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Rehabilitation for ankle fractures in adults (Review)

Lin CWC, Donkers NAJ, Refshauge KM, Beckenkamp PR, Khera K, Moseley AM

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TABLE OF CONTENTS

[Intervention Review]

Rehabilitation for ankle fractures in adults

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ABSTRACT

Background

Rehabilitation after ankle fracture can begin soon after the fracture has been treated, either surgically or non-surgically, by the use of different types of immobilisation that allow early commencement of weight-bearing or exercise. Alternatively, rehabilitation, including the use of physical or manual therapies, may start following the period of immobilisation. This is an update of a Cochrane review first published in 2008.

Objectives

To assess the effects of rehabilitation interventions following conservative or surgical treatment of ankle fractures in adults.

Search methods

We searched the Specialised Registers of the Cochrane Bone, Joint and Muscle Trauma Group and the Cochrane Rehabilitation and Related Therapies Field, CENTRAL via *The Cochrane Library* (2011 Issue 7), MEDLINE via PubMed, EMBASE, CINAHL, PEDro, AMED, SPORTDiscus and clinical trials registers up to July 2011. In addition, we searched reference lists of included studies and relevant systematic reviews.

Selection criteria

Randomised and quasi-randomised controlled trials with adults undergoing any interventions for rehabilitation after ankle fracture were considered. The primary outcome was activity limitation. Secondary outcomes included quality of life, patient satisfaction, impairments and adverse events.

Data collection and analysis

Two review authors independently screened search results, assessed risk of bias and extracted data. Risk ratios and 95% confidence intervals (95% CIs) were calculated for dichotomous variables, and mean differences or standardised mean differences and 95% CIs were calculated for continuous variables. End of treatment and end of follow-up data were presented separately. For end of follow-up data, short term follow-up was defined as up to three months after randomisation, and long-term follow-up as greater than six months after randomisation. Meta-analysis was performed where appropriate.

Main results

Thirty-eight studies with a total of 1896 participants were included. Only one study was judged at low risk of bias. Eight studies were judged at high risk of selection bias because of lack of allocation concealment and over half the of the studies were at high risk of selective reporting bias.

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Three small studies investigated rehabilitation interventions during the immobilisation period after conservative orthopaedic management. There was limited evidence from two studies (106 participants in total) of short-term benefit of using an air-stirrup versus an orthosis or a walking cast. One study (12 participants) found 12 weeks of hypnosis did not reduce activity or improve other outcomes.

Thirty studies investigated rehabilitation interventions during the immobilisation period after surgical fixation. In 10 studies, the use of a removable type of immobilisation combined with exercise was compared with cast immobilisation alone. Using a removable type of immobilisation to enable controlled exercise significantly reduced activity limitation in five of the eight studies reporting this outcome, reduced pain (number of participants with pain at the long term follow-up: 10/35 versus 25/34; risk ratio (RR) 0.39, 95% confidence interval (CI) 0.22 to 0.68; 2 studies) and improved ankle dorsiflexion range of motion. However, it also led to a higher rate of mainly minor adverse events (49/201 versus 20/197; RR 2.30, 95% CI 1.49 to 3.56; 7 studies).

During the immobilisation period after surgical fixation, commencing weight-bearing made a small improvement in ankle dorsiflexion range of motion (mean difference in the difference in range of motion compared with the non-fractured side at the long term follow-up 6.17%, 95% CI 0.14 to 12.20; 2 studies). Evidence from one small but potentially biased study (60 participants) showed that neurostimulation, an electrotherapy modality, may be beneficial in the short-term. There was little and inconclusive evidence on what type of support or immobilisation was the best. One study found no immobilisation improved ankle dorsiflexion and plantarflexion range of motion compared with cast immobilisation, but another showed using a backslab improved ankle dorsiflexion range of motion compared with using a bandage.

Five studies investigated different rehabilitation interventions following the immobilisation period after either conservative or surgical orthopaedic management. There was no evidence of effect for stretching or manual therapy in addition to exercise, or exercise compared with usual care. One small study (14 participants) at a high risk of bias found reduced ankle swelling after non-thermal compared with thermal pulsed shortwave diathermy.

Authors' conclusions

There is limited evidence supporting early commencement of weight-bearing and the use of a removable type of immobilisation to allow exercise during the immobilisation period after surgical fixation. Because of the potential increased risk of adverse events, the patient's ability to comply with the use of a removable type of immobilisation to enable controlled exercise is essential. There is little evidence for rehabilitation interventions during the immobilisation period after conservative orthopaedic management and no evidence for stretching, manual therapy or exercise compared to usual care following the immobilisation period. Small, single studies showed that some electrotherapy modalities may be beneficial. More clinical trials that are well-designed and adequately-powered are required to strengthen current evidence.

PLAIN LANGUAGE SUMMARY

Rehabilitation for ankle fractures in adults

Ankle fracture is one of the most common fractures of the lower limb, especially in older women and young men. It is generally treated surgically or non-surgically, followed by a period of immobilisation to prevent complications such as malunion. Because of the fracture and the subsequent immobilisation period, people often experience pain, stiffness, weakness and swelling at the ankle, and a reduced ability to participate in activities. This review looked at the evidence on the effects of different rehabilitation interventions for these fractures.

Rehabilitation for ankle fracture can begin soon after the fracture has been treated, either surgically or non-surgically, by the use of different types of immobilisation that allow early commencement of weight-bearing or exercise. Alternatively, rehabilitation, including the use of physical or manual therapies, may start following the period of immobilisation.

Thirty-eight studies with a total of 1,896 participants were included in the review. Many of the trials were potentially biased.

Three studies examined rehabilitation interventions that started during the immobilisation period after non-surgical treatment. There is some very limited evidence of short term benefit of one type of brace compared with immobilisation with a cast or orthosis. There was no evidence for hypnosis.

Thirty studies investigated rehabilitation interventions that started during the immobilisation period after surgical treatment. Ten of these compared the use of a removable type of immobilisation combined with exercise with cast immobilisation alone. There is some evidence from these that using a removable brace or splint so that gentle ankle exercises can be performed during the immobilisation period may enhance the return to normal activities, reduce pain and improve ankle movement. However, the incidence of adverse events (such as problems with the surgical wound) may also be increased. Starting walking early may also slightly improve ankle movement. One small and biased study showed that neurostimulation, an electrotherapy modality, may be beneficial in the short-term. There was little and inconclusive evidence on what type of support or immobilisation was the best.

Five studies investigated different rehabilitation interventions that started after the immobilisation period. There is no evidence of improved function for stretching or manual therapy when either of these are added to an exercise programme, or for an exercise programme when this is compared with usual care. One small and potentially biased study found reduced ankle swelling after non-thermal compared with thermal pulsed shortwave diathermy.

BACKGROUND

Description of the condition

Ankle fracture is a term used to describe fracture of the distal tibia or fibula (Whittle 2003). It is one of the most common lower limb fractures (Lash 2002), and the frequency has been increasing over the past few decades (Bengner 1986; Kannus 1996). The annual incidence of ankle fracture is between 107 to 184 per 100,000 persons (Bengner 1986; Court-Brown 1998; Daly 1987; Jensen 1998). The most common causes of ankle fracture are twisting injuries and falls, followed by sports injuries (Court-Brown 1998; Daly 1987; Jensen 1998). The peak incidence of ankle fracture is seen in middle-aged to older women and young men (Court-Brown 1998; Jensen 1998).

Depending mainly on its severity, ankle fracture is treated with or without surgery, usually followed by a period of immobilisation (Lesic 2004). Surgical management generally comprises open reduction, to reposition the fractured parts, and internal fixation of the fracture using osteosynthesis material such as wires, screws and other devices. After surgery, the ankle can be immobilised in a cast, splinted, bandaged or left unsupported. In conservative management, the fracture if displaced is reduced by manipulation of the fractured parts through the skin and then the ankle is stabilised by cast or split immobilisation. Immobilisation can result in decreased range of motion, muscle atrophy and decreased peak muscle torque at the ankle (Chesworth 1995; Shaffer 2000; Stevens 2004; Vandenborne 1998). The majority of these changes occur within the first two weeks of immobilisation (Shaffer 2000; Stevens 2004; Vandenborne 1998). In addition, ankle fracture can be accompanied by other injuries, which may further impair recovery. These injuries include damage to the cartilage and ligaments, the existence of free bodies within the intra-articular space, and diastasis of the distal tibio-fibular joint (Ono 2004). Consequently, people with an ankle fracture often experience pain, stiffness, weakness, swelling, limitations in activities such as stair climbing and walking (Shaffer 2000), and reduced participation in work and recreation. Some people continue to report reduced participation (Belcher 1997; Lesic 2004; Nilsson 2003; Ponzer 1999), increased complaints in the extremities and spine, and fatigue (van der Sluis 1998) years after the initial injury.

Description of the intervention

A number of rehabilitation interventions are used to address the sequelae of ankle fracture and immobilisation. Rehabilitation may begin during the period of immobilisation, where a patient may commence early passive (Davies 1991) or active (Dogra 1999; Hedstrom 1994; Lehtonen 2003; Tropp 1995) exercises, or early weight-bearing (Ahl 1987; Ahl 1988). Alternatively, rehabilitation may start following the period of immobilisation, where interventions may include exercise (Moseley 2005) and manual therapy (Wilson 1991). Methods of immobilisation include casts (custom-made immobilisation made of plaster or synthetic material), back-slabs (half casts) and orthoses (commercially available braces), and were considered as a part of rehabilitation for this review as they may facilitate or restrict the commencement of other rehabilitation interventions during the immobilisation period, such as weight-bearing and exercise.

How the intervention might work

The initial conservative or surgical management of an ankle fracture aims to restore the anatomy and stability of the ankle. Immobilisation is thought to provide the optimal environment for fracture healing. It is used to minimise the risk of non-union or malunion at the fracture site. However, immobilisation also increases the risk of ankle stiffness, weakness, swelling and residual pain. While immobilised, weight-bearing is either restricted or not permitted, with consequent reduction of general mobility and functioning. Rehabilitation is aimed at improving participation in work and leisure activities, restoring mobility and reducing pain and other impairments.

Why it is important to do this review

This is an update of a Cochrane review first published in 2008 (Lin 2008a). In Lin 2008a, we identified 31 studies which supported the judicious use of early weight-bearing or exercise during the immobilisation period to improve activity limitation or ankle range of motion, and manual therapy after the immobilisation period to improve ankle range of motion. There was no evidence for other therapies. Overall the evidence was limited as it was mainly based on individual studies. We updated the review given that additional studies had since been published.

OBJECTIVES

To assess the effects of rehabilitation interventions following conservative or surgical treatment of ankle fractures in adults. The primary outcome was activity limitation; and secondary outcomes were quality of life, patient satisfaction, pain, ankle range of motion, strength, swelling and adverse events.

METHODS

Criteria for considering studies for this review

Types of studies

Only randomised and quasi-randomised (method of allocating participants to a treatment which is not strictly random; e.g. by date of birth, hospital record number, alternation) controlled trials were included.

Types of participants

We included studies of adult participants of either sex who had presented to a hospital or community setting for rehabilitation following ankle fracture. Allocation to treatment group must have been within three months of ankle fracture, and participants could have had either conservative or surgical orthopaedic management. We anticipated that group allocation was likely to occur within days after orthopaedic management for studies investigating the effectiveness of interventions administered during the period of immobilisation. Conversely, we anticipated that allocation would occur some weeks after orthopaedic management for studies of rehabilitation following a period of immobilisation.

We excluded studies conducted exclusively on participants with multi-trauma, pathological fracture or established complications secondary to ankle fracture (e.g. non-union). Studies conducted exclusively on patients with tibial pilon or plafond fracture, which is defined as intra-articular fracture of the distal tibia (Whittle 2003), or fracture of the talus were also excluded. Trials with mixed populations of adults and children were included if data for the adult population were reported separately.

Types of interventions

We included any rehabilitation intervention (e.g. different orthoses, early weight-bearing, ankle exercises, electrotherapy, manual therapy, stretching) employed by any health professional (e.g. physiotherapist, doctor) started at or after orthopaedic management (i.e. conservative orthopaedic management or surgical fixation) of ankle fracture. Eligible studies were grouped according to the timing of the commencement of intervention (i.e. during or after the period of immobilisation), the orthopaedic management if interventions were administered during the immobilisation period, and the type of intervention. Thus, interventions investigated by the included studies were grouped under three categories:

1. Rehabilitation interventions during the immobilisation period after conservative management
2. Rehabilitation interventions during the immobilisation period after surgical fixation
3. Rehabilitation interventions following the immobilisation period after either conservative or surgical management

Included interventions could be compared with placebo, no treatment or another rehabilitation intervention. Studies were excluded if they occurred before orthopaedic management, or examined pharmaceutical or surgical intervention alone.

Types of outcome measures

To be considered for our review, studies must have included at least one of the following outcome measures.

Primary outcomes

The primary outcome was activity limitation, which could be measured by questionnaires or performance tests. Questionnaires were the preferred primary outcome measure in instances where activity limitation was measured by a questionnaire and a performance test, because questionnaires tend to have more robust measurement properties (Andersson 2010). Possible questionnaires include the Olerud Molander Ankle Score (Olerud 1984) and the Lower Extremity Functional Scale (Binkley 1999). Possible tests include timed walking or stair climbing tasks (Moseley 2005).

Secondary outcomes

Secondary outcome measures were quality of life, patient satisfaction, and the impairment measures of pain, ankle dorsiflexion and plantarflexion range of motion, strength, swelling and adverse events. Examples of quality of life measures include Short Form 36 (Ware 1992) and Assessment of Quality of Life (Hawthorne 2001).

We anticipated that studies would have a variety of methods to assess pain, range of motion, strength and swelling. Pain can be measured with scales such as the numerical rating scale (Downie 1978), visual analogue scale (Huskisson 1974), or McGill Pain Questionnaire (Melzack 1975). Goniometry (Lehtonen 2003) or the weight-bearing lunge test (Bennell 1998) are among the common tests for range of motion, and torque is one of the ways to measure strength (Shaffer 2000). Examples of ways to measure swelling include ankle circumference (Airaksinen 1989; Lehtonen 2003) and volumetric measurements (Christie 1990).

For adverse events, we were especially interested if there were cases of delayed union (malunion or non-union) or pain resulting in cessation of the intervention. Authors of studies were contacted for reasons for withdrawals and dropouts, as they may have been related to adverse events.

Economic data

Economic data were tabulated if available, but were not analysed due to differences in costs and currencies between countries.

Timing of outcome assessment

Data at the end of the treatment period (end of treatment) and on the last follow-up (end of follow-up) were collected. For end of follow-up data, short term follow-up was defined as up to three months after randomisation, and long-term follow-up as greater than six months after randomisation. Time periods that fell between three to six months were dichotomised at 18 weeks, with follow-up less than 18 weeks classed as short-term and follow-up of 18 weeks or more classed as long-term.

Search methods for identification of studies

Electronic searches

We searched the Specialised Registers of the Cochrane Bone, Joint and Muscle Trauma Group and the Cochrane Rehabilitation and Related Therapies Field, the Central Register of Controlled Trials (CENTRAL) via *The Cochrane Library* (2011 Issue 7), MEDLINE via PubMed, EMBASE, CINAHL, PEDro, AMED and SPORTDiscus. For this update, the searches were performed from the last search date (September 2007) of our original review (Lin 2008a) up to July 2011. There were no language or publication restrictions to the search.

Search strategies are shown in Appendix 1 for CENTRAL, MEDLINE, EMBASE, CINAHL, AMED and SPORTDiscus. For MEDLINE, the subject specific search was combined with the sensitivity-maximising version of the 'Cochrane Highly Sensitive Search Strategy for identifying randomised trials' (Lefebvre 2011). In this update, we amended our original search strategies slightly with assistance from the Cochrane Bone, Joint and Muscle Trauma Group due to changes in MeSH terms or keywords (for CENTRAL, MEDLINE, EMBASE and AMED) or the database platform (for CINAHL and SPORTDiscus). The search strategy for PEDro was unchanged and included 'fracture' in the 'Abstract & Title' field, combined (using 'and') with 'foot or ankle' in the 'Body Part' field using the advanced search option.

Searching other resources

We also checked the reference lists of included studies and relevant systematic reviews, and identified unpublished or ongoing studies via the WHO International Clinical Trials Registry Platform (ICTRP). We looked for entries after the last search date (September 2007) of our original review (Lin 2008a) up to July 2011.

Data collection and analysis

Selection of studies

Two review authors independently screened search results for eligibility. Differences were resolved first in discussion, and then, if necessary, arbitrated by an independent third review author. Where a study was not written in English, colleagues fluent in that language assessed the eligibility and, if required, rated the risk of bias and extracted data for the study, or a translation was obtained through The Cochrane Collaboration.

To screen search results, first the titles of the studies were assessed. If deemed potentially eligible from the title, the abstract and then the full-text article were obtained. We checked for duplicate publications, and obtained more information from study authors if necessary.

Data extraction and management

Data extraction was performed by two independent review authors using a form designed for this review, which was piloted prior to use. Review authors did not extract data from studies in which they were involved; these studies were evaluated by other authors.

Assessment of risk of bias in included studies

In Lin 2008a, we assessed methodological quality using the PEDro scale (Maher 2003). For this update, we used the 'Risk of bias' tool provided by The Cochrane Collaboration (Higgins 2011). We assessed selection bias (random sequence generation and allocation concealment), performance and detection bias (blinding of participants, treatment providers and outcome assessors), attrition bias (completeness of outcome data), reporting bias (selection of outcomes reported) and other sources of bias (e.g. baseline comparability). Bias might be introduced if study groups are not comparable at baseline. Therefore, we assessed the studies' baseline comparability on the important participant characteristics and a key outcome measure as a potential other source of bias. Our presentation of bias relating to blinding includes both performance and detection bias as in the first version of the risk of bias tool (Higgins 2008).

The risk of bias was assessed by two independent review authors. In order to present the risk of bias in a universal manner in this update, studies included in the earlier review were also assessed using The Cochrane Collaboration's tool. Review authors did not evaluate the risk of bias of studies in which they were involved; these studies were evaluated by other authors.

Measures of treatment effect

We anticipated that most of our outcome measures would be continuous, with the exception of adverse events and dropouts, which would be dichotomous. For dichotomous variables, risk ratios (RRs) and 95% confidence intervals (95% CIs) were calculated. For continuous variables, mean differences (MDs) and 95% CIs were calculated if studies used the same outcome measure. Standardised mean differences (SMDs) and 95% CIs were calculated if studies used different measures to assess the same outcome (e.g. measuring activity limitation with the Olerud Molander Ankle Score or the Lower Extremity Function Scale) and the studies were pooled.

Unit of analysis issues

We anticipated that for our review potential unit of analysis issues would most commonly arise due to having more than two treatment groups in one study and reporting of adverse events by the number of events rather than number of participants with these outcomes. If a study had more than two groups within the one meta-analysis, to avoid unit of analysis issues we combined groups to create a single pair-wise comparison (Higgins 2011). For adverse events, we used the number of participants as the unit of measurement in the meta-analysis.

Dealing with missing data

We attempted to contact study authors where additional information was required. In the case of missing data, available case analysis was performed. For studies with missing standard deviations, we followed the advice of the Cochrane Handbook on methods of imputing data (Higgins 2011). For studies that did not report group allocation of dropouts, the number of participants used for data analysis was imputed by evenly distributing dropouts between groups. If studies did not report dropouts we assumed there were none.

Assessment of heterogeneity

Statistical heterogeneity was determined by visual inspection of the forest plots and with consideration of the I^2 and Chi^2 tests.

Data synthesis

Where possible, we performed a meta-analysis if the studies were clinically homogeneous. If studies were statistically homogeneous, the fixed-effect model was used. If studies were statistically heterogeneous, the random-effects model was used or results were not pooled, whichever was the most appropriate.

Subgroup analysis and investigation of heterogeneity

We planned to perform a subgroup analysis of rehabilitation after conservative orthopaedic management and rehabilitation after surgical orthopaedic management if studies included participants after either conservative or surgical orthopaedic management and data were available for extraction. This subgroup analysis was only used for rehabilitation interventions after the immobilisation period.

Sensitivity analysis

The planned sensitivity analyses were on the following risk of bias features: random sequence generation, allocation concealment, blinding and incomplete outcome data. Studies rated as having a low risk of bias on each of these features were included in the sensitivity analysis.

RESULTS

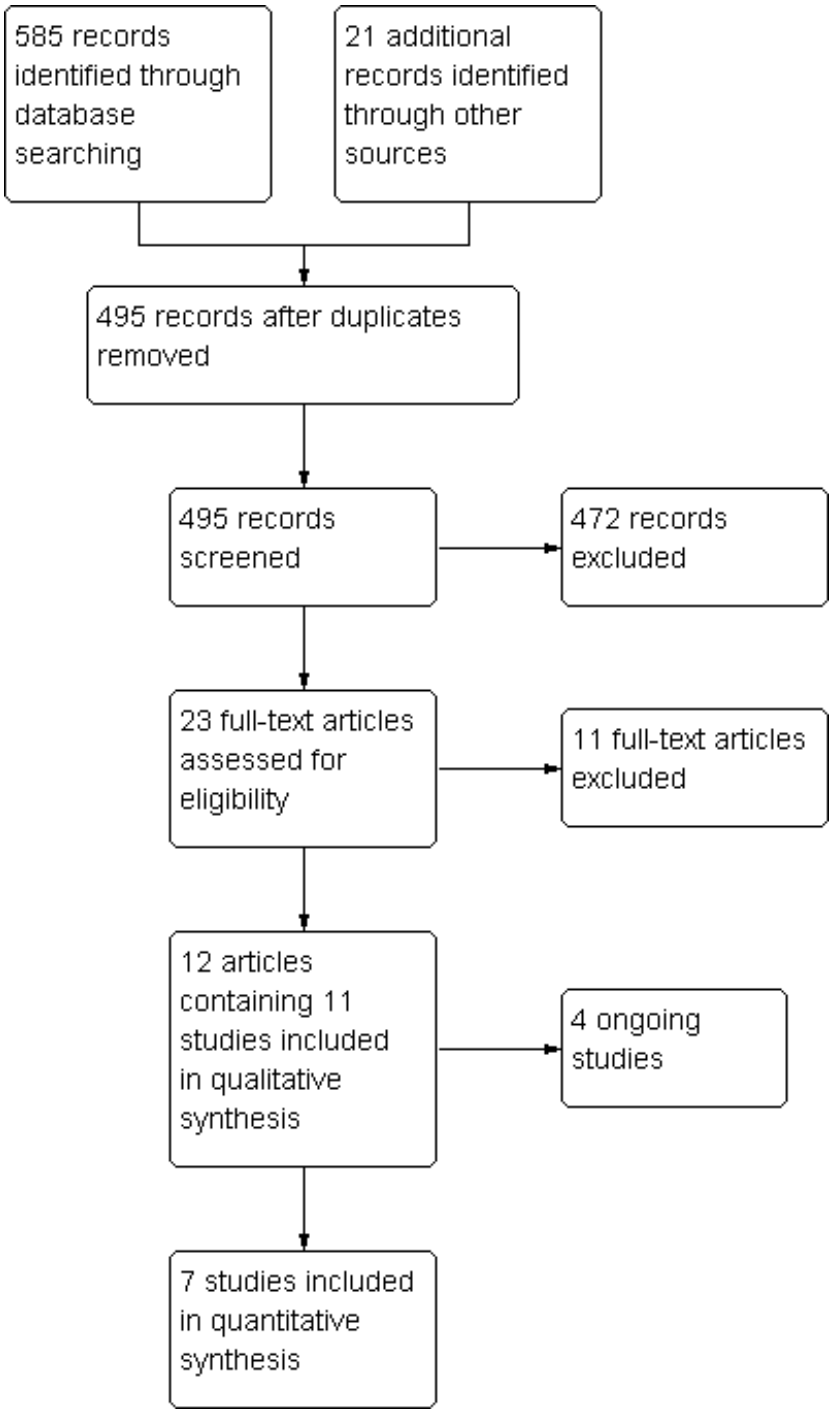
Description of studies

See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of ongoing studies.

Results of the search

The search for this update (search period September 2007 to July 2011) produced 606 references (Figure 1) from the following databases: Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (7 records); Cochrane Rehabilitation and Related Therapies Field Specialised Register (1 record); CENTRAL (20 records); MEDLINE (91 records); EMBASE (358 records); CINAHL (61 records); PEDro (11 records); AMED (3 records); SPORTDiscus (33 records); and the WHO ICTRP (21 records). After duplicates were removed, we screened a total of 495 records. We also identified one potentially eligible study from correspondence with a study author (Holland 2010). The results from the previous searches (up to September 2007) yielded 588 references (Lin 2008a).

Figure 1. Study flow diagram of the current update (search period September 2007 to July 2011)



The search update resulted in the identification of 23 potentially eligible studies, for which 23 full-text articles were obtained. Upon study selection, eight articles reporting seven studies (Franke 2008; Gorodetskyi 2010; Lin 2008b; Nilsson 2009; Romero Zepeda 2008; Seiger 2009; Venesmaa 2004) were included (Lin 2008b was represented by a published article and a clinical trial registration); 11 articles containing 10 studies (Farsetti 2009; Hershko 2008; Holland 2010; Lin 2010; Mason 2010; Mittal 2010; Munn 2009; Noh 2010; Scott 2010; Solomon 2011) were excluded (Holland 2010 was represented by a published article and a clinical trial registration); and four were ongoing studies (ACTRN12610000557033; ISRCTN33416471; Moseley; NCT01127776). No study awaits classification.
Overall, there are now 38 included trials, 52 excluded studies and five ongoing trials.

