

Systematic Review

Effectiveness and outcome of early weight bearing in ankle fracture. A systemic review

Abstract:

Introduction: Ankle fractures are claimed to affect 70-185 patients out of 100,000 people each year. There is currently no unanimity among surgeons throughout the world on early versus restricted weight bearing in surgically treated trauma patients with fractures. The aim of this study was to systematically review the effectiveness and outcome of early weight bearing in ankle fracture as well as quality of life and pain. **Methods:** An electronic search was conducted of the databases EMBASE, PubMed, and The Cochrane Library, as well as Medline, Google Scholar to identify all articles related to the topic that have been published after 2006.

Results: Initially, 2434 records were identified. Due to similarity and duplication, 1308 records were eliminated, and 1126 records were kept. Following the screening of the records and their subjects, 921 further unconnected records were eliminated. Then, 205 qualified full-text articles were selected, and 10 articles were included in qualitative analysis. **Conclusion:** According to the findings of this study, surgical therapy, both aggressive and minimal, appears to be a safe alternative for the elderly. Short-term advantages of early weight-bearing include a decreased incidence of thromboembolic disease. Active movement reduces joint stiffness while maintaining muscle mass. Post-operative mobility, quality of life, and post-operative early weight bearing status are considered as significant outcome indicators. Unsafe weight as tolerated after ankle surgery might be a safe and encouraging option. As a result, future research should include this possibilities.

Key words: Ankle Fracture, Weight bearing, Ankle surgery, Internal fixation

Introduction:

Ankle fractures are the most prevalent type of lower extremity fracture in the globe.¹ Ankle fractures are claimed to affect 70-185 patients out of 100,000 people each year.^{2,3} The prevalence was found to be 57 out of 100,000 persons in 1970, and it is anticipated to rise to almost 270 out of 100,000 by 2030. Women have a higher incidence (0.3 % per year) than men, and the incidence increases with age (0.1 % per annum).^{2- 4} Ankle fractures most commonly found under age of 50 in older women and young men, nonetheless, ankle fractures in men are the most common.⁵ Because of anatomical shape and often injured during daily activities ankle joint considered as the most unstable parts of the body. Most ankle fractures occur second to low, but regardless of the nature of the injury, fracture features often require the need for functional stability.⁶

When body rotates with the injured foot Multiple ankle fractures or minor injuries may occurred , whether during sports or daily walking. Stable ankle fractures can usually be treated without surgery, whereas fractures are frequently treated with limited surgery and correction, if the indications are well-defined and previously published.

An ankle fracture is distinct in that it can result in insufficient mobility when using casts or other types of external splints. Patients were traditionally not allowed to bear weight until the fracture showed signs of healing by developing callus. ⁷ Whether there is callus or not, most surgeons will allow you to carry a monitored weight after six weeks. Several studies have looked at a wide range of post-operative management strategies, including full weight bearing, partial weight bearing, and paralysis. ⁷ The findings of these studies were inadequate to provide any benefit in the short term. However, some studies found no significant differences in consequences after one year. ⁷⁻⁸

The forced use of walking aids, increasing dependency, and/or prolonged hospital admissions are all consequences of this weight-bearing restriction on patients and health services. ^{9,10} Patients also report significant time away from work, with the resulting personal and societal costs. ⁹⁻¹² Most patients would prefer to be free of weight limitations if there was a little possibility of damage. There have been a number of systematic reviews published on various parts of postoperative care medicine. ¹³⁻¹⁶ However, because there are different regimens for ankle protection, ankle mobility, and weight bearing, none of these examinations can provide exact advice on post-operative care for ankle fractures.

There is currently no unanimity among surgeons throughout the world on early versus restricted weight bearing in surgically treated trauma patients with fractures. The aim of this study was to **systematically** review the effectiveness and outcome of early weight bearing in ankle fracture as well as quality of life and pain.

Methods

Literature search:

A systematic review of scientific literature concerning effectiveness and outcome of early weight bearing in ankle fracture was done in the manuscript. This systematic review was conducted following the PRISMA guidelines¹⁷ was used to develop inclusion criteria and search terms per intervention. All types of ankle fracture and early weight bearing were involved in this search strategy. Outcome was based on the effectiveness and outcome of early weight bearing.

