

## A Study on New Fixation Method for Lateral Dislocation Malleolar Spina Bifida

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### Abstract

**Introduction:** One of the most common types of fractures around the ankle is a lateral ankle fracture. Lateral ankle head fracture is one of the fracture types for which different fixation methods have been proposed. Surgeons always tend to use a method that, although it is less expensive, gives good results in the short and long term, and the surgical technique is simple.

**Patients and Methods:** The present study included the evaluation of the functional and radiological results as well as the complexity of the new fixation method (stretch cable on the third of the tube plate) for lateral ankle fractures. Twenty-one consecutive patients undergoing this novel approach were followed up retrospectively.

**Results:** No significant pain on the lateral ankle was observed in all patients after a short follow-up period (6 months to 2 years). Ankle X-ray showed complete healing of the lateral ankle fracture with no cracks or calluses.

**Conclusion:** The new fixation method (straightening belt on the third part of the tubular plate) is an inexpensive, simple, safe and easy surgical procedure to treat and stabilize a lateral displaced ankle fracture with the A Denis Weber.

**Keywords:** Fixation; Malleolar Tip Fracture; Surgical technique; Tension Band Wiring

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### Introduction

One of the most common types of fractures around the ankle is a lateral ankle fracture. Denis-Weber classified this fracture into three categories based on the location of the fracture line relative to the articular surface of the ankle (Figure 1). Type A is the sub-syndesmotic type and type B is the trans-syndesmotic type. In type C, a superparticular fracture [1]. In class A fractures, stabilized ankle joints are treated mainly with a cast, but in cases of fracture with displacement, surgery, and immobilization are required [2]. The difficulty in immobilizing these fractures lies in their very small size in the distal part of the fracture. Therefore, to treat this type of fracture, several immobilization methods have been proposed (such as placement of longitudinal screws or intramedullary nails, use of anatomical locking plates, wire tensioning with pins, or even placement of a sheet of pipe, one-third of the end having the shape of a hook) [3-5]. In a biomechanical study that my colleagues and I conducted in 2016, we compared existing methods with our proposed method, which is to attach a tension strip to the side tube plate. third, this method is better than other methods in terms of structural stability. (Resistance to bending, torsion, and compression). Furthermore, this method is very inexpensive and its surgical technique is easy [6]. In this paper, we decided to present a report on the results of the fixation of cable tension bands on one-third of the tube plate in 21 patients undergoing surgery with this method.



**Figure 1:** Denis-Weber classification for lateral malleolar fracture.

## Materials and Method

The present study included the evaluation of the functional and radiological outcomes and the complexity of the novel fixation approach for lateral displacement ankle fractures with Denis-Weber type A. Twenty-one consecutive patients undergoing this novel approach were followed up retrospectively. (Mean age, 40.7 years; age range, 21–70 years; 8 males, 13 females).

### Integration Criteria

- Patient with displaced lateral ankle fracture (type A Denis-Weber)
- Soft tissues suitable for lateral ankle surgery
- Closed fracture

### Exclusion Criteria

- Patient with nondisplaced lateral ankle fracture (class A Denis-Weber)
- Patients with external ankle fractures (class B or C Denis-Weber)
- Uncontrolled diabetes
- birth defects of the lower extremities,

- Ankle joint infection,
- a history of ankle ligament injury or any previous ankle surgery

### X-ray of the ankle before and after surgery

Preoperative and postoperative radiographs before and after surgery (AP), lateral (Lat.), and mortise radiographs were obtained from all patients to analyze the displacement of the fracture site within fracture lateral ankle bone and the degree of step in the healed fracture and the degree of osteoarthritis of the ankle.

## Ankle Pain Rating

**Ankle pain was assessed using a visual analog scale (VAS).**

### AOFAS . Ankle-Foot Score Assessment

The American Ankle-Ankle Assessment System (AOFAS) is a standard assessment of the clinical condition of the posterior ankle-foot. It combines both subjective and objective information. Patients report their pain and doctors assess alignment. The patient and the doctor work together to complete the functional part. Scores range from 0 to 100, with a healthy ankle getting 100. This score is commonly used to evaluate functional outcomes of the ankle, subtalar, tarsal, and calcaneal joints and may be useful for fracture, arthroplasty, orthopedic, and spondyloarthropathy and procedures. unstable.

### Surgical technique

The patient with a Denis-Weber A displacement ankle fracture was placed in the supine position under spinal anesthesia. Under the appropriate tourniquet pressure (100 mmHg above systolic blood pressure), a longitudinal incision of approximately 7 cm was made in the lateral skin of the lateral ankle. Fracture reduction was performed. A 1/3 tube sheet with 5 or 6 holes is reshaped after bending to the shape of the lateral part of the lateral ankle. The fracture was then fixed with five cortical screws. The second and third screws on the far side have been loosened slightly to allow tension between the ends of these two screws. After tensioning the wire strip, these screws are fully tightened (Figure 2). Screw and plate position has been checked with C-Arm to make sure it is correct. Finally, after the wound was sutured and bandaged, the patient was placed in a short cast for two weeks. The patient was allowed to carry weight on the affected leg from the same day of surgery as pain was tolerated. After two weeks, the patient was advised to wear high heels for three months. After the bandage is removed, the ankle's range of motion begins.