Included studies

In this update, we included seven additional studies. In total, 38 studies have been included (*see* the Characteristics of included studies for details).

Design

Seven of the 38 included studies were quasi-randomised controlled trials (Davies 1991; DiStasio 1994; Siddique 2005; Stockle 2000; van Laarhoven 1996; Vioreanu 2007; Wetzler 1991); the rest were randomised controlled trials. Most of the included studies used a two-group design (i.e. treatment versus control), but two studies (Finsen 1989; Moseley 2005) used a three-group design (i.e. two treatment groups and one control group).

Sample sizes

The sample size of individual studies ranged from 12 to 150 with a median of 45 participants. Overall, 1896 participants were included. The number of dropouts was reported in all but four studies (Siddique 2005; Stockle 2000; Venesmaa 2004; Wetzler 1991). Four studies did not specify the group allocation of the dropouts and we were unable to obtain more information from the authors (Ahl 1993; Egol 2000; Finsen 1989; van Laarhoven 1996). The number of dropouts in each included study is listed in the Characteristics of included studies.

Setting

Over half of the studies reported the setting in which the study took place. All but DiStasio 1994 were conducted in hospital.

Participants

All studies included adults only. The median or mean age of trial participants ranged from 26 (Tropp 1995) to 57 years (Ahl 1987). Fifteen studies (Christie 1990; Davies 1991; Dogra 1999; Franke 2008; Ginandes 1999; Gorodetskyi 2010; Handolin 2005a; Honigmann 2007; Nilsson 2009; Rasmussen 2000; Siddique 2005; Stockle 2000; Tropp 1995; Vioreanu 2007; Wilson 1991) had an upper age limit for inclusion. This ranged from 49 (Ginandes 1999) to 65 years (Dogra 1999; Franke 2008; Handolin 2005a; Honigmann 2007; Stockle 2000; Vioreanu 2007; Wilson 1991); although for the majority of these studies, this limit was 60 years or above. There were no trials that focused exclusively on older patients. Where gender was reported, studies included both females and males.

Interventions

Rehabilitation interventions during the immobilisation period after conservative orthopaedic management

Two studies (Brink 1996; Stuart 1989) investigated interventions that commenced during the period of immobilisation and exclusively recruited participants after conservative orthopaedic management. One other study did not specify the orthopaedic management (Ginandes 1999), but recruited only participants with non-displaced lateral malleolar fracture. We were unable to gain additional information from the authors, so presumed the participants in this study received conservative orthopaedic management. Of these three studies, two exclusively recruited participants with less severe fractures (Brink 1996; Ginandes 1999), and one included participants with varying degrees of fracture severity (Stuart 1989). Brink 1996 compared the use of an air-stirrup with an orthosis and Stuart 1989 compared the use of an air-stirrup with a walking cast as the method of immobilisation. Ginandes 1999 investigated the use of hypnosis.

Rehabilitation interventions during the immobilisation period after surgical fixation

Thirty studies investigated interventions that commenced during the period of immobilisation and exclusively recruited participants after surgical fixation (Ahl 1986; Ahl 1987; Ahl 1988; Ahl 1993; Christie 1990; Davies 1991; DiStasio 1994; Dogra 1999; Egol 2000; Finsen 1989; Fitzgerald 1994;Franke 2008; Gorodetskyi 2010; Handolin 2005a; Hedstrom 1994; Hernandez 2006; Honigmann 2007; Lehtonen 2003; Losch 2002; Rasmussen 2000; Reed 1998; Romero Zepeda 2008; Siddique 2005; Sondenaa 1986; Stockle 2000; Tropp 1995; van Laarhoven 1996; Venesmaa

2004; Vioreanu 2007; Wetzler 1991). Of these studies, 12 included participants with varying degrees of fracture severity (Christie 1990; Davies 1991; Egol 2000; Finsen 1989; Hernandez 2006; Honigmann 2007; Lehtonen 2003; Reed 1998; Romero Zepeda 2008; Siddique 2005; Sondenaa 1986; van Laarhoven 1996), five exclusively recruited participants with less severe fractures (Ahl 1986; Ahl 1988; Handolin 2005a; Hedstrom 1994; Venesmaa 2004), 11 exclusively recruited participants with more severe fractures (Ahl 1987; Ahl 1993; Fitzgerald 1994; Dogra 1999; Franke 2008; Gorodetskyi 2010; Losch 2002; Rasmussen 2000; Stockle 2000; Tropp 1995; Vioreanu 2007), and two studies did not report on fracture severity (DiStasio 1994; Wetzler 1991).

Six of these studies investigated the effectiveness of cast immobilisation (Siddique 2005), the effectiveness of one type of immobilisation compared with another type (Reed 1998; Romero Zepeda 2008; Venesmaa 2004; Wetzler 1991), or the effectiveness of a compression stocking in addition to cast immobilisation (Fitzgerald 1994). The immobilisation period was six weeks in all studies except for Reed 1998 and Romero Zepeda 2008, which had a short immobilisation period of one to two days.

Six studies investigated the effectiveness of starting weight-bearing during the immobilisation period. In three of these studies, participants in the treatment group started to weight-bear from the first post-operative day, and those in the control group started weight-bearing four weeks later (Ahl 1986; Ahl 1987) or at the end of the immobilisation period (Finsen 1989). Participants in these groups wore the same type of immobilisation (cast immobilisation). In the other three studies (Ahl 1988; Ahl 1993; van Laarhoven 1996), participants were allocated to receive early (i.e. during the immobilisation period) or late (i.e. after the immobilisation period) commencement of weight-bearing. In addition, participants in the treatment and control groups received different types of immobilisation to allow for the different weight-bearing requirements.

Thirteen studies investigated the effectiveness of exercise during the immobilisation period, in which participants in the treatment group commenced exercise, but those in the control group did not. The most common form of exercise prescribed was active (DiStasio 1994; Dogra 1999; Egol 2000; Finsen 1989; Hedstrom 1994; Lehtonen 2003; Rasmussen 2000; Sondenaa 1986; Tropp 1995; Vioreanu 2007) or passive (Davies 1991; DiStasio 1994; Egol 2000) ankle range of motion exercises, but some studies also included strengthening and functional exercises (DiStasio 1994; Tropp 1995). Exercise was sometimes delivered in a physiotherapy programme (Davies 1991; DiStasio 1994; Losch 2002; Sondenaa 1986; Stockle 2000). To enable performance of the exercises, participants in the treatment groups wore a removable type of immobilisation (i.e. backslab, orthosis, brace, air-stirrup) or had no immobilisation. Participants in the control groups typically received a cast that could not be removed.

Two studies investigated the effectiveness of commencing both weight-bearing and exercise during the immobilisation period (Franke 2008; Honigmann 2007). Participants in the treatment group used an orthosis for immobilisation, performed ankle range of motion exercises and were allowed to commence weight-bearing earlier than the control group. Participants in the control group used a cast (Franke 2008) or splint (Honigmann 2007) and then bandage, and performed no exercise. Participants in the control group of Franke 2008 attended physiotherapy three times a week for four weeks following their six weeks immobilisation period.

Four studies investigated the effectiveness of electrotherapy during the immobilisation period after surgical fixation. The interventions were ultrasound for bone healing (Handolin 2005a), electrical stimulation for muscle strength (Hernandez 2006), non-invasive interactive neurostimulation (Gorodetskyi 2010) and interferential therapy (Christie 1990).

Rehabilitation interventions following the immobilisation period after either conservative or surgical orthopaedic management

Five studies investigated interventions which commenced after the immobilisation period (Lin 2008b; Moseley 2005; Nilsson 2009; Seiger 2009; Wilson 1991). Two studies exclusively recruited participants after surgical fixation (Nilsson 2009; Seiger 2009); the other three studies recruited participants after either conservative or surgical orthopaedic management. The average length of the immobilisation period was around six weeks. One study (Seiger 2009) did not specify the duration of immobilisation. Two of the studies exclusively recruited participants with more severe fractures (Seiger 2009; Wilson 1991); the other studies included participants with varying degrees of fracture severity. The studies investigated the effectiveness of a physiotherapy exercise programme compared with usual care (Nilsson 2009) or the effectiveness of stretching (Moseley 2005), joint mobilisation (Lin 2008b; Wilson 1991) or pulsed shortwave diathermy (Seiger 2009) in addition to a physiotherapy programme.

Outcomes

Primary outcome: activity limitation

Activity limitation was measured in 23 included studies using questionnaires. The most commonly used questionnaire was the Olerud Molander Ankle Score (Dogra 1999; Handolin 2005a; Hedstrom 1994; Hernandez 2006; Honigmann 2007; Lehtonen 2003; Nilsson 2009; Rasmussen 2000; Siddique 2005; Tropp 1995; van Laarhoven 1996; Vioreanu 2007). Other questionnaires used were Clinical Demerit Points (based on the Weber protocol; Finsen 1989; Hughes 1979), Lower Extremity Functional Scale (Lin 2008b; Moseley 2005), Ankle Function Assessment (modified from the Olerud Molander Ankle Score; Wilson 1991), Inflammatory Score (Brink 1996), Maryland Foot Score (DiStasio 1994), visual analogue scale (Wetzler 1991) and scales by

Mazur 1979 (Egol 2000) and Kaikkonen 1994 (Venesmaa 2004). Losch 2002 assessed activity limitation with a dichotomous variable (ability to climb 12 steps independently, yes or no). Four studies used other scales as well as the Olerud Molander Ankle Score to measure activity limitation (Hedstrom 1994; Lehtonen 2003; van Laarhoven 1996; Vioreanu 2007): for example, the American Orthopaedic Foot and Ankle Society (AOFAS) scoring system (Vioreanu 2007). For these studies we extracted data from the Olerud Molander Ankle Score as it is used more widely. With the exception of Clinical Demerit Points, a higher score on all questionnaires of activity limitation indicated less limitation.

Four studies used performance tests to measure activity limitation, and all of these studies used more than one test (Ginandes 1999; Lin 2008b; Moseley 2005; Nilsson 2009). Because walking was the only test that was used in all studies, data from the walking test were extracted. Walking was measured as distance walked (Ginandes 1999), walking speed (Lin 2008b; Moseley 2005) or walking time (Nilsson 2009). With the exception of walking time, a higher score indicated less limitation. An example of other activity limitation tests used was stepping rate on stairs or time to ascend stairs (Lin 2008b; Moseley 2005; Nilsson 2009).

Secondary outcomes

Of the secondary outcome measures, four studies used quality of life to assess treatment effect (Egol 2000; Honigmann 2007; Lin 2008b; Nilsson 2009), and five measured patient satisfaction (Brink 1996; Honigmann 2007; Lin 2008b; Moseley 2005; Siddique 2005). Pain was reported either as a dichotomous variable (i.e. present or absent; Davies 1991; Handolin 2005a; Rasmussen 2000; Sondenaa 1986) or a continuous variable (Brink 1996; Dogra 1999; Ginandes 1999; Gorodetskyi 2010; Hernandez 2006; Honigmann 2007; Lin 2008b; Moseley 2005; Reed 1998; Romero Zepeda 2008; Seiger 2009; Wetzler 1991).

Ankle range of motion was the most common outcome measured. It was measured either in dorsiflexion (Ahl 1986; Ahl 1987; Ahl 1988; Dogra 1999; Ginandes 1999; Hedstrom 1994; Hernandez 2006; Honigmann 2007; Lehtonen 2003; Losch 2002; Lin 2008b; Moseley 2005; Nilsson 2009; Reed 1998; Siddique 2005; Sondenaa 1986; Stockle 2000; Tropp 1995; Vioreanu 2007; Wetzler 1991; Wilson 1991), plantarflexion (Ahl 1986; Ahl 1987; Ahl 1988; Dogra 1999; Ginandes 1999; Hedstrom 1994; Hernandez 2006; Honigmann 2007; Lehtonen 2003; Losch 2002; Nilsson 2009; Siddique 2005; Stockle 2000; Tropp 1995; Vioreanu 2007; Wetzler 1991; Wilson 1991), or combined dorsiflexion and plantarflexion (Brink 1996; Gorodetskyi 2010; Rasmussen 2000; Seiger 2009; Stuart 1989). Some studies expressed range of motion in degrees (Honigmann 2007; Gorodetskyi 2010; Lehtonen 2003; Moseley 2005; Nilsson 2009; Rasmussen 2000; Siddique 2005; Seiger 2009; Tropp 1995; Vioreanu 2007; Wilson 1991), in millimetres (Lin 2008b), or as a percentage or ratio of the non-fractured side (Ahl 1986; Ahl 1987; Ahl 1988; Ahl 1993; Davies 1991; Hedstrom 1994; Hernandez 2006; Wetzler 1991), where a higher score indicated better progress. Other studies reported range of motion as the difference between the fractured and non-fractured sides in degrees (Brink 1996; Dogra 1999; Ginandes 1999; Sondenaa 1986; Stockle 2000; van Laarhoven 1996), where a lower score indicated better progress. In these cases, where appropriate, data were multiplied by -1 so studies under the same comparison could be presented in the same analysis. Venesmaa 2004 did not specify the measure used for ankle dorsiflexion range of motion, but it was likely to have been an item of the scale by Kaikkonen 1994 ($\geq$10 degrees, 5 to 9 degrees, < 5 degrees).

Strength was measured as torque (Tropp 1995) or the number of toe or heel rises performed (Nilsson 2009). Swelling was presented either as a percentage of the non-fractured ankle (Ahl 1986; Ahl 1987; Ahl 1988), the difference in circumference between the fractured and non-fractured ankle (Gorodetskyi 2010), as a circumference measurement of the ankle (Fitzgerald 1994; Honigmann 2007; Lehtonen 2003; Romero Zepeda 2008; Tropp 1995; Vioreanu 2007) or a volumetric measure of the lower leg (Seiger 2009). Most studies reported adverse events but there were incomplete data or no reporting in ten studies (Christie 1990; Dogra 1999; Ginandes 1999; Gorodetskyi 2010; Losch 2002; Reed 1998; van Laarhoven 1996; Venesmaa 2004; Wilson 1991; Wetzler 1991).

Reporting of outcomes

Most studies reported measures of central tendency (either means or medians) and measures of dispersion (most commonly standard deviations) of each study group to allow calculation of the between-group mean differences and their 95% confidence intervals, and data presentation in forest plots. Two studies provided raw data (Seiger 2009; Wilson 1991). Data reported by 18 studies were incomplete and no further data were available following contact with the authors (Ahl 1993; Brink 1996; Christie 1990; Davies 1991; DiStasio 1994; Dogra 1999; Egol 2000; Franke 2008; Hedstrom 1994; Honigmann 2007; Romero Zepeda 2008; Siddique 2005; Sondenaa 1986; Stuart 1989; van Laarhoven 1996; Venesmaa 2004; Vioreanu 2007; Wetzler 1991). Where this is the case, findings from the studies are described in the text or included in additional tables.

Timing of outcome assessment

The follow-up periods ranged from one day (Romero Zepeda 2008) to two years (Lehtonen 2003) following randomisation. Twenty-five studies reported end of treatment outcomes (Brink 1996; Christie 1990; Egol 2000; Fitzgerald 1994; Franke 2008; Ginandes 1999; Gorodetskyi 2010; Hernandez 2006; Honigmann 2007; Lehtonen 2003; Lin 2008b; Moseley 2005; Rasmussen 2000; Reed 1998; Romero Zepeda 2008; Siddique

2005; Seiger 2009; Stuart 1989; Sondenaa 1986; Stockle 2000; Tropp 1995; van Laarhoven 1996; Vioreanu 2007; Wilson 1991; Wetzler 1991), 10 reported outcomes after a short-term follow-up period (Brink 1996; Dogra 1999; Hernandez 2006; Honigmann 2007; Losch 2002; Moseley 2005; Siddique 2005; Stockle 2000; Tropp 1995; Vioreanu 2007), and 19 reported outcomes after a long-term follow-up period (Ahl 1986; Ahl 1987; Ahl 1988; Ahl 1993; Davies 1991; DiStasio 1994; Egol 2000; Finsen 1989; Fitzgerald 1994; Handolin 2005a; Hedstrom 1994; Lehtonen 2003; Lin 2008b; Nilsson 2009; Rasmussen 2000; Sondenaa 1986; van Laarhoven 1996; Venesmaa 2004; Wetzler 1991).

Excluded studies

Fifty-two studies appeared to meet the inclusion criteria based on titles and abstracts, but were excluded following further assessment (*see* Characteristics of excluded studies for details). Two of the excluded studies fulfilled the inclusion criteria but had to be excluded as study details were incomplete and the available data were insufficient for extraction and analysis (Mittlmeier 2000; Stapert 1986).

Ongoing studies

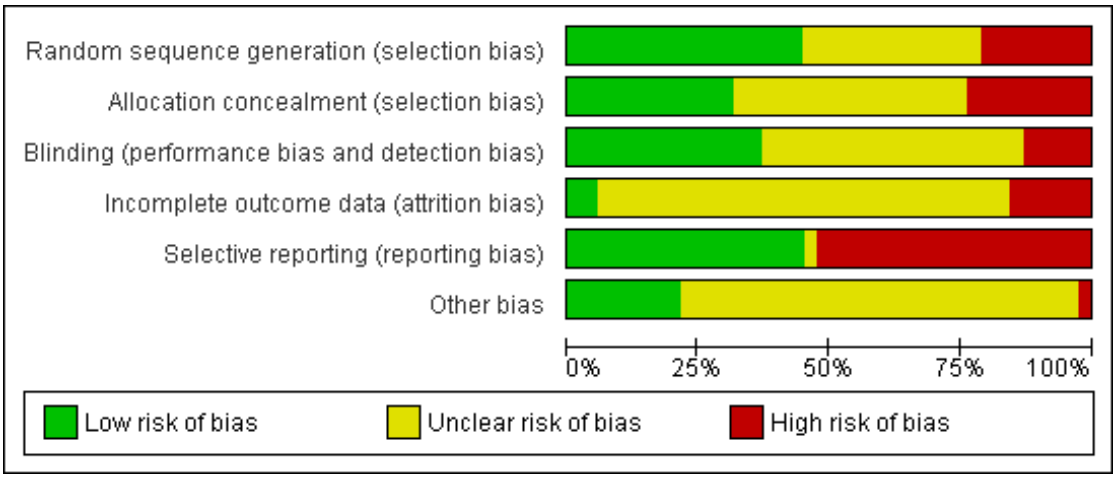
In this update, four new ongoing studies were identified (ACTRN12610000557033; ISRCTN33416471; Moseley; NCT01127776: *see* the Characteristics of ongoing studies for details). Of the two ongoing studies identified in the last version of the review (Lin 2008a), one has been included in this update (Lin 2008b) and the other is still ongoing (N0055190984).

Risk of bias in included studies

Figure 2 presents a summary of the review authors' judgements about each risk of bias item for the included study; and Figure 3 presents a summary of the risk of bias items across all included studies.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

Figure 3. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Allocation

Of the 31 randomised controlled trials, six had sufficiently described how the random sequence was generated (Brink 1996; Franke 2008; Ginandes 1999; Lin 2008b; Rasmussen 2000; Stuart 1989) and sufficient additional information was obtained from 11 studies (Dogra 1999; Egol 2000; Fitzgerald 1994; Honigmann 2007; Moseley 2005; Nilsson 2009; Reed 1998; Romero Zepeda 2008; Sondenaa 1986; Tropp 1995; Wilson 1991). Together, these 17 studies were rated as having a low risk of bias relating to random sequence generation. Thirteen studies were unclear about how the random sequence was generated (Ahl 1986; Ahl 1987; Ahl 1988; Ahl 1993; Christie 1990; Finsen 1989; Gorodetskyi 2010; Handolin 2005a; Hedstrom 1994; Hernandez 2006; Lehtonen 2003; Losch 2002; Venesmaa 2004). One study paired participants by entry date (Seiger 2009). The first of the pair was randomly allocated to a group, but the second of the pair was then automatically allocated to the other group. This study was rated as having a high risk of bias because the random sequence was generated by a rule based on date of entry.

Eleven randomised controlled trials were rated as having a low risk of bias relating to successful allocation concealment, as the procedure was sufficiently described (Lin 2008b; Moseley 2005) or sufficient additional information was obtained (Brink 1996; Egol 2000; Fitzgerald 1994; Franke 2008; Handolin 2005a; Honigmann 2007; Reed 1998; Stuart 1989; Tropp 1995). In 18 studies it was unclear whether or not allocation was concealed (Ahl 1986; Ahl 1987; Ahl 1988; Ahl 1993; Christie 1990; Dogra 1999; Finsen 1989; Ginandes 1999; Gorodetskyi 2010; Hedstrom 1994; Hernandez 2006; Lehtonen 2003; Losch 2002; Nilsson 2009; Rasmussen 2000; Sondenaa 1986; Venesmaa 2004; Wilson 1991). Most of these studies reported having used envelopes, but did not specify whether they were sealed, opaque and consecutively numbered. Two studies had a high risk of bias in allocation concealment, as an open list of random numbers (Romero Zepeda 2008) or secondary allocation by alternation (Seiger 2009) was used.

The seven quasi-randomised controlled trials had a high risk of bias for both random sequence generation and allocation concealment (Davies 1991; DiStasio 1994; Siddique 2005; Stockle 2000; van Laarhoven 1996; Vioreanu 2007; Wetzler 1991).

Blinding

The nature of the interventions meant that studies that involved the participants wearing immobilisation devices, weight-bearing, exercising or receiving most forms of physical therapies (e.g. hypnosis, manual therapy) were unable to blind the participant and the therapist. Only two studies implemented both participant and therapist blinding. These studies investigated ultrasound (Handolin 2005a) and pulsed shortwave diathermy (Seiger 2009) respectively. In one study investigating non-invasive, interactive neurostimulation (Gorodetskyi 2010) blinding of the participant,

but not therapist, was possible and implemented.
Five studies had a high risk of detection bias, as they did not attempt to blind the assessor (Davies 1991; Franke 2008; Ginandes 1999; Hernandez 2006; van Laarhoven 1996). Fourteen studies had assessor blinding and satisfied the criteria for a low risk of bias (Christie 1990; Dogra 1999; Gorodetskyi 2010; Handolin 2005a; Lehtonen 2003; Lin 2008b; Moseley 2005; Nilsson 2009; Rasmussen 2000; Romero Zepeda 2008; Siddique 2005; Seiger 2009; Tropp 1995; Wilson 1991). The remaining studies were unclear about assessor blinding.

Incomplete outcome data

Although 24 studies had fewer than 15% dropouts (Ahl 1986; Ahl 1987; Ahl 1993; Brink 1996; Christie 1990; Dogra 1999; Egol 2000; Franke 2008; Ginandes 1999; Gorodetskyi 2010; Handolin 2005a; Hedstrom 1994; Hernandez 2006; Honigmann 2007; Lehtonen 2003; Lin 2008b; Moseley 2005; Nilsson 2009; Rasmussen 2000; Romero Zepeda 2008; Seiger 2009; Stuart 1989; van Laarhoven 1996; Vioreanu 2007), only two studies had a low risk of attrition bias (Gorodetskyi 2010; Lin 2008b). All the other studies had missing data, did not report how they dealt with missing data and/or did not mention following an intention-to-treat principle and hence had an unclear risk of bias. Six studies had a high risk of attrition bias because participants were excluded upon not complying with the study protocol (Hernandez 2006; Seiger 2009; Stuart 1989; Vioreanu 2007; Wilson 1991) and/or being lost to follow-up (Ginandes 1999; Hernandez 2006).

Selective reporting

Risk of reporting bias was high in 18 studies because of not reporting all measured outcomes (Ahl 1986; Ahl 1987; Ahl 1988; Christie 1990), presenting data in such a way (i.e. without a measure of dispersion or as categorical data) that they could not be entered into a meta-analysis (Brink 1996; Davies 1991; DiStasio 1994; Egol 2000; Finsen 1989; Franke 2008; Romero Zepeda 2008; Siddique 2005; Sondenaa 1986; Venesmaa 2004; Vioreanu 2007; Wetzler 1991) or not pre-specifying outcome measures (Losch 2002; Stuart 1989). In addition, we assessed whether a study was prospectively registered or had a publicly available protocol prior to participant enrolment in the studies included in this update. Of these, two did not have a registered or publicly available protocol and therefore were judged to have an unclear risk of reporting bias (Gorodetskyi 2010; Seiger 2009). One study had a retrospectively published protocol (Nilsson 2009). Risk of reporting bias was high in this study because not all measurements reported in the study were pre-specified in the protocol. All of the studies included in the first version of the review (Lin 2008a) were published before 2005, when trial registration became mandatory for International Committee of Medical Journal Editors member journals (de Angelis 2004). Therefore, not having a registered or publicly available protocol was not used as a criterion for assessing reporting bias for these studies.

Other potential sources of bias

Ten studies scored a low risk of other bias as the study groups were comparable at baseline (Christie 1990; DiStasio 1994; Fitzgerald 1994; Handolin 2005a; Hernandez 2006; Honigmann 2007; Lin 2008b; Moseley 2005; Romero Zepeda 2008; Seiger 2009). The other studies did not provide sufficient information on baseline comparability and were rated as having an unclear risk of bias. One study had a high risk of other bias as it received research and personal funding from the manufacturer of the therapeutic device that was being investigated in the study (Gorodetskyi 2010).

