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Early vs. Late Weight Bearing After Surgical Fixation of Ankle Fractures: A Systematic Review and Meta-Analysis

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Abstract

Introduction: Multiple studies have demonstrated the safety of early protected-weight bearing after surgical fixation of ankle fractures. However, some surgeons are hesitant to allow early-weight bearing, due to fear of potential complications. The purpose of this study was to systematically review comparative studies comparing early post-operative weight bearing (EWB) and late weight bearing (LWB) on functional outcome and complications in adult patients undergoing surgical fixation of ankle fractures.
Methods: A systematic review of the literature was performed to identify randomized clinical trials or matched cohort studies comparing outcomes of EWB (within 2 weeks post-operatively) and LWB (4-6 weeks post-operatively). The primary outcome was ankle functional outcome as measured by the Olerud Molander Ankle score (OMA). Secondary outcomes included time off work, and complications such as nonunion, malunion, wound complications, and re-operations.
Results: Twelve studies and 798 patients were included at final analysis. The pooled results demonstrated that compared to LWB, EWB results in a near 10-point improvement in OMA scores at 6 weeks post-operatively ($p<0.00001$), and return to work 15 days sooner ($p=0.02$). There was no difference with respect to nonunion, malunion or wound complications between the two groups.
Conclusion: This meta-analysis suggests improved early functional outcomes in patients treated with EWB compared to LWB, as well as less time off work. The results show no difference in rates of nonunion, malunion, or wound complications between the two groups. Given the improved outcomes and lack of increased risk, early post-operative weight bearing after surgical fixation of ankle fracture is recommended.
Level of Evidence: Level I

Keywords: Ankle Fracture; Late Weight Bearing; Early Weight Bearing; Risk of Bias

Abbreviations: EWB: Early Weight Bearing; LWB: Late Weight Bearing; OMA: Olerud Molander Ankle score; MD: Mean Differences; CI: Confidence Intervals; OR: Odds Ratio, RCT: Randomized Controlled Trial; ROM: Range of Motion; M: Male; W: Weeks; F: Female; M: months.

Introduction

Ankle fractures are common injuries, and the third leading fracture in North America [1]. The post-operative protocols with regards to time to weight bearing and range of motion after surgical fixation of ankle fractures are diverse, with no agreed upon consensus. Historically, patients have been treated by a delayed weight bearing protocol, which entails non-weight bearing for about six weeks post-operatively, while wearing a cast or brace/split. Early weight bearing protocols allow patients to start weight bearing within two weeks post-operatively, with use of cast or functional bracing.

Safe, early weight bearing has the potential to accelerate rehabilitation, improve functional outcome, decrease time away from work, and thus significantly decrease the cost of this common injury to the healthcare system and society. However, a potential risk of early weight bearing remains an increased risk of fracture displacement, fixation failure, and wound complications [2,3]. Studies comparing early and delayed postoperative weight bearing have advocated for early weight bearing Ahl T, et al. [2], Honigmann P, et al. [4], Laarhoven CJV, et al. [5], Ahl T, et al. [6], Finsen V, et al. [7], and have reported improvement in early functional outcome Ahl T, et al.[2], Honigmann P, et al. [4], Ahl T, et al. [6], with no loss of fixation in the early weight bearing patients [2,5-7]. However, some surgeons are still hesitant to allow early mobilization for fear of potential complications.

There have been multiple randomized and non-randomized comparative studies on this topic, comparing early and delayed rehabilitation protocols [2-4,6-10]. Previous systematic reviews have shown mixed results with regards to outcomes of patients treated with early or late weight bearing rehabilitation protocols [11,12]. These reviews had methodological issues, such as inclusion of poor-quality studies (retrospective case series) with higher quality randomized controlled trials. In the recent decade there have been an increasing number of studies investigating early weight bearing rehabilitation protocols. Therefore, there is a need for an updated meta-analysis of the literature, to compare outcomes of patients treated with early and late weight bearing protocols, after surgical fixation of ankle fractures.

The purpose of this study is to systematically review and compare outcomes of early (within two weeks) and delayed (4-6 weeks) post-optative weight bearing protocols in adult patients undergoing surgical fixation of ankle fractures. The primary outcome is early ankle functional outcome scores; by use of the Olerud and Molander Ankle score (OMA) Olerud C, et al. [13] at six weeks post-operatively. Secondary outcomes include OMA scores at one year, days off work, and complications such as nonunion, malunion, wound complications, and repeat operations.

