

Retrospective Study

COMPARATIVE OUTCOMES OF EARLY VERSUS DELAYED WEIGHT-BEARING IN FIFTH METATARSAL BASE FRACTURES: A RETROSPECTIVE STUDY

F. Pezone², G. D'Andrea², M. Alessio Mazzola¹, G. Placella², S. Mosca² and V. Salini²

¹IRCCS San Raffaele Hospital, Milan, Italy;

²Vita-Salute University, IRCCS San Raffaele Hospital, Milan, Italy

Correspondence to:

Mattia Alessio Mazzola, MD

IRCCS San Raffaele Hospital,

Clinical Unit of Orthopedics and Traumatology,

Via Olgettina 60,

Milano, Italy

e-mail: mattia.alessio@hotmail.com

ABSTRACT

Fractures of the fifth metatarsal base are common foot injuries, especially in athletes and active individuals. Treatment strategies vary between early and delayed weight-bearing, but limited evidence exists on which approach leads to better clinical and functional outcomes. This retrospective, single-center study compares the effects of early versus delayed weight-bearing on clinical and functional recovery in patients with fifth metatarsal base fractures between January 1, 2020, and December 31, 2021. Data from 40 patients treated at a single center for fifth metatarsal base fractures were analyzed. Patients were divided into two groups according to treatment decision: 20 in the early weight-bearing group (within 2 weeks post-injury) and 20 in the delayed weight-bearing group (after 4-6 weeks of immobilization). Clinical and functional outcomes, including return to activity, pain levels measured with Visual Analogue Scale (VAS), Foot and Ankle Disability Index (FADI), satisfaction rates, and complications, were assessed and compared at 6 months follow-up. The study included 14 male and 26 female patients, with a mean age of 43.5 ± 15.5 years. No significant difference in subjective satisfaction and FADI score was found between early and delayed weight-bearing at the final follow-up assessment ($p > 0.05$). However, a significantly earlier return to sports and physical activity was observed in the early weight-bearing group ($p < 0.001$). In conclusion, early weight-bearing in fifth metatarsal base fractures allows for an earlier return to activity without compromising patient satisfaction or increasing complications. These findings support early weight-bearing as a viable option for promoting faster recovery in appropriately selected patients without compromising clinical outcomes.

KEYWORDS: *fracture, bone, foot, metatarsal, weight-bearing*

INTRODUCTION

Metatarsal fractures are one of the most common injuries of the foot, with an incidence of up to 75 persons per 100,000 per year among adults (1-3). More than half of all metatarsal fractures involve the fifth metatarsal bone, and the majority are located at the proximal end (1, 3). The peak incidence of fifth metatarsal fractures in men is below 40, whereas mostly women older than 50 are affected (3, 4).

Received: 29 June 2022
Accepted: 14 August 2022

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The fifth metatarsal plays a crucial role in mechanics and stability during weight-bearing activities, playing a significant role in walking and balance due to fibularis brevis and tertius tendon insertion (5). Despite its biomechanical importance, the base of the fifth metatarsal bone has a poor and retrograde blood supply, primarily from the diaphyseal and metaphyseal arteries. This limited blood supply contributes to a higher risk of delayed union or non-union of fractures (6).

Different classification systems were developed over the years according to the location and number of fragments (7-11). Several treatment options have been proposed (12-18) without a clear consensus among orthopedic surgeons. Weightbearing is a critical factor in the management of fifth metatarsal base fractures. While early weight-bearing can promote muscle function and joint mobility, there is concern that premature loading of the fractured area may increase the risk of delayed healing, non-union, or re-fracture, particularly in Jones's fractures (19). Conversely, delayed weight-bearing may protect the fracture site but prolongs immobilization and recovery time, potentially leading to muscle atrophy, joint stiffness, and longer rehabilitation periods (20).

The optimal timing for weight-bearing in these fractures remains still debated. The aim of this study is to compare functional outcomes retrospectively, return to activity and satisfaction rate of two different conservative protocols on patients with fifth metatarsal base fractures who underwent either early or late weight-bearing protocols. The hypothesis of this study is that early weight-bearing provides a quicker return to activity without compromising clinical outcomes.