Effects of interventions

In the following, we present a total of 13 main comparisons, several with sub-categories. This is followed by Comparison 14, which presents some subgroup analyses split by surgical or conservative management, and Comparison 15, which presents some sensitivity analyses. The two treatment groups in Finsen 1989 received different interventions, and therefore appear in different comparisons (Comparisons 6 and 7). The treatment groups in Moseley 2005 received similar interventions, so were combined into one group in Comparison 10 to avoid unit of analysis issues.

Rehabilitation interventions during the immobilisation period after conservative orthopaedic management

Air-stirrup versus other immobilisation after conservative orthopaedic management (Comparison 1)

The two studies (Brink 1996 (66 participants); Stuart 1989 (40 participants)) included in this comparison were not pooled due to clinical heterogeneity. Brink 1996 reported, without providing measures of dispersion, that the use of an air-stirrup compared with an orthosis for immobilisation gave better results for activity limitation, patient satisfaction, pain and ankle range of motion (combined dorsiflexion and plantarflexion) but not for swelling at the end of the four-week treatment (Brink 1996) (*see* Table 1). There was no reporting of between-group differences in all outcomes at the end of follow-up (12 weeks).
Stuart 1989 reported, without providing measures of dispersion, that the use of an air-stirrup compared with a walking cast gave better ankle range of motion (combined dorsiflexion and plantarflexion) at the end of treatment (four to six weeks) (MD 17 degrees, reported $P < 0.001$).
There was no statistically significant difference between groups in adverse events in either study (*see* Analysis 1.1). Aside from two cases of deep vein thrombosis in the walking cast group in Stuart

1989, the other adverse events for the two trials were related to skin irritation or ulceration.

Hypnosis during immobilisation after conservative orthopaedic management (Comparison 2)

One study of 12 participants (Ginandes 1999) evaluated the effectiveness of hypnosis, reporting outcome at the end of the 12-week treatment period. There were no statistically significant differences between groups as measured by an activity limitation test (Analysis 2.1), pain (Analysis 2.2), ankle dorsiflexion and plantarflexion range of motion (Analysis 2.3; Analysis 2.4), or swelling (Analysis 2.5). Adverse events were not reported.

Rehabilitation interventions during the immobilisation period after surgical fixation

No immobilisation versus cast immobilisation after surgical fixation (Comparison 3)

One study (Siddique 2005) investigated the effectiveness of no immobilisation compared with cast immobilisation in 44 patients. It found no statistically significant difference between groups in activity limitation at the end of the six-week treatment period or 12-week follow-up (Analysis 3.1). There were also no reported statistically significant differences between groups in patient satisfaction or pain at the end of treatment (reported P = 0.55 and P = 0.95 respectively). There was a statistically significant improvement in ankle dorsiflexion and plantarflexion range of motion at the end of treatment, but not at 12-week follow-up (Analysis 3.2 and Analysis 3.3). The authors reported no cases of delayed union in either group (Analysis 3.4).

Type of immobilisation after surgical fixation (Comparison 4)

Four studies were included in this comparison, where participants in the treatment and control groups used different types of immobilisation. These studies were presented in two sub-categories.

Bandage versus backslab (sub-category 1)

Two studies were included in this category: Reed 1998 (55 participants) and Romero Zepeda 2008 (50 participants). There was only one common outcome: the pooled results on pain (10 cm visual analogue scale) showed no between-group difference at the end of the treatment (MD 0.09 cm, 95% CI -1.08 to 0.91; Analysis 4.1). Reed 1998 found a statistically significant improvement in ankle dorsiflexion range of motion favouring the use of a backslab (MD 23.36 degrees from plantigrade, 95% CI 2.80 to 43.92; Analysis 4.2). Romero Zepeda 2008 reported no between-group difference in swelling at the end of treatment (Table 2 outcome 9).

Cast versus other immobilisation (sub-category 2)

Two studies were included in this category, which compared immobilisation by cast with either aircast (Venesmaa 2004: 32 participants) or pneumatic brace (Wetzler 1991: 45 participants). A meta-analysis was not considered due to clinical heterogeneity and data insufficiency.

Venesmaa 2004 reported no between-group differences in activity limitation questionnaire and ankle dorsiflexion range of motion at the six-month follow-up, but no data were given. Adverse events were not reported. Wetzler 1991 reported a statistically significant difference in activity limitation and pain favouring the pneumatic brace at the end of the six-week treatment, but not at the one-year follow-up (Table 2 outcomes 1 to 4). The groups did not differ in ankle dorsiflexion or plantarflexion range of motion (Table 2 outcomes 5 to 8).

Compression stocking in addition to cast immobilisation after surgical fixation (Comparison 5)

The use of a compression stocking in addition to a cast (Fitzgerald 1994: 20 participants) had no effect on swelling at the end of the six-week treatment period, but had a statistically significant effect at the 18-week follow-up (MD -0.70 cm in the difference of ankle circumference between sides, 95% CI -1.20 to -0.20; Analysis 5.1). However, this effect size was small and probably not clinically worthwhile. No adverse events occurred in either group (Analysis 5.2).

Weight-bearing during immobilisation after surgical fixation (Comparison 6)

A total of six studies were included in this comparison. A fixed-effect model was used to pool studies within each sub-category if more than one study was present in a sub-category. We did not pool across the sub-categories due to clinical heterogeneity.

Early versus late weight-bearing (sub-category 1)

Three studies were included in this sub-category (Ahl 1986: 46 participants; Ahl 1987: 53 participants; Finsen 1989: 38 participants). No end of treatment data were available. At the one-year follow-up, early commencement of weight-bearing made no significant difference to activity limitation compared with late commencement of weight-bearing (Finsen 1989; Analysis 6.1.1). The pooled results showed a statistically significant difference in ankle dorsiflexion range of motion at the end of the six-month follow-up in favour of early weight-bearing (MD 6.17% in the difference in percentage to the non-fractured side, 95% CI 0.14 to 12.20; Analysis 6.2.1). The clinical importance of this treatment effect, expressed in percentages, is difficult to interpret but appears small. There was no between-group difference in plantarflexion range of motion (Analysis 6.3.1) or swelling (Analysis 6.4.1). No delayed

union occurred in Ahl 1986. Adverse events reported by the other two studies (Ahl 1987; Finsen 1989) were skin irritation or superficial wound infections; with no statistical significance between groups (Analysis 6.5.1).

Walking cast and early weight-bearing versus no immobilisation and late weight-bearing (sub-category 2)

van Laarhoven 1996 (81 participants), which was the sole study in this sub-category, reported a statistically significance difference between groups in activity limitation favouring a walking cast and early weight-bearing at the end of the six-week treatment period (reported P = 0.03: Table 3 outcome 1), but not at one-year follow-up (reported P = 0.94: Table 3 outcome 2.2). No between-group differences in dorsiflexion range of motion were noted (Table 3 outcomes 3 and 4). While the occurrence of adverse events was reported, including one case of delayed union, the data could not be analysed because group allocation was not specified.

Orthosis and early weight-bearing versus dorsal splint and late weight-bearing (sub-category 3)

Two studies were included in this sub-category (Ahl 1988: 51 participants; Ahl 1993: 43 participants). Ahl 1988 found there were no differences between groups at the six-month follow-up in ankle dorsiflexion or plantarflexion range of motion (Analysis 6.2.3, Analysis 6.3.3), or swelling (Analysis 6.4.3) in people with unimalleolar fracture. The same comparison was conducted in people with bimalleolar or trimalleolar fractures (Ahl 1993), but the mean differences between groups in activity limitation and ankle range of motion did not appear clinically worthwhile (Table 3 outcomes 2.3, 5.3 and 6.3). No adverse events occurred in Ahl 1988 (Analysis 6.5.3). Ahl 1993 reported three cases of arthrosis and five cases of skin irritation or wound infection in the early weight-bearing group, and three cases of arthrosis in the late-weight-bearing group. The total number of participants with these adverse events was not clear so these data could not be presented in the analysis.

Exercise during immobilisation after surgical fixation (Comparison 7)

Thirteen studies were included in three sub-categories in this comparison. Data could not be pooled within or across sub-categories because of statistical and/or clinical heterogeneity, except for the outcomes of pain, swelling and adverse events for at least one sub-category.

Backslab and exercise versus backslab and no exercise (sub-category 1)

The only study in this sub-category (Dogra 1999: 52 participants) found no differences between groups at the 12-week follow-up in activity limitation (measured on the 100-point Olerud Molander Ankle Score, backslab and exercise group: mean 46.2, range 35 to 60; backslab and no exercise group: mean 43.4, range 30 to 65), pain (measured on the visual analogue scale, backslab and exercise group: mean 2.8, range 1 to 5; backslab and no exercise group: mean 3.0, range 1 to 6) and ankle dorsiflexion and plantarflexion range of motion (Analysis 7.7.1, Analysis 7.9.1). There was one superficial wound infection (group not stated) and no cases of implant failure or loss of reduction.

No immobilisation and exercise versus cast and no exercise (sub-category 2)

This comparison was tested by two studies: Finsen 1989 (37 participants) and Sondenaa 1986 (43 participants). Finsen 1989 found no difference between the groups in activity limitation at the one-year follow-up (Analysis 7.2.2), and Sondenaa 1986 found no between-group differences in pain (Analysis 7.5.2), ankle dorsiflexion range of motion at end of treatment and follow-up (Analysis 7.6.2, Analysis 7.7.2) . Sondenaa 1986 reported improved plantarflexion range of motion in participants who received no immobilisation and exercise (MD 9 degrees difference between fractured and non-fractured sides, reported P = 0.001). There was one adverse event reported for each study (Analysis 7.16.2).

Removable type of immobilisation and exercise versus cast and no exercise (sub-category 3)

Ten studies were included in this sub-category: Davies 1991 (41 participants); DiStasio 1994 (61 participants); Egol 2000 (60 participants); Hedstrom 1994 (53 participants); Lehtonen 2003 (100 participants); Losch 2002 (40 participants); Rasmussen 2000 (40 participants); Stockle 2000 (40 participants); Tropp 1995 (30 participants); Vioreanu 2007 (66 participants).

Three of the five studies that measured activity limitation using a continuous outcome measure found some evidence that the use of a removable type of immobilisation and exercise conferred positive benefits (Egol 2000; Rasmussen 2000; Vioreanu 2007), whereas this was not the case for two studies (Lehtonen 2003; Tropp 1995), which did not find differences between groups. The heterogeneity of the results at end of treatment (Analysis 7.1.3) and end of follow-up (Analysis 7.2.3) is evident visually but there is a clear tendency in favour of removable type of immobilisation and exercise at end of follow-up, supported also by the findings of Losch 2002 (Analysis 7.3.3). DiStasio 1994 and Hedstrom 1994 also measured activity limitation but the data could not be presented on the forest plot. DiStasio 1994 found a statistically significant between-group difference at the end of the six-month follow-up (Table 4 outcome 1); in contrast, Hedstrom 1994 measured activity limitation at the end of the 18-month follow-up and did not find a between-group difference (Table 4 outcome 2).

Two studies measured quality of life (Egol 2000; Vioreanu 2007). One of the studies (Egol 2000) reported that the group which

received a removable type of immobilisation and exercise had significantly higher quality of life scores in two subsets on the Short Form 36 (vitality and perceptions of general health). However, they did not specify the timing of this assessment. The other study (Vioreanu 2007) reported no difference between groups in quality of life at the 24-week follow-up but no data were given.

Two studies reported pain outcomes. Using a removable type of immobilisation and exercise reduced pain at the end of treatment (Rasmussen 2000: RR 0.12, 95% CI 0.03 to 0.44, Analysis 7.4.3). The pooled results at the end of follow-up also demonstrated a positive result in favour of removable immobilisation and exercise (RR 0.39, 95% CI 0.22 to 0.68, Analysis 7.5.3).

All studies in this sub-category that measured dorsiflexion range of motion demonstrated that the use of a removable type of immobilisation and exercise was beneficial at the end of treatment (Lehtonen 2003; Stockle 2000; Tropp 1995; Vioreanu 2007; Analysis 7.6.3), but only two of six studies found a difference at the end of follow-up (Losch 2002, Analysis 7.7.3; plus Davies 1991, Table 4 outcome 3). Some of the studies measuring plantarflexion range of motion found a positive outcome for the use of a removable type of immobilisation and exercise at the end of treatment (Stockle 2000; Vioreanu 2007; Analysis 7.8.3) or follow-up (Losch 2002; Stockle 2000; Analysis 7.9.3; plus Davies 1991, Table 4 outcome 4). One study reported dorsiflexion and plantarflexion combined range of motion (Rasmussen 2000), and showed a statistically significant improvement with the use of a removable type of immobilisation and exercise at the end of treatment (MD 30.00 degrees, 95% CI 17.42 to 42.58; Analysis 7.10.3) but not at follow-up (Analysis 7.11.3).

The only study reporting on strength (Tropp 1995) found no difference between the two groups at 10 weeks (Analysis 7.12.3) but a positive effect for exercise at one year (Analysis 7.13.3). Pooled results for swelling (three studies) showed no significant between-group differences at any time point (Analysis 7.14.3, Analysis 7.15.3; Table 4 outcome 5).

There was a statistically significant difference between groups in adverse events favouring the cast and no exercise group (pooled data from 7 studies: 49/201 versus 20/197; RR 2.30, 95% CI 1.49 to 3.56; Analysis 7.16.3). Two studies could not be included in the meta-analysis because they reported the number of adverse events rather than the number of participants with adverse events (Hedstrom 1994; Tropp 1995). Both studies also found results favouring the cast and no exercise group. Hedstrom 1994 reported four cases of arthrosis and two cases of superficial wound infection in the removable type of immobilisation and exercise group, and one case of superficial wound infection in the cast and no exercise group. Tropp 1995 reported six cases of failure of the syndesmotic staple and one case of wound secretion in the removable type of immobilisation and exercise group, and one case of failure of the syndesmotic staple in the cast and no exercise group. Overall, the adverse events were mainly minor (e.g. problems with the surgical wound, changes in skin sensation) except for four cases of arthrosis (Hedstrom 1994), seven cases of failure of the syndesmotic staple (Tropp 1995), one loss of internation fixation and one re-fracture (Lehtonen 2003), and one case of fixation failure (DiStasio 1994); all but one of these cases occurred in the removable type of immobilisation and exercise group.

Weight-bearing and exercise during immobilisation after surgical fixation (Comparison 8)

The effects of early weight-bearing and exercise were investigated by two studies (Franke 2008 (27 participants); Honigmann 2007 (45 participants). The studies presented contradictory results, and the results could not be pooled due to incomplete reporting of data or lack of events. For activity limitation, Honigmann 2007 found no differences between groups at the end of the six-week treatment or 10-week follow-up (see Table 5 outcomes 1 and 2), but Franke 2008 reported a significant (reported P = 0.02) between-group difference at the end of the treatment period in favour of early weight-bearing and exercise (Olerud Molander Ankle Score (0 to 100 best result): MD 20.00, 95% CI 6.88 to 33.12; Analysis 8.1). Similar contradictory results were found in secondary outcomes. For quality of life, Honigmann 2007 found no difference between groups (Analysis 8.2), compared with a statistically significant but small difference in favour of early weight-bearing and exercise demonstrated by Franke 2008 (Table 5 outcome 3). For patient satisfaction, Honigmann 2007 found a statistically significant but small difference in favour of no weight-bearing or exercise at the end of treatment (MD -1.00 points on a 10-point visual analogue scale, 95% CI -1.69 to -0.31; Analysis 8.3.1) but not at end of follow-up. Franke 2008 reported a statistically significant difference in patient satisfaction for the parameters of 'comfort' and 'pain' in favour of early weight-bearing and exercise (no data reported; P = 0.03 and P = 0.004, respectively).

Only Honigmann 2007 assessed pain (10-point visual analogue scale), finding reduced pain at the 10-week follow-up in the group that did not weight-bear or exercise (MD 1.00 points, 95% CI 0.23 to 1.77; Analysis 8.4.2). The between-group difference was small and unlikely to be clinically worthwhile. For ankle dorsiflexion and plantarflexion range of motion, Honigmann 2007 found no difference between groups (Analysis 8.5 and Analysis 8.6). Franke 2008 reported ankle dorsiflexion and plantarflexion range of motion as categorical data only but reported, without presenting treatment effect data, a statistically significant difference in favour of early weight-bearing and exercise for plantarflexion range of motion.

Three cases of adverse events were reported (two in the weight-bearing group and one in the control group) in Franke 2008, whereas no adverse events were reported in Honigmann 2007: there was no statistically significance between the two groups (Analysis 8.8).

Electrotherapy during immobilisation after surgical fixation (Comparison 9)

This comparison was divided into four sub-categories according to the electrotherapy modality used. The studies compared active electrotherapy to sham treatment or no treatment.

Ultrasound for bone healing (sub-category 1)

In a trial comparing ultrasound with sham ultrasound (16 participants), Handolin 2005a found no significant difference between the two groups at 18-month follow-up in activity limitation (Analysis 9.2.1), pain (Analysis 9.5.1), ankle dorsiflexion range of motion (Analysis 9.8.1) or swelling (Analysis 9.14.1). There were no adverse events (Analysis 9.15.1).

Electrical stimulation for muscle strength (sub-category 2)

Hernandez 2006 (24 participants) found that electrical stimulation to the gastrocnemius muscle did not improve outcome at the end of the six-week treatment or 12-week follow-up in activity limitation (Analysis 9.1.2, Analysis 9.2.2), pain (Analysis 9.3.2, Analysis 9.4.2), ankle dorsiflexion (Analysis 9.6.2, Analysis 9.7.2) or plantarflexion (Analysis 9.9.2, Analysis 9.10.2), or swelling (Analysis 9.12.2). One case of minor skin irritation was reported in the electrical stimulation group (Analysis 9.15.2).

Interferential therapy (sub-category 3)

Christie 1990 (24 participants) reported no difference between interferential therapy versus sham therapy in swelling (reported P = 0.96) at the end of treatment (two to four days).

Non-invasive interactive neurostimulation (sub-category 4)

In a placebo-controlled trial of 60 participants, Gorodetskyi 2010 found better results in the neurostimulation group at the end of treatment (10 days): pain (VAS 0 to 10: MD -2.10, 95% CI -2.36 to -1.84; Analysis 9.3.4), ankle range of motion for combined dorsiflexion and plantarflexion (MD 18 degrees, 95% CI 14.33 to 21.67; Analysis 9.11.4) and swelling (MD -11.00 mm, 95% CI -11.88 to -10.12; Analysis 9.12.4). All treatment effect size appear clinically worthwhile. However, no longer term follow-up data were collected and this study had a high risk of 'other bias'. There was no reporting of adverse events.

Rehabilitation interventions following the immobilisation period after either conservative or surgical orthopaedic management

Stretching post-immobilisation after conservative or surgical orthopaedic management (Comparison 10)

Data from the two groups in Moseley 2005 (150 participants) given stretching (short- versus long-duration stretches) were combined in this review and compared with those of the control group. Moseley 2005 found no significant between-group differences at the end of the 4-week treatment period or 12-week in: activity limitation (Analysis 10.1, Analysis 10.2), patient satisfaction (Analysis 10.3), pain on stair descent (Analysis 10.4) or ankle dorsiflexion range of motion (Analysis 10.5) when stretching was added to a physiotherapy exercise programme. The adverse events reported were discomfort with exercise or daily activities; the difference between groups was not statistically significant (Analysis 10.6).

Manual therapy post-immobilisation after conservative or surgical orthopaedic management (Comparison 11)

Two studies investigated the effectiveness of manual therapy (Lin 2008b: 94 participants; Wilson 1991: 12 participants). Data from two common outcomes (activity limitation, ankle dorsiflexion range of motion) were not pooled due to heterogeneity. At end of treatment, neither study found that adding manual therapy to a physiotherapy exercise programme resulted in statistically significant improvements in activity limitation (Analysis 11.1; Analysis 11.2). Lin 2008b found no statistically significant between-group differences in quality of life (Analysis 11.3), patient satisfaction (Analysis 11.4), pain (Analysis 11.5) and ankle dorsiflexion range of motion (Analysis 11.6). Wilson 1991 found a statistically significant but clinically insignificant difference that favoured the manual therapy group in ankle dorsiflexion (Analysis 11.6), but not in plantarflexion (Analysis 11.7), range of motion.

End of follow-up data and adverse events were only measured in Lin 2008b. After 24 weeks of follow-up, no statistically significant differences were found in activity limitation (Analysis 11.1; Analysis 11.2), pain (Analysis 11.5) or ankle dorsiflexion range of motion (Analysis 11.6). Although a statistically significant difference in quality of life was found in favour of the control group (MD 1.49 out of 45 on the Assessment of Quality of Life scale; 95% CI 0.14 to 2.84; Analysis 11.3), the difference was small and unlikely to be clinically significant. The adverse events reported were pain after physiotherapy (4 cases in the manual therapy group) and pain from an unconfirmed stress fracture (1 case in the control group). The difference between groups was not statistically significant (Analysis 11.8).

Exercise post-immobilisation after surgical fixation (Comparison 12)

Exercise prescribed by the physiotherapist was compared with usual care in one study of 110 participants (Nilsson 2009). At the end of follow-up (12 months) no statistically significant between-group differences were found in activity limitation (Analysis 12.1; Analysis 12.2), quality of life (Analysis 12.3), ankle dorsiflexion and plantarflexion range of motion (Analysis 12.4; Analysis 12.5)

or strength (Analysis 12.6). However, the results may have been underestimated as the usual care group was free to seek physiotherapy and had an average of seven sessions (mean sessions in the exercise group was 17). A high number of adverse events were reported (Analysis 12.7): 11 participants in the exercise group and 12 participants in the usual care group required additional surgery on the fractured ankle. However, the difference between the groups was not statistically significant.

Thermal versus non-thermal pulsed shortwave diathermy after surgical fixation (Comparison 13)

One small study (Seiger 2009: 14 participants) compared thermal pulsed shortwave diathermy with non-thermal pulsed shortwave diathermy in addition of a physiotherapy programme (joint mobilisation and home exercises) (Seiger 2009). The between-group differences at the end of treatment (12 sessions) were not statistically significant for pain (Analysis 13.1) or ankle dorsiflexion and plantarflexion range of motion (Analysis 13.2, Analysis 13.3). A statistically significant and clinically worthwhile between-group difference was present for swelling (ankle circumference: MD 217.7 mm, 95% CI 16.29 to 419.11 mm; Analysis 13.4) in favour of the non-thermal pulsed shortwave diathermy group (Seiger 2009). No adverse events were reported in either group (Analysis 13.5).

Economic data

While seven studies reported costs data (Brink 1996; Franke 2008; Lin 2008b; Losch 2002; Stockle 2000; Tropp 1995; Wetzler 1991), no study performed an economic evaluation.

Subgroup analysis (Comparison 14)

Three of the studies that investigated rehabilitation interventions following the immobilisation period recruited a mix of participants with conservative or surgical orthopaedic management (Lin 2008b; Moseley 2005; Wilson 1991). Additional data were obtained from two studies (Lin 2008b; Moseley 2005). Subgroup analyses on the primary outcome of activity limitation revealed (visual assessment) that stretching (Analysis 14.1 and Analysis 14.2) or manual therapy (Analysis 14.3 and Analysis 14.4), in addition to an exercise programme, conferred no additional benefit for participants regardless of the type of orthopaedic management.

Sensitivity analysis (Comparison 15)

We were only able to pool studies in Comparison 6, 'Weight-bearing during immobilisation after surgical fixation', and in some of the outcomes in Comparison 4, 'Type of immobilisation after surgical fixation' (Analysis 4.1.1) and Comparison 7, 'Exercise during immobilisation after surgical fixation' (Analysis 7.6; Analysis 7.14; Analysis 7.15; Analysis 7.16). Sensitivity analyses could not be performed because studies had identical methodological features (Comparison 6, Ahl 1986; Ahl 1987), or because of the low number of studies pooled (Analysis 4.1.1; Analysis 7.6; Analysis 7.14; Analysis 7.15; Analysis 7.16.2). Sensitivity analysis was conducted for Analysis 7.16.3 (Analysis 15.1). The results from studies at low risk of bias for various domains strengthened the finding that using a removable type of immobilisation and starting exercise during the immobilisation period were associated with a higher rate of adverse events.

DISCUSSION

Summary of main results

Thirty-one randomised and seven quasi-randomised controlled trials were included. The results were limited as pooling was not possible in most instances due to the low number of studies in that comparison, or heterogeneity. Additionally, each risk of bias item had at least half of the studies scoring unclear or high. Around one quarter of the studies had incomplete or no reporting of adverse events.

For interventions administered during the immobilisation period after conservative orthopaedic management, there was limited indication that using an air-stirrup may be more effective than a cast (one study) or an orthosis (one study) in the short term, but the precision and size of the treatment effect are unclear. A small study (12 participants) provided no evidence that using hypnosis improved activity limitation or other outcomes.

