological union at an average of 15 ± 2.86 weeks, which is a little higher as compared to the Panagopoulos A et al. [12] study (mean time of 2.7 ± 0.6 months) and the Vikas et al. [13] study (mean union was 11 ± 2.8 weeks).

Stress fracture of the clavicle is insignificant in this technique compared with hook plate fixation because of the lack of a stress riser at its medial end. There are fewer complications such as fixation failures, iatrogenic rotator cuff injury, AC joint osteoarthritis, and subacromial bursitis.

The procedure is less invasive, leading to reduced soft-tissue damage, quicker recovery time, and potentially less postoperative pain. Biomechanically, the endobutton provides superior strength and stability, which is particularly important in active patients or those with high functional demands. The lower complication rates, especially concerning hardware-related issues, make the endobutton system a safer option for many patients.

High levels of patient satisfaction were reported, likely due to quick return to daily activities and the strong functional outcomes. The results of our study are quite promising and supported well by a few other studies in the literature. The mean constant score at the end of 1 year was found to be 94.4 ± 3.17 , which is higher than that of Ahmad et al. [42] (85.9 ± 6.9), probably due to the smaller sample size (10 cases of lateral end clavicle fractures). It is also higher than that of Kuner et al. (81.8 ± 8) and Kraus et al. (89%), who also used an arthroscopic endobutton for fixation of lateral clavicle fractures [43, 44]. Zheng et al. reported a score of 92.33 ± 4.89 using the double endobutton with open technique [8], whereas Struhl et al., in his study of the closed-loop double endobutton technique, achieved a constant score of 95.6 ± 8.4 [22]. The mean CS was 96.6 ± 3.4 for Panagopoulos A et al. [12].

The DASH score in our study was observed to have a significant change postoperatively from 3 months to 1 year, i.e., 32% and 31% among males and females, respectively. Unlike purely clinical or radiological assessments, the DASH score reflects the patient's subjective experience, capturing aspects such as pain, weakness, and difficulty in performing specific tasks. Following surgery, there was a marked reduction in DASH scores reflecting the restoration of shoulder function and alleviation of symptoms.

Although the results are promising, the study does have limitations. The sample size, though adequate for initial findings, is relatively small, which may limit the generalizability of the study. Second, although the short- to mid-term results are encouraging, the study's follow-up period may not be long enough to fully capture the long-term durability of the endobutton system and the potential for late-onset complications. A long-term follow-up is necessary to fully assess the durability of the endobutton system and to monitor late complications such as post-traumatic arthritis, coracoid, and clavicular osteolysis [40, 41]. The study design is prospective and observational but not randomized, which introduces potential bias. A randomized controlled trial would be ideal to compare the endobutton system directly with other fixation techniques.

Conclusion

The use of the endobutton system for CC reconstruction in Neer's Type II distal clavicle fractures presents itself as a promising and effective treatment option. This technique has demonstrated significant improvements in clinical outcomes, particularly in terms of pain relief, functional recovery, and patient satisfaction. The strong biomechanical properties of the endobutton system ensure that the reduction is well-maintained and the healing process is effectively supported,

with most fractures achieving union within a satisfactory timeframe. The minimally invasive nature of the procedure further enhances its appeal, as it reduces soft-tissue damage allows for quicker recovery and minimizes the risk of postoperative complications such as hardware irritation or migration. Endobutton supports early mobilization, which is crucial for maintaining shoulder function and preventing long-term stiffness. These factors contribute to the high levels of patient satisfaction observed in our study.

Despite the positive outcomes, it is important to acknowledge the limitations of the study. The relatively small sample size, shorter duration of follow-up, and lack of randomization limit the broader applicability of the findings and introduce potential bias.

Moving forward, it is essential that future research involve larger, randomized controlled trials with extended follow-up periods to more comprehensively evaluate the endobutton system's performance. These studies should also compare the endobutton with other fixation techniques to determine the best practices for treating Neer's Type II distal clavicle fractures. If these promising early results are validated, the endobutton system could well become the preferred method of treatment, offering patients a reliable, safe, and effective solution for a notoriously difficult fracture type.