As a consequence, four major medical databases were analyzed, including The EMBASE, PubMed, and The Cochrane Library, Medline, Google Scholar databases, and some more relevant journals, and eligible records were selected with high precision. The title, abstract, and MeSH terms were searched for all combinations of words for adnexa. Initially, 2434 records were identified. Due to similarity and duplication, 1308 records were deleted, leaving 1126 records. Following an examination of the records and their themes, 921 further unrelated records were eliminated. Then, 205 qualified full-text articles published between 2006 and 2021 were selected (Figure 1). Finally, among the 205 qualified full-text articles selected, 10 articles including 3 retrospective case series, 2 prospective cohort study, 1 retrospective cohort study, 1 retrospective observational studies, 1 case series, 1 observational study and 1 case reports were included in this review. The outcome and effectiveness of

early weight bearing ankle fracture was the frontline discussion part of this study and less or more daily activity in contest to being active and living on your own.

Eligibility criteria

Inclusion criteria: Article published after 2006 were included and the Patients must have one of the following fractures: Lateral malleolus fracture, Medial malleolus fracture, Bimalleolar ankle fracture, Bimalleolar equivalent fracture, Trimalleolar fracture, Posterior malleolus fracture, Maisonneuve fracture, Distal tibia fracture, Distal fibula fracture.

Study selection

Two different independent reviewers were completed the study selection in two steps. In first step the inclusion criteria were screened. In second step both reviewers assessed the full text of the studies.