Thirty studies investigated rehabilitation interventions during the immobilisation period after surgical fixation. Ten studies compared the use of a removable type of immobilisation combined with exercise with cast immobilisation alone. The intervention reduced activity limitation in five of eight studies reporting this outcome. There was also some evidence for reduced pain and improved ankle range of motion for this intervention. However, using a removable type of immobilisation and starting exercise during the immobilisation period after surgical fixation was also associated with increased adverse events, albeit mostly minor (e.g. wound infection). The ability of a patient to safely adhere to the regimen of removing immobilisation, performing exercise, and re-applying immobilisation is without doubt an important factor to be considered when applying this intervention in clinical practice. Early commencement of weight-bearing (two studies) showed a positive, although generally minor, effect on ankle range of motion. A small study showed that using neurostimulation improved pain, ankle range of motion and swelling in the short term. But this study had a high risk of bias due to receiving funding from the device manufacturer. There was little and inconclusive evidence on what type of support or immobilisation was most effective. One study found no immobilisation improved ankle dorsiflexion

and plantarflexion range of motion compared with cast immobilisation, but another showed using a backslab improved ankle dorsiflexion range of motion compared with using a bandage.

Five studies investigated different rehabilitation interventions following the immobilisation period after either conservative or surgical orthopaedic management. These showed that adding stretching or manual therapy to exercise, and exercise compared with usual care, did not improve outcomes after ankle fracture. This evidence is largely based on single studies. Evidence from one small study (14 participants) at a high risk of bias showed reduced ankle swelling after non-thermal compared with thermal pulsed shortwave diathermy.

Most of the studies included in our review compared one rehabilitation intervention versus another rehabilitation intervention or one type of immobilisation versus another type of immobilisation. For these studies, the results should not be interpreted as evidence of the lack of efficacy of the rehabilitation interventions presented. Interventions may be equally effective, or indeed equally ineffective, so that no difference could be detected between groups.

Overall completeness and applicability of evidence

It is important to consider the clinical significance of the size of the treatment effect. Nine of the 24 studies that measured activity limitation, our primary outcome, showed statistically significant between-group differences, but only four provided enough data to assess of the size of the treatment effect (Egol 2000; Losch 2002; Rasmussen 2000; Vioreanu 2007). All investigated exercise during the immobilisation period after surgical fixation (Comparison 7). Two studies used the Olerud Molander Ankle Score (Rasmussen 2000; Vioreanu 2007), a 100-point scale (Olerud 1984), for which there are currently no data on the minimal clinically important change. Based on the scoring of the scale and relevant literature in low back and neck pain (Cleland 2006; Ostelo 2005; van der Roer 2006), we propose that an improvement of approximately 10 points on this scale could be considered clinically worthwhile. The treatment effect in Rasmussen 2000 was large and clinically worthwhile at the end of treatment (mean difference 47.30 points, 95% CI 37.86 to 56.74, Analysis 7.1.3) and two-year follow-up (MD 8.50 points, 95% CI 3.77 to 13.23, Analysis 7.2.3). Vioreanu 2007 also reported clinically significant findings at the end of follow-up (MD 12.10 points, 95% CI 7.51 to 16.69, Analysis 7.2.3). In contrast, Egol 2000 found a statistically significant, though unlikely clinically worthwhile, treatment effect at the end of the six-week treatment (MD 4.10 points out of 100 points on a grading system by Mazur 1979, 95% CI 0.63 to 7.57, Analysis 7.1.3). Losch 2002 used a dichotomous variable (Analysis 7.3.3) and treatment details are not available for this study, so the findings can only provide preliminary evidence. Although these results are heterogeneous, they suggest that the use of a removable type of immobilisation and exercise may confer reductions in activity limitation that are clinically worthwhile. This needs to be balanced against possible adverse events and be strengthened with further research.

Improvements in impairment measures often failed to translate into gains in activity limitation. For example, statistically significant differences were seen in ankle range of motion when no immobilisation was compared to cast immobilisation (Siddique 2005; Analysis 3.2; Analysis 3.3), and the use of a removable type of immobilisation and exercise was compared to a cast and no exercise (Lehtonen 2003; Analysis 7.6.3), but neither of these studies showed significant between-group differences in activity limitation (Analysis 3.1.1; Analysis 7.1.1). It is possible that changes in a few impairments are not significant enough to translate into changes in activity limitation. For example, the initial gains in range of motion may be important to allow activities of daily living, but gains towards the extremes of range may not significantly influence activity limitation, despite an improvement in the impairment score. Alternatively, the relevant mix of impairments may not have been measured, or the measures of activity limitation were not responsive to change.

Significant between-group differences at the end of the treatment period tended to reduce in magnitude (e.g. activity limitation in Rasmussen 2000; Analysis 7.1.3; Analysis 7.2.3) or cease to be significant (e.g. ankle dorsiflexion and plantarflexion combined range of motion in Rasmussen 2000; Analysis 7.10.3; Analysis 7.11.3) at the end of follow-up. This could be attributed to natural recovery in this patient population. A short-term treatment effect may still be worthwhile in a clinical situation, as it may enable patients to have an earlier return to activities or lead to reduced length of treatment.

Quality of the evidence

The evidence presented in this review is limited as it is primarily based on individual studies with unclear risk of bias and therefore should be interpreted with caution. The median sample size is small and interpretation of the results of small studies may be compromised by the lack of power. A wide confidence interval in the results also affects the interpretation of the clinical significance. For example, Nilsson 2009 failed to demonstrate a statistically significant difference between groups in activity limitation, but there was a tendency towards improved activity limitation in the treatment group (Analysis 12.1) and the wide confidence interval cannot rule out a potentially clinically worthwhile benefit for exercise. Future trials need to be adequately powered so that the results can be conclusive and a type II error can be avoided.

The clinical and statistical heterogeneity among studies in each comparison prevented the pooling of most comparisons, which would have made the results more robust. In addition, a number of interventions were investigated by single studies. If future research could first focus on interventions that are in common use, such as weight-bearing and exercise starting during the immobilisation

period, and exercise starting after the immobilisation period, it would allow more opportunities for pooling studies and provide evidence that is most pertinent to current clinical practice.
One small study (N = 60) which investigated non-invasive neurostimulation found benefits in pain, ankle range of motion and swelling compared to sham neurostimulation (Gorodetskyi 2010). However this study had a high risk of other bias as it received funding from the manufacturer. Industry-funded trials tend to favour the product under investigation (Lexchin 2003) which has been highlighted as a potential source of bias (Goodman 2011).

Potential biases in the review process

We are confident that we were exhaustive in our search strategy. We included only randomised and quasi-randomised controlled trials as they are less susceptible to selection bias (Roberts 1998). In an effort to locate all relevant trials, sensitive searches were conducted across a comprehensive list of electronic databases as well as reference lists of the included studies. We also searched two Specialised Registers of The Cochrane Collaboration, each of which handsearch major journals in relevant areas. To identify grey literature, we performed citation tracking and searched for unpublished studies through internet clinical trials registers. But we may have missed trials that published only in conference proceedings. This review is limited by the availability of data from the studies. Two studies met the inclusion criteria but had to be excluded due to the incompleteness of the study details and the reported data (Mittlmeier 2000; Stapert 1986). Data presentation was also limited in 18 studies (Ahl 1993; Brink 1996; Christie 1990; Davies 1991; DiStasio 1994; Dogra 1999; Egol 2000; Franke 2008; Hedstrom 1994; Honigmann 2007; Romero Zepeda 2008; Siddique 2005; Sondenaa 1986; Stuart 1989; van Laarhoven 1996; Venesmaa 2004; Vioreanu 2007; Wetzler 1991) due to incompleteness in the reporting of point estimates or measures of dispersion. This means that the clinical significance of the treatment effects was not able to be adequately assessed. We contacted authors of all studies for additional data, but many were unable to supply the necessary data. We received unpublished raw data from seven studies (Fitzgerald 1994; Handolin 2005a; Lin 2008b; Moseley 2005; Rasmussen 2000; Reed 1998; Seiger 2009), and imputed missing standard deviations (Higgins 2011) from standard errors (Ginandes 1999; Sondenaa 1986), inter-quartile ranges (Franke 2008; Honigmann 2007; Romero Zepeda 2008) and graphs (Honigmann 2007; Sondenaa 1986; Wilson 1991). Missing data for dropouts were imputed in two studies (Finsen 1989; Siddique 2005). As data imputation may compromise validity of the results, it was carried out only as a last resort after failure to obtain more data from study authors.

Agreements and disagreements with other studies or reviews

Our results are consistent with two previous reviews (Smith 2006; Thomas 2009), which reported limited evidence supporting the early commencement of exercise during the immobilisation period in reducing activity limitation and improving ankle range of motion in the short term. Similar to our review, Thomas 2009 also found that these benefits were accompanied by an increased risk of adverse events (wound infection). Our review adds to the evidence from these reviews by evaluating the effects of rehabilitation interventions other than exercise.
Compared with our original review (Lin 2008a), seven new studies were added: four studies investigated the type of immobilisation (Romero Zepeda 2008; Venesmaa 2004), weight-bearing and exercise (Franke 2008) and electrotherapy (Gorodetskyi 2010) implemented during the immobilisation period after surgical fixation, and three studies investigated manual therapy (Lin 2008b), exercise (Nilsson 2009) and electrotherapy (Seiger 2009) implemented after the immobilisation period. Results on rehabilitation interventions implemented during the immobilisation period were largely the same as those presented in the original review (Lin 2008a), except for the limited evidence that neurostimulation improves pain, ankle range of motion and swelling from a single study partially funded by the device manufacturer (Gorodetskyi 2010). In our original review, we found that manual therapy may improve ankle range of motion, based on one small study (Wilson 1991). This finding is not supported in this current update. In addition, in this update we found single studies (hence weak evidence) reporting that exercise implemented after the immobilisation did not improve outcome compared to usual care (Nilsson 2009), but non-thermal compared with thermal shortwave diathermy may reduce swelling (Seiger 2009).

AUTHORS' CONCLUSIONS

Implications for practice

Evidence provided by this review is limited by the clinical and statistical heterogeneity between studies, which prevented meta-analyses in most instances, the small number of available studies for some comparisons, and the unclear risk of bias overall. Evidence based on single studies, particularly when they are small, needs to be confirmed by well-designed and large-scale future trials.

For rehabilitation interventions administered during the immobilisation period after conservative orthopaedic management, there was insufficient evidence to determine the benefits of using an air-stirrup over a cast or orthosis, and limited evidence from one very small study that hypnosis was not effective.

For rehabilitation interventions implemented during the immobilisation period after surgical fixation, using a removable type of

immobilisation to enable gentle exercise during the immobilisation period may reduce activity limitation and pain, and improve ankle range of motion after the treatment period and in the long term. But the incidence of adverse events, mainly problems with the surgical wound, may be increased. In addition, commencement of weight-bearing during the immobilisation period may improve ankle range of motion. Independent confirmation is required of the promising short-term benefits for neurostimulation found by one small study with a high risk of bias. There is no evidence of an effect for other electrotherapy modalities.

After the period of immobilisation there is no evidence of an effect for stretching, manual therapy or exercise. A small study showed that non-thermal compared with thermal shortwave diathermy may reduce swelling in the short term.

Implications for research

Evidence for the best management of people during the immobilisation period after conservative orthopaedic management, which is currently lacking, needs to be established. For rehabilitation interventions administered during the immobilisation period after surgical fixation, although some tentative conclusions can be drawn about the benefits of the early commencement of exercise or weight-bearing, more trials that are well-designed and adequately-powered are required to confirm these findings. This is also true for physical and manual therapies administered after the immobilisation period, where there is currently no strong evidence of effect, despite the common use of these therapies.

Our review shows that there is currently no ongoing study investigating rehabilitation interventions during the immobilisation period after conservative orthopaedic management. Four ongoing studies are investigating early commencement of exercise or weight-bearing during the immobilisation period after surgical fixation (ISRCTN33416471; ACTRN12610000557033; NCT01127776; N0055190984), which will add to current evidence. One ongoing study is investigating the effects of structured exercise after the immobilisation period (Moseley).

Future research should first focus on interventions that are commonly used, such as weight-bearing and exercise during the immobilisation period and exercise after the immobilisation period. Better reporting of data is required in future studies, particularly in the reporting of the size of the treatment effect, so that researchers, clinicians and consumers can make better judgement on the clinical significance of the results. Also, the risk of bias needs to be kept low by providing clear information such as random sequence generation, allocation concealment, blinding, data attrition and the outcomes measured.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Ahl 1986

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: by sealed envelopes
Participants	Source population: Department of Orthopaedics, Danderyd Hospital, Sweden Inclusion criteria: closed dislocated fibular fracture with ruptured anterior tibiofibular ligament, surgical fixation required, age > 18 years, able to cooperate (e.g. alcohol and drug addiction, senility excluded), no concomitant injuries, except fracture of the posterior tibial margin Participants randomised (N): treatment group - 24; control group - 22 Age (y): overall mean 44 Sex (female/male): overall 24/22 Surgery: all had surgery Fracture severity (Weber B/C): treatment group - 18/6; control group - 18/4
Interventions	Timing of randomisation: immediately after surgery Treatment group: weight-bearing from first post-operative day Control group: weight-bearing from fourth post-operative week Both groups: below knee plaster cast for 7 weeks
Outcomes	Timing of assessments: 3, 6 and 18 months after randomisation End of treatment: nil End of follow-up: 6-month data used as more complete than 18-month data Included in this review: ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events Other: activity limitation questionnaire (measured but not reported), calf circumference, radiographs, roentgen stereophotogrammetric analysis, bone mineral content Dropouts (N): treatment group - 2; control group - 3
Notes	Additional information received from T Ahl (relationship between this study and other included references by Ahl et al)

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "each patient was randomly allocated." Comment: method of randomisation not described
Allocation concealment (selection bias)	Unclear risk	Quote: "by instruction in a sealed envelope. " Comment: insufficient information pro-

Ahl 1986 (*Continued*)

		vided.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "Forty-six patients were included in this study. Two patients were lost to follow-up." Comment: unclear reasons for loss to follow-up and insufficient reporting of attrition
Selective reporting (reporting bias)	High risk	Comment: activity limitation questionnaire measured, but not reported
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Ahl 1987

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: not described
Participants	Source population: Department of Orthopaedics, Danderyd Hospital, Sweden Inclusion criteria: closed dislocated bimalleolar or trimalleolar fracture with ruptured anterior tibiofibular ligament, surgical fixation required, adults, able to cooperate (e.g. alcohol and drug addiction, senility excluded), no other injuries which could interfere with rehabilitation, except fracture of the posterior tibial margin Participants randomised (N): treatment group - 25; control group - 28 Age (y): overall mean 57 Sex (female/male): treatment group - 15/10; control group - 22/6 Surgery: all had surgery Fracture severity (Weber B/C): treatment group - 12/13; control group - 15/13
Interventions	Timing of randomisation: immediately after surgery Treatment group: weight-bearing from first post-operative day Control group: weight-bearing from fourth post-operative week Both groups: below knee plaster cast for 7 weeks
Outcomes	Timing of assessments: 3, 6 and 18 months after randomisation End of treatment: nil End of follow-up: 6-month data used as more complete than 18-month data Included in this review: ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events this review

Ahl 1987 (*Continued*)

	Other: activity limitation questionnaire (measured but not reported), calf circumference, radiographs, roentgen stereophotogrammetric analysis, bone mineral content Dropouts (N): treatment group - 1; control group - 3
Notes	Additional information received from T Ahl (relationship between this study and other included references by Ahl et al)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "all the fractures were randomly allocated." Comment: method of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	Comment: method of allocation not described.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "of 53 patients included in this study, 2 patients were lost to follow-up." Comment: unclear reasons for loss to follow-up and insufficient reporting of attrition
Selective reporting (reporting bias)	High risk	Comment: activity limitation questionnaire measured, but not reported
Other bias	Unclear risk	Comment: no data on baseline comparability with regard to one of the key outcomes reported

Ahl 1988

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: not described
Participants	Source population: not reported Inclusion criteria: closed displaced lateral malleolar fracture with ruptured anterior tibiofibular ligament, surgical fixation required, adults, able to cooperate (e.g. alcohol and drug addiction, senility excluded), no other injuries which could interfere with rehabilitation, except fracture of the posterior tibial margin Participants randomised (N): treatment group - 26; control group - 25

Ahl 1988 (*Continued*)

	Age [mean (range)] (y): treatment group - 47 (18 to 74); control group - 39 (18 to 74) Sex (female/male): treatment group - 13/13; control group - 13/12 Surgery: all had surgery Fracture severity (Weber B/C): treatment group - 19/7; control group - 15/10
Interventions	Timing of randomisation: immediately after surgery Treatment group: below knee plaster cast in the first post-operative week, then orthosis for 7 weeks, weight-bearing after first post-operative week Control group: below knee plaster cast in the first post-operative week, then dorsal splint for 7 weeks, non weight-bearing Both groups: active unloaded dorsiflexion and plantarflexion exercises 5 times/day from the second to seventh post-operative weeks
Outcomes	Timing of assessments: 3 and 6 months after randomisation End of treatment: nil End of follow-up: 6-month data used Included in this review: ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events Other: activity limitation questionnaire (measured but not reported), calf circumference, radiographs, roentgen stereophotogrammetric analysis, work capacity, capacity for sports and leisure Dropouts (N): treatment group - 5; control group - 3
Notes	Additional information received from T Ahl (relationship between this study and other included references by Ahl et al)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "the patients were randomly allocated." Comment: method of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	Comment: method of allocation not described.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: activity limitation questionnaire measured, but not reported

Ahl 1988 (*Continued*)

Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Ahl 1993

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: not described
Participants	Source population: not reported Inclusion criteria: closed displaced bimalleolar and trimalleolar fracture, surgical fixation required, adults, able to cooperate (e.g. alcohol and drug addiction, senility excluded), no other injuries which could interfere with rehabilitation, except fracture of the posterior tibial margin Participants randomised (N): treatment group - 21; control group - 19; plus 3 excluded after randomisation, group allocation not reported Age [mean (range)] (y): treatment group - 55 (20 to 76); control group - 55 (22 to 77) Sex (female/male): treatment group - 17/4; control group - 16/3 Surgery: all had surgery Fracture severity (Lauge-Hansen supination-eversion IV/pronation-abduction III/ pronation-eversion IV): treatment group - 15/3/3; control group - 13/3/3
Interventions	Timing of randomisation: immediately after surgery Treatment group: plaster cast in the first post-operative week, then orthosis for 7 weeks, weight-bearing after first post-operative week Control group: plaster cast in the first post-operative week, then dorsal splint for 7 weeks, non weight-bearing Both groups: active unloaded dorsiflexion and plantarflexion exercises 5 times/day from the second to seventh post-operative weeks
Outcomes	Timing of assessments: 3, 6 and 18 months after randomisation End of treatment: nil End of follow-up: 18-month data used Included in this review: activity limitation questionnaire, ankle dorsiflexion and plantarflexion range of motion, adverse events Other: work capacity, capacity for sports and leisure, calf circumference, radiographs, roentgen stereophotogrammetric analysis Dropouts (N): 3 excluded after randomisation (group allocation not reported)
Notes	Additional information received from T Ahl (relationship between this study and other included references by Ahl et al)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**

Ahl 1993 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	Quote: "the patients were randomly allocated." Comment: method of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	Comment: method of allocation not described.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes reported.
Other bias	Unclear risk	Comment: no baseline data on any outcomes (such as baseline quality of life) were reported to assess study group comparability

Brink 1996

Methods	Randomised controlled trial Method of randomisation: by random number table Method of allocation: by consecutively numbered, opaque envelopes
Participants	Source population: emergency departments at Aarhus University Hospital and Silkeborg Hospital, Denmark Inclusion criteria: acute (< 24 hours), stable, isolated supination-eversion II fracture of the lateral malleolus, age >18 years, no tenderness on medial side of ankle Participants randomised (N): treatment group - 33; control group - 33 Age [mean (range)] (y): treatment group - 45 (18 to 82); control group - 45 (18 to 84) Sex (female/male): treatment group - 29/4; control group - 18/15 Surgery: none had surgery Fracture severity: all had stable lateral malleolar fractures
Interventions	Timing of randomisation: within 24 hours after surgery Treatment group: Aircast air-stirrup for an average of 39 days Control group: DonJoy orthosis with hinges locked for an average of 35 days Both groups: full weight-bearing within limits of pain and using crutches if necessary, rest and elevation for 3 to 5 days for swelling, brace could be removed for bathing, when resting in chair and at night after 4 weeks

Brink 1996 (*Continued*)

Outcomes	Timing of assessments: 1, 4 and 12 weeks after randomisation (and 6 weeks if not clinically united at 4 weeks) End of treatment: 4-week data used End of follow-up: 12-week data used Included in this review: activity limitation questionnaire, patient satisfaction, pain, ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events Other: radiographs Dropouts (N): treatment group - 4; control group - 5
Notes	Additional information received from O Brink (method of allocation, assessor blinding, adverse events)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "randomized by random number table."
Allocation concealment (selection bias)	Low risk	Additional information obtained from author: by consecutively numbered, opaque envelopes
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis due to incomplete reporting (no measure of dispersion was presented)
Other bias	Unclear risk	Comment: the treatment group had a higher proportion of females. No baseline data on any outcomes were reported to assess study group comparability

Christie 1990

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: not described
Participants	Source population: Royal Adelaide Hospital, Australia Inclusion criteria: acute closed ankle fracture, surgical fixation required, age 15 to 61 years, none of the following: peripheral vascular disease, history of bleeding disorders, ankle swelling on uninvolved side, medication likely to affect swelling, previous treatment or contraindication with interferential Participants randomised (N): treatment group - 12; control group - 12 Age [mean (range)] (y): treatment group - 33 (19 to 52); control group - 37 (15 to 61) Sex (female/male): treatment group - 4/8; control group - 6/6 Surgery: all had surgery Fracture severity (uni-/bi-/trimalleolar): treatment group - 6/5/1; control group - 4/3/5
Interventions	Timing of randomisation: immediately after surgery Treatment group: interferential - frequency 0-100 Hz, intensity 20 mA, 20 minutes/day from the physiotherapist for 2 to 4 days until below knee cast application Control group: sham interferential - electrodes applied but no current, 20 minutes/day from the physiotherapist for 2 to 4 days until below knee cast application Both groups: electrodes (4) placed on the medial and lateral sides of the ankle, and the medial and lateral sides of the shank. Plaster backslab for 2 to 4 days after surgery, elevation, twice daily supervised dorsiflexion and plantarflexion exercises, then below knee cast for an unspecified period
Outcomes	Timing of assessments: 2-4 days after randomisation End of treatment: 2 to 4-day data used End of follow-up: nil Included in this review: swelling Other: nil Dropouts (N): treatment group - 0; control group - 0
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "the subjects were then randomly assigned." Comment: method of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	Comment: method of allocation not described.
Blinding (performance bias and detection bias) All outcomes	Low risk	Comment: participants were not blinded, but the outcome was unlikely to have been influenced. Therapists and assessors were blinded

Christie 1990 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: post-treatment swelling measured, but not reported.
Other bias	Low risk	Comment: the study groups were comparable at baseline in characteristics and the outcome of swelling

Davies 1991

Methods	Quasi-randomised controlled trial Method of allocation: by day of admission and admitting consultant
Participants	Source population: East Glamorgan General Hospital, UK, between 1/1/1987 to 31/12/1988 Inclusion criteria: fracture of the medial, lateral or posterior malleolus involving the articular surface, surgical fixation required, age < 50 years, no co-existing fractures of either leg, could have lateral, deltoid or inferior tibio-fibular ligament injuries Participants randomised (N): treatment group - 21; control group - 20 Age (mean) (y): treatment group - 31; control group - 30 Sex (female/male): treatment group - 5/16; control group - 10/10 Surgery: all had surgery Fracture severity (uni-/bi-/trimalleolar): treatment group - 7/11/3; control group 11/6/3
Interventions	Timing of randomisation: immediately after surgery Treatment group: below knee backslab for 24 hours, then retained for night use only for an unspecified period, continuous passive motion 12 to 15 hours/day for an average of 6 days (range of motion set to that achieved actively by the participant and then increased daily within pain limits), regular active hip, knee, toe movements, physiotherapy after hospital discharge for an average of 6 weeks Control group: below knee plaster cast for an average of 57 days, physiotherapy (if referred) after removal of plaster for an average of 3 weeks Both groups: injured leg elevation for 3 to 4 days post-operatively, non weight-bearing with crutches until radiological union
Outcomes	Timing of assessments: before hospital discharge (timing not reported), 6 and 12 months after randomisation End of treatment: nil End of follow-up: 12-month data used Included in this review: pain, ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events Other: ability to resume former hobbies, return to work or full activity, subtalar range of motion, calf circumference, radiographs Dropouts (N): treatment group - 6; control group - 5

Davies 1991 (*Continued*)

Notes	

Risk of bias		***Risk of bias***
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Quote: "subject selection depended on which consultant was responsible for the care of the patient." Comment: quasi-random procedure.
Allocation concealment (selection bias)	High risk	Comment: quasi-random procedure.
Blinding (performance bias and detection bias) All outcomes	High risk	Quote: "The assessor was aware of the study-group allocation of the subject."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis due to incomplete reporting (no measure of dispersion was presented)
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

DiStasio 1994

Methods	Quasi-randomised controlled trial Method of allocation: by order of presentation
Participants	Source population: active duty military personnel Inclusion criteria: isolated closed ankle fractures, surgical fixation required Participants randomised (N): treatment group - 30; control group - 31 Age: not reported Sex: not reported Surgery: all had surgery Fracture severity: not reported
Interventions	Timing of group allocation: immediately after surgery Treatment group: DonJoy orthosis for 6 weeks, physiotherapy from the first post-operative week Control group: below knee cast for 6 weeks, physiotherapy after cast removal Both groups: partial weight-bearing or full weight-bearing in air-stirrup after 6 weeks, syndesmosis screws (if used) removed at 6 to 8 weeks post-operatively