Clinical Message

Endo button fixation for type 2 lateral end clavicle fracture promises to be a safe, minimally invasive technique with satisfactory clinical outcome in terms of pain relief and shoulder function.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

References

1. Van Der Meijden OA, Gaskill TR, Millett PJ. Treatment of clavicle fractures: Current concepts review. *J Shoulder Elbow Surg* 2012;21:423-9.
2. Toogood P, Horst P, Samagh S, Feeley BT. Clavicle fractures: A review of the literature and update on treatment. *Phys Sportsmed* 2011;39:142-50.
3. Allman FL Jr. Fractures and ligamentous injuries of the clavicle and its articulation. *J Bone Joint Surg Am* 1967;49:774-84.
4. Nordquit A, Peterson C. The incidence of fractures of the clavicle. *Clin Orthop Relat Res* 1994;300:127-32.
5. Robinson CM. Fractures of the clavicle in the adult. Epidemiology and classification. *J Bone Joint Surg Br* 1998;80:476-84.
6. Postacchini F, Gumina S, De Santis P, Albo F. Epidemiology of clavicle fractures. *J Shoulder Elbow Surg* 2002;11:452-6.
7. Neer CS 2nd. Fractures of the distal third of the clavicle. *Clin Orthop Relat Res* 1968;58:43-50.
8. Zheng YR, Lu YC, Liu CT. Treatment of unstable distal-third clavicle fractures using minimal invasive closed-loop double endobutton technique. *J Orthop Surg Res* 2019;14:37.
9. Asadollahi S, Bucknill A. Hook plate fixation for acute unstable distal clavicle fracture: A systematic review and meta-analysis. *J Orthop Trauma* 2019;33:417-22.
10. Stegeman SA, Nacak H, Huvenaars KH, Stijnen T, Krijnen P, Schipper IB. Surgical treatment of Neer type-II fractures of the distal clavicle: A meta-analysis. *Acta Orthop* 2013;84:184-90.
11. Yagnik GP, Seiler JR, Vargas LA, Saxena A, Narvel RI, Hassan R. Outcomes of arthroscopic fixation of unstable distal clavicle fractures: A systematic review. *Orthop J Sports Med* 2021;9(5):1-10.
12. Panagopoulos A, Tatani I, Kattou C, et al. (May 22, 2022) Clinical and Radiological Outcomes of Closed-Loop, Double Button, Coracoclavicular Fixation for Extralateral (Neer Type IIC) Fractures of the Distal Clavicle. *Cureus* 14(5): e25228. doi:10.7759/cureus.25228
13. Vikas V, Bhatia N, Jalan D, Prakash J, Singh J, Khare S. Clinical outcome of Neer type II lateral end clavicle fractures with coracoclavicular ligament disruption treated with pre-contoured locking plate and endobutton. *Cureus* 2021;13:e12585.
14. Dalei TR, Samal BP, Gupta AK, Senapati R, Sahoo TP. Coraco-clavicular endobutton and fiber tape fixation for Neer's type II unstable lateral clavicular fracture: A case series with literature review. *J Surg Case Rep* 2022;2022:rjac120.
15. Yagnik GP, Brady PC, Zimmerman JP, Jordan CJ, Porter DA. A biomechanical comparison of new techniques for distal clavicular fracture repair versus locked plating. *J Shoulder*



Elbow Surg 2019;28:982-8.