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Prisma flow chart

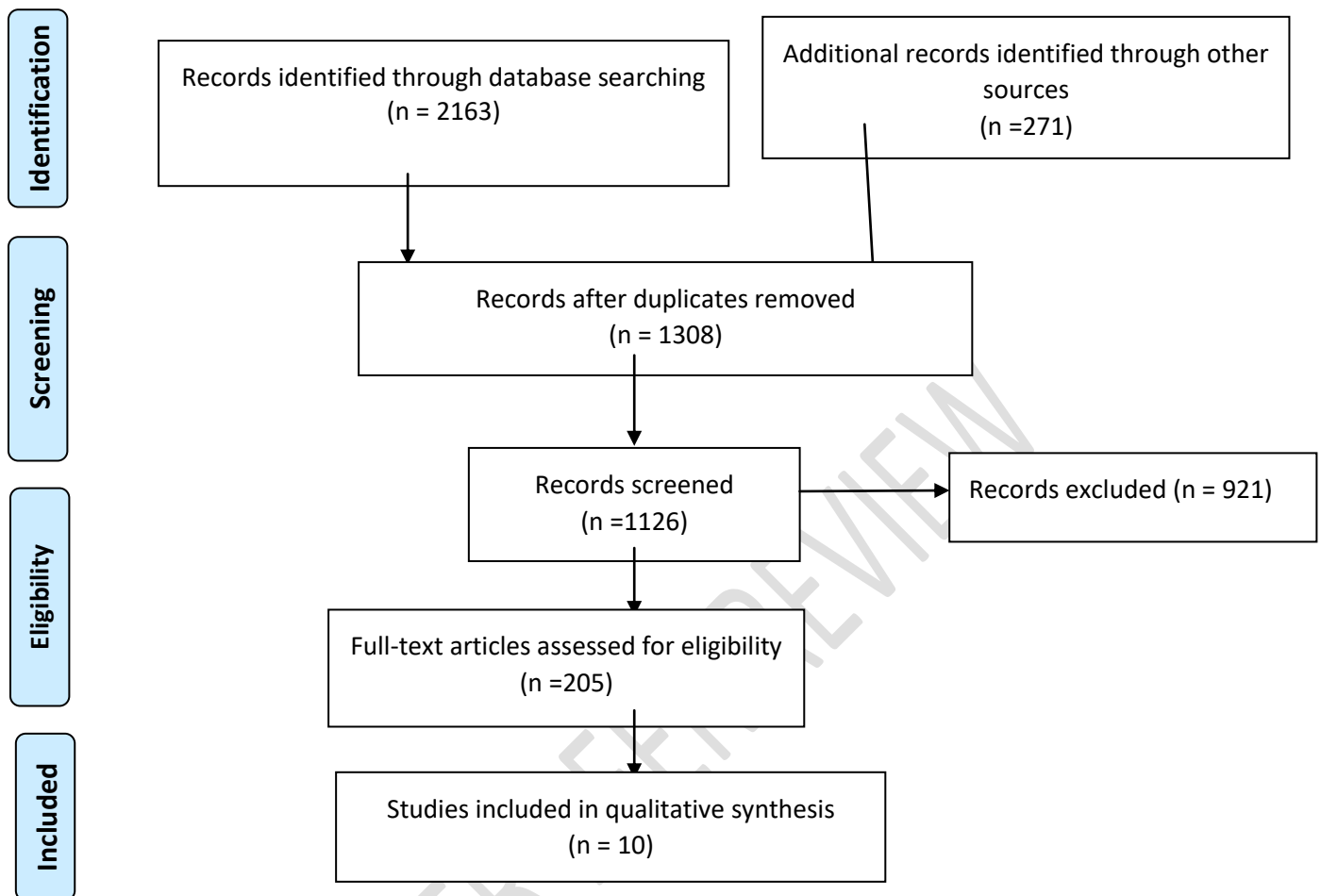


Figure 1. The selection mechanism schedule of records relevant to the present study in accordance with the PRISMA technique

Quality assessment of data

PEDro ratings from all analyzed trials were completely consistent. Given that no cutoff value for this scale is known, the following criteria were employed to define methodological quality: A PEDro score of 7 or higher ($n = 2$) indicates good methodological quality; scores between 5 and 7 ($n = 3$) indicate moderate methodological quality; and scores less than 5 ($n = 0$) indicate low methodological quality.

Statistical analysis

If enough trials were found and they were clinically homogenous, a meta-analysis was undertaken. After considering the I^2 and χ^2 tests, statistical heterogeneity was identified. The fixed-effect model was adopted when studies were statistically homogenous. If studies were statistically dissimilar, The methodological quality of qualifying research was assessed. The PEDro scale¹⁷ was used, with a focus on our items: random allocation, hidden allocation, and assessor blinding. The random effects model was used or results were not pooled

whatever seemed more suited. For statistical analysis, the Cochrane Review Manager program was employed.

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Results

Literature selection

Initially, 2434 records were identified. Due to similarity and duplication, 1308 records were eliminated and 1126 records were kept. Following the screening of the records and their subjects, 921 further unconnected records were eliminated. Then, 205 qualified full-text articles were selected (Figure 1). Among the 205 qualified full-text articles selected, 10 articles including 3 retrospective case series, 2 prospective cohort study, 1 retrospective cohort study, 1 retrospective observational studies, 1 case series, 1 observational study and 1 case reports were included in this review.

The selected study characteristic were studied and compared in table 1. Types of fracture and treatments were discussed in the same table 1.

UNDER PEER REVIEW

Effect of weight-bearing

The impact of weight-bearing on postoperative recovery has been studied in many studies comparing early versus late weight-bearing.^{12,26-31} Wetzler et al. did not give appropriate data for analysis, but Honigmann et al. and Laarhoven van et al. found median scores after 6 weeks were 42 and 42.5 ($p = 0.46$) and after 10 weeks 69 and 72 ($p = 0.55$) in the OG and CG, respectively. As a result, these three researches were ruled out of the study.²⁹⁻³¹ The Olerud Molander score in the short term cannot be possible. Despite the fact that the long-term Olerud Molander score was published in four different studies, only Simanski et al. reported the SD values, making long-term score analysis impossible.¹¹ Therefore, only 2 of the 3 studies were analysable. There was no statistically significant difference in the occurrence of complications (RR 0.69; 95%CI 0.28 to 1.73)

Outcomes

Trauma, comorbidities, complications, mortality, wound healing, post-operative post-traumatic stress disorder, and fracture segregation are all effect factors seen in different studies. The OMAS score will be compared between treatment groups as variables based on the regression model of the mixed outline model for primary analysis and correction of stratification and baseline (preinjury) OMAS scores. A random impact will be added to follow any variance in response due to the hiring center. Consistent impacts will be included to accommodate participant age and gender. The treatment difference will be based on a modified approach and 95% confidence intervals. Severe functional recovery is predicting age, female gender, obesity, diabetes, syndesmotic injury, major ASA segmentation, trimalleolar fractures, the presence of open fractures or fracture fractures, type C fracture, and inability to walk for a long time.

Discussion:

The major goal of surgical therapy for ankle fractures is to establish stable correction through open reduction and internal correction, allowing for painless and effective ankle movements as well as a return to work and normal activities.^{32,33} The initial weight after surgical treatment for an ankle fracture can be measured in a variety of methods.^{11,32,33}

Two separate system reviews were obtained, which support initial weight bearing after ankle fracture correction compared with late or non-weight bearing six weeks after surgery. These revisions did not find significant adverse effects on the first weighted groups, while they did return to previous activities and return to previous work.^{34,35} Furthermore, Assal et al. demonstrated that bearing the initial weight in older patients (over 70) with Weber B ankle fractures was a safe and satisfactory form of postoperative treatment with better adjustment.³⁶

There have been few studies on weight gain following surgery, although it has been demonstrated that overweight patients return to work before underweight ones and external talar rotation.³⁶ As a result, early weight bearing after active ankle stabilization should be promoted.