DiStasio 1994 (*Continued*)

Outcomes	Timing of assessments: 6 weeks, termination of physiotherapy (timing not reported), 3 and 6 months after randomisation End of treatment: nil End of follow-up: 6-month data used Included in this review: activity limitation questionnaire, adverse events Other: activity limitation test (only measured in 21/61 participants), ankle range of motion (only measured in 21/61 participants), strength (only measured in 21/61 participants), swelling (only measured in 21/61 participants), time to return to full duty Dropouts (N): treatment group - 1; control group - 3
Notes	Additional information received from A DiStasio (method of allocation)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Additional information obtained from author: randomisation was performed by order of presentation Comment: quasi-random procedure.
Allocation concealment (selection bias)	High risk	Comment: quasi-random procedure.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: data on some of the key outcomes could not be entered into meta-analysis due to incomplete reporting (no measure of dispersion was presented)
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Dogra 1999

Methods	Randomised controlled trial Method of randomisation: by computer random number function Method of allocation: by sealed opaque envelopes

Dogra 1999 (*Continued*)

Participants	Source population: Hartlepool District General Hospital, UK Inclusion criteria: bimalleolar fracture, surgical fixation required, stable fixation, age 16 to 65 years, no previous ankle disease, no concomitant skeletal injury Participants randomised (N): treatment group - 26; control group - 26 Age (y): overall mean 42.7, range 18 to 65 Sex (female/male): overall 25/27 Surgery: all had surgery Fracture severity: all had bimalleolar fracture
Interventions	Timing of randomisation: within 24 hours after surgery Treatment group: active ankle dorsiflexion and plantarflexion movements starting 24 hours post-operatively, 4 times 10 minutes/day for 2 weeks. Ankle resting in below knee backslab at all other times Control group: ankle continuously in below knee backslab for 2 weeks Both groups: below knee walking cast for 4 weeks after 2 weeks in backslab, graduated weight-bearing, advice on ankle remobilisation after 6 weeks post-operatively
Outcomes	Timing of assessments: 12 weeks after randomisation End of treatment: nil End of follow-up: 12-week data used Included in this review: activity limitation questionnaire, pain, ankle range of motion, adverse events Other: nil Dropouts (N): treatment group - 0; control group - 0
Notes	Additional information received from A Rangan (method of randomisation, source population)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: randomisation by computer random number function
Allocation concealment (selection bias)	Unclear risk	Quote: "sealed opaque randomization envelopes." Comment: insufficient information provided about number of the envelopes
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "all patients were assessed by a single observer who was 'blind' to the post operative regime." Comment: participant and therapist blinding not possible. Assessor blinding was implemented

Dogra 1999 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "All patients attended for follow-up until completion of the study." Comment: insufficient information provided about missing data or intention to treat analysis
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Egol 2000

Methods	Randomised controlled trial Method of randomisation: by random numbers table Method of allocation: by sealed, opaque and consecutively numbered envelopes
Participants	Source population: a tertiary care centre between 30/6/1995 to 30/6/1997 Inclusion criteria: closed, isolated, unstable ankle fracture, surgical fixation required, complete skeletal growth, non-neuropathic joint Participants randomised (N): treatment group - 27; control group 28; plus 5 dropouts, group allocation not reported Age [mean (SD)] (y): treatment group - 39.5 (17.2); control group - 45.6 (17.5) Sex (female/male): treatment group - 14/13; control group - 18/10 Surgery: all had surgery Fracture severity (Lauge-Hansen supination-external rotation/supination-adduction/pronation-external rotation/pronation-abduction): treatment group - 24/1/1/1; control group - 22/1/1/4
Interventions	Timing of group allocation: after surgery Treatment group: plaster splint 2-3 days post-operatively, then Aircast removable functional brace for 6 weeks, active and passive ankle and subtalar exercises 3 times/day from 3-4 days post-operatively Control group: plaster splint 2-3 days post-operatively, then fibreglass short-leg cast for 6 weeks, physiotherapy after 6 weeks post-operatively Both groups: weight-bearing started 6 weeks post-operatively (8 weeks for those with syndesmosis screw)
Outcomes	Timing of assessments: 6, 12, 26 and 52 weeks after randomisation End of treatment: 6-week data used End of follow-up: 52-week data used Included in this review: activity limitation questionnaire, adverse events Other: quality of life (incomplete raw data and no between-group differences given), radiographs, return to work Dropouts (N): 5 in total (group allocation not reported)

Egol 2000 (*Continued*)

Notes	Additional information received from K Egol (method of allocation, source population)

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: randomisation by random numbers table
Allocation concealment (selection bias)	Low risk	Additional information obtained from author: by sealed, opaque and consecutively numbered envelopes
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis due to incomplete reporting (insufficient data on quality of life)
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Finsen 1989

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: not described
Participants	Source population: not reported Inclusion criteria: displaced ankle fracture (must include fracture of the lateral malleolus) , surgical fixation required, operation within 1 week of fracture, stable osteosynthesis allowing active ankle movement but not unprotected weight-bearing, no concomitant injury, could attend follow-up visits at Trondheim University Hospital, Norway Participants randomised (N): weight-bearing group - 19; exercise group - 18; control group - 19 Age [mean (SE)] (y): weight-bearing group - 43 (5.2); exercise group - 43 (3.2); control group - 40 (3.3) Sex (female/male): weight-bearing group - 14/5; exercise group - 10/8; control group - 11/8

Finsen 1989 (*Continued*)

	Surgery: all had surgery Fracture severity (Weber A/B/C, uni-/bi-/trimalleolar): weight-bearing group - 0/16/3, 8/4/7; exercise group - 0/15/3, 8/4/6; control group - 0/16/3, 8/2/9
Interventions	Timing of randomisation: immediately after surgery Weight-bearing group: below knee plaster cast with rubber walker for 6 weeks, weight-bearing as tolerated Exercise group: below knee plaster cast for 3 days, ankle and subtalar range of motion exercises daily Control group: below knee light-weight plaster cast for 6 weeks, non weight-bearing All groups: full weight-bearing after 6 weeks post-operatively
Outcomes	Timing of assessments: 9, 18, 36, 52 and 104 weeks after randomisation End of treatment: nil End of follow-up: 52-week data used as more complete than 104-week data Included in this review: activity limitation questionnaire, adverse events Other: pain (categorical scale), ankle dorsiflexion and plantarflexion range of motion (categorical scale), swelling (categorical scale), return to work, subtalar range of motion, radiographs, bone mineral content Dropouts (N): 14 in total (group allocation not reported)
Notes	The weight-bearing group was the treatment group in Comparison 6 ("Weight-bearing during immobilisation after surgical fixation"), and the exercise group was the treatment group in Comparison 7 ("Exercise during immobilisation after surgical fixation"). Data of the control group were used in both comparisons

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "patients were randomly assigned. " Comment: method of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	Comment: method of allocation not described.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Quote: "'each patient was examined by one of us." Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.

Finsen 1989 (*Continued*)

Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis because they were presented as categorical data
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Fitzgerald 1994

Methods	Randomised controlled trial Method of randomisation: by shuffling envelopes Method of allocation: by sealed opaque and consecutively numbered envelopes
Participants	Source population: Emergency Department of a general hospital, Ireland Inclusion criteria: ankle fracture, surgical fixation required, no other injuries or pathologies, adults Participants randomised (N): treatment group - 10; control group - 10 Age [mean (range)] (y): treatment group - 36.5 (25 to 60); control group - 34.8 (21 to 64) Sex (female/male): treatment group - 4/6; control group - 3/7 Surgery: all had surgery Fracture severity (bi-/trimalleolar): treatment group - 8/2; control group - 7/3
Interventions	Timing of randomisation: after surgery Treatment group: compression stocking (18 mmHg at the ankle, 8 mmHg below the knee) and below knee plaster cast for 6 weeks Control group: below knee plaster cast for 6 weeks Both groups: nil other
Outcomes	Timing of assessments: baseline, 6, 12 and 18 weeks after randomisation End of treatment: 6-week data used End of follow-up: 18-week data used Included in this review: swelling Other: air plethysmography Dropouts (N): treatment group - 3 (loss to follow-up); control group - 0
Notes	Additional information received from P Fitzgerald (methods of randomisation and allocation, assessor blinding, source population, adverse events, dropouts, additional data). A third group (early weight-bearing) from the study was not included in this review as allocation to this group was a clinical decision and not by randomisation

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**

Fitzgerald 1994 (*Continued*)

Random sequence generation (selection bias)	Low risk	Additional information obtained from author: randomisation by shuffling envelopes
Allocation concealment (selection bias)	Low risk	Additional information obtained from author: by sealed, opaque and consecutively numbered envelopes
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Low risk	Comment: the study groups were comparable at baseline in characteristics and the outcome of swelling

Franke 2008

Methods	Randomised controlled trial Method of randomisation: computer-generated block-randomisation sequence Method of allocation: by sealed, opaque envelope, randomised off site
Participants	Source population: Berufsgenossenschaftlichte Unfallklinik (Liability Insurance Traumatology Clinic), Ludwigshafen, Germany Inclusion criteria: closed, isolated, surgically treated ankle fractures, age 18 to 65 years, simple or bi-malleolar fractures, no comminuted fractures and fractures requiring a positioning screw, no disorders involving a restriction of mobility, limited ambulation on forearm crutches or situations affecting the healing process. Participants randomised (N): treatment group - 14; control group - 13 Age [median (range)] (y): treatment group - 44.3 (20.3 to 59.4); control group - 40.8 (25 to 64.1) Sex (female/male): treatment group - 7/7; control group - 5/8 Surgery (yes/no): all had surgery Fracture severity (simple Weber B/bimalleolar Weber B): treatment group - 13/1; control group - 13/0
Interventions	Timing of randomisation: not described Treatment group: dynamic vacuum orthosis for 6 weeks. Partial weight bearing and ankle exercises (10 degrees dorsi- and plantarflexion) from the second postoperative day. Thrombosis prophylaxis during the period of limited mobility. Control group: circular cast (with a window cut in it on the second post-operative day to permit ankle plantarflexion). After replacement by a supportive bandage, partial weight

	bearing of 20 kg was prescribed from the time of wound healing to the 14th postoperative day. Patients attended physiotherapy 3 times a week for 4 weeks following their 6 weeks immobilisation. Thrombosis prophylaxis for the duration of immobilisation. Both groups: full weight bearing allowed from day 15.
Outcomes	Timing of assessments: 6 and 10 weeks End of treatment: 10-week data used End of follow-up: nil Included in this review: activity limitation questionnaire, quality of life, patient satisfaction, adverse events Other: ankle dorsiflexion range of motion (categorical data), ankle plantarflexion range of motion (categorical data), time to return to work, economic parameters Dropouts (N): treatment group - 1; control group - 2.
Notes	Additional information obtained from J Franke (method of allocation, assessor blinding, intention to treat)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "computer-generated block-randomisation sequence."
Allocation concealment (selection bias)	Low risk	Additional information obtained from author: opening a closed, opaque envelope randomised off-site Comment: randomisation occurred off-site.
Blinding (performance bias and detection bias) All outcomes	High risk	Additional information obtained from author: neither participants, therapists nor assessors were blinded
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Additional information obtained from author: the analyses were conducted following the intention-to-treat principle Comment: 3 dropouts, method of imputation unclear.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis because they were presented as categorical data
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Ginandes 1999

Methods	Randomised controlled trial Method of randomisation: by list of random numbers Method of allocation: not described
Participants	Source population: Orthopaedic Emergency Department of Massachusetts General Hospital, USA, and McLean Hospital, USA Inclusion criteria: acute non-displaced lateral malleolar fracture, age 19 to 49 years, no previous fracture or arthritic condition involving the injured ankle, no co-existing illness, condition, medication or substance use that would influence bone healing or contraindicate hypnosis, fluency in English, available for the treatment period Participants randomised (N): treatment group - 6; control group - 6 Age: not reported Sex: not reported Surgery: not reported Fracture severity: not reported
Interventions	Timing of randomisation: within 48 hours of presentation Treatment group: 6 individual hypnotic interventions over 12 weeks with a psychologist trained in clinical hypnosis, hypnotic audiotapes for daily home practice Control group: see below Both groups: cast immobilisation for 6 weeks, orthopaedic follow-up clinics at 1, 3, 6, 9, 12 weeks after injury, no physiotherapy or rehabilitation
Outcomes	Timing of assessments: 1, 3, 6, 9 and 12 weeks after randomisation End of treatment: 12-week data used End of follow-up: nil Included in this review: activity limitation test, pain, ankle dorsiflexion and plantarflexion range of motion, swelling Other: use of analgesics, tenderness on palpation, radiographs, hypnotic induction profile Dropouts (N): treatment group - 1; control group - 0
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "randomized by order of presentation using a list of random numbers."
Allocation concealment (selection bias)	Unclear risk	Comment: method of allocation not described.
Blinding (performance bias and detection bias) All outcomes	High risk	Quote: "both the hypnotherapist and the orthopedist were aware of subject assignment. The participating radiologist who reviewed all records was blinded to subject assignment."

Ginandes 1999 (*Continued*)

		Comment: participant and therapist blinding not possible. Assessor blinding (the orthopedist and the radiologist conducted the outcome assessment) was not fully implemented
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "an intention-to-treat approach was used." Quote: "the 1 subject who dropped out with no follow-up data could not be included." Comment: missing data from the dropout not imputed.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Gorodetskyi 2010

Methods	Randomised controlled trial Method of randomisation: "fixed randomisation scheme" Method of allocation: sealed envelopes
Participants	Source population: Moscow, Russia Inclusion criteria: surgically treated bimalleolar, AO type B2 ankle fracture with comminution and displacement of fragments, age 20-60 years, able to begin therapy within 24 hours of the initial procedure, compliance with the ongoing regimen of care, no limitation that could interfere with delivery of electrical stimulation, ability to consent to participation Participants randomised (N): treatment group - 30; control group - 30 Age [mean (range)] (y): treatment group - 35.3 (21 to 57); control group - 38.4 (22 to 58). Sex (female/male): treatment group - 14/16; control group - 13/17. Surgery (yes/no): all had surgery Fracture severity: all had bimalleolar, AO type B2 ankle fracture with comminution and displacement of fragments
Interventions	Timing of randomisation: no more than 24 hours after surgery Treatment group: twice daily non-invasive interactive neurostimulation (NIN) for 10 consecutive days, delivered to the tissue on 7 different sites in the foot/ankle region via a pair of concentric electrodes placed in direct contact with the target area. Control group: twice daily sham NIN for 10 consecutive days Both groups: standard interdisciplinary postoperative care and daily physiotherapy sessions focused on exercise to increase range of motion and mobility. Non-narcotic anal-

Gorodetskyi 2010 (*Continued*)

	gesic (Ketorolac) as needed up to 3 times per day
Outcomes	Timing of assessments: daily (measured after the morning treatment session) from day 1 to 10 of treatment. End of treatment: 10-day data used End of follow-up: nil Included in this review: pain, range of motion, swelling Other: nil Dropouts (N): treatment group - 0; control group - 0
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "fixed randomisation scheme." Comment: insufficient information on method of randomisation
Allocation concealment (selection bias)	Unclear risk	Quote: "with sealed envelopes." Comment: insufficient information on method of allocation.
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "although health care personnel delivering postoperative therapy with the NIN device were necessarily aware of treatment status, all of the patients, evaluating physicians and nurses (including individuals responsible for collection of outcome measures) were blinded to group assignment." Comment: participant and assessor blinding implemented.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: CONSORT flowchart showed all participants were followed up and included in the data analysis
Selective reporting (reporting bias)	Unclear risk	Comment: no protocol was registered for this trial.
Other bias	High risk	Comment: the first author was a paid consultant for the company supplying the therapeutic device and the study was partially funded by the same company

Handolin 2005a

Methods	Randomised controlled trial Method of randomisation: performed off-site by the ultrasound manufacturer Method of allocation: ultrasound machines were allocated in the sequence provided by the manufacturer
Participants	Source population: Department of Orthopaedics and Traumatology, Helsinki University Central Hospital, Finland Inclusion criteria: closed isolated Weber B lateral malleolar ankle fracture (bimalleolar or trimalleolar fracture excluded), surgical fixation required, age 18 to 65 years No. of participants randomised (N): treatment group - 8; control group - 8 Age [mean (range)] (y): treatment group - 43.3 (28 to 66); control group - 41.8 (22 to 59) Sex (female/male): treatment group - 5/3; control group - 4/4 Surgery: all had surgery Fracture severity: all had Weber B unimalleolar fracture
Interventions	Timing of randomisation: 2 weeks after surgery Treatment group: active ultrasound 20 minutes/day for 6 weeks from 2 weeks post-operatively, to the lateral side of the ankle over the fracture line Control group: sham ultrasound 20 minutes/day for 6 weeks from 2 weeks post-operatively, to the lateral side of the ankle over the fracture line Both groups: removable soft cast brace for 6 weeks, partial weight-bearing at 2 weeks post-operatively, full weight-bearing at 4 weeks post-operatively
Outcomes	Timing of assessments: 18 months after randomisation (radiographs also taken at 2, 6, 9 and 12 weeks) End of treatment: nil End of follow-up: 18-month data used Included in this review: activity limitation questionnaire, pain, ankle dorsiflexion range of motion, swelling, adverse events Other: radiographs, computed tomography, clinical assessment of wound and ankle stability, bone mineral content Dropouts (N): treatment group - 0; control group - 0
Notes	Additional information received from L Handolin (methods of randomisation and allocation, details of assessment, adverse events, dropouts, additional data)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Commnent: insufficient information on method of randomisation
Allocation concealment (selection bias)	Low risk	Additional information obtained from the author: randomisation was performed off-site

Handolin 2005a (*Continued*)

Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "The patients were provided randomly in a double-blind manner with either an active... or a sham ... ultrasound device" Quote: "All the analyses were performed blind to the ultrasound treatment."
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Low risk	Comment: the study groups were comparable at baseline in characteristics and the outcome of activity limitation (questionnaire; additional data received from L Handolin)

Hedstrom 1994

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: by sealed envelopes
Participants	Source population: not reported Inclusion criteria: closed lateral malleolar fracture dislocated > 2 mm, surgical fixation required, adults, those able to cooperate Participants randomised (N): treatment group - 28; control group - 25 Age [mean (range)] (y): treatment group - 44 (15 to 70); control group - 41 (16 to 71) Sex (female/male): treatment group - 15/13; control group - 14/11 Surgery: all had surgery Fracture severity (Lauge Hansen supination-eversion II/supination-eversion III/supination-eversion IV/pronation-abduction III/pronation-eversion III/pronation-eversion IV): treatment group - 13/2/8/1/1/3; control group - 10/5/7/1/1/1
Interventions	Timing of randomisation: immediately after surgery Treatment group: orthosis for an unspecified period, unloaded dorsiflexion and plantarflexion exercises at least 5 times/day Control group: walking cast for an unspecified period Both groups: weight-bearing
Outcomes	Timing of assessments: 3, 6 and a minimum 18 months after randomisation End of treatment: nil End of follow-up: 18-month data used Included in this review: activity limitation questionnaire, ankle dorsiflexion and plantarflexion range of motion, adverse events Other: radiographs

Hedstrom 1994 (*Continued*)

	Dropouts (N): treatment group - 2; control group - 4
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "the patients were randomly allocated." Comment: insufficient information on method of randomisation
Allocation concealment (selection bias)	Unclear risk	Comment: insufficient information on method of allocation.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "at 18 months, six patients were lost to follow-up." Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Hernandez 2006

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: by pre-prepared sealed opaque envelopes
Participants	Source population: recruitment between 5/2004 to 11/2004 Inclusion criteria: closed ankle fracture, surgical fixation required, adults, and none of the following: conditions preventing mobilisation or immobilisation, history of cardiomyopathy, pacemaker use, peripheral vascular disease, females of childbearing age, and medication affecting bone metabolism Participants randomised (N): treatment group - 12; control group - 12 Age [mean (SD)] (y): treatment group - 41.5 (13.4); control group - 43.5 (14.1) Sex (female/male): treatment group - 4/8; control group - 4/8 Surgery: all had surgery Fracture severity (uni-/bi/trimalleolar): treatment group - 2/9/1; control group - 5/5/2

Hernandez 2006 (*Continued*)

Interventions	Timing of randomisation: 24 hours after surgery Treatment group: electrical stimulator (Myospare) at an intensity sufficient to elicit a muscular twitch to gastrocnemius, 1 minute on, 4 minutes off , for an unspecified length of time daily for 6 weeks Control group: see below Both groups: walking cast for 6 weeks, weight-bearing as tolerated, passive ankle range of motion exercises for 24 hours 1 to 2 days after surgery, instructions in cast care, walking and stairs
Outcomes	Timing of assessments: 2, 6, and 12 weeks after randomisation End of treatment: 6-week data used End of follow-up: 12-week data used Included in this review: activity limitation questionnaire, pain, ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events Other: nil Dropouts (N): treatment group - 2; control group - 1
Notes	Additional information received from E Leibner (additional data, dropouts)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "patients were randomised." Comment: insufficient information on method of randomisation
Allocation concealment (selection bias)	Unclear risk	Quote: "using pre-prepared, identical, sealed opaque envelopes." Comment: insufficient information provided about numbering of envelopes
Blinding (performance bias and detection bias) All outcomes	High risk	Quote: "No blinding was used." Comment: participant and therapist blinding not possible. Assessor blinding not implemented
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "Two patients did not return for scheduled follow-up visits and one patient did not comply with the cast treatment protocol. These patients were not included in the analysis." Comment: analyses were not performed according to the intention-to-treat principle. No imputation was implemented
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.

Hernandez 2006 (*Continued*)

Other bias	Low risk	Comment: the study groups were comparable at baseline in characteristics and the outcomes of ankle dorsiflexion and plantarflexion range of motion and swelling (additional data received from E Leibner)

Honigmann 2007

Methods	Randomised controlled trial Method of randomisation: randomisation sequence provided by external independent investigator Method of allocation: by sealed, opaque and consecutively numbered envelopes
Participants	Source population: not reported Inclusion criteria: isolated and displaced Weber A or B ankle fracture, surgical fixation required, age 16 to 65 years, body mass index < 35 Participants randomised (N): treatment group - 23; control group - 22 Age [median (range)] (y): treatment group - 42.5 (17.3 to 61.9); control group - 38.1 (18.5 to 65.7) Sex (female/male): treatment group - 9/14; control group - 13/9 Surgery: all had surgery Fracture severity (Weber A/B): treatment group - 1/22; control group - 0/22
Interventions	Timing of randomisation: after surgery Treatment group: Vacoped (removable immobilisation in a vacuum orthosis) for 6 weeks, full weight-bearing after 14 days, walking without crutches allowed at 3 weeks, orthosis off for ankle range of motion exercises and sleep Control group: plaster splint 2 to 4 days, then bandage only, full weight-bearing after 6 weeks Both groups: partial weight-bearing with crutches, ankle range of motion exercises
Outcomes	Timing of assessments: 6 and 10 weeks after randomisation End of treatment: 6-week data used End of follow-up: 10-week data used Included in this review: activity limitation questionnaire, quality of life, patient satisfaction, pain, ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events Other: return to work, duration of hospitalisation Dropouts (N): treatment group - 2; control group - 0
Notes	Additional information received from P Honigmann (method of randomisation, sex of participants, confirmation of results reported)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**

Honigmann 2007 (*Continued*)

Random sequence generation (selection bias)	Low risk	Additional information obtained from author: randomisation sequence provided by external independent investigator
Allocation concealment (selection bias)	Low risk	Additional information obtained from author: by sealed, opaque and consecutively numbered envelopes
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Lehtonen 2003

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: by sealed envelopes
Participants	Source population: Section of Orthopaedics, Tampere University Hospital, Finland, between 11/1995-4/1998 Inclusion criteria: acute (<72 hours), displaced or unstable Weber A or B ankle fractures, surgical fixation required, stable for early mobilisation, ability to cope with either protocol, no open fractures, pilon fracture, Weber C fracture needing syndesmosis screw or other severe injuries Participants randomised (N): treatment group - 50; control group - 50 Age [mean (SD)] (y): treatment group - 41 (13); control group - 41 (13) Sex (female/male): treatment group - 25/25; control group - 19/31 Surgery: all had surgery Fracture severity (Weber A/B, uni-/bi-/trimalleolar): treatment group - 2/48, 30/14/6; control group - 2/48, 29/14/7
Interventions	Timing of randomisation: immediately after surgery Treatment group: air-stirrup for 6 weeks, daily active and passive ankle and subtalar range of motion exercises Control group: below knee plaster cast for 2 weeks, then fibreglass walking cast for the next 4 weeks Both groups: FoamWalker leg brace until randomisation, non weight-bearing and

	crutches for the first 2 weeks, partial weight-bearing for the next 4 weeks, but full weight-bearing allowed at 4 weeks, strength and balance exercises 10 times/exercise, 5 to 10 times/day after 6 weeks, taping after 6 weeks as required, running, stairs and sports after achieving full ankle range of motion, orthosis for sports or strenuous activities for 3 to 6 months after injury
Outcomes	Timing of assessments: 2, 6, 12, 52 and 104 weeks after randomisation End of treatment: 6-week data used End of follow-up: 104-week data used Included in this review: activity limitation questionnaire, ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events Other: calf circumference, return to work, radiographs, length of hospitalisation Dropouts (N): treatment group - 4; control group - 8
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "patients were randomly allocated. " Comment: insufficient information on method of randomisation
Allocation concealment (selection bias)	Unclear risk	Quote: "use of sealed envelopes." Comment: insufficient information on numbering or opacity of envelopes
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "the follow-up examinations were performed by the same independent physician who had not been involved in the actual treatment of any of the patients." Comment: the participants and therapists were not blinded, but the outcome was unlikely to have been influenced. The assessor was blinded
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "A total of 12 patients were lost to follow-up." Comment: insufficient reporting of imputation and intention to treat analysis
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Lin 2008b

Methods	Randomised controlled trial Method of randomisation: by computer generated random sequence Method of allocation: by consecutively numbered, sealed, opaque envelopes
Participants	Source population: 3 large teaching hospitals, Australia, between 11/2004 to 1/2007 Inclusion criteria: ankle fracture treated with cast immobilisation with or without surgical fixation (average length of immobilisation = 43 days), cast removed in preceding 7 days, approval to weight-bear as tolerated or partial weight-bear, referral to outpatient physiotherapy for treatment, at least 2 out of 10 pain (VAS) in the affected ankle on equal weight-bearing at cast removal, available for the 24-week follow-up period, no concurrent pathologies Participants randomised (N): manual therapy group - 47; control group - 47. Age [mean (SD)] (y): manual therapy group - 42.5 (14.3); control group - 40.8 (15.1). Sex (female/male): manual therapy group - 26/21; control group - 17/30. Surgery (yes/no): manual therapy group - 30/17; control group - 26/21. Fracture severity (uni- or bimalleolar/trimalleolar): manual therapy group - 30/17; control group - 31/16
Interventions	Timing of group allocation: within 7 days of cast removal Treatment group: 2 sessions a week for 4 weeks applying 3 sets of 60 seconds of large amplitude (grade III) anterior-posterior glides of the talus. The treatment could be progressed by increasing the number of repetitions, the force of application and by increasing the range of dorsiflexion in which the treatment was performed. Control group: 2 sessions in the first week, followed by 1 session a week for the next 3 weeks. Both groups: a physiotherapy programme including exercise, gait re-training, progression of walking aids, advice on prognosis and return to activities and ice, elevation and compression if required. After 4 weeks participants in both groups could progress to exercise other than those from the standardised exercise programme
Outcomes	Timing of assessments: 4, 12 and 24 weeks after randomisation End of treatment: 4-week data used End of follow-up: 24-week data used Included in this review: activity limitation questionnaire, activity limitation test, quality of life, patient satisfaction, pain, ankle dorsiflexion range of motion, adverse events Other: return to work, return to sports and leisure activities, global perceived effect of treatment, number of days to pain-free walking. Dropouts (N): manual therapy group - 1; control group - 2.
Notes	Additional information received from C Lin (additional data)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "the randomization sequence was computer-generated a priori by an independent investigator to ensure concealment."