## Results

All patients were followed for at least 6 months. Median follow-up was 15.8 months (range 6–24 months). The mean image similarity score decreased significantly, from 7.9 preoperatively



**Figure 2:** A. Lateral malleolar tip fracture B. Post-operation radiography of fracture fixation by the method of tension band wiring over the one-third tubular plate.

on the day of surgery to 0.5 postoperatively at the last follow-up. In the ankle radiograph (AP, Lat. and mortise view), performed on the last day of follow-up in all patients, complete solidification was evident. Malunion was not seen. There were also no degenerative changes. In all patients, the ankle range of motion was similar to that of the contralateral side. In four patients, they complained of immobilization prominence and device removal was performed for them. The AOFAS average posterior ankle-foot rating system was 96.7 at last follow-up (range, 90-100).

## Discussion

If the ankle is stable and the lateral ankle fracture is not displaced, nonsurgical treatment will give excellent results. If clinical/radiographic findings suggest that the ankle is unstable, the appropriate treatment option is surgical fixation, including placement of a splint on the lateral or posterior aspect of the lateral ankle, or immobilization in the marrow. Plates that lock and secure with small pieces or pieces are important and are additions that the surgeon may consider depending on the needs of the individual patient [1,7,8]. Based on research done by Haroon Rehman et al. in 2015, they stated that fixation with intramedullary nails for distal fibula fractures may be more effective than conventional fixation with splints and screws [3].

In a multicenter case series performed by Vincenzo Giordano et al. By 2020, frame fixation of lateral ankle fractures has become an appropriate and safe option for the treatment of most types of adult fibula fractures [4].

Magnesium (Mg) bio-absorbable screw is a new biomaterial used in fracture immobilization. In the current literature, there is only one case of the use of bioresorbable magnesium screws in ankle fractures, reported by Baver et al. In a patient with a one-time lateral ankle fracture, treated with open correction and fixation with an intramedullary magnesium screw, followed by

two years of follow-up. Composition of the fracture was achieved without any complications such as failure of fixation, loss of manoeuvrability, infection or any other adverse reactions. For this reason, they propose that resorbable magnesium screws are an alternative method for fracture immobilization compared to conventional metal implants, as they eliminate the need for implant removal [9]. Locking plates are increasingly used in the treatment of lateral ankle fractures. Biomechanical studies have shown increased stability using locking plates compared with non-locking plates. However, although the cost of these plates is much higher than that of conventional non-locking plates in the past, the exact benefit of locking plates over non-locking plates in patients with lateral ankle fractures is unknown. A meta-analysis by Nesar Ahmad Hasami et al. showed no clear advantage of choosing a locking plate over a non-locking plate in the treatment of lateral ankle fractures [10].

In a study conducted by Bankston et al. In 44 patients with lateral ankle fractures, intra-frame screw fixation for non-abrasive lateral ankle fractures has been shown to provide stable fixation with good clinical outcomes. This technique has the advantage of dynamic fixation in the pulp with limited surgical dissection and the absence of subcutaneous material [11]. In a retrospective study published by Yenal G"urkan Bilgetekin in 2018, a total of 62 orthopedic patients underwent surgery for a lateral ankle fracture. In this study, there was no evidence of a significant difference between the use of a third tube lock plate and the anatomical distal fibula lock plate in lateral ankle fixation in terms of clinical and radiographic outcomes, incidence complications and fracture healing time [12]. In a study conducted by Paul et al. In 2007, the outcomes of delayed screw fixation performed alone in 25 patients with unstable, non-abrasive lateral ankle fractures were retrospectively evaluated. In this study, they demonstrated that hysteresis screw fixation only for the lateral ankle is a safe and effective method, with several advantages over plate fixation,

especially less tissue dissection. softer, less prominent material, symptomatic and palpable, and reduces the need for secondary surgery. surgical resection [13].

In a retrospective study conducted by Girgis Latif et al. of forty-six patients with displaced Weber A fractures and low Weber lateral ankle fractures who underwent closed correction and percutaneous internal fixation with a fully threaded intramedullary screw, showing that if the eye fracture was reduced, side by side by means of a closed fixation, fixation can be performed with a percutaneous screw. This technique is quick, safe, and easy to perform, with few complications [14]. Qudong Yin et al. also reported the results of the immobilization of lateral ankle fractures with a symmetrical double-tooth hook plate in their 2019 study [15].

The aim of the biomechanical study conducted by Moghadam et al in 2016 was to compare three popular internal fixation techniques and a new immobilization technique (stretch cable on the third part of the tubular plate). for malleolar lateral end cracks using finite element analysis. In their study, 3D finite element models of the fibula and tibia were generated based on the CT scan data used for the analysis. The screw model has been added to this model. The simulation results show that most of the stresses are generated under axial bending loads and the stress values decrease with the second technique. However, the results show that the displacement at failure under axial bending is larger than the torsional load. Due to the high stress in the plate holes in the first technique, external fixation should be used to improve this technique [6].

Based on the biomechanical results of the Moghadam study, we used this novel fixation method (stretch cable on the third of the tube plate) in patients with a lateral ankle head fracture and reported the results. it's on the clinic.

## Conclusion

In summary, our preliminary data demonstrate that the new fixation (stretch belt in the third part of the tube plate) is an inexpensive, simple, safe and easy to treat, and stable surgical procedure. lateral head fracture. However, some limitations to this study should be noted. First, the follow-up period is relatively short. Second, we have no control group. Third, the number of cases is relatively low. Perhaps in the near future, this method will become popular for displacement fractures of the lateral ankle with Denis-Weber type A fixation. According to the biomechanical research that has been done on this method, no dressing is required for the first two weeks, which will make the patient more satisfied with the treatment.

## Declaration of Conflict of Interest

The authors declare that there is no conflict of interest.

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