MATERIAL AND METHODS

Study characteristics

Patients affected by a fracture of the base of the fifth metatarsal bone from January 1, 2020, to December 31, 2021, were screened by consulting the institutional database. Inclusion criteria were avulsion type (pseudo-Jones) fractures, proximal articular fractures (Jones fractures), and proximal extra-articular fractures (march fractures) with conservative indication.

Exclusion criteria were non-healing fractures with surgical indication (21), open or pathological fractures, concurrent lower-extremity injuries (such as Lisfranc or cuboid fractures), and those with obesity (BMI >30 kg/m² or weight >100 kg), diabetes, or neuroarthropathy were excluded, as these factors could negatively impact recovery to pre-injury activity levels.

Patients were screened, selected and divided by treatment decision into two groups. In the early weight-bearing group, the orthopedic surgeon prescribed a hard sole with partial weight-bearing with crutches for 4 weeks. In the delayed weight-bearing group, the orthopedic surgeon prescribed a splint without weight-bearing for 4 weeks. After splint removal, progressive partial weight-bearing was then recommended. Table I summarizes the general features of the population.

Table I. *General features of the population included.*

	Early weight-bearing	Delayed weight-bearing	P-value
Patients	20	20	-
Age (years)	44.8 ± 17.3 (95%CI from 36.7 to 52.8)	42.2 ± 13.8 (95%CI from 35.7 to 48.7)	0.610
Gender (M/F)	9 (45%) / 11 (55%)	5 (25%) / 15 (75%)	0.081
Follow-up (months)	7.3 ± 0.8 (95%CI from 6.8 to 7.6)	7.6 ± 0.4 months (95%CI from 6.9 to 7.7)	0.142

Primary and secondary outcomes

The primary outcome measured was the patient's return to pre-injury activity levels. Secondary outcomes included pain levels, which were assessed using the Visual Analog Scale (VAS), the Foot and Ankle Disability Index (FADI) score, and patient satisfaction, which were categorized into three groups: satisfied, fair, and very satisfied.

The FADI score is a questionnaire-based tool that evaluates the foot and ankle function, which is particularly useful after injuries or surgeries. This score reflects the patient's self-reported level of disability and functional ability in

performing daily activities. It is commonly used by clinicians to assess treatment effectiveness and monitor recovery progress over time.

Statistical analysis

Statistical analysis was conducted using IBM SPSS Statistics (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as the absolute number of cases and/or percentage. The Shapiro-Wilk test was used to identify normally distributed parameters. Differences between means were calculated with the t-test for continuous variables or with the Mann-Whitney U test if not normally distributed. The Wilcoxon log-rank test was used to compare unpaired values that were not normally distributed. Categorical variables were calculated using the chi-square test or Fisher's exact test. A p-value of <.05 was considered statistically significant.

RESULTS

Primary outcome

The statistical analysis indicated that an early return to weight-bearing (within 2 weeks from trauma) with hard sole was associated with a significantly quicker return to overall physical activity ($p < 0.01$) (Fig. 1). The early weight-bearing group had a mean return time of 8.4 ± 0.9 (95% CI from 7.9 to 8.9) weeks, compared to the delayed group, which had a mean return time of 10.8 ± 1.6 (95% CI from 9.9 to 11.7) weeks with a mean difference of -2.4 weeks (< 0.001) (Table II).

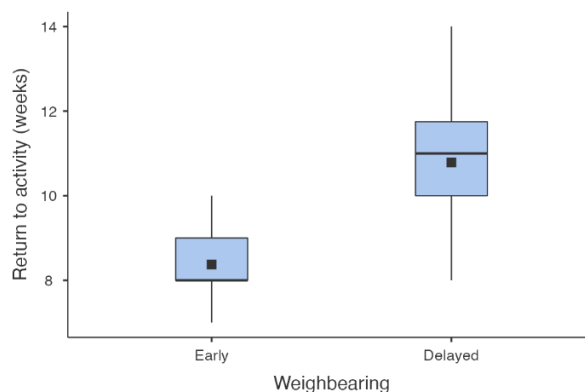


Fig. 1. Graphical expression of return to activity following two different managements showing the significant superiority of early weight-bearing and earlier return to activity of daily living.