Methods

Data Sources

A literature search was performed using Medline, PubMed, and Cochrane library. The search was employed from January 1980-May 2020, restricted English manuscripts. The help of a professional librarian was employed for electronic search conducted. The reference lists of included studies, as well as reference lists of relevant systematic reviews on this topic were also examined. Moreover, published abstracts of prominent orthopaedic meetings from the past 10 years were also assessed, including the American Academy of Orthopaedic Surgeons, Orthopaedic Trauma Association, as well as Foot and Ankle Orthopaedic Society.

To screen search results, first the titles of the studies were assessed, and if deemed potentially eligible, the abstract and then the full-text article were obtained. Two authors independently screened the search results for study eligibility and differences were resolved by discussion. A check for potential duplicate publications was performed. Authors of manuscripts were contacted if further information was required.

Study Selection

Studies were assessed for eligibility based on criteria regarding type of study, participants in the study, interventions and reported outcomes.

Types of Studies: Randomized controlled trials, as well as non-randomized prospective cohort studies with a control group were included. Studies lacking a control group, retrospective case series, case reports, and letter to the editor were excluded. Studies published prior to 1980, non-English language, or studies with less than 6 weeks follow-up post-operatively were also excluded.

Types of Participants: Studies focusing on adult participants of either sex, who had undergone acute surgical fixation of ankle fractures (within 2 weeks of injury) were included. Allocation to rehabilitation treatment must have been within two weeks after surgical fixation of the ankle fracture. Participants could have had either early weight bearing (within two weeks postoperatively), or delayed weight bearing (4-6 weeks post operatively) treatment. Exclusion criteria were: studies focusing on established complications of ankle fractures, or surgical complications (e.g. non-union, malunion, osteomyelitis); and studies focusing on tibial pilot fractures, poly-trauma participants, pathological fractures, or paediatric population.

Types of interventions: Studies were included if they compared early weight bearing rehabilitation (within two weeks post operatively) to delayed weight bearing (4-6 weeks post-operatively). Interventions were grouped under two categories:

- Early weight-bearing group (EWB)
- Late weight-bearing group (LWB)

Types of Outcome Measures: To be considered for review, studies must have included at least one of the following outcomes: Olerud Molander Ankle scores; time off work; rates of nonunion, malunion, wound complications, and secondary operations.

Data Extraction

Data Collection Process: Two independent review authors performed data extraction (ND MD), by use of a pre-established form specific to this review. Information collected included details regarding patient demographics, surgical technique, post-operative rehabilitation protocol, number of patients per group, number of patients lost to follow-up, length of follow-up, as well as all relevant information for the primary (OMA score) and secondary outcomes (non-union, malunion, revision surgery, time off work). The OMA score was assessed at short term (6 weeks post-operatively) as well as long term (beyond 6 months post-operatively).

Risk of Bias in Individual Studies: Two independent review authors assessed the risk of bias for each study (ND, MD). The "Risk of Bias" tool for randomized controlled trials provided by The Cochrane Collaboration Higgins JPT, et al. [14] was utilized. Studies were assessed for selection bias (randomization), performance bias (systematic differences between groups in care other than the intervention of interest), attrition bias (differences in withdrawal between groups), detection bias (differences in how outcome is assessed), and reporting bias (selective outcome reporting). For prospective cohort studies the New Castle Ottawa Quality Assessment Scale was used Wells GA, et al. [15] to assess the risk of bias in patient selection, comparability and outcomes.

Data Synthesis

For continuous variables (OMA score, days off work) mean differences (MD) and 95% confidence intervals (CI) were calculated. For dichotomous variables (nonunion, malunion, wound complications, re-operations), Odds Ratio (OR) and 95% CI were calculated. For studies with missing standard deviations, the advice of the Cochrane Handbook on methods of data extraction was used [14], and imputation techniques involving making assumptions about unknown statistics was avoided wherever possible. If loss to follow-up was not reported, it was assumed that there was none. If a study had more than one group assigned to EWB or LWB, the data from the comparable groups were combined to create a single pair-wise comparison.

A random effects model was utilized to ensure selected studies represent a random sample of all potentially available studies. In the pooled analysis, studies were weighted by the inverse of the sum of variance and heterogeneity for the reported outcome. Statistical heterogeneity was assessed by consideration of the I^2 and Chi^2 tests, as well as with visual inspection of the forest plots. Regarding Chi^2 $p<0.10$ was considered significant, while for I^2 25% was considered low heterogeneity, 50% moderate, and >75% as high heterogeneity. The Review Manager (RevMan) software program version 5.4 (The Nordic Cochrane Centre, Copenhagen, Denmark) was used for graphical representation of the pooled data. For dichotomous outcomes with zero events in either group, the Open Meta Analyst software was used for analysis of pooled data, as it makes adjustments by adding 0.5 events to the zero event outcomes.