Lin 2008b (*Continued*)

Allocation concealment (selection bias)	Low risk	Quote: "sealed, opaque and consecutively numbered envelopes."
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "outcome assessments were conducted by an assessor blinded to treatment allocation." Comment: participant and therapist blinding not possible. Assessor blinding implemented
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote: "statistical analysis was based on intention-to-treat principles" Quote: "missing data were replaced by the last known value carried forward or by the means of the allocated group if no data were available"
Selective reporting (reporting bias)	Low risk	Comment: all expected (mentioned in protocol and pre-specified) outcomes included
Other bias	Low risk	Comment: the study groups were comparable at baseline in characteristics and the outcomes of activity limitation questionnaire, activity limitation test, quality of life, pain and ankle dorsiflexion range of motion

Losch 2002

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: not described
Participants	Source population: not reported Inclusion criteria: isolated Weber C ankle fracture, surgical fixation required Participants randomised (N): treatment group - 20; control group - 20 Age (mean) (y): treatment group - 37; control group - 38 Sex (female/male): treatment group - 12/8; control group - 12/8 Surgery: all had surgery Fracture severity: all Weber C
Interventions	Timing of group allocation: not stated Treatment group: combi-cast orthosis for an unspecified period, 3 hours of functional rehabilitation programme given by the physiotherapist 3 times/week for an unspecified period after discharge from hospital Control group: walking cast for 6 weeks (but weight-bearing status not reported), non-structured physiotherapy Both groups: nil other

Losch 2002 (*Continued*)

Outcomes	Timing of assessments: 10 weeks after randomisation End of treatment: nil End of follow-up: 10-week data used Included in this review: activity limitation questionnaire, ankle dorsiflexion and plantarflexion range of motion Other: length of absence from work, radiographs Dropouts (N): treatment group - 1; control group - 6
Notes	Published in German. Study eligibility assessed by the German Cochrane Centre, data extraction performed by Erwin Scherfer and Jutta Jablonski. Risk of bias assessed by Arianne Verhagen and Nicole Donkers

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Comment: method of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	Comment: method of allocation not described.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: Seven out of 40 patients were lost to follow-up, but the authors fail to provide a reason for that
Selective reporting (reporting bias)	High risk	Comment: it is unclear from the methods section which outcomes were going to be measured
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Moseley 2005

Methods	Randomised controlled trial Method of randomisation: by computer generated random sequence Method of allocation: by consecutively numbered, sealed, opaque envelopes
Participants	Source population: plaster clinics of 2 large teaching hospitals, Australia Inclusion criteria: ankle fracture treated with cast immobilisation with or without surgical fixation (average length of immobilisation = 45 days), cast removed in preceding 5

	days, approval to weight-bear as tolerated or partial weight-bear, decreased passive ankle dorsiflexion, complete skeletal growth, no concurrent pathologies Participants randomised (N): long-duration stretch group - 51; short-duration stretch group - 49; control group - 50 Age [mean (SD)] (y): long-duration stretch group - 47 (15); short-duration stretch group - 43 (15); control group - 49 (15) Sex (female/male): long-duration stretch group - 27/24; short-duration stretch group - 26/23; control group - 25/25 Surgery (yes/no): long-duration stretch group - 24/27; short-duration stretch group - 26/23; control group - 34/16 Fracture severity (Weber A/B/C/missing): long-duration stretch group - 9/31/3/8; short-duration stretch group - 11/30/5/3; control group - 9/30/7/4
Interventions	Timing of randomisation: within 5 days of cast removal Long-duration stretch group: 30 minutes of stretches/day Short-duration stretch group: 12 sets of 30 second stretches/day, i.e. a total of 6 minutes/day Control group: see below All groups: home exercise programme, up to 5 sessions with the physiotherapist (gait retraining and advice, ice, compression and elevation if required)
Outcomes	Timing of assessments: 4 weeks and 3 months after randomisation End of treatment: 4-week data used End of follow-up: 3-month data used Included in this review: activity limitation questionnaire, activity limitation test, patient satisfaction, pain, ankle dorsiflexion range of motion, adverse events Other: return to work, return to sports and leisure activities, perceived effect of treatment, duration of physiotherapy Dropouts (N): treatment group - 12; control group - 4
Notes	Additional information received from A Moseley (method of randomisation, adverse events, additional data). Data from the long-duration stretch group and the short-duration stretch group were pooled together as the treatment group for data analysis

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: by computer generated random sequence
Allocation concealment (selection bias)	Low risk	Quote: "the randomization was concealed by using consecutively numbered, sealed, opaque envelopes."
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "All measurements were made by assessors who were blind to group allocation."

Moseley 2005 (*Continued*)

		Comment: participant and therapist blinding not possible. Assessor blinding implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "All analyses were by ITT." Comment: insufficient information on imputation of missing data (16 dropouts)
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Low risk	Comment: the study groups were comparable at baseline in characteristics and the outcomes of activity limitation questionnaire, activity limitation test, quality of life, pain and ankle dorsiflexion range of motion

Nilsson 2009

Methods	Randomised controlled trial Method of randomisation: by shuffling envelopes Method of allocation: by sealed envelopes without codes on the outside
Participants	Source population: Department of Orthopaedics, University Hospital, Lund, Sweden Inclusion criteria: surgically treated ankle fracture, between 18 and 64 years old, living within an area of 50 kilometres from the hospital, proficient in the Swedish language, no co-existing fracture on the other or the same leg, no psychiatric diagnosis or history of drug abuse, no symptomatic osteoarthritis in the lower extremity, no rheumatic or other systemic diseases, no delayed surgery due to complications. Participants randomised (N): exercise group - 52; usual care group - 58 Age [mean (SD)] (y): exercise group - men 34 (22), women 51 (22); usual care group - men 32 (26) women 51 (19) Sex (female/male): exercise group - 31/19; usual care group - 31/24. Surgery: all had surgery Fracture severity (uni-/bi-/trimalleolar internal fixation): exercise group - 28/19/3; usual care group - 36/18/1
Interventions	Timing of group allocation: randomised the day after surgery, treatment started after plaster removal Treatment group: 2 physiotherapy sessions a week for 12 weeks plus daily home exercises. The programme was based on neuromuscular principles, standardized and progressed, including range of motion, strength and balance, and stretching, weight-bearing and walking exercises. Control group: usual care, consisting of instruction from the physician to start walking and return to normal function as soon as possible. A referral to physiotherapists was in some cases given, based on the physicians judgement, and patients were free to seek physiotherapy if they chose

Nilsson 2009 (*Continued*)

Outcomes	Timing of assessments: 6 and 12 months End of treatment: nil End of follow-up: 12-months data used Included in this review: activity limitation questionnaire, activity limitation test, quality of life, ankle dorsi- and plantarflexion range of motion, strength, adverse events. Other: nil Dropouts (N): exercise group - 4; usual care group - 10.
Notes	Additional information received from G Nilsson (method of randomisation, drop outs, adverse events)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: by shuffling envelopes
Allocation concealment (selection bias)	Unclear risk	Additional information obtained from author: by sealed envelopes without codes on the outside Comment: insufficient information on numbering and opacity of envelopes
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "all subjects were examined by the same physiotherapist who was blinded to the allocation group." Comment: participant and therapist blinding not possible. Assessor blinding implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "the statistical tests were performed according to the intention to treat principles" Quote: "... two patients allocated to the training group were excluded ... and additionally three patients allocated to the control group dropped out." Comment: insufficient information on imputation of missing data (14 dropouts)
Selective reporting (reporting bias)	High risk	Comment: the published protocol doesn't state the SF-36 will only be partly used. Also, a few of the reported outcomes weren't pre-specified in the published protocol

Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Rasmussen 2000

Methods	Randomised controlled trial Method of randomisation: by computer generated random sequence Method of allocation: by concealed, numbered envelopes
Participants	Source population: Hvidovre University Hospital, Denmark between 11/1997 to 2/1999 Inclusion criteria: bimalleolar ankle fractures, Lauge-Hansen supination eversion type IV or AO classification type B2.2 injury, surgical fixation required, age 18 to 55 years, no rupture of the tibio-fibular syndesmosis, in full working capacity Participants randomised (N): treatment group - 20; control group - 20 Age [mean (SD)] (y): treatment group - 35.3 (12.1); control group - 37.5 (9.5) Sex (female/male): treatment group - 12/8; control group - 10/10 Surgery: all had surgery Fracture severity: all had bimalleolar fracture
Interventions	Timing of randomisation: immediate after surgery Treatment group: below knee plaster cast for 1 day after surgery, then pneumatic brace for 6 weeks, early active range of motion exercises, compression from pneumatic brace Control group: below knee plaster cast for 6 weeks Both groups: full weight-bearing with 2 crutches
Outcomes	Timing of assessments: 6, 8 and 12 weeks, and 24 months after randomisation End of treatment: 6-week data used End of follow-up: 24-month data used Included in this review: activity limitation questionnaire, ankle dorsiflexion and plantarflexion range of motion, pain Other: days of hospitalisation, radiographs, return to work, days of using crutches Dropouts (N): treatment group - 0; control group - 1
Notes	Additional information received from S Rasmussen (method of allocation, assessor blinding, adverse events, dropouts, details of intervention, additional data)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "The patients were allocated to the two groups according to a computer generated randomized list."

Rasmussen 2000 (*Continued*)

Allocation concealment (selection bias)	Low risk	Quote: "concealed in a set of numbered envelopes." Comment: insufficient information on numbering or opacity of envelopes
Blinding (performance bias and detection bias) All outcomes	Low risk	Additional information obtained from author: assessor was blinded Comment: participants and therapists were not blinded, but the outcome was unlikely to have been influenced
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Reed 1998

Methods	Randomised controlled trial Method of randomisation: by shuffling envelopes Method of allocation: by sealed, opaque and consecutively numbered envelopes
Participants	Source population: district general hospital, UK, between 10/1995 to 2/1997 Inclusion criteria: ankle fractures, surgical fixation required, stable surgical fixation, adults, safe to leave out of backslab Participants randomised (N): treatment group - 27; control group - 28 Age [mean (SD)] (y): treatment group - 41.3 (18.3); control group - 40.3 (14.0) Sex: not reported Surgery: all had surgery Fracture severity (Weber A/B/C): treatment group - 2/15/10; control group - 3/21/4
Interventions	Timing of randomisation: immediate after surgery Treatment group: wool and crepe bandage for 1-2 days Control group: below knee backslab for 1-2 days Both groups: physiotherapy after removal of immobilisation
Outcomes	Timing of assessments: 1-2 days after randomisation End of treatment: 1 to 2-day data used End of follow-up: nil Included in this review: ankle dorsiflexion range of motion, pain Other: days of hospitalisation Dropouts (N): treatment group - 9; control group - 13

Reed 1998 (*Continued*)

Notes	Additional information received from M Reed (methods of randomisation and allocation, assessor blinding, details of assessment and intervention, additional data)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: by shuffling envelopes
Allocation concealment (selection bias)	Low risk	Additional information obtained from author: by sealed, opaque and consecutively numbered envelopes
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Assessor blinding implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: the author supplied additional data to impute into the meta analysis
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Romero Zepeda 2008

Methods	Randomised controlled trial Method of randomisation: drawing of lots Method of allocation: using an open random list of numbers
Participants	Source population: emergency department of a general hospital, Mexico Inclusion criteria: ankle fracture (confirmed through x-ray), within 12 hours of fracture, both genders, over 15 years of age, patients had to be able to rest for 24 hours after the bandage was applied, no dislocation, no associated fracture of the other leg, no open fracture, no multi-trauma, no vascular or neurological diseases of the lower limb, no compartment syndrome Participants randomised (N): treatment group - 26; control group - 24 Age [mean (SD)] (y): both groups combined - 39.6 (15.39) Sex (female/male): treatment group - 4/22; control group - 10/14 Surgery (yes/no): all had surgery Fracture severity (Weber A/B/C/missing): treatment group - 2/18/6/0; control group - 0/14/10/0

Interventions	Timing of randomisation: within 12 hours after fracture Treatment group: circular (Robert Jones) bandage for 24 hours Control group: backslab for 24 hours Both groups: resting with the lower limb at body level for 24 hours. Metamizol (15 mg/kg/dosis) every 6 hours or ketorolaco (30 mg fixed dosage) every 8 hours in case of allergies
Outcomes	Timing of assessments: baseline, 24 hours after randomisation End of treatment: 24-hours data used End of follow-up: nil Included in this review: pain, swelling Other: nil Dropouts (N): treatment group - 0; control group - 0.
Notes	Published in Spanish (with English abstract). Study eligibility assessed by Paula Beckenkamp and Daniel Steffens; data extraction performed by Paula Beckenkamp and Rafael Zambelli Pinto Additional information obtained from E Romero Zepeda (method of randomisation and allocation, surgery, dropouts, adverse events)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: by drawing of lots
Allocation concealment (selection bias)	High risk	Additional information obtained from author: using an open random list of numbers
Blinding (performance bias and detection bias) All outcomes	Low risk	Comment: participant and therapist blinding not possible. Assessor blinding implemented (an independent assessor measured swelling)
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis
Other bias	Low risk	Comment: the study groups were comparable at baseline in characteristics and the outcome of pain

Seiger 2009

Methods	Randomised controlled trial Method of randomisation: subjects chose a letter (A or B) out of a cup Method of allocation: not described
Participants	Source population: local orthopaedic surgeons offices, Provo, Utah, United States of America Inclusion criteria: ankle fracture, 6 to 12 weeks postoperative, wearing a walking boot and allowed to periodically remove the boot, able to weight bear as tolerated, implanted orthopedic metal at the fracture site, active dorsiflexion ROM < 10 degrees, no cardiac pacemaker, neuro-stimulator or fine wire implant, no neurological or metabolic disorder, no impaired mental cognition, no severe osteoporosis, no non-union of the fracture site, no altered or absent temperature sensation in the lower limb, not receiving concurrent physical therapy, chiropractic or osteopathic treatment for the fractured ankle. Participants randomised (N): treatment group - 7; control group - 7 Age [mean (SD)] (y): treatment group - 45.7 (10.6); control group - 37.0 (14.4) Sex (female/male): treatment group - 5/2; control group - 5/2 Surgery (yes/no): all had surgery Fracture severity (Weber A/B/C/missing): treatment group - 0/2/2/3; control group - 0/1/2/4
Interventions	Timing of randomisation: 6 to 12 weeks after surgical fixation, after participants were allowed to weight-bear as tolerated. Treatment group: thermal pulsed shortwave diathermy (27.12 MHz; 400 μsec; 800 pps; 48 W) 20 minutes twice a week for 12 sessions. Control group: non-thermal pulsed shortwave diathermy (27.12 MHz; 20 μsec; 50 pps) 20 minutes twice a week for a total of 12 sessions. Both groups: ankle and foot joint mobilisations, cold gel pack, home exercises twice a day
Outcomes	Timing of assessments: two to three times during each of the 12 treatment sessions End of treatment: 6-week data used End of follow-up: nil Included in this review: pain, ankle dorsiflexion and plantarflexion range of motion, swelling, adverse events Other: nil Dropouts: treatment group - 1; control group - 0
Notes	Additional information received from C Seiger (method of randomisation, source population)

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Participants were paired according to their entry date. The first of the pair was randomly assigned to groups by drawing a number out of a hat. The second in each pair was assigned to the other group

Seiger 2009 (*Continued*)

		Comment: randomisation sequence generated by a rule based on date of entry
Allocation concealment (selection bias)	High risk	Comment: allocation of the second participant in each pair was by alternation
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "The same therapist obtained all measurements. This therapist and all subjects were blinded to group assignment."
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "Participants were allowed to miss up to 3 sessions, no more than 2 sequentially, before being discharged from the study." Quote: "One subject in the treatment group completed 7 of 12 treatment sessions then stopped participation." Comment: data were not reported for this one participant at end of treatment. Excluding a patient from the analyses contradicts the intention-to-treat principle
Selective reporting (reporting bias)	High risk	Comment: one measurement (pain during shortwave diathermy) was not pre-specified in the protocol
Other bias	Low risk	Comment: the study groups were comparable at baseline in characteristics and the outcomes of pain, ankle dorsiflexion and plantarflexion range of motion and swelling

Siddique 2005

Methods	Quasi-randomised controlled trial Method of allocation: according to day of admission and the admitting consultant
Participants	Source population: four emergency departments within the catchment area of Merlin Park Regional Hospital, Ireland, between 15/01/2001 to 30/11/2001 Inclusion criteria: isolated Weber B lateral malleolar or bimalleolar ankle fracture, no syndesmosis injury, surgery within 24 hours, age 16 to 60 years, no cognitive difficulties, available for follow-up Participants randomised (N): treatment group - 22; control group - 22 Age: not reported Sex: not reported Surgery: all had surgery Fracture severity: all had Weber B uni- or bimalleolar fracture

Siddique 2005 (*Continued*)

Interventions	Timing of randomisation: on admission to emergency department Treatment group: no immobilisation Control group: below knee plaster cast for 6 weeks Both groups: partial weight-bearing at 4 weeks post-operatively, with gradual progression to full weight-bearing
Outcomes	Timing of assessments: 6 and 12 weeks after randomisation End of treatment: 6-week data used End of follow-up: 12-week data used Included in this review: activity limitation questionnaire, ankle dorsiflexion and plantarflexion range of motion, adverse events Other: patient satisfaction (data incomplete), pain (data incomplete), radiographs Dropouts: not reported
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Quote: "patients admitted under the care of consultant A were included to the immobilized group. Patients admitted under the care of consultant B were included to the mobilized group." Comment: quasi-random procedure.
Allocation concealment (selection bias)	High risk	Comment: quasi-random procedure.
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "An independent and blinded physiotherapist assessed all patients at 6 and 12 weeks post-surgery." Comment: participants and therapists were not blinded, but the outcome was unlikely to have been influenced. Assessor was blinded
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis due to incomplete reporting (insufficient data are presented for patient satisfaction and pain)
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Sondenaa 1986

Methods	Randomised controlled trial Method of randomisation: by mixing envelopes Method of allocation: by sealed envelopes
Participants	Source population: not reported Inclusion criteria: ankle fracture, surgical fixation required, satisfactory fracture reduction and osteosynthesis, compound or compression fracture excluded Participants randomised (N): treatment group - 20; control group - 23 Age [median (range)] (y): treatment group - 35 (16 to 59); control group - 37 (16 to 66) Sex (female/male): treatment group - 11/9; control group - 14/9 Fracture severity (Weber A/B/C): treatment group - 2/8/10; control group - 0/15/8
Interventions	Timing of randomisation: 1 day after surgery Treatment group: below knee backslab for 3 days, active ankle exercises after removal of backslab, 12 appointments of physiotherapy before 6 weeks Control group: below knee plaster cast for 6 weeks, non weight-bearing, 12 appointments of physiotherapy after 6 weeks Both groups: full weight-bearing after 6 weeks
Outcomes	Timing of assessments: 6, 12, 18 and 52 weeks after randomisation End of treatment: 6-week data used End of follow-up: 52-week data used Included in this review: pain, ankle dorsiflexion and plantarflexion range of motion, adverse events Other: strength (measured but not reported), swelling (subjective data), radiographs Dropouts (N): treatment group - 0; control group - 0
Notes	Additional information received from K Sondenaa (method of randomisation, assessor blinding, details of assessment and intervention, adverse events, co-morbidities)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: by mixing envelopes
Allocation concealment (selection bias)	Unclear risk	Additional information obtained from author: sealed envelopes Comment: insufficient information on numbering or opacity of envelopes
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented

Sondenaa 1986 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis due to incomplete reporting (insufficient data are presented for strength)
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Stockle 2000

Methods	Quasi-randomised controlled trial Method of allocation: random assignment according by order of presentation
Participants	Source population: not reported Inclusion criteria: isolated and first incidence of ankle fracture, surgical fixation required, age 18-65 years Participants randomised (N): treatment group - 20; control group - 20 Age (y): overall mean 45, range 20 to 65 Sex (female/male): overall 19/21 Surgery: all had surgery Fracture severity (Weber B/C): treatment group - 15/5; control group - 12/8
Interventions	Timing of randomisation: after surgery Treatment group: immobilised in Vacoped (removable immobilisation in a vacuum orthosis) for 6 weeks, which could be removed for wound check, hygiene and intermittent physiotherapy. Details of physiotherapy not reported. Control group: below knee plaster cast for 6 weeks Both groups: partial weight-bearing with crutches, heparin
Outcomes	Timing of assessments: 6 weeks and 3 months after randomisation End of treatment: 6-week data used End of follow-up: 3-month data used Included in this review: ankle dorsiflexion and plantarflexion range of motion, adverse events Other: subtalar range of motion, calf circumference Dropouts: not reported
Notes	Published in German. Study eligibility assessed by the German Cochrane Centre. English translation available and used as primary source of data extraction. Data extraction from German article by Erwin Scherfer and Jutta Jablonski

Risk of bias		***Risk of bias***

Stockle 2000 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Quote: "the assignment took place randomly after order of admittance to the emergency ward." Comment: quasi-random procedure.
Allocation concealment (selection bias)	High risk	Comment: quasi-random procedure.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Stuart 1989

Methods	Randomised controlled trial Method of randomisation: by random numbers table Method of allocation: by sealed, opaque and consecutively numbered envelopes
Participants	Source population: Newcastle General Hospital Accident Department, UK Inclusion criteria: stable supination-eversion stage II lateral malleolar fractures, adults, no tenderness on the medial side of ankle Participants randomised (N): treatment group - 20; control group - 20 Age: not reported Sex (female/male): not reported Surgery: none had surgery Fracture severity (supervision-eversion stage II): treatment group - all; control group - all
Interventions	Timing of group allocation: immediate on attendance Treatment group: air-stirrup for 4 weeks, then plaster cast for another 2 weeks if required Control group: below knee walking cast for 4 weeks, then plaster cast for another 2 weeks if required, non weight-bearing for 2 days to allow cast to dry Both groups: weight-bearing as tolerated, leg elevation while resting

Stuart 1989 (*Continued*)

