

# Early full weight-bearing in patients with isolated displaced lateral malleolar fracture after rigid internal fixation with locking plates

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## Abstract

**Background:** The timing of post-operative full weight-bearing in patients of isolated displaced lateral malleolar fractures remains controversial. The aim of this study was to evaluate the outcomes of early full weight-bearing after rigid internal fixation of such fractures with locking plates.

**Methods:** From 2012 to 2018, 46 patients who had closed isolated displaced lateral malleolar fractures were included in the study. All fractures were managed with open reduction and internal fixation with locking plates. The patients were allowed to walk bearing their full weight 2 weeks after the operation. The follow-up period was 41.5 months on average (range: 12-70 months). The patients were available to evaluate union conditions, functional results, and complications.

**Results:** The fractures united smoothly with an average union time of 10.5 weeks (range: 8-16). At the final follow-up, the average American Orthopaedic Foot and Ankle Score Ankle-Hindfoot Score was 91 (range: 85-98). No complications were observed.

**Conclusion:** For patients with isolated displaced lateral malleolar fractures, full weight-bearing is safe and effective, without an increase in the rate of complications, 2 weeks after open reduction and rigid fixation with locking plates.

**Keywords:** Lateral malleolar fractures; Locking plates; Weight-bearing

## 1. INTRODUCTION

Lateral malleolar fractures are the most common fractures among the young population.<sup>1</sup> In displaced fractures, open reduction and internal fixation (ORIF) are now generally recommended to restore adequate stability in the lower limbs and to prevent the occurrence of post-traumatic osteoarthritis. Thus, the anatomic reduction of ankle fractures has been highly recommended in recent clinical practices.<sup>1-4</sup> Postoperative weight-bearing in ankle fracture cases has been restricted in several studies. Nevertheless, recent clinical trials showed that early weight-bearing with ankle fractures significantly improved short-term outcomes.<sup>9-11</sup> The purpose of this study was to evaluate the clinical outcomes of early weight-bearing in patients with isolated displaced lateral malleolar fractures after rigid internal fixation with locking plates.

## 2. METHODS

A total of 46 orthopedic patients were enrolled in this study who had a diagnosis of closed, displaced, isolated lateral malleolar

fractures and underwent ORIF at our centre between 2012 and 2018, with at least 12-month follow-up. Data were collected in our database system and was approved by the institutional review board for publication. The fractures were classified according to the Danis-Weber system using preoperative radiographs, including the anteroposterior, mortise, and lateral views of the ankle. All patients were treated in the same treatment protocols. Patients with multiple fractures, open fracture, pathological fracture, pediatric fracture, bimalleolar/trimalleolar fracture, fractures associated with syndesmotic injuries, or inadequate follow-up were excluded from this study. This article has been approved by the Institutional Review Board of Taipei Veterans General Hospital of Taiwan with TPEVGH IRB No. 2019-06-012AC.

### 2.1. Operative technique

All surgical procedures were performed by the same surgical team under the supervision of the same senior author (F.Y. Chiu). Prophylactic antibiotics, including first-generation cephalosporin (Cefazolin; VPP, 1000 mg), were administered 30 minutes before skin incision; Clindamycin (Nang Kuang; 300 mg) was administered to three patients with a penicillin allergy. Under spinal (n = 35) or general (n = 11) anesthesia, patients were operated on, without tourniquet, in the supine position. Possible syndesmosis injuries were examined and confirmed under intraoperative fluoroscopy through an external stress test. The direct lateral approach was used in all cases. After anatomic fracture reduction was obtained, rigid fixation (with at least three screws/six cortices, in proximal fragment) was performed with a single locking plate (DePuy Synthes Locking Compression Plate System - 2.7/3.5 mm LCP Distal Fibula Pate, Davos, Swiss). The surgical wound was closed with layers, without drainage tubes. A short leg splint was applied.