Subgroup Analysis and Investigation of Heterogeneity: The type of surgical technique utilized for fixation of ankle fracture may have an effect on the outcome of malunion. The Cedell technique has been used in the past, with use of pins and cerclage wires; however, the modern method of fixation is the AO technique, by utilizing plates and screws to obtain stable anatomic fixation. The AO technique is thought to decrease the risk of fracture malunion. A subgroup analysis was performed to assess the rates of malunion based on the two techniques of fixation: Cedell and AO technique.

The manuscript was completed by use of PRISMA guidelines [16] on reporting of systematic reviews and meta-analysis.

Results

Study Selection

The database search identified 57 possible studies, and review of study references provided another 7 studies for a total of 64 studies for assessment. Review of study titles led to exclusion of 31 studies, and the remaining 33 studies were included for abstract review. After abstract review 12 studies were excluded, and 20 were included for full manuscript review. Of the 20 manuscripts reviewed 9 were excluded: one study did not report of any of the relevant outcomes Finsen V, et al. [17], one study had no comparison group Harager K, et al. [18], and 7 other studies had two groups comparing different range of motion practices but with similar weight bearing protocols [19-25]. In the end 12 studies were included for analysis [2-10,26-28]. Flow diagram of the study selection process is represented in Figure 1.

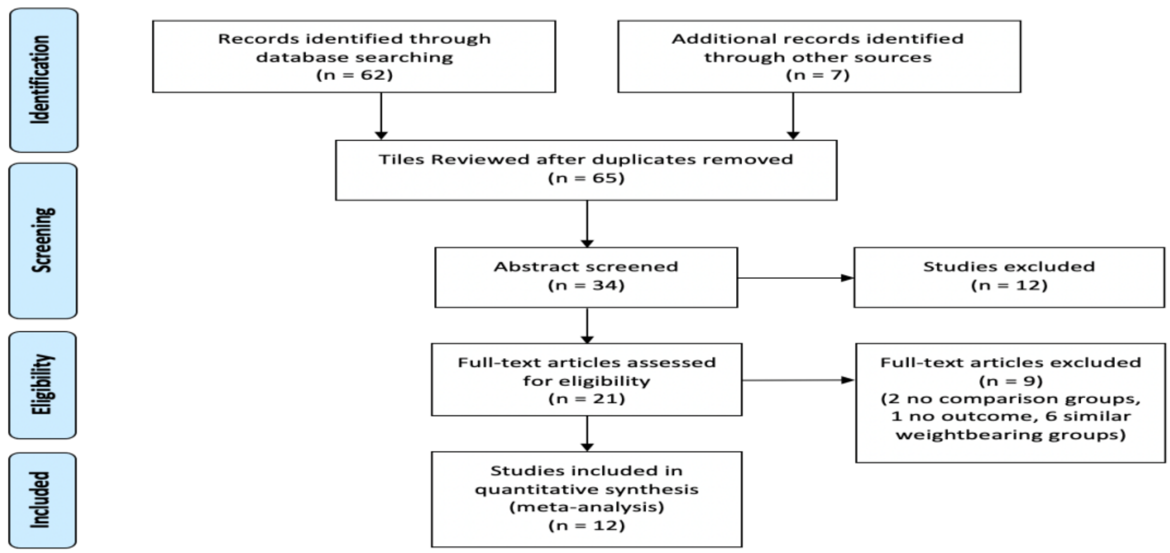


Figure 1: Flow chart describing the process of study selection and exclusion.

Study Characteristics

Of the 12 included studies, 9 were randomized controlled trials Ahl T, et al.[2], Ahl T, et al. [3], Honigmann P, et al. [4], Ahl T, et al. [6], Finsen V, et al. [7], Ahl T, et al. [8], Dehghan N, et al. [26], Schubert J, et al. [27], Smeeing DPJ, et al. [28], one quasi randomized trial Laarhoven CJV, et al. [5], one a prospective cohort study with retrospective matches cases Simanski CJ, et al. [10], and one a retrospective matched cohort study [9]. Studies were conducted at various countries, the majority were conducted in Europe (Netherlands Laarhoven CJV, et al. [5], Ahl T, et al. [6], Finsen V, et al. [7], Ahl T, et al. [8], Gul A, et al. [9], Simanski CJ, et al. [10], Black JDJ, et al. [11], Smith TO, et al. [12], Olerud C, et al. [13], Higgins JPT, et al. [14], Wells GA, et al. [15], Moher D, et al. [16], Finsen V, et al. [17], Harager K, et al. [18], Tropp H, et al. [19], Hedstrom M, et al. [20], Cimino W, et al. [21], Lehtonen H, et al. [22], Sondenaa K, et al. [23], Vioreanu M, et al. [24], Egol KA, et al. [25], Dehghan N, et al. [26], Schubert J, et al. [27], Smeeing DPJ, et al. [28], Switzerland [4], Sweden Ahl T, et al.[2], Ahl T, et al. [3], Ahl T, et al. [6], Ahl T, et al. [8], Norway Finsen V, et al. [7], United Kingdom Gul A, et al. [9], Germany Simanski CJ, et al. [10]), with only one study from North America [26].

