International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
Impact Factor (RJIF): 6.72
IJOS 2025; 11(4): 115-118

www.orthopaper.com
Received: 23-08-2025
Accepted: 28-09-2025

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Transosseous FiberTape repair of displaced fracture lateral end of clavicle: A novel technique

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DOI: https://www.doi.org/10.22271/ortho.2025.v11.i4b.3837

Abstract
Introduction: The treatment of displaced fracture lateral end of clavicle always poses a great challenge to the orthopaedic surgeons globally. The incidence of hardware failure and non-union is high among such fractures following fixation. A novel alternative method to counter these drawbacks is currently the 'need of the hour'.
Objective: The objective of this study is to assess the fracture union rates and functional outcome following the fixation of displaced lateral end clavicle fractures using transosseous FiberTape repair method.
Methods: 25 cases done in LLM Hospital over 6 years with completely displaced fracture of lateral end of clavicle with a minimum follow up of 6 months were included in this study.
Patients were positioned in beach chair. Shoulder strap incision made. A 4mm driil hole made in clavicle 2cm medial to fracture. FiberTape passed under coracoid, one end passed through clavicle and other end taken through acromioclavicular ligament and tied to each other.
Xrays taken immediate postoperative period, after 1 month and 3 months. Average follow up is around 2 years postoperatively.
The fracture union assessed by clinical examination and follow-up Xrays.
The fuctional outcome of the patients were assessed using Short Musuloskeletal functional assessment and Quick disabilities of arm, shoulder and hand score (QUICK DASH Score).
Results: The study showed 100 percent union rates and near normal functional outcome in all patients
Conclusion: The transosseous FiberTape repair for displaced lateral end of clavicular fracture is a novel alternative for hardware fixation, as the former is having high efficacy and economical advantage. Moreover, the method avoids re-surgery of hardware removal and functionally superior with 100 percent union rates.
No similar study is reported in literature.

Keywords: Transosseous repair, lateral end of clavicle, fiber tape, shoulder strap incision, novel technique

Introduction
The clavicle fractures account around 2.6% of all fractures and about 40-60% fractures of shoulder region [1]. 15% of clavicle fractures are involving the lateral end of clavicle, which is our field of interest discussing the technique of fixation and its functional outcome.
The lateral end of clavicle fractures are classified according to Neers classification [2]. Type II and V fractures are displaced and unstable due to coracoclavicular and acromioclavicular ligament disruption. These displaced unstable fractures represent 10-50% of distal clavicle fractures.
Usually occurs during a fall or trauma or road accidents as a result of compression force.
Conservatively treated displaced type 2 fracture results either bony union, fibrous union or nonunion. The rate of nonunion is as high as 30% in the literature [3]. Nonunion of the lateral end of the clavicle is painful and recommended open reduction and internal fixation for type 2 fractures of the distal clavicle because of their tendency of delayed healing and residual shoulder disability.
The choice of ideal method of internal fixation of displaced lateral end clavicle fracture remains as a hot-button to date. However, fixation using coracoclavicular screws, tension bands, Kirshner wires, hook plates and contoured locked and non locked plates have been

published with encouraging results in all series.
The troublesome complications of open reduction and internal fixation (ORIF) include fixation failure, pin migration, refracture, malunion and extensive tissue damage during hardware removal.
Levy described a minimally invasive suture fixation with good outcome, which obviates the need for implant removal[4].
Badhe et al. modified the Levy technique and mentioned tension band suturing for such displaced type 2 lateral end clavicle fractures with 100% union in their studies.
The results using transosseous FiberTape repair of displaced type 2 fracture of the lateral end clavicle is shared here.