Table II. Details of measured outcomes with mean difference (MD). Significant values are highlighted with asterisks.

	Early weight-bearing	Delayed weight-bearing	MD	P-value
Return to activity (weeks)	8.4 ± 0.9 (95% CI from 7.9 to 8.9)	10.8 ± 1.6 (95% CI from 9.9 to 11.7)	-2.4	<0.001 *
Pain level (VAS points)	1.9 ± 1.0 (95% CI from 1.3 to 2.4)	2.1 ± 0.7 (95% CI from 1.8 to 2.5)	-0.3	0.577
FADI score (points)	101 ± 2.6 (95% CI from 99.9 to 103.0)	101 ± 1.4 (95% CI from 99.8 to 101.0)	+0.7	0.150

Secondary outcomes

Secondary outcomes included pain, which was assessed by the VAS, the FADI score, satisfaction rate, and complications. The pain was evaluated at the final follow-up assessment using the VAS. The early weight-bearing group reported a mean pain score of 1.9 ± 1.0 (95% CI 1.3 to 2.4) points, while the delayed weight-bearing group had a mean

pain score of 2.1 ± 0.7 (95% CI 1.8 to 2.5) points. Although the early weight-bearing group showed a lower pain score, this difference was not statistically significant ($p > 0.05$) (Table II).

The FADI score was evaluated at the final follow-up to assess self-reported levels of functional activity and disability. The statistical analysis showed no differences in reported functional scores. The early weight-bearing group reported a FADI score of 101 ± 2.6 (95% CI 99.9 to 103.0) points, while the delayed weight-bearing group had a score of 101 ± 1.4 (95% CI 99.8 to 101.0) points. The mean difference between the groups was +0.7, with a p-value of 0.150. This indicates that the score was slightly higher in the early weight-bearing group, though the difference was not statistically significant (Table II).

The satisfaction rate was assessed at the final follow-up assessment in both groups, with outcomes categorized into three levels: satisfied, fair, and very satisfied. In the early weightbearing group, 15 patients reported being satisfied, 1 reported fair satisfaction, and 4 reported being very satisfied. In the delayed weightbearing group, 17 patients reported being satisfied, 2 reported fair satisfaction, and 1 reported being very satisfied (Table III). Overall, most patients reported being satisfied, regardless of their group. No significant difference in subjective satisfaction was observed between the groups at the end of the follow-up period ($p = 0.492$) (Fig. 2). Complications (non-union, mal union, delayed union, infection) were not detected either in the early weight-bearing groups nor in the late weight-bearing group.

Tab. III: Contingency table with details of measured subjective satisfaction at the end of the follow-up period.

Satisfaction	Weightbearing		Total
	Early	Delayed	
Satisfied	15	17	32
Fair	1	2	3
Very Satisfied	4	1	5
Total	20	20	40

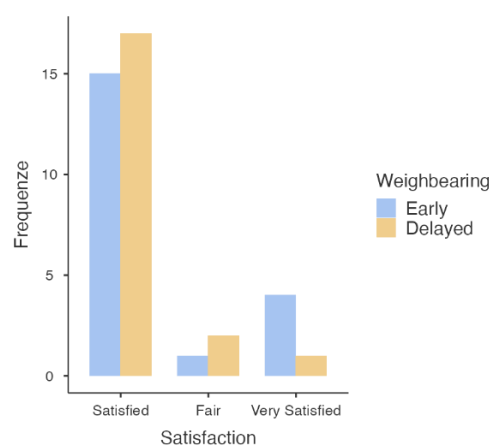


Fig. 2. Graphical expression of subjective satisfaction following two different management.

DISCUSSION

The main finding of this study is that early weight-bearing in the conservative management of fractures at the base of the fifth metatarsal allows for a significantly reduced recovery period and faster return to regular activity without increasing complication rates or negatively impacting clinical outcomes.