Study	Country	Design	n	Patient Demographics	Surgical technique	Weight Bearing Protocol	Early ROM Restrictions	F/U (months)	OMA Score	Return to Work (days)	Non-union	Mal-union	Wound Complications	Re-Operations
Ahl T, et al. [2]	Sweden	RCT	Total: 53 EWB 25 LWB 28	Mean age: 57 M: 16 F: 37	Cedell technique	EWB: WB at day 1 LWB: WB at 4 weeks	All no ROM	6 m	18 m: EWB: 54 LWB: 47	-	0	EWB:1 LWB:0	EWB:6 LWB:2	0
Ahl T, et al. [3]	Sweden	RCT	Total: 51 EWB 26 LWB 25	Mean age: 43 M: 25 F: 26	Cedell technique	EWB: WB at 1 week LWB: WB at 4 weeks	All with ROM at week 1	6 m	-	-	0	EWB:3 LWB:4	-	0

Finsen V, et al. [7]	Norway	RCT	Total: 56 EWB 19 LWB 37	Mean age: 42 M: 21 F: 35	AO technique	EWB: WB at day 1 LWB: WB at 6 weeks	2 groups with NWB 1 with EWB	24 m	-	-	-	EWB:1 LWB:2	-	-
Ahl T, et al. [8]	Sweden	RCT	Total: 99 EWB 49 LWB 50	Mean age: 50 M: 38 F: 61	Cedell technique	EWB: WB at day 1 LWB: WB at 4-5 weeks	All no ROM	18 m	-	-	0	EWB: 1 LWB: 2	-	-
Ahl T, et al. [6]	Sweden	RCT	Total: 40 EWB 21 LWB 19	Mean age: 55 M: 7 F: 33	Cedell technique	EWB: WB at LWB: WB at	All ROM at 1 week	18 m	18m: EWB: 90 LWB: 83	-	0	EWB:1 LWB:0	-	0
van Laarhoven CJ, et al. [5]	Netherlands	Quasi RCT	Total: 81 EWB: 41 LWB: 40	Mean age: 36 M: 45 F: 36	AO technique	EWB: WB at 2-5 days LWB: WB at 6 weeks	EWB no ROM LWB with ROM	12 m	6 w: EWB: 65 ± 28.8 LWB: 50 ± 18.5 12 m: EWB: 95 ± 28.8 LWB: 95 ± 18.5	EWB: 78 ± 68 LWB: 79 ± 103	-	-	EWB: 5 LWB: 3	-
Simanski CJ, et al. [10]	Germany	Prospective Cohort, retrospective control	Total: 46 EWB: 23 LWB: 23	Mean age: 55 M: 18 F: 28	AO technique	EWB: WB at day 1 LWB: WB at 6 weeks	EWB with ROM LWB no ROM	12 m	> 12 m: EWB: 87±14 LWB: 79±19	EWB: 64.4 ± 38.5 LWB: 75.8 ± 49	EWB: 0 LWB: 1	0	EWB: 2 LWB: 3	-
Gul A, et al. [9]	United Kingdom	Retrospective cohort	Total: 50 EWB: 25 LWB: 25	Mean age: 44 M: 33 F: 17	AO technique	EWB: WB at day 1 LWB: WB at 6 weeks	LWB no ROM	12 m	-	EWB: 54.6 ±15.5 LWB: 91.3 ±20.2	EWB: 0 LWB: 1	0	EWB: 3 LWB: 1	EWB: 0 LWB: 1
Honigmann P, et al. [4]	Switzerland	RCT	Total: 47 EWB: 25 LWB: 22	Mean age: 40 M: 25 F: 22	AO technique	EWB: WB at 2 weeks LWB: WB at 6 weeks	EWB With ROM LWB no ROM	10 w	6 w: EWB: 72 ± 17.3 LWB: 70 ± 13	EWB: 37 ± 20.5 LWB: 53 ± 15.3	0	0	-	0