Materials and Methods

A retrospective study conducted in department of Orthopaedics, LLM hospital Kidangoor on 25 cases with displaced fracture lateral end of clavicle
The patients aged between 18-60 years satisfying the inclusion and exclusion criteria underwent surgical treatment open reduction and transosseous FiberTape repair between 2018-2024 are include in this study.
The patients undergone regular follow-up at 15 days, 2 and 6 months postoperatively

Inclusion criteria

- Age b/w 18-60 yrs
- Isolated lateral end displaced fractures of clavicle- Neer type II fractures
- Who are willing for 6 months regular follow-up

Exclusion criteria

- Associated ftacture of clavicle shaft
- Floating shoulder injury
- Neurovascular injury

Surgical procedure

Patients were positioned in beach chair. Shoulder strap incision made. A 4mm driil hole made in clavicle 2cm medial to fracture. FiberTape passed under coracoid, one end passed through clavicle and other end taken through acromioclavicular ligament and tied to each other. Reduction confirmed intraoperatively under C arm. Postoperatively arm sling pouch immobilsation given for 3 weeks followed by active mobilisation and physiotherapy.

Fig 1: Beach chair position

Fig 2: Shoulder strap incision

Fig 3: Transosseous fibertaping

Fig 4: Preoperative xray

Fig 5: Immediate postoperative x-ray

Fig 6: Month follow up x-ray

Results

All 25 fractures united clinically and radiologically. At the end of 6 month follow-up, all patients have reached their preinjury functional ability. Functional assessment done through quick DASH score and short musculoskeletal functional assessment and the results were excellent. No complications of surgery reported.

Discussion

The important result of this study is that the transosseous FiberTape repair of displaced lateral end clavicle fractures achieves excellent outcome at a mean follow-up of 6 months. The functional recovery were high so as the patient satisfaction. No complications reported. Our study result was superior to conventional open techniques such as hook plate, locking plates, coracoclavicular screw fixation, and intramedullary fixation. Our results were comparable with arthroscopic surgical techniques of coracoclavicular stabilization with lesser complication rates and also cost effective than the arthroscopic method.

As we use FiberTape, the bony erosion chance of the clavicle was less and no bony erosions were seen in any patients compared to the previous studies.

The incidence of complications after procedures including coracoclavicular fixation has been reported to be 4.8% [5]. Xiong *et al*. did a comparison for three different methods of internal fixation for distal end of clavicle fracture, and they concluded that coracoclavicular stabilization with either using single or double Endobutton technique is associated with some complications, such as suture failure and microgenesis of the coracoid process [6]. Rose *et al*. and colleagues presented arthroscopy-assisted treatment of displaced distal clavicle fractures utilizing curved buttons and suture tape with a single coracoclavicular tunnel and they had identified that one problem with coracoclavicular fixation techniques is iatrogenic fracture of the clavicle and coracoid associated with large diameter bone tunnels used to secure the implants [7]. Takase *et al.* reported good functional results and bony union achievement in a series of seven patients treated with an artificial ligament and an end button with a mean follow-up of 2 years and 5 months. No complications occurred [8]. Similarly, Loriaut *et al*. presented to report a technique with double button device for 21 patients, and they experienced single implant failure [9].

There are various open techniques for internal fixation of these fractures. However, due to the high complication rate, they are not preferred mode of treatment. The complication rate was significantly higher when using the hook plate (40.7%) [5]. In other modalities like coracoclavicular screws, intramedullary fixation with Knowles pin/AO screws and tension band wiring risk of implant migration (9.3%) and arthritis of acromioclavicular joint with implant related complications prevails [10].

Our technique is a minimally invasive technique with less injury to soft-tissue structures and without involving the fracture site thereby increasing fracture union. This technique does not require metallic implant, thus preventing resurgery for implant removal. However, our study group is small, further studies are necessary for solidifying the results.

Conclusion

The transosseous FiberTape repair for displaced lateral end of clavicular fracture is a novel alternative for hardware fixation, as the former is having high efficacy and economical advantage. This is a novel minimally invasive surgical technique that preserves acromioclavicular joint anatomy and without damaging adjacent soft-tissue structures. Moreover, the method avoids re-surgery of hardware removal and functionally superior with 100 percent union rates.

No similar study is reported in literature.

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How to Cite This Article
Anand A, Jose J. Transosseous FiberTape repair of displaced fracture lateral end of clavicle: A novel technique. International Journal of Orthopaedics Sciences. 2025; 11(4): 115-118.