Studies on weight gain after surgery are scarce, but it has been shown that overweight patients return to work before underweight patients.^{11,35} According to biomechanical research, axial loading stabilizes the ankle joint and inhibits both translational and external talar movement.³⁶ As a result, early weight bearing after ankle stabilization surgery should be recommended.^{13,35, 37}

Wound complications are the most commonly seen complications, with deep infection having the most destructive implications (Soohoo et al. 2009, Schepers et al. 2013).^{38, 39} As a result, the current investigation emphasized on deep SSI following ankle fracture procedures. Study I discovered significant patient- and surgery-related risk factors for deep SSI, while Study IV looked at the outcome of patients who had a deep infection with hardware exposure and were treated with flap reconstruction. In Study II, the major factors that predispose to treatment failure after a deep infection were found. In contrast to the other studies, Study III did not focus on postoperative infection. Rather, the study's purpose was to identify the most common surgical errors that lead to early reoperation after ankle fracture repair. The most serious consequence of ankle fracture surgery is deep infection. Although reconstructive treatments can successfully correct soft-tissue defects with exposed hardware, treatment failure is common. We depend mostly on preventative measures in the absence of a cure for postoperative infections. As a result, identifying risk factors is critical for designing measures to avoid potentially devastating repercussions.

Previous research revealed that full load weight-bearing should be given six weeks to three months following surgery to avoid problems or implant failure.⁴⁰⁻⁴⁶ Early weight-bearing with ankle fractures enhanced short-term results and allowed for a rapid resume normal work and activities, according to recent studies.⁴⁶⁻⁴⁸ With 115 patients, Smeeing et al.⁴⁵ conducted a multicenter randomized control experiment. The group that practiced unprotected weight-bearing had much better short-term functional effects. Dehghan et al.⁴⁴ observed that early weight bearing increased ankle range of motion, Olerud/Molander ankle function scores, and the 36-item short-form health survey scores in 110 patients in another randomized control trial. In the case of calcaneal fractures, it is widely accepted that three months of nonweight-bearing has been the conventional standard of care after open reduction internal fixation. Both Hyer et al. and Kayali et al. conducted retrospective studies of early weight bearing after open reduction and internal fixation of calcaneal fractures with locking plate fixation, and their findings were significant for no negative effects of early weight bearing.^{47,48} Park et al. evaluated 86 patients with acute fifth metatarsal base fractures, categorizing them as conservatively treated or operatively treated, and then further categorizing them as early weight-bearing or late weight-bearing. They looked at bone resorption, clinical union, and AOFAS and VAS scores, and found no changes in AOFAS or VAS ratings, fewer incidences of bone resorption, and earlier bony unions in the early weight-bearing groups. Their conclusion was early weight-bearing may help this population, regardless of surgical or conservative treatment.⁴⁹

Taking into consideration the life expectancy of this age group, we believe that quality of life is an essential outcome component in addition to the regularly utilized characteristics. Despite this rise in life expectancy, this age group still has a restricted life duration. As a result, in this figure, the functional effect may be more clinically relevant than the radiological / anatomical effect. However, there have been few studies that employ quality of

life as a consequence of the outcome. The current thesis' findings can be used to fine-tune treatment algorithms in individuals undergoing surgical therapy for ankle fractures.

Conclusion:

One of the most prevalent types of lower leg fractures is an ankle fracture. Complications from surgery include wound infections, pulmonary edema, implant or repair failure, death, amputation, and reconstruction. The OMAS score was compared between treatment groups and was found to be a reliable and valid tool with values similar to those reported for the original and other translated versions. Postoperative care may also include the application of cast plaster. This was not achievable, however, due to a paucity of literature for this demographic. Based on the available evidence, we may conclude that surgical therapy for the elderly, both aggressive and minimal, appears to be a safe option. The authors argue that post-operative mobility, quality of life, and post-operative weight bearing status should all be used as significant outcome measures in this society. Unsafe weight gained after ankle surgery could be a safe and promising option. As a result, this possibility should be investigated more in the future.

Conflicts of interest: Author declare that there is no conflict of interest.

Authors' contributions: Conceptualization, methodology, formal analysis resources, data curation, writing—original draft preparation, writing—review and editing, and visualization were contributed by Abdulmalik B Albaker.