Dehghan N, et al. [26]	Canada	RCT	Total: 110 EWB: 56 LWB: 54	Mean age: 42 M: 58 F: 52	AO technique	EWB: WB at 2 weeks LWB: WB at 6 weeks	EWB With ROM LWB no ROM	12 m	6 w: EWB: 45 ± 21.8 LWB: 32 ± 17.1 12 m: EWB: 89 ± 16.7 LWB: 85 ± 13.9	EWB 51.2 LWB 47.8	0	0	EWB: 3 LWB: 1	EWB: 1 LWB: 10
Schubert J, et al. [27]	Australia	RCT	Total: 50 EWB: 25 LWB: 25	Mean age: 44 M: 29 F: 21	AO technique	EWB: WB at 2 weeks LWB: WB at 6 weeks	Both groups allowed ROM at 2 weeks	26 w	6 w: EWB: 36 ± 19 LWB: 27 ± 13 26 w: EWB: 84 ± 16 LWB: 81 ± 17	-	-	-	EWB: 1 LWB: 0	
Smeeing DPJ, et al. [28]	Netherlands	RCT	Total 115 EWB 78 LWB: 37	Mean age: 39 M: 61 F: 54	AO technique	EWB: 42 WB at 24 hours 36 WB at 10 days, LWB: WB at 6 weeks	EWB 42 immediate ROM, 36 ROM at 6 weeks LWB: immediate ROM	12 m	6 w: EWB: 57 ± 19.6 LWB: 46 ± 22.4 12 m: EWB: 88 ± 15.5 LWB: 89 ± 11.4	EWB 34 ± 28 LWB 49 ± 37	0	-	No difference	-

Table 1: Summary of studies included.

In total 798 patients were included, 413 in the EWB, and 385 in the LWB groups. Sample size of individual studies ranged from 40 Ahl T, et al. [2] to 115 [28]. The mean age of participants ranged from 36 Laarhoven CJV, et al. [5] to 57 Ahl T, et al. [6], and in total there were 376 men and 422 women included. All four studies from Sweden utilized non-AO techniques of fixation, mainly the Cedell technique with use of cerclage wires, staples and pins Ahl T, et al.[2], Ahl T, et al. [3], Ahl T, et al. [6], Ahl T, et al. [8], while studies from other countries utilized AO technique of internal fixation by use of plates and screws [4,5,7,9,10,26-28]. Timing of early weight-bearing varied from 1 day to 2 weeks post-operatively. Patients in the late weight-bearing group started weight bearing after 4-6 weeks post operatively. Details of the included studies are available in Table 1 and Appendix 1 [2-10,26-28].

Risk of Bias within Studies

There was a moderate risk of bias in most of the studies included. The majority of randomized controlled trials did not describe the randomization technique [2,3,5-8]. Many of the earlier studies lacked appropriate outcome reporting, and did not include appropriate information regarding loss to follow-up. Details regarding outcome measurement were also lacking in many studies. Summary of the review authors' judgment regarding risk of bias in each study is available in Figure 2.

Cochrane risk of bias assessment tool for randomized controlled trials

	Ahl et al, 1987	Ahl et al, 1988	Ahl et al, 1989	Finsen et al, 1989	Ahl et al, 1993	van Laarhoven et al, 1996	Honigman et al, 2007	Dehghan et al, 2014	Schubert et al, 2020	Smeeing et al, 2020
Selection bias (Randomization)	+	+	+	+	+	+	+	+	+	+
Performance Bias (Difference in exposure other than intervention of interest)	?	?	?	−	?	−	−	−	+	−
Attrition bias (Incomplete outcome data, difference in withdrawal)	+	−	?	−	?	+	+	+	+	+
Detection bias (Difference in how outcome is determined)	?	?	?	?	?	?	?	+	+	+
Reporting bias (selective outcome reporting)	−	?	−	−	?	−	+	+	+	+
Overall	?	?	?	?	?	?	+	+	+	+

New Castle – Ottawa Quality Assessment Scale for Cohort Studies

Study	Selection	Comparability	Outcome
Simanski et al, 1996	***	**	**
Gul et al, 2007	***	**	*

Figure 2: Assessment of risk of bias in studies included for analysis.

Pooled Results

Olerud Molander Ankle Functional Outcome Score:

- **Short term (6 weeks):** Five studies reported on short term (6 week) functional outcome using the OMA score [4,5,26-28]. In total 390 patients were included in this analysis, 216 in the EWB group and 174 in the LWB group. The results demonstrate a significant improvement of 9.8 points in OMA score in patients treated with EWB compared to LWB (95% CI 5.7-14.0, p<0.00001). This result is not only statistically, but also clinically significant, as the clinically minimally difference in OMA score is 5 points. There was a minimal amount of heterogeneity noted, with I2 value of 6% (Figure 3).
- **Long term (> 6 months):** Seven studies reported on long term data (6-18 months) [2,5,6,10,26-28]. However two of these studies only included the mean, with no information on standard deviation or range of data Ahl T, et al. [2]; Ahl T, et al. [6], therefore, the results of these could not be included in the final meta-analysis. The final pooled analysis comprised of five studies and 388 patients: 215 in the EWB group and 173 in the LWB group. The results demonstrate a minimal improvement in the EWB group (MD 1.9; 95% CI -1.3-5.2; p=0.23), which did not reach clinical or statistical significance (Figure 3).