16. Xu Y, Guo X, Peng H, Dai H, Huang Z, Zhao J. Different internal fixation methods for unstable distal clavicle fractures in adults: A systematic review and network meta-analysis. *J Orthop Surg Res* 2022;17:43.
17. Steven S. Double endobutton technique for repair of complete acromioclavicular joint dislocations. *Tech Shoulder Elbow Surg* 2007;8:175-9.
18. Conboy VB, Morris RW, Kiss J, Carr AJ. An evaluation of the constant-Murley shoulder assessment. *J Bone Joint Surg* 1996;78-B:229-32.
19. Ziegler P, Kühle L, Stöckle U, Wintermeyer E, Stollhof LE, Ihle C, et al. Evaluation of the Constant score: Which is the method to assess the objective strength? *BMC Musculoskelet Disord* 2019;20:403.
20. Beaton DE, Davis AM, Hudak P, McConnell S. The dash (disabilities of the arm, shoulder and hand) outcome measure: What do we know about it now? *Br J Hand Ther* 2001;6:109-18.
21. Yoo JH, Chang JD, Seo YJ, Shin JH. Stable fixation of distal clavicle fracture with comminuted superior cortex using oblique T-plate and cerclage wiring. *Injury* 2009;40:455-7.
22. Struhl S, Wolfson TS. Closed-loop double endobutton technique for repair of unstable distal clavicle fractures. *Orthop J Sports Med* 2016;4:2325967116657810.1-7
23. Nowak J, Holgersson M, Larsson S. Sequelae from clavicular fractures are common: A prospective study of 222 patients. *Acta Orthop* 2005;76:496-502.
24. Inman VT, Saunders JB. Observations on the function of the clavicle. *Calif Med* 1946;65:158-66.
25. Lazarides S, Zafiropoulos G. Conservative treatment of fractures at the middle third of the clavicle: The relevance of shortening and clinical outcome. *J Shoulder Elbow Surg* 2006;15:191-4.
26. De Giorgi S, Notarnicola A, Tafuri S, Solarino G, Moretti L, Moretti B. Conservative treatment of fractures of the clavicle. *BMC Res Notes* 2011;4:333.
27. Robinson CM, Cairns DA. Primary nonoperative treatment of displaced lateral fractures of the clavicle. *J Bone Joint Surg* 2004;86:778-82.
28. Lee YS, Lau MJ, Tseng YC, Chen WC, Kao HY, Wei JD. Comparison of the efficacy of hook plate versus tension band wire in the treatment of unstable fractures of the distal clavicle. *Int Orthop* 2009;33:1401-5.
29. Lee SK, Lee JW, Song DG, Choy WS. Precontoured locking plate fixation for displaced lateral clavicle fractures. *Orthopedics* 2013;36:801-7.
30. Anderson JR, Willis MP, Nelson R, Mighell MA. Precontoured superior locked plating of distal clavicle fractures: A new strategy. *Clin Orthop Relat Res* 2011;469:3344-50.
31. Tiren D, Vroemen JP. Superior clavicle plate with lateral extension for displaced lateral clavicle fractures: A prospective study. *J Orthop Traumatol* 2013;14:115-20.
32. Tiren D, Van Bommel AJ, Swank DJ, Van Der Linden FM. Hook plate fixation of acute displaced lateral clavicle fractures: Mid-term results and a brief literature overview. *J Orthop Surg Res* 2012;7:2.
33. Haidar SG, Krishnan KM, Deshmukh SC. Hook plate fixation for type II fractures of the lateral end of the clavicle. *J Shoulder Elbow Surg* 2006;15:419-23.
34. Flinkkila T, Ristiniemi J, Lakovaara M, Hyvonen P, Leppilahti J. Hook-plate fixation of unstable lateral clavicle fractures: A report on 63 patients. *Acta Orthop* 2006;77:644-9.
35. Macheras G, Kateros KT, Savvidou OD, Sofianos J, Fawzy EA, Papagelopoulos PJ. Coracoclavicular screw fixation for unstable distal clavicle fractures. *Orthopaedics* 2005;28:693-6.
36. Esenyele CZ, Ceylan HH, Ayanoglu S, Kebudi A, Adanir O, Bülbül M. Treatment of Neer type 2 fractures of the distal clavicle with coracoclavicular screw. *Acta Orthop Traumatol Turc* 2011;45:291-6.
37. Yang SW, Lin LC, Chang SJ, Kuo SM, Hwang LC. Treatment of acute unstable distal clavicle fractures with single coracoclavicular suture fixation. *Orthopedics* 2011;34:e172-7.
38. Soliman O, Koptan W, Zarad A. Under-coracoid-around-clavicle (UCAC) loop in type II distal clavicle fractures. *Bone Joint J* 2013;95-B:983-7.
39. Li Y, Shi S, Ou-Yang YP, Liu TL. Minimally invasive treatment for Neer IIB distal clavicle fractures with titanium cable. *J Trauma* 2011;71:E37-40.
40. Sambandam B, Gupta R, Kumar S, Maini L. Fracture of distal end clavicle: A review. *J Clin Orthop Trauma* 2014;5:65-73.
41. Hou Z, Graham J, Zhang Y, Strohecker K, Feldmann D, Bowen TR, et al. Comparison of single and two-tunnel techniques during open treatment of acromioclavicular joint disruption. *BMC Surg* 2014;14:53.
42. Ahmad S, Sinha S, Narang A, Kalra M, Arshad A. Open double endobutton loop fixation, a one-stop solution for both; Lateral end clavicle fractures and acromioclavicular joint dislocations. *Int J Orthop Res* 2022;4:89-94.
43. Kuner E, Beeres FJ, Babst R, Schoeniger R. Which lateral



clavicle fractures can be treated by an arthroscopic-assisted endobutton procedure? An analysis of risk factors. Arch Orthop Trauma Surg 2019;139:331-7.

44. Kraus N, Stein V, Gerhardt C, Scheibel M. Arthroscopically

assisted stabilization of displaced lateral clavicle fractures with coracoclavicular instability. Arch Orthop Trauma Surg 2015;135:1283-90.

Conflict of Interest: Nil

Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this case report

How to Cite this Article

Dash NB, Jain SK, Dalei TR, Panda PK, Sahoo BS. Clinical and Radiological Outcome Assessment following Coracoclavicular Reconstruction with Endobutton and Fibertape for Neer's Type II Lateral End Clavicle Fracture: A Prospective Study. Journal of Orthopaedic Case Reports 2025 October;15(10): 280-287.