Outcomes	Timing of assessments: 24 hours, 1, 4 weeks (and 6 weeks if required), 3 months after randomisation End of treatment: 4- and 6-week data used End of follow-up: nil Included in this review: ankle dorsiflexion and plantarflexion range of motion, adverse events Other: patient satisfaction (not measured at end of treatment or follow-up), swelling (not measured at end of treatment or follow-up), time to union, radiographs Dropouts (N): treatment group - 1; control group - 2
Notes	Additional information received from P Stuart (method of randomisation, method of allocation, no participant had surgery)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "the patients were allocated to one of two groups using a table of random numbers."
Allocation concealment (selection bias)	Low risk	Additional information obtained from author: by sealed, opaque and consecutively numbered envelopes
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "One patient requested a change from air stirrup. This must be considered a failure of the air stirrup management." Comment: this patient was excluded from the analysis. Excluding participants from analysis due to treatment adherence contravenes the intention to treat principle
Selective reporting (reporting bias)	High risk	Comment: some of the primary outcomes reported were not pre-specified
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Tropp 1995

Methods	Randomised controlled trial Method of randomisation: by shuffling envelopes Method of allocation: by sealed, opaque and consecutively numbered envelopes
Participants	Source population: not reported Inclusion criteria: Weber B or C ankle fracture, surgical fixation required, stable fracture fixation and satisfactory reduction, age 18 to 60 years, no large posterior tibial fragments Participants randomised (N): treatment group - 15; control group - 15 Age (y): overall mean 26, range 19 to 60 Sex: not reported Surgery: all had surgery Fracture severity: not reported
Interventions	Timing of randomisation: after surgery Treatment group: brace for 10 weeks, dorsiflexion and plantarflexion movements, strength and functional exercises starting immediately, crutches for at least the first 2 weeks Control group: walking cast for 6 weeks, crutches used during immobilisation and at least 2 to 4 weeks after removal of cast, mobility, strength and functional exercises starting after 6 weeks Both groups: weight-bearing
Outcomes	Timing of assessments: 10 weeks and 12 months after randomisation End of treatment: 10-week data used End of follow-up: 12-month data used Included in this review: activity limitation questionnaire, ankle dorsiflexion and plantarflexion range of motion, strength through range (data at 60 degrees/second used for analysis), swelling, adverse events Other: calf circumference, radiographs Dropouts (N): treatment group - 0; control group - 0
Notes	Additional information received from H Tropp (methods of randomisation and allocation, assessor blinding, fracture severity, details of intervention, dropouts, adverse events)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: by shuffling envelopes
Allocation concealment (selection bias)	Low risk	Additional information obtained from author: by sealed, opaque and consecutively numbered envelopes
Blinding (performance bias and detection bias) All outcomes	Low risk	Additional information obtained from author: assessor was blinded Comment: participant and therapist blinding not possible. Assessor blinding imple-

Tropp 1995 (*Continued*)

		mented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

van Laarhoven 1996

Methods	Quasi-randomised controlled trial Method of allocation: by day of accident
Participants	Source population: not reported Inclusion criteria: ankle fracture, surgical fixation required, stable fracture after operation suitable for early mobilisation, able to cope with either regime, no pilon fracture, open injury to physeal plate or grade II or III open fractures Participants randomised (N): treatment group - 41; control group - 40 Age [median (range)] (y): treatment group - 35.5 (17 to 77); control group - 37 (15 to 77) Sex (female/male): treatment group - 17/24; control group - 19/21 Surgery: all had surgery Fracture severity (uni-/bi- or trimalleolar): treatment group 17/24; control group - 16/24
Interventions	Timing of randomisation: 3 to 5 days after surgery Treatment group: walking cast for 6 weeks, weight-bearing, 9/41 participants received physiotherapy after 6 weeks Control group: no immobilisation, non weight-bearing with crutches, 14/40 participants received physiotherapy after 6 weeks Both groups: below knee plaster cast and range of motion exercises until randomisation
Outcomes	Timing of assessments: 10-16 days, 6 weeks, 3 months and 1 year after randomisation End of treatment: 6-week data used End of follow-up: 1-year data used Included in this review: activity limitation questionnaire, ankle dorsiflexion range of motion, adverse events Other: dropouts (data incomplete), radiographs, return to work Dropouts (N): 2 in total (group allocation not reported)
Notes	Additional information received from C van Laarhoven (co-morbidities)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**

van Laarhoven 1996 (*Continued*)

Random sequence generation (selection bias)	High risk	Quote: "we randomized using an odd or even date of accident." Comment: quasi-random procedure.
Allocation concealment (selection bias)	High risk	Comment: quasi-random procedure.
Blinding (performance bias and detection bias) All outcomes	High risk	Quote: "it was not possible to undertake blind assessment of the treatment groups." Comment: participant and therapist blinding not possible. Assessor blinding possible but not implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Venesmaa 2004

Methods	Randomised controlled trial Method of randomisation: not described Method of allocation: not described
Participants	Source population: Kuopio University Hospital, Finland Inclusion criteria: low energy uni- or bi-malleolar fracture Participants randomised (N): treatment group - 18; control group - 14 Age [median (range)] (y): treatment group - 41 (20 to 63); control group - 48 (19 to 69) Sex (female/male): treatment group - 10/8; control group - 8/6 Surgery: all had surgery Fracture severity: all had uni- or bi-malleolar fracture
Interventions	Timing of randomisation: not reported Treatment group: aircast for 6 weeks Control group: plaster cast for 6 weeks Both groups: nil other
Outcomes	Timing of assessments: 9 and 26 weeks after randomisation End of treatment: nil End of follow-up: 26-week data used Included in this review: activity limitation questionnaire, ankle dorsiflexion range of motion Other: nil

Venesmaa 2004 (*Continued*)

	Dropouts (N): not reported
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Comment: method of allocation not described.
Allocation concealment (selection bias)	Unclear risk	Comment: method of allocation not described.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient information provided.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis due to incomplete reporting (insufficient data are presented for activity limitation questionnaire)
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Vioreanu 2007

Methods	Quasi-randomised controlled trial Method of allocation: by birth dates
Participants	Source population: recruitment between 8/2004 to 3/2005 Inclusion criteria: acute, closed ankle fracture, surgical fixation required, age 14 to 65 years, fibular displacement > 2 mm, non-neuropathic joint, and none of the following - other severe injuries, pilon fracture, isolated medial malleolar fracture, diabetes mellitus, insufficiently stable fracture fixation Participants randomised (N): treatment group - 33; control group - 29; plus 4 dropouts, group allocation not reported Age [mean (SD)] (y): treatment group - 37.2 (12.9); control group - 34.9 (16.0) Sex (female/male): treatment group - 10/21; control group - 9/20 Surgery: all had surgery Fracture severity (Weber B/C): treatment group 29/4; control group - 21/8

Interventions	Timing of randomisation: after surgery Treatment group: removable fibreglass cast for 6 weeks, ankle range of motion exercise 3 times 10 minutes/day Control group: fibreglass cast (non-removable) for 6 weeks Both groups: prophylactic antibiotics pre-operatively, dorsal splint for 10-14 days, non weight-bearing with crutches, partial weight-bearing and physiotherapy after 6 weeks, full weight-bearing after 8 weeks
Outcomes	Timing of assessments: 2, 6, 9, 12, 24 weeks after randomisation (activity limitation measured at 9 and 12 weeks only) End of treatment: 6-week data used End of follow-up: 12-week data used as included activity limitation Included in this review: activity limitation questionnaire, quality of life (measured at 24 weeks only), ankle dorsiflexion range of motion, swelling, adverse events Other: radiographs, return to work, muscle atrophy, time to return to work and pre-injury activity Dropouts (N): 4 in total (group allocation not reported)
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Quote: "patients were randomly assigned, using their odd or even day of date of birth. " Comment: quasi-random procedure.
Allocation concealment (selection bias)	High risk	Comment: quasi-random procedure.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was implemented
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "two were noncompliant with either the weight-bearing status or exercise programme." Comment: these patients were excluded from the analysis. Excluding participants from analysis due to treatment adherence contravenes the intention to treat principle
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis due to incomplete reporting (insufficient data are presented for quality of life)

Vioreanu 2007 (*Continued*)

Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Wetzler 1991

Methods	Quasi-randomised controlled trial Method of allocation: by birth dates
Participants	Source population: Department of Orthopaedic Surgery, Boston City Hospital, USA Inclusion criteria: ankle fracture, surgical fixation required, adults Participants randomised (N): treatment group - 20; control group - 25 Age: not reported Sex: not reported Surgery: all had surgery Fracture severity : not reported
Interventions	Timing of randomisation: after surgery Treatment group: pneumatic walker for 1 to 2 weeks, then pneumatic ankle brace for an unspecified period Control group: below knee plaster cast for 6 weeks Both groups: weight-bearing
Outcomes	Timing of assessments: 1, 2, 4, 6, 12 weeks, 6 months and 1 year after randomisation End of treatment: 6-week data used End of follow-up: 1-year data used Included in this review: activity limitation questionnaire, pain, ankle dorsiflexion and plantarflexion range of motion Other: nil Dropouts: not reported
Notes	Additional information received from M Wetzler (method of allocation, weight-bearing status)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Additional information obtained from author: allocation by birth dates Comment: quasi-random procedure.
Allocation concealment (selection bias)	High risk	Comment: quasi-random procedure.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Comment: participant and therapist blinding not possible. Insufficient information on whether assessor blinding was imple-

Wetzler 1991 (*Continued*)

		mented
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Comment: insufficient reporting of attrition.
Selective reporting (reporting bias)	High risk	Comment: data on key outcomes could not be entered into meta-analysis due to incomplete reporting (insufficient data are presented for all outcomes presented)
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Wilson 1991

Methods	Randomised controlled trial Method of randomisation: by shuffling envelopes Method of allocation: by sealed opaque envelopes selected by receptionist/physiotherapy assistant
Participants	Source population: Fracture Clinic at Rotorua Hospital, New Zealand Inclusion criteria: ankle fracture treated with or without surgery, age 16 to 65 years, immediate referral from fracture clinic to physiotherapy after cast removal (length of immobilisation = 6 weeks), no pre-existing joint pathology or severe leg injury/pathology, able to comply with treatment protocol, full mobility of unaffected ankle Participants randomised (N): treatment group - 7; control group - 5 Age [mean (SD)] (y): treatment group - 47.2 (16.3); control group - 40.6 (15.4) Sex (female/male): treatment group - 1/4; control group - 2/3 Surgery (yes/no): treatment group - 1/4; control group - 2/3 Fracture severity (Weber B/C): treatment group - 4/1; control group - 4/1
Interventions	Timing of randomisation : immediately after cast removal Treatment group: 3 physiotherapy sessions/week for 5 weeks of Kaltenborn-based manual therapy to the talocrural and talocalcaneal joints, plus other lower limb joints assessed to be hypomobile by the physiotherapist Control group: 3 physiotherapy sessions/week for 5 weeks Both groups: whirlpool exercises, individual exercise programme, home exercises
Outcomes	Timing of assessments: 5 weeks after randomisation End of treatment: 5-week data used End of follow-up: nil Included in this review: activity limitation questionnaire, ankle dorsiflexion and plantarflexion range of motion Other: nil Dropouts (N): treatment group - 2; control group - 0
Notes	Additional information received from F Wilson (methods of randomisation and allocation)

Wilson 1991 (*Continued*)

Risk of bias		*Risk of bias*
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Additional information obtained from author: by shuffling envelopes
Allocation concealment (selection bias)	Unclear risk	Additional information obtained from author: by sealed opaque envelopes selected by receptionist/physiotherapy assistant Comment: insufficient information on numbering of envelopes
Blinding (performance bias and detection bias) All outcomes	Low risk	Quote: "A 'blind' assessor recorded measurements." Comment: participants and therapists were not blinded, but the outcome was unlikely to have been influenced. The assessor was blinded
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "Excluded from the study were two patients who were ascribed to the manual therapy group, but failed to complete five week treatment." Comment: Excluding participants from analysis due to treatment adherence contravenes the intention to treat principle
Selective reporting (reporting bias)	Low risk	Comment: all pre-specified outcomes included.
Other bias	Unclear risk	Comment: no baseline data on any outcomes were reported to assess study group comparability

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Airaksinen 1988	Unable to contact authors to obtain clarifying information regarding study eligibility (study design, timing of allocation to treatment)
Airaksinen 1989	Unable to contact author to obtain clarifying information regarding study eligibility (study design, timing of allocation to treatment)

(*Continued*)

Biewener 2002	Not a randomised or quasi-randomised controlled trial
Bottai 1992	Not a randomised or quasi-randomised controlled trial
Burwell 1965	Not a randomised or quasi-randomised controlled trial
Caschman 2004	Treatment was administered pre-operatively, not post-operatively
Chen 2003	Not a randomised or quasi-randomised controlled trial
Cimino 1991	The sample included a non-randomised subset which was included retrospectively. Data for the randomised participants were not available separately for extraction
Cohen 2001	Results included participants with other arm and leg injuries. Data for participants with ankle fracture were not available separately for extraction
Cook 1997	Tibial shaft fracture, not ankle fracture
Dietrich 2002	Not a randomised or quasi-randomised controlled trial. Study compared surgical orthopaedic treatment to conservative orthopaedic treatment
Farsetti 2009	Not a randomised or quasi-randomised controlled trial
Fischer 1982	Unable to retrieve abstract or full-text article to assess study eligibility
Fourie 1998	Tibial shaft fracture, not ankle fracture
Geboers 2000	Not a randomised or quasi-randomised controlled trial
Godsiff 1993	Not a randomised or quasi-randomised controlled trial
Handolin 2005b	The only outcome reported was fracture healing
Handolin 2005c	The only outcomes reported were fracture healing and bone mineral density
Heckman 1994	Tibial shaft fracture, not ankle fracture
Hershko 2008	Lower limb fracture, not ankle fracture
Holland 2010	The only outcomes reported were length of hospital stay, wound breakdown rate and morphine equivalence score
Jorgensen 1986	Results included participants with other injuries. Data for participants with ankle fracture were not available separately for extraction
Kalish 1987	Not a randomised or quasi-randomised controlled trial
Konrad 2005	Treatment was administered pre-operatively, not post-operatively

(*Continued*)

Leung 2004	Tibial shaft fracture, not ankle fracture
Lin 2010	Not a randomised or quasi-randomised controlled trial
Mason 2010	Not a randomised or quasi-randomised controlled trial
Miller 2006	Participants included had to be malnourished, and most had hip fractures
Mittal 2010	Study compares surgical and conservative orthopaedic management
Mittlmeier 2000	Fulfilled inclusion criteria but insufficient information available on study details (including the numbers allocated to each group and participant characteristics) and insufficient data available for data analysis, even after contact with author. In this trial, adults after ankle fracture were randomly allocated to cryotherapy, compression or no treatment. Outcomes included swelling. (Study written in German. Study eligibility assessed by the German Cochrane Centre. Data extraction performed by Erwin Scherfer and Jutta Jablonski.)
Mora 2002	Treatment was administered pre-operatively, not post-operatively
Munn 2009	Not a randomised or quasi-randomised controlled trial
Neumann 1989	Participants were normal healthy subjects
Nielsen 1981	Results included participants with other fractures. Data for participants with ankle fracture were not available separately for extraction
Noh 2010	The study compared an air stirrup splint in patients with ankle sprains versus patients with an avulsion fracture
Partio 1992	Unable to contact authors to obtain clarifying information regarding study eligibility (study design)
Polendakov 1999	Not a randomised or quasi-randomised controlled trial
Port 1996	Not a randomised or quasi-randomised controlled trial
Richter 1994	Not a randomised or quasi-randomised controlled trial
Sarmiento 1995	Closed diaphyseal tibial fracture, not ankle fracture
Schleikis 2002	Unable to contact authors to obtain clarifying information regarding study eligibility (study design). (Published in German. Study eligibility assessed by the German Cochrane Centre.)
Scott 2010	Not a randomised or quasi-randomised controlled trial
Shaffer 2000	Not a randomised or quasi-randomised controlled trial
Solomon 2011	Not ankle fracture

(*Continued*)

Stapert 1986	Fulfilled inclusion criteria but insufficient information available on study details (including the numbers allocated to each group and participant characteristics) and insufficient data available for data analysis, even after contact with author. In this randomised controlled trial, adults after Weber A ankle fracture received a walking cast and physiotherapy, or a bandage and no physiotherapy. Outcomes were assessed at 9, 12, and 14 weeks, and 1 and 5 years after randomisation, and included activity limitation and swelling. (Published in German. Study eligibility assessed by the German Cochrane Centre. Data extraction performed by Erwin Scherfer and Jutta Jablonski.)
Stockle 1997	Results included participants with other arm and leg injuries. Data for participants with ankle fracture were not available separately for extraction. (Published in German. Study eligibility assessed by the German Cochrane Centre.)
Stotzer 1995	Surgical treatment only
Thordarson 1997	Treatment was administered pre-operatively, not post-operatively
Trimble 2005	Treatment was administered pre-operatively, not post-operatively
Veldhuizen 1988	Not a randomised or quasi-randomised controlled trial
Wang 2005	Unable to contact authors to obtain clarifying information regarding study eligibility (tibial fracture included but unclear whether study included ankle fracture, timing of allocation to treatment). (Published in Chinese. Study eligibility assessed by the Chinese Cochrane Centre.)
Zeegers 1989	Not a randomised or quasi-randomised controlled trial

Characteristics of ongoing studies *[ordered by study ID]*

ACTRN12610000557033

Trial name or title	Early mobilisation post ankle fracture fixation
Methods	Randomised controlled trial
Participants	Source population: not described Inclusion criteria: ankle fracture, surgical fixation required, age 18 to 65 years, males and females, no diabetes or multi-trauma Participants randomised (N): 80
Interventions	Treatment group: no cast post surgical fixation. Moonboot for comfort only, range of motion exercises but no formal outpatient physiotherapy for 6 weeks Control group: cast for 6 weeks Both groups: non weight-bearing for 6 weeks, after which weight-bearing as tolerated and encouragement to work on ankle range of motion. Referral to physiotherapy as patients desire
Outcomes	Activity limitation questionnaire, adverse events Other: return to work

ACTRN12610000557033 (*Continued*)

Starting date	1/10/2010
Contact information	R Kejriwal, 66 Ngahere Drive, Whangarei 0110, New Zealand, ritwikkejriwal@gmail.com
Notes	This study is in the recruitment stage (information obtained from R Kejriwal)

ISRCTN33416471

Trial name or title	A trial comparing weight bearing to non-weight bearing following ankle fracture fixation
Methods	Randomised controlled trial
Participants	Source population: Trauma and Orthopaedic Department at St George's Hospital and St Thomas' Hospital, United Kingdom Inclusion criteria: ankle fracture, surgical fixation required, female and male subjects, age 18 to 70 years, body mass index 16 to 33 kg/m² (minimum body weight 50 kg, maximum 140 kg), Glasgow coma score 15, informed consent, able to undertake assessment and treatment procedures, no contralateral lower limb injury, able to non-weight bear initially if allocated to non-weight bearing group, stable fracture after surgical fixation, no rupture to the syndesmosis, no previous ankle fracture, closed, no bone grafting required, no active or past history of malignant tumour, no systemic or localised infection at time of surgery, no evidence of immunosuppression, no diabetes mellitus (Type I or Type II), no gross osteoarthritic changes of the ankle joint, no previous surgical intervention to the operated ankle, able to attend out-patient physiotherapy appointments, able to independently mobilise with or without walking aids Participants randomised (N): not described
Interventions	Early weight-bearing group: aircast and full weight bearing from 2 weeks after surgery Delayed weight-bearing group: non weight bearing cast from 2 weeks after surgery Both groups: backslab applied at the time of surgery. Full weight-bearing from 6 weeks
Outcomes	Activity limitation questionnaire, quality of life, ankle dorsiflexion and plantarflexion range of motion, adverse events Other: patient reported outcome measures (not described), time lost from work, duration of in-patient stay, duration of physiotherapy rehabilitation, anatomical reduction and time to fracture union
Starting date	01/01/2011
Contact information	C Hing, St George's Hospital, Tooting, London, SW17 0QT, United Kingdom
Notes	

Moseley

Trial name or title	Exercise or advice after ankle fracture
Methods	Randomised controlled trial
Participants	Source population: fracture clinics of four public hospitals in Sydney, Australia Inclusion criteria: ankle fracture treated with immobilisation (with or without surgical fixation), age > 16 years, males and females, immobilisation removed on the day of recruitment, weight-bear as tolerated or partial weight-bear, reduced ankle dorsiflexion range of motion, at least 2 out of 10 pain in the ankle when up to 50% of body weight is borne through the affected leg, completed skeletal growth, no concurrent pathologies, provides informed consent Participants randomised (N): 342
Interventions	Treatment group: participate in an exercise programme that is designed, monitored and progressed by a physiotherapist Control group: see intervention for both groups. Both groups: Advice will be provided in a single session in the fracture clinic, after cessation of immobilisation. A physiotherapist will instruct the participant to do exercises that focus on ankle movement in non-weight-bearing positions and will explain how to perform these exercises and how to progressively reduce the use of any walking aids at home
Outcomes	Activity limitation questionnaire, activity limitation test, ankle range of motion, pain Other: quality-adjusted life years, number of days to pain-free walking, number of days to return to full pre-fracture work, return to pre-fracture work and leisure, level of physical activity, global perceived effect of treatment, cost-effectiveness and cost-utility
Starting date	15/11/2010
Contact information	Dr Anne Moseley The George Institute for Global Health PO Box M201 Missenden Road NSW 2050 Australia Ph: +61 2 9657 3000 Fax: +61 2 9657 0301 E: amoseley@georgeinstitute.org.au
Notes	

N0055190984

Trial name or title	Post operative management of ankle fractures treated with ORIF, six weeks in cast vs no cast and active early physiotherapy
Methods	Randomised controlled trial
Participants	Source population: not described Inclusion criteria: ankle fracture, surgical fixation required Participants randomised (N): 90 in total

N0055190984 (*Continued*)

Interventions	Treatment group: ice for 48 hours and on signs of inflammation, elevation. Referral to physiotherapy on hospital discharge. Range of motion and theraband exercises, soft tissue techniques. Control group: immobilisation for 6 weeks Both groups: non weight-bearing on auxillary crutches for 6 weeks. After 6 weeks - progress to partial then full weight-bearing, ice for inflammation, ankle range of motion, stretching, strengthening, proprioception, agility and plyometric exercises, cardiovascular exercises, soft tissue techniques, joint mobilisation to ankle and foot if range of motion restricted, and join lower limb rehabilitation group if appropriate
Outcomes	Activity limitation questionnaire
Starting date	March 2007
Contact information	A Sprowson, Specialist Registrar in Orthopaedics, NCAHT, Cumberland Infirmary, UK
Notes	This study was identified in the earlier version of the review. It is still recruiting patients (information obtained from A Sprowson)

NCT01127776

Trial name or title	APOS System Effects in Post-operation Bi-trimalleolar Fracture of Ankle Prospective, Comparative Randomized Trial Study
Methods	Randomised controlled trial
Participants	Source population: not described Inclusion criteria: bi-/trimalleolar ankle fracture, surgical fixation required, age 18 to 65 years, males and females, cast after 3 weeks, full weight-bearing after 6 weeks, able to receive physiotherapy, willing to participate and giving informed consent, no muscular or nerve disorders, able to use the APOS System, no physical or mental handicap to interfere with completing the experimental protocol, cooperative with the basic rehabilitation programme Participants randomised (N): 60.
Interventions	Treatment group: APOS walking system. Control group: same walking protocol as the treatment group without biomechanics units
Outcomes	Activity limitation questionnaire, activity limitation test, quality of life Other: WOMAC, clinical examination.
Starting date	October 2010
Contact information	Dr Ezequiel Palmanovich Orthopedics Department Meir Medical Center Tchernichovsky st. 59 Kfar-Saba - 44281 Israel Email: ezepalm@gmail.com

NCT01127776 (*Continued*)

Notes	This study is in the recruitment stage (information obtained from Dr Palmanovich)

DATA AND ANALYSES

Comparison 1. Air-stirrup vs other immobilisation after conservative orthopaedic management

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Adverse events	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
1.1 Air-stirrup vs orthosis	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 Air-stirrup vs cast	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 2. Hypnosis during immobilisation after conservative orthopaedic management

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation test (longest distance walked in m)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Pain (0 to 10 numerical scale)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Ankle dorsiflexion range of motion (difference between sides in degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Ankle plantarflexion range of motion (difference between sides in degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Swelling (difference in ankle circumference between sides in cm)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 3. No immobilisation vs cast immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 At end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