Days off work: Number of days off work was reported in six studies, with a total of 403 patients [4,5,9,10,26,28]: 224 patients in the EWB and 179 in the LWB group. The pooled results demonstrate fewer days off work for patients in the EWB group compared to LWB group with a mean difference of 15.4 days (95% CI -28.6 to -2.3, p=0.02). There was a high amount of heterogeneity in this outcome, with I^2 value of 73% (Figure 4).

Nonunion: Nine studies reported on nonunion [2-4,6,8-10,26,28]. Nonunion was present in 3/268 (1.1%) patients in the LWB, and 0/314 in the EWB group. The pooled analysis showed no difference between the two groups (p=0.40) (Figure 5).

Malunion: Nine studies reported on malunion [2-4,6,8-10,17,26]. Malunion was present in 6/255 (2.4%) patients in the EWB, and 10/268 (3.7%) in the LWB group. The pooled analysis showed no difference between the two groups (p=0.52) (Figure 5).

Wound complications: There were five studies reporting wound complications [2,5,9,10,26]. There were 19/162 (11.7%) wound complications in the EWB group, and 11/164 (6.7%) in the LWB group. The pooled analysis demonstrated no difference between the two groups (p=0.15) (Figure 5).

Re-Operations: Re-operations were reported in six studies [2-4,6,9,26]. Rate of reoperation was 1/170 (0.6%) in the EWB group and 11/169 (6.5%) in the LWB group. The pooled results demonstrated that compared to LWB, EWB group had lower rate of re-operation, which trended towards significance (OR 0.31, 95% CI 0.08-1.16, p=0.08) (Figure 5).

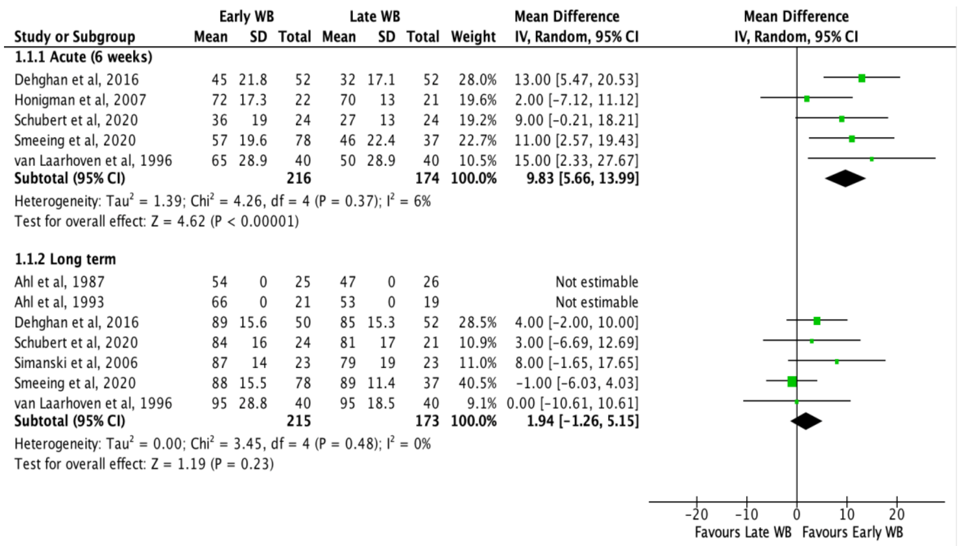


Figure 3: Olerud Molander Ankle (OMA) Score.