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## 2.2. Postoperative care and follow-up

A portable radiograph of the ankle joint was checked before transferring the patient back to the ward unit. Ultracet (Tramadol; Janssen/acetaminophen, 37.5 mg/325 mg) 0.5 Tab Q6H and p.r.n. intravenous morphine were administered for pain control, if not contraindicated. Nonsteroidal anti-inflammatory drugs were prohibited. Intravenous antibiotics were continuously administered every 8 hours after surgery for 1 day. The average hospital stay was 5.2 days (range: 3-8). Each patient had one special chart with detailed records, including their personal data; mechanism and associated condition of their injury; type and classification of the fracture and non-union; course of management (including timing of treatment, status of fixation, course of operation, amount of blood loss, operation time, type and duration of antibiotics used, length of hospital stay, early complications, late complications, and management of complications); condition and course of the fracture healing; and functional recovery. Regular follow-up was arranged at 2 weeks, 4 weeks, 6 weeks, 8 weeks, 10 weeks, 12 weeks, 14 weeks, 16 weeks, 20 weeks, 9 months, and 12 months post operation. The anteroposterior and lateral views of the radiographs, wound condition and ankle function (assessed by the American Orthopaedic Foot and Ankle Score [AOFAS] Ankle-Hindfoot Score) were evaluated by the same senior author (F.Y. Chiu) during each OutPatient Department (OPD) visit. The short leg splint was removed, and full load weight-bearing was allowed at the first OPD visit. The average follow-up period was 41.5 months (range: 12-70).

## 2.3. Outcomes and statistical analysis

A fracture union was defined as the complete disappearance of the fracture line and was evaluated by the radiographs taken at every OPD visit. Complications and causes for reoperation were recorded. The functional outcomes were assessed during every outpatient visit.

## 3. RESULTS

The patients' demographics data are presented in Table 1. The patients received operations under protocol and were followed for at least 12 months after surgery. The average age of the patients at the time of the injury was 43 years old (range: 17-84 years old) (Table 1). There were 18 male and 28 female patients. The physical health and associated medical conditions of the patients were rated based on the American Society of Anesthesiologists physical status classification, 6 patients were in class III, 12 patients were in class II, and 28 patients were in class I. Three patients had chronic cardiovascular disease, five patients had diabetes mellitus, and no patients had chronic pulmonary disease, chronic cerebrovascular or neuromuscular disease, or any other chronic medical diseases. The mean body mass index was 26.8 kg/m<sup>2</sup> (range: 18.7-37.6). There were 17 left-sided fractures and 29 right-sided fractures. The mechanisms of injury were traffic accident (n = 14), sports injury (n = 10), and sprain injury (n = 22). There were 29 type-B fractures and 17 type-C fractures. Twelve fractures were operated within 2 days after injury, 15 were operated between 2 and 7 days after injury, and the other 19 fractures were operated between 1 and 3 weeks after injury.

No superficial or deep infections, loss of reduction, delayed union or nonunion, or neurovascular injury were observed in this study. Two patients underwent local debridement of the surgical wound due to poor wound healing; aerobic and anaerobic cultures were collected, but no bacterial growth was identified. In these cases, no associated medical conditions were noted, and their fracture union times were 12 and 14 weeks. The average fracture union time was 10.5 weeks (range: 8-16) (Fig. 1). The implant was removed in six patients due to personal preference. The average AOFAS Ankle-Hindfoot Score was 91. The clinical, radiographic, and functional outcomes are summarized in Table 2.

**Table 1**

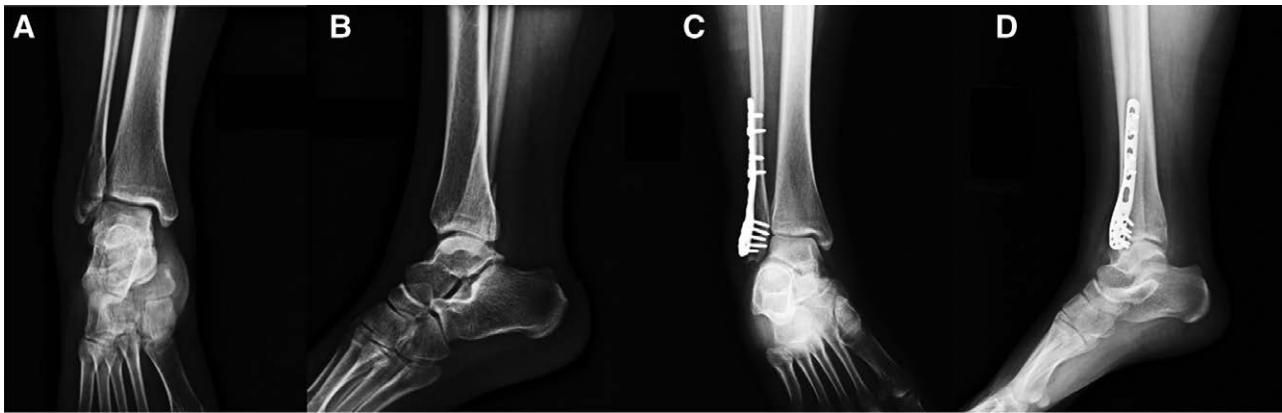
**Patent demographics and fracture characteristics (N = 46)**