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Table 1 : Characteristics of included studies

Reference	Type of study	Total patients	Type of Fracture	Treatments	Follow up time	
Smith T et al ¹⁵	A systemic review	366	Bimalleolar fractures, Trimalleolar Fractures, Fracture dislocation of the ankle	open reduction and internal fixation	Average of 6-8 months	The evidence revealed that encouraging early or delayed weight bearing following open reduction and internal fixation of ankle fractures made no impact.
Shivarathre et al. ¹⁸	Single-center retrospective case series	92	Danis-Weber: Type B (77) Type C (14) Isolated lateral malleolus (4) Isolated medial malleolus (1) Bimalleolar (70) Trimalleolar (16)	Lateral malleolus 1/3 Tubular plates (83) DCP (4) Locking plates (4) Medial malleolus Two screws (45) One screw (5) Tension band wiring (25) Posterior malleolus Anterior-posterior screw fixation (4)	Average of 15 months	In most cases, operational stabilization of unstable ankle fractures resulted in satisfactory functional recovery and return to pre-injury mobility level.
Lorente et al. ¹⁹	A multicenter prospective cohort study	70	Bimalleolar non-displaced fractures	Closed cast: Immobilized patients (control group)(37) Weight-bearing activities (experimental group)(33)	2 years	In older individuals with Weber type B fractures, early weight-bearing improves quality of life and functionality without increasing morbidity.
Meijer et al. ²⁰	Single-center retrospective cohort study	15	Transarticular Steinmann pin/External fixation Weber type B (8/3) Weber type C (1/3) Bimalleolar/Tri- (4/5)	Steinmann pin (9), External fixation (6)	No specific information about the follow-up time	In older patients, transarticular Steinmann pin fixation and external fixation had few problems but, as expected, poor fracture reduction and functional outcomes.

O'Daly et al. ²¹	Single-center retrospective case series	9	Bimalleolar fractures (5) Trimalleolar fracture (3) Fracture dislocation of the ankle (1)	Gallagher nail fixation	Mean of 34 months	In the therapy of unstable osteoporotic ankle fractures in the elderly, Gallagher nail percutaneous trans-calcaneal stabilization provides a technique of sole final fixation.
Schray et al. ²²	Single-center retrospective observational cohort study	58	Most frequent fracture type (AO type) 44 B (72%)	External fixation converted to ORIF External fixation as final treatment Open reduction and internal fixation	Mean of 16 +/- 8.5 months	Ankle fractures in the elderly treated surgically in a recognized geriatric fracture center appear to have little impact on their quality of life.
J.M. Muthuuri et al. ⁷	A prospective, randomized and non-blinded, outcome study	70	Supination-External Rotation (SER) injuries (63%), Pronation-Abduction (PA) injuries (18%), Supination-Adduction (SA) fractures (11%), Pronation-External Rotation (PER) (8%)	Lateral malleolus was fixed with a well contoured 6-8 hole 35mm DCP and the medial malleolus with two lag screws (35-45 mm malleolar screws). Weight-bearing activities,	Mean of 6 month	After surgical stabilization of ankle fractures, early weight-bearing in a below-knee total contact cast is permitted as long as the exclusion criteria are met.
Nilsson et al. ²³	case-series a descriptive study	65	Low-energy trauma 44 (88%) were bi- or trimalleolar, post-operative reduction 23 (46%).	Internal fixation, percutaneous fixation, surgical treatment of the fracture	6-12 months	The majority of individuals with surgically repaired ankle fractures still have symptoms and functional impairments one year later.
Gul Arif et al. ²⁴	Single-center observational study	25	Rigidly internally fixed fractured ankles, Weber A/B/C fractures	Surgical treatments of Weber A/B/C fractures	Mean : 91.3 +/- 20.2 vs. 54.6 +/- 15.5 days)	Patients in the non-cast group tolerated full weight-bearing sooner than those in the cast group, and there were no negative effects on hospital stay, pain

						intensity, or functional ratings.
Armstrong et al. ²⁵	Single center retrospective case series	20	Gustilo–Anderson grade 3B open ankle fracture	Tibiototalcaneal nail fixation, T2 ankle arthrodesis nail (10/1) Versanail (9/5), Titanium cannulated hindfoot arthrodesis nail (2/1)	The duration of follow up is short-term.	In unstable open ankle fractures in frail patients, tibiototalcaneal nail fixation with soft tissue coverage allows for an early return to ambulation with a low complication and re-operation rate.

UNDER PEER REVIEW