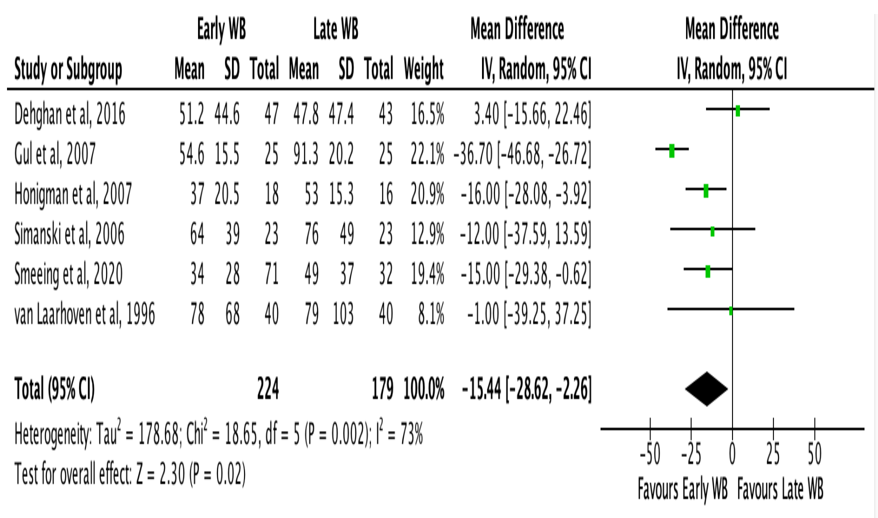
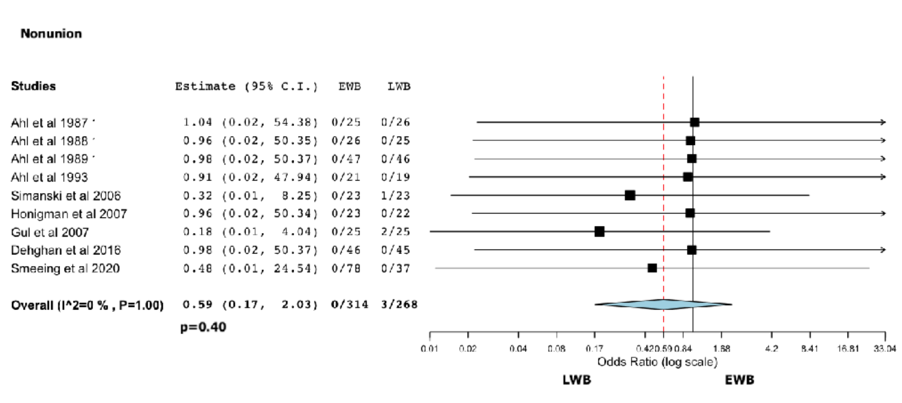


Figure 4: Number of days off work.