The anatomical position of the fifth metatarsal base, situated at the transition between the midfoot and forefoot, subjects it to substantial biomechanical stress, primarily due to its tendon and fascial insertion (22). These anatomical structures provide critical support and lateral stability to the foot, particularly during dynamic actions like pivoting, sidestepping, and directional changes, which are frequent in both daily and athletic activities. This high demand for stability and the forces generated during such movements often make fractures in this region more challenging to heal,

with an increased risk of complications such as delayed union or non-union due to limited vascular supply and repetitive mechanical stress on the fracture site.

Early weight-bearing strategies aim to take advantage of the biological and mechanical responses to controlled load-bearing. By initiating gradual weight-bearing soon after injury, there is an increase in mechanical loading at the fracture site, which promotes callus formation through improved circulation and cellular activity (23-24). Enhanced blood flow and micro-movements at the fracture site stimulate bone healing, leading to a more robust callus and promoting bone remodeling. Thus, carefully monitored weight-bearing not only aids in the biological healing process but can also minimize muscle atrophy, joint stiffness, and psychological barriers to resuming activity, which can otherwise result from prolonged immobilization (24).

In comparison to a previous study by Marecek et al. (24), where unrestricted weight-bearing was adopted immediately after a Jones fracture, the current study provides further analysis of specific pain and functional outcomes that are highly relevant in clinical decision-making. Marecek et al. (24) indicated that unrestricted weight-bearing did not elevate the rates of non-union or delayed union, supporting the notion that early loading may not compromise fracture stability. Their findings demonstrated favorable outcomes in terms of healing time, patient comfort, and functional recovery, underscoring that early weight-bearing may safely accelerate rehabilitation. This study builds upon these insights by examining a wider set of functional outcomes, including scores on the FADI. Although the early weight-bearing group showed slightly higher FADI scores, these were not statistically significant, the trend suggests a potential functional benefit. Additionally, patient satisfaction remained comparably high across groups, highlighting that early weight-bearing did not compromise comfort, quality of life, or overall satisfaction with treatment.

The practical implications of this study are particularly significant for athletes and physically active individuals who may benefit from a shorter recovery and early return to sport without compromising the process of fracture healing. By facilitating an earlier return to activities and maintaining functional strength, the early weight-bearing protocols could be valuable in minimizing both the physical and psychological impacts of prolonged inactivity, which are especially critical in competitive sports settings where rehabilitation time is limited. This approach offers a balanced pathway for conservative management, enabling safe and effective healing while optimizing recovery times.

Despite the precise design this study has certain limitations, including the limited sample size and the potential influence of variables such as fracture severity and patient adherence to weight-bearing guidelines. Further, while the study controlled for some key factors, variables such as the severity of the fracture, variations in individual healing responses, and adherence to prescribed weight-bearing guidelines may have influenced the outcomes observed. In clinical settings, these factors could impact the effectiveness and safety of early weight-bearing protocols. Finally, this is a retrospective, non-randomized monocentric observational study and treatment decision exclusively based on orthopedic surgeon preference and technical confidence. Future studies should focus on addressing these limitations through larger, randomized, multicenter trials that incorporate a broader spectrum of patient demographics and injury types. Such studies could also explore stratified rehabilitation approaches, where patients with different fracture severities or activity levels receive tailored weight-bearing guidelines. Additionally, objective measures of bone healing, such as advanced imaging or biomarkers, could provide more precise assessments of the effects of early weight-bearing on fracture consolidation. These studies would ultimately contribute to refining early weight-bearing protocols, potentially establishing individualized rehabilitation strategies that maximize healing while minimizing downtime.

CONCLUSIONS

In conclusion, the study's findings suggest that early weight-bearing provides meaningful benefits by reducing healing time and enabling a quicker return to activity, without increasing complication risks. This is particularly valuable given the biomechanical role of the fifth metatarsal in foot stability, weight distribution, and propulsion.

Early weight-bearing may enhance recovery by promoting bone remodeling and maintaining soft tissue strength around the fracture, ultimately supporting a safe and efficient return to full functionality for patients, especially athletes and those with high physical demands.

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