Age, y	
Mean + SD	43 ± 19.61
Range	17-84
Gender	
Male	018 (36.1)
Female	28 (63.9)
BMI, kg/m <sup>2</sup>	
Mean + SD	26.8 ± 4.96
Range	18.7-37.6
Tobacco consumption	
Yes	012 (19.4)
No	34 (80.6)
Alcohol consumption	
Yes	02 (4.4)
No	44 (95.6)
Type 2 diabetes mellitus	
Yes	0 5 (10.9)
No	41 (89.1)
Injury mechanism	
Traffic accident	014 (30.4)
Sports injury	010 (21.7)
Sprain injury	22 (47.8)
Time from injury to initial consultation, d (mean)	4.4
Time from Injury to operation, d (mean)	8.2
Fracture side	
Left	17 (37.0)
Right	029 (63.0)
Danis-Weber fracture classification	
Type B	29 (63.0)
Type C	017 (37.0)
Total screws used for plate fixation	
Mean + SD	9.3 ± 1.4
Range	6-13
Operation time, min (mean)	59.7
Duration of hospitalization, d (mean)	5.2

Data presented as N (%) unless otherwise stated in the table.

## 4. DISCUSSION

The appropriate timing for the continuation of weight-bearing after ankle fractures that have been treated with ORIF remains controversial. Previous studies suggested that the full load weight-bearing should be allowed 6 weeks to 3 months after operation to prevent complications or the failure of implants.<sup>1-4</sup> However, recent studies have shown that early weight-bearing significantly improved short-term outcomes with ankle fractures and provided opportunities for returning to daily work and exercises earlier.<sup>9-11</sup> Smeeing et al<sup>10</sup> underwent a multicentre randomized control trial with 115 patients; the group that practiced unprotected weight-bearing exhibited significantly improved short-term functional outcomes. In another randomized control trial, performed by Dehghan et al,<sup>9</sup> with 110 patients enrolled, the early weight-bearing group had shown significant improvements in ankle range of motion, Olerud/Molander ankle function scores and the 36-item short-form health survey scores. In our study, we enrolled a population of orthopedic patients with isolated displaced lateral malleolar fractures who underwent ORIF with locking plates. The patients were allowed to resume full weight-bearing 2 weeks after surgical intervention. The average fracture union time was 10.5 weeks with an average AOFAS Ankle-Hindfoot Score of 91; this was comparable to other studies.<sup>2,6,8</sup> No major complications were noted.



**Fig. 1** A case of isolated lateral malleolar fracture without syndesmotom injury, Danis-Weber Type-B fracture, (A) anteroposterior view, (B) lateral view. Fracture with complete bone union 8 weeks after surgery, (C) anteroposterior view, and (D) lateral view.

**Table 2**

**Clinical, radiographic and functional outcomes (N = 46)**

Complications	
Superficial/deep infection	0 (0)
Loss of reduction	0 (0)
Delayed union/nonunion	0 (0)
Reoperation	
Local debridement	2 (4.3)
Removal of implant	6 (13.0)
Symptomatic removal	0 (0)
Planned removal	6 (100)
Screw washout/plate malposition	0 (0)
AOFAS Ankle-Hindfoot score (mean $\pm$ SD)	91 $\pm$ 4.9
Duration of follow-up, mo (mean $\pm$ SD)	41.5 $\pm$ 19.8
Time for Fracture Union, <sup>a</sup> wk (mean $\pm$ SD)	10.5 $\pm$ 3.7

Data presented as N (%) unless otherwise stated in the table. AOFAS = American Orthopaedic Foot & Ankle Society. <sup>a</sup>Fracture union is defined as the complete disappearance of fracture lines in regular follow-up radiographs.

There are several limitations in this study. First, this study is a single-centre, single-surgical team study. It lacks a control group to compare the clinical outcomes for patients who underwent ORIF with other plating systems, or for patients who undergo full load weight-bearing with different timings after surgery. Second, although this study provides the timing of early weight-bearing in a specific population, the case number is still small. Thus, further comprehensive research and randomized controls studies are required. In conclusion, for patients with displaced isolated lateral malleolar fractures, full load weight-bearing, 2 weeks after ORIF with locking plates, is safe and effective, without increasing complication rates.

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