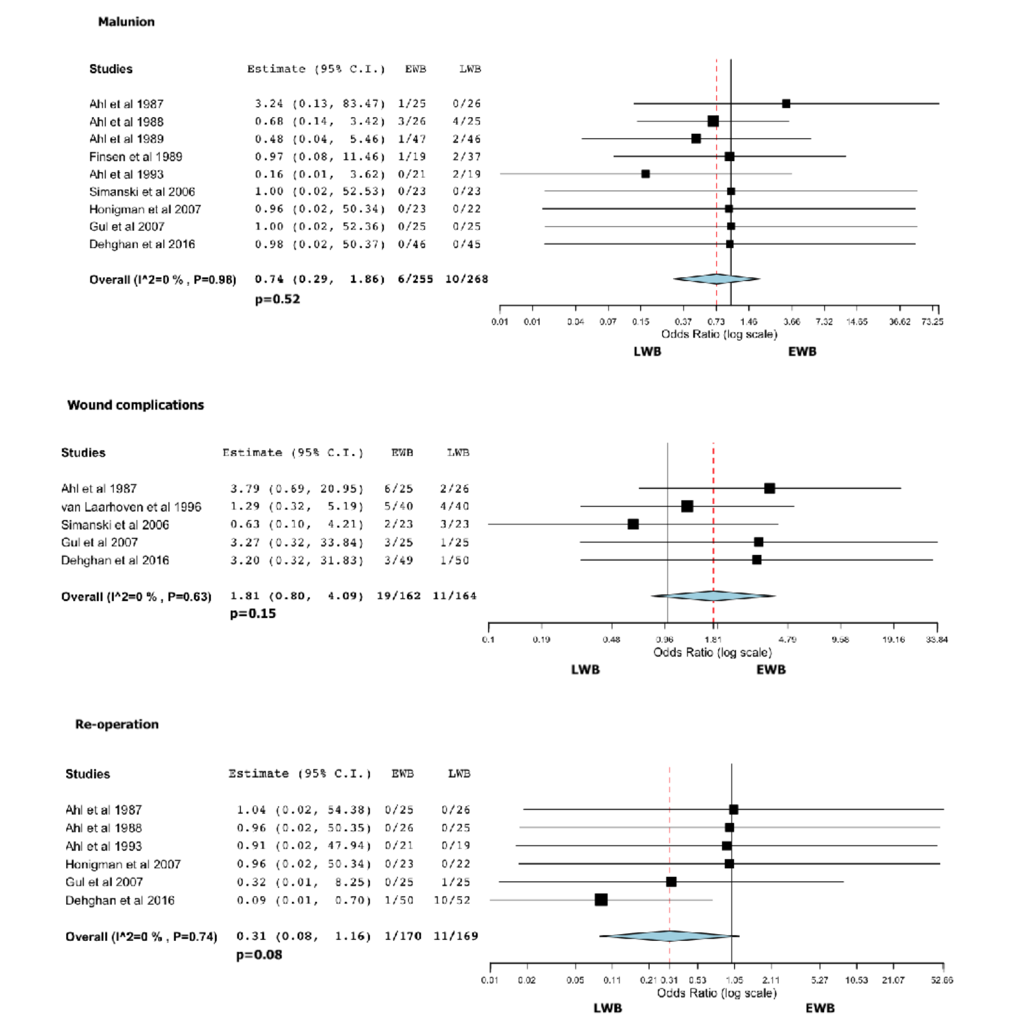


Figure 5: Complications: nonunion, malunion, wound complications, repeat-operations.

Subgroup Analysis

Analysis was performed comparing results of malunion in patients treated with AO and Cedell techniques as separate subgroups. Five studies utilized AO method of fixation [4,7,9,10,26]: rate of malunion was 1/136 in the EWB and 2/152 in the LWB group, with no difference between the two groups (p=0.98). Four studies utilized the Cedell technique Ahl T, et al.[2]; Ahl T, et al. [3]; Ahl T, et al. [6]; Ahl T, et al. [8], with 4.2% (5/119) rate of malunion in EWB and 6.9% (8/116) in LWB, with no difference between the two groups (p=0.43).

Heterogeneity

Clinical heterogeneity was assessed to determine if results of studies could be pooled for a meta-analysis. It was felt that while there were some differences in practice setting and treatment details, overall the study methods and outcomes were homogeneous, and summary measure of treatment effect was reported for all outcomes. Assessment of statistical heterogeneity demonstrated no heterogeneity for dichotomous outcomes (I^2 0%, p >0.10), and minimal statistical heterogeneity for OMA scores. With respect to days of work there was considerable statistical heterogeneity present (I^2 73%, p= 0.002). This is likely due to the very large standard deviations in one study Laarhoven CJV, et al. [5], which created statistical heterogeneity given the small number of studies present for analysis.

Discussion

This meta-analysis reveals improved results early on with an early weight bearing protocol, with a near 10-point improvement in OMA scores at 6 weeks for patients in the EWB group compared to LWB group (95% CI 5.7-14.0, p<0.00001). There was no clinical difference between the two groups long term beyond 6 months. With regards to time off work, patients in the EWB group returned to work earlier, with reduction of 15.4 days compared to LWB group (95% CI -28.6 – -2.3, p=0.02). The study also demonstrated safety of early weight bearing and rehabilitation, as there was no difference with regards to complications such as nonunion, malunion, wound complications or re-operations compared to the LWB group.

The results of this meta-analysis suggest that patients in the EWB protocol and have better function early on, but in the long term, the NWB group "catches up". Some may argue that since the long-term function is the same in both groups, a delayed weight bearing protocol is appropriate due to concerns for increased risk of fixation failure or wound complications. However, this study demonstrates that the risk of complications is similar between the two groups, with no increased risk of wound complications, nonunion or fixation failure. Moreover, the EWB group also has the added benefit of, on average, 15 day earlier return to work. Give the similar complication rates, improved outcomes with early weight bearing, and lack of benefit with prolonged weight bearing restrictions; routine delayed weight bearing in this patient population no longer appears to be justified.

Prior systematic reviews on this topic have been contradictory. Black et al published a systematic review with 9 studies and 555 patients. The noted that outcomes were better in the EWB group regarding ankle dorsi flexion, time to return to work, and length of hospital stay [11]. Smith and Davies published a systematic review of five papers with 366 patients, and reported no difference in function, pain, range of movement, radiological assessment, complications, or return to work between the early and delayed weight bearing protocols. However, the studies included were generally poor in quality, and the authors noted that the conclusion of their systematic review was not persuasive, and higher quality studies were needed [12].

The strengths of this study are that it is a meta-analysis and includes randomized controlled trials and high-quality prospective studies. It also has strict inclusion criteria, and includes studies from across multiple continents. To our knowledge, this is the first meta-analysis with a focus comparing early and delayed weight bearing protocols after surgical fixation of ankle fractures. The results of this review are limited by the small number of available studies, and the unclear risk of bias in certain cases. Many studies were published over a decade ago, and some lacked modern methods of surgical fixation, or complete data presentation. Time to range of motion was also heterogeneous amongst the studies, some allowing earlier motion in both groups, some only in the early weight bearing group, and some delayed it in both groups. This meta-analysis suggests early improvement in functional outcome and reduction in days off work in patients treated with EWB compared to LWB after surgical fixating of ankle fractures, with no difference in complications. These results support early weight bearing protocols after surgical fixation of ankle fractures.

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