2 Ankle dorsiflexion range of motion (degrees)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 At end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 At end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Ankle plantarflexion range of motion (degrees)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 At end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.2 At end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Adverse events	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 4. Type of immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain (10-cm visual analogue scale) at end of treatment	2		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Bandage vs backslab	2	86	Mean Difference (IV, Fixed, 95% CI)	-0.09 [-1.08, 0.91]
1.2 Cast vs other immobilisation	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Ankle dorsiflexion range of motion (degrees from plantigrade) at end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Bandage vs backslab	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 Cast vs other immobilisation	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 5. Compression stocking in addition to cast immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Swelling (difference in ankle circumference between sides in cm)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Adverse events	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 6. Weight-bearing during immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation questionnaire at end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Early vs late weight-bearing	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 Walking cast and early weight-bearing vs no immobilisation and late weight-bearing	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.3 Orthosis and early weight-bearing vs dorsal splint and late weight-bearing	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Ankle dorsiflexion range of motion (% of non-fractured side) at end of follow-up	3		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Early vs late weight-bearing	2	90	Mean Difference (IV, Fixed, 95% CI)	6.17 [0.14, 12.20]
2.2 Walking cast and early weight-bearing vs no immobilisation and late weight-bearing	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.3 Orthosis and early weight-bearing vs dorsal splint and late weight-bearing	1	43	Mean Difference (IV, Fixed, 95% CI)	3.0 [-3.29, 9.29]
3 Ankle plantarflexion range of motion (% of non-fractured side) at end of follow-up	3		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3.1 Early vs late weight-bearing	2	90	Mean Difference (IV, Fixed, 95% CI)	-1.55 [-6.35, 3.25]
3.2 Walking cast and early weight-bearing vs no immobilisation and late weight-bearing	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.3 Orthosis and early weight-bearing vs dorsal splint and late weight-bearing	1	43	Mean Difference (IV, Fixed, 95% CI)	2.0 [-2.21, 6.21]
4 Swelling (% of non-fractured side) at end of follow-up	3		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
4.1 Early vs late weight-bearing	2	90	Mean Difference (IV, Fixed, 95% CI)	0.0 [-1.42, 1.42]
4.2 Walking cast and early weight-bearing vs no immobilisation and late weight-bearing	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.3 Orthosis and early weight-bearing vs dorsal splint and late weight-bearing	1	43	Mean Difference (IV, Fixed, 95% CI)	0.0 [-1.79, 1.79]

5 Adverse events	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Early vs late weight-bearing	3	132	Risk Ratio (M-H, Fixed, 95% CI)	2.02 [0.60, 6.85]
5.2 Walking cast and early weight-bearing vs no immobilisation and late weight-bearing	0	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.3 Orthosis and early weight-bearing vs dorsal splint and late weight-bearing	1	43	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 7. Exercise during immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation questionnaire at end of treatment	4		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Backslab and exercise vs backslab and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 No immobilisation and exercise vs cast and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.3 Removable type of immobilisation and exercise vs cast and no exercise	4		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Activity limitation questionnaire at end of follow-up	6		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Backslab and exercise vs backslab and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 No immobilisation and exercise vs cast and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.3 Removable type of immobilisation and exercise vs cast and no exercise	5		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Activity limitation questionnaire (able to climb 12 steps independently) at the end of follow-up	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Backslab and exercise vs backslab and no exercise	0		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.2 No immobilisation and exercise vs cast and no exercise	0		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.3 Removable type of immobilisation and exercise vs cast and no exercise	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Pain (numbers with pain) at end of treatment	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

4.1 Backslab and exercise vs backslab and no exercise	0		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.2 No immobilisation and exercise vs cast and no exercise	0		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.3 Removable type of immobilisation and exercise vs cast and no exercise	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Pain (numbers with pain) at end of follow-up	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Backslab and exercise vs backslab and no exercise	0	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.2 No immobilisation and exercise vs cast and no exercise	1	43	Risk Ratio (M-H, Fixed, 95% CI)	1.01 [0.44, 2.28]
5.3 Removable type of immobilisation and exercise vs cast and no exercise	2	69	Risk Ratio (M-H, Fixed, 95% CI)	0.39 [0.22, 0.68]
6 Ankle dorsiflexion range of motion at end of treatment	5		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6.1 Backslab and exercise vs backslab and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.2 No immobilisation and exercise vs cast and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.3 Removable type of immobilisation and exercise vs cast and no exercise	4		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Ankle dorsiflexion range of motion at end of follow-up	7		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
7.1 Backslab and exercise vs backslab and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.2 No immobilisation and exercise vs cast and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.3 Removable type of immobilisation and exercise vs cast and no exercise	5		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8 Ankle plantarflexion range of motion at end of treatment	4		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
8.1 Backslab and exercise vs backslab and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.2 No immobilisation and exercise vs cast and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.3 Removable type of immobilisation and exercise vs cast and no exercise	4		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
9 Ankle plantarflexion range of motion at end of follow-up	6		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
9.1 Backslab and exercise vs backslab and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
9.2 No immobilisation and exercise vs cast and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

9.3 Removable type of immobilisation and exercise vs cast and no exercise	5		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
10 Ankle dorsiflexion and plantarflexion combined range of motion (degrees) at end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
10.1 Backslab and exercise vs backslab and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
10.2 No immobilisation and exercise vs cast and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
10.3 Removable type of immobilisation and exercise vs cast and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
11 Ankle dorsiflexion and plantarflexion combined range of motion (degrees) at end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
11.1 Backslab and exercise vs backslab and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
11.2 No immobilisation and exercise vs cast and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
11.3 Removable type of immobilisation and exercise vs cast and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12 Strength (peak torque in Nm) at end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
12.1 Backslab and exercise vs backslab and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12.2 No immobilisation and exercise vs cast and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12.3 Removable type of immobilisation and exercise vs cast and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
13 Strength (peak torque in Nm) at end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
13.1 Backslab and exercise vs backslab and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
13.2 No immobilisation and exercise vs cast and no exercise	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
13.3 Removable type of immobilisation and exercise vs cast and no exercise	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
14 Swelling (difference in ankle circumference between sides in cm) at end of treatment	3		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
14.1 Backslab and exercise vs backslab and no exercise	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
14.2 No immobilisation and exercise vs cast and no exercise	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

14.3 Removable type of immobilisation and exercise vs cast and no exercise	3	192	Mean Difference (IV, Fixed, 95% CI)	-0.04 [-0.32, 0.25]
15 Swelling (difference in ankle circumference between sides in cm) at end of follow-up	2		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
15.1 Backslab and exercise vs backslab and no exercise	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
15.2 No immobilisation and exercise vs cast and no exercise	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
15.3 Removable type of immobilisation and exercise vs cast and no exercise	2	118	Mean Difference (IV, Fixed, 95% CI)	-0.19 [-0.52, 0.14]
16 Adverse events	9		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
16.1 Backslab and exercise vs backslab and no exercise	0	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
16.2 No immobilisation and exercise vs cast and no exercise	2	80	Risk Ratio (M-H, Fixed, 95% CI)	1.10 [0.16, 7.36]
16.3 Removable type of immobilisation and exercise vs cast and no exercise	7	398	Risk Ratio (M-H, Fixed, 95% CI)	2.30 [1.49, 3.56]

Comparison 8. Weight-bearing and exercise during immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Quality of life (SF-12 physical subscale)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 At end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Patient satisfaction (visual analogue scale, /10)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.2 At end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Pain (visual analogue scale, /10)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.2 At end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Ankle dorsiflexion range of motion (degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.2 At end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Ankle plantarflexion range of motion (degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

6.2 At end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Swelling (difference in ankle circumference between sides in cm)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
7.1 At end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.2 At end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8 Adverse events	2	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 9. Electrotherapy during immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100) at end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Ultrasound for bone healing	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 Electrical stimulation for muscle strength	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.3 Interferential therapy	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.4 Non-invasive interactive neurostimulation	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Activity limitation questionnaire (Olerud Molander Ankle Score, /100) at end of follow-up	2		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Ultrasound for bone healing	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 Electrical stimulation for muscle strength	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.3 Interferential therapy	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.4 Non-invasive interactive neurostimulation	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Pain (visual analogue scale, /10) at end of treatment	2		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 Ultrasound for bone healing	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.2 Electrical stimulation for muscle strength	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.3 Interferential therapy	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.4 Non-invasive interactive neurostimulation	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Pain (visual analogue scale, /10) at end of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 Ultrasound for bone healing	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.2 Electrical stimulation for muscle strength	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.3 Interferential therapy	0		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

4.4 Non-invasive interactive neurostimulation	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Pain (numbers with pain) at end of follow-up	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 Ultrasound for bone healing	1	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.2 Electrical stimulation for muscle strength	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.3 Interferential therapy	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.4 Non-invasive interactive neurostimulation	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Ankle dorsiflexion range of motion (ratio of fractured over non-fractured side) at end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6.1 Ultrasound for bone healing	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.2 Electrical stimulation for muscle strength	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.3 Interferential therapy	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.4 Non-invasive interactive neurostimulation	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Ankle dorsiflexion range of motion (ratio of fractured over non-fractured side) at end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
7.1 Ultrasound for bone healing	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.2 Electrical stimulation for muscle strength	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.3 Interferential therapy	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.4 Non-invasive interactive neurostimulation	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8 Ankle dorsiflexion range of motion (mild restriction, yes/no)	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
8.1 Ultrasound for bone healing	1	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.2 Electrical stimulation for muscle strength	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.3 Interferential therapy	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.4 Non-invasive interactive neurostimulation	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
9 Ankle plantarflexion range of motion (ratio of fractured over non-fractured side) at end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
9.1 Ultrasound for bone healing	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
9.2 Electrical stimulation for muscle strength	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

9.3 Interferential therapy	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
9.4 Non-invasive interactive neurostimulation	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
10 Ankle plantarflexion range of motion (ratio of fractured over non-fractured side) at end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
10.1 Ultrasound for bone healing	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
10.2 Electrical stimulation for muscle strength	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
10.3 Interferential therapy	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
10.4 Non-invasive interactive neurostimulation	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
11 Ankle range of motion (dorsi- and plantarflexion combined, degrees)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
11.1 Ultrasound for bone healing	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
11.2 Electrical stimulation for muscle strength	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
11.3 Interferential therapy	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
11.4 Non-invasive interactive neurostimulation	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12 Swelling at end of treatment	2	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
12.1 Ultrasound for bone healing	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12.2 Electrical stimulation for muscle strength	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12.3 Interferential therapy	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12.4 Non-invasive interactive neurostimulation (mm)	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
13 Swelling (ratio of fractured over non-fractured side) at end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
13.1 Ultrasound for bone healing	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
13.2 Electrical stimulation for muscle strength	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
13.3 Interferential therapy	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
13.4 Non-invasive interactive neurostimulation	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
14 Swelling (yes/no)	1	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
14.1 Ultrasound for bone healing	1	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
14.2 Electrical stimulation for muscle strength	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
14.3 Interferential therapy	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
14.4 Non-invasive interactive neurostimulation	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
15 Adverse events	2	Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

15.1 Ultrasound for bone healing	1	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
15.2 Electrical stimulation for muscle strength	1	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
15.3 Interferential therapy	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
15.4 Non-invasive interactive neurostimulation	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 10. Stretching post-immobilisation after conservative or surgical orthopaedic management

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation questionnaire (Lower Extremity Functional Scale, /80)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Activity limitation test (walking speed, m/s)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Patient satisfaction (100-mm visual analogue scale)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 At end of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Pain (on stair descent, 100 mm visual analogue scale)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.2 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Ankle dorsiflexion range of motion (degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.2 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Adverse events	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 11. Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation questionnaire	2		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 End of treatment	2		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 End of follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Activity limitation test (walking speed, m/s)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.2 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

3 Quality of life (Assessment of Quality of Life, /45)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 End of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.2 End of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Patient satisfaction (100-mm visual analogue scale)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 End of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Pain (on equal weight bearing, 100-mm visual analogue scale)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5.1 End of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.2 End of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Ankle dorsiflexion range of motion	2	Std. Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6.1 End of treatment	2	Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.2 End of follow-up	1	Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Ankle plantarflexion range of motion (difference between sides in degrees)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
7.1 End of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.2 End of follow-up	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8 Adverse events	1	Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

Comparison 12. Exercise post-immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Activity limitation test (9-meter walking test, seconds)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Quality of life (SF-12 physical subscale)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Ankle dorsiflexion range of motion (degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Ankle plantarflexion range of motion (degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5.1 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Strength (number of toe rises performed)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6.1 End of follow-up	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Adverse events	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
7.1 End of follow-up	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 13. Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain (100-mm visual analogue scale)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Ankle dorsiflexion range of motion (degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Ankle plantarflexion range of motion (degrees)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Swelling (volumetric displacement, ml)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 End of treatment	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Adverse events	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 End of treatment	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 14. Subgroup analysis (conservative versus surgical treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Effect of stretching on activity limitation questionnaire (Lower Extremity Functional Scale, /80)	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Participants with conservative orthopaedic management at end of treatment	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 Participants with conservative orthopaedic management at end of follow-up	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.3 Participants with surgical orthopaedic management at end of treatment	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.4 Participants with surgical orthopaedic management at end of follow-up	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Effect of stretching on activity limitation test (walking speed, m/s)	1		Mean Difference (IV, Random, 95% CI)	Totals not selected

2.1 Participants with conservative orthopaedic management at end of treatment	1	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.2 Participants with conservative orthopaedic management at end of follow-up	1	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.3 Participants with surgical orthopaedic management at end of treatment	1	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.4 Participants with surgical orthopaedic management at end of follow-up	1	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Effect of manual therapy on activity limitation questionnaire (Lower Extremity Functional Scale, /80)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 Participants with conservative orthopaedic management at end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.2 Participants with conservative orthopaedic management at end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.3 Participants with surgical orthopaedic management at end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.4 Participants with surgical orthopaedic management at end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Effect of manual therapy on activity limitation test (walking speed, m/s)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 Participants with conservative orthopaedic management at end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.2 Participants with conservative orthopaedic management at end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.3 Participants with surgical orthopaedic management at end of treatment	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.4 Participants with surgical orthopaedic management at end of follow-up	1	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 15. Sensitivity analysis (on Analysis 7.16.3)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Adverse events	5		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Low risk random sequence generation	3	194	Risk Ratio (M-H, Fixed, 95% CI)	2.83 [1.59, 5.04]
1.2 Low risk allocation concealment	3	194	Risk Ratio (M-H, Fixed, 95% CI)	2.83 [1.59, 5.04]
1.3 Low risk blinding	3	194	Risk Ratio (M-H, Fixed, 95% CI)	2.83 [1.59, 5.04]
1.4 Low risk incomplete outcome data	5	317	Risk Ratio (M-H, Fixed, 95% CI)	2.62 [1.53, 4.48]

Analysis 1.1. Comparison 1 Air-stirrup vs other immobilisation after conservative orthopaedic management, Outcome 1 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 1 Air-stirrup vs other immobilisation after conservative orthopaedic management

Outcome: 1 Adverse events

Study or subgroup	Air-stirrup n/N	Other n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Air-stirrup vs orthosis				
Brink 1996	1/29	1/28		0.97 [0.06, 14.70]
2 Air-stirrup vs cast				
Stuart 1989	1/19	2/18		0.47 [0.05, 4.78]

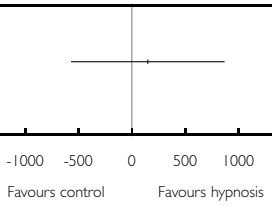
Analysis 2.1. Comparison 2 Hypnosis during immobilisation after conservative orthopaedic management, Outcome 1 Activity limitation test (longest distance walked in m).

Review: Rehabilitation for ankle fractures in adults

Comparison: 2 Hypnosis during immobilisation after conservative orthopaedic management

Outcome: 1 Activity limitation test (longest distance walked in m)

Study or subgroup	Hypnosis N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Ginandes 1999 (1)	5	3150 (820.64)	6	3000 (0.001)		150.00 [-569.31, 869.31]



(1) SDs imputed from standard errors (SEs), but control group SE = 0.0, SD was entered as 0.001 to calculate 95% CI

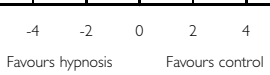
Analysis 2.2. Comparison 2 Hypnosis during immobilisation after conservative orthopaedic management, Outcome 2 Pain (0 to 10 numerical scale).

Review: Rehabilitation for ankle fractures in adults

Comparison: 2 Hypnosis during immobilisation after conservative orthopaedic management

Outcome: 2 Pain (0 to 10 numerical scale)

Study or subgroup	Hypnosis N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Ginandes 1999 (1)	5	0.4 (0.54)	6	0.83 (1.18)		-0.43 [-1.49, 0.63]



(1) SD imputed from standard error (hypnosis group 0.24; control group 0.48)

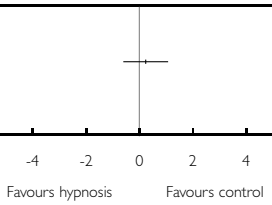
Analysis 2.3. Comparison 2 Hypnosis during immobilisation after conservative orthopaedic management, Outcome 3 Ankle dorsiflexion range of motion (difference between sides in degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 2 Hypnosis during immobilisation after conservative orthopaedic management

Outcome: 3 Ankle dorsiflexion range of motion (difference between sides in degrees)

Study or subgroup	Hypnosis N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Ginandes 1999 (1)	5	0.4 (0.89)	6	0.17 (0.42)		0.23 [-0.62, 1.08]



(1) SD imputed from standard error (hypnosis group 0.40; control group 0.17)

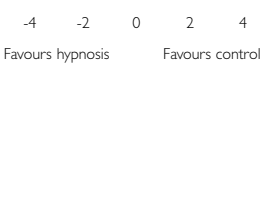
Analysis 2.4. Comparison 2 Hypnosis during immobilisation after conservative orthopaedic management, Outcome 4 Ankle plantarflexion range of motion (difference between sides in degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 2 Hypnosis during immobilisation after conservative orthopaedic management

Outcome: 4 Ankle plantarflexion range of motion (difference between sides in degrees)

Study or subgroup	Hypnosis N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Ginandes 1999 (1)	5	0.6 (0.54)	6	0.83 (2.03)		-0.23 [-1.92, 1.46]



(1) SD imputed from standard error (hypnosis group 0.60; control group 0.83)

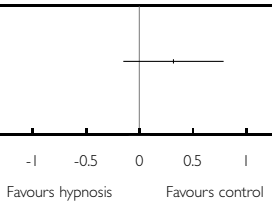
Analysis 2.5. Comparison 2 Hypnosis during immobilisation after conservative orthopaedic management, Outcome 5 Swelling (difference in ankle circumference between sides in cm).

Review: Rehabilitation for ankle fractures in adults

Comparison: 2 Hypnosis during immobilisation after conservative orthopaedic management

Outcome: 5 Swelling (difference in ankle circumference between sides in cm)

Study or subgroup	Hypnosis N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Ginandes 1999 (1)	5	1.4 (0.42)	6	1.08 (0.37)		0.32 [-0.15, 0.79]



(1) SD imputed from standard error (hypnosis group 0.19; control group 0.15)

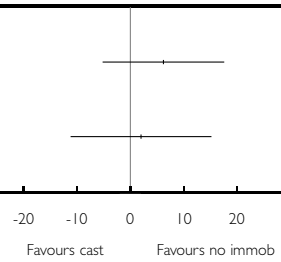
Analysis 3.1. Comparison 3 No immobilisation vs cast immobilisation after surgical fixation, Outcome 1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100).

Review: Rehabilitation for ankle fractures in adults

Comparison: 3 No immobilisation vs cast immobilisation after surgical fixation

Outcome: 1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100)

Study or subgroup	No immobilisation N	Mean(SD)	Cast N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Siddique 2005 (1)	22	39.2 (19.5)	22	33 (19)		6.20 [-5.18, 17.58]
2 At end of follow-up						
Siddique 2005 (2)	22	69.5 (22.5)	22	67.5 (21.9)		2.00 [-11.12, 15.12]



(1) No information on dropouts reported, so presumed none.

(2) No information on dropouts reported, so presumed none.

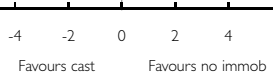
Analysis 3.2. Comparison 3 No immobilisation vs cast immobilisation after surgical fixation, Outcome 2 Ankle dorsiflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 3 No immobilisation vs cast immobilisation after surgical fixation

Outcome: 2 Ankle dorsiflexion range of motion (degrees)

Study or subgroup	No immobilisation N	Mean(SD)	Cast N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Siddique 2005 (1)	22	11.05 (3.75)	22	8.27 (2.91)		2.78 [0.80, 4.76]
2 At end of follow-up						
Siddique 2005 (2)	22	13.59 (2.54)	22	12.18 (2.46)		1.41 [-0.07, 2.89]



(1) No information on dropouts reported, so presumed none.

(2) No information on dropouts reported, so presumed none.

Analysis 3.3. Comparison 3 No immobilisation vs cast immobilisation after surgical fixation, Outcome 3 Ankle plantarflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 3 No immobilisation vs cast immobilisation after surgical fixation

Outcome: 3 Ankle plantarflexion range of motion (degrees)

Study or subgroup	No immobilisation N	Mean(SD)	Cast N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Siddique 2005 (1)	22	27.8 (10.1)	22	12.77 (2.64)		15.03 [10.67, 19.39]
2 At end of follow-up						
Siddique 2005 (2)	22	35 (11.1)	22	32.09 (8.2)		2.91 [-2.86, 8.68]

(1) No information on dropouts reported, so presumed none.

(2) No information on dropouts reported, so presumed none.

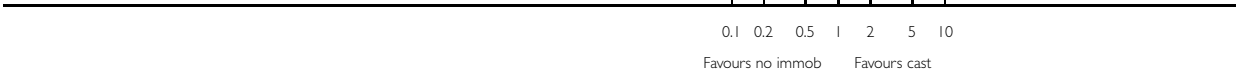
Analysis 3.4. Comparison 3 No immobilisation vs cast immobilisation after surgical fixation, Outcome 4 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 3 No immobilisation vs cast immobilisation after surgical fixation

Outcome: 4 Adverse events

Study or subgroup	No immobilisation n/N	Cast n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Siddique 2005 (1)	0/22	0/22		Not estimable



(1) No information on dropouts reported, so presumed none.

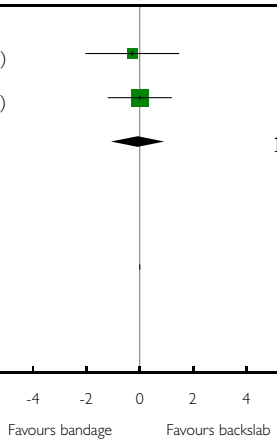
Analysis 4.1. Comparison 4 Type of immobilisation after surgical fixation, Outcome 1 Pain (10-cm visual analogue scale) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 4 Type of immobilisation after surgical fixation

Outcome: 1 Pain (10-cm visual analogue scale) at end of treatment

Study or subgroup	Bandage N	Mean(SD)	Backslab N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Bandage vs backslab							
Reed 1998	18	5.93 (2.74)	16	6.21 (2.5)		31.9 %	-0.28 [-2.04, 1.48]
Romero Zepeda 2008 (1)	26	2 (2.22)	26	2 (2.22)		68.1 %	0.0 [-1.21, 1.21]
Subtotal (95% CI)	**44**		**42**			**100.0 %**	**-0.09 [-1.08, 0.91]**
Heterogeneity: Chi^2 = 0.07, df = 1 (P = 0.80); I^2 =0.0%							
Test for overall effect: Z = 0.18 (P = 0.86)							
2 Cast vs other immobilisation							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							



(1) SD imputed from interquartile ranges (1 to 4 versus 1 to 4)

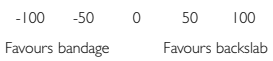
Analysis 4.2. Comparison 4 Type of immobilisation after surgical fixation, Outcome 2 Ankle dorsiflexion range of motion (degrees from plantigrade) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 4 Type of immobilisation after surgical fixation

Outcome: 2 Ankle dorsiflexion range of motion (degrees from plantigrade) at end of treatment

Study or subgroup	Bandage N	Mean(SD)	Backslab N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Bandage vs backslab						
Reed 1998	18	48.33 (31.18)	16	24.97 (29.95)		23.36 [2.80, 43.92]
2 Cast vs other immobilisation						



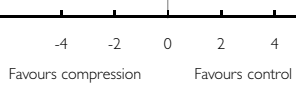
Analysis 5.1. Comparison 5 Compression stocking in addition to cast immobilisation after surgical fixation, Outcome 1 Swelling (difference in ankle circumference between sides in cm).

Review: Rehabilitation for ankle fractures in adults

Comparison: 5 Compression stocking in addition to cast immobilisation after surgical fixation

Outcome: 1 Swelling (difference in ankle circumference between sides in cm)

Study or subgroup	Compression stocking N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Fitzgerald 1994	10	0.32 (0.86)	10	0.82 (0.58)		-0.50 [-1.14, 0.14]
2 End of follow-up						
Fitzgerald 1994	7	0.45 (0.3)	10	1.15 (0.72)		-0.70 [-1.20, -0.20]



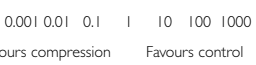
Analysis 5.2. Comparison 5 Compression stocking in addition to cast immobilisation after surgical fixation, Outcome 2 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 5 Compression stocking in addition to cast immobilisation after surgical fixation

Outcome: 2 Adverse events

Study or subgroup	Compression stocking n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Fitzgerald 1994	0/10	0/10		Not estimable



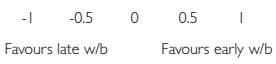
Analysis 6.1. Comparison 6 Weight-bearing during immobilisation after surgical fixation, Outcome 1 Activity limitation questionnaire at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 6 Weight-bearing during immobilisation after surgical fixation

Outcome: 1 Activity limitation questionnaire at end of follow-up

Study or subgroup	Early weight-bearing N	Mean(SD)	Late weight-bearing N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Early vs late weight-bearing						
Finsen 1989 (1)	14	3.6 (0.6)	15	3.9 (0.4)		-0.30 [-0.67, 0.07]
2 Walking cast and early weight-bearing vs no immobilisation and late weight-bearing						
3 Orthosis and early weight-bearing vs dorsal splint and late weight-bearing						



(1) Group allocation for dropouts not reported; assumed to be 5 versus 4 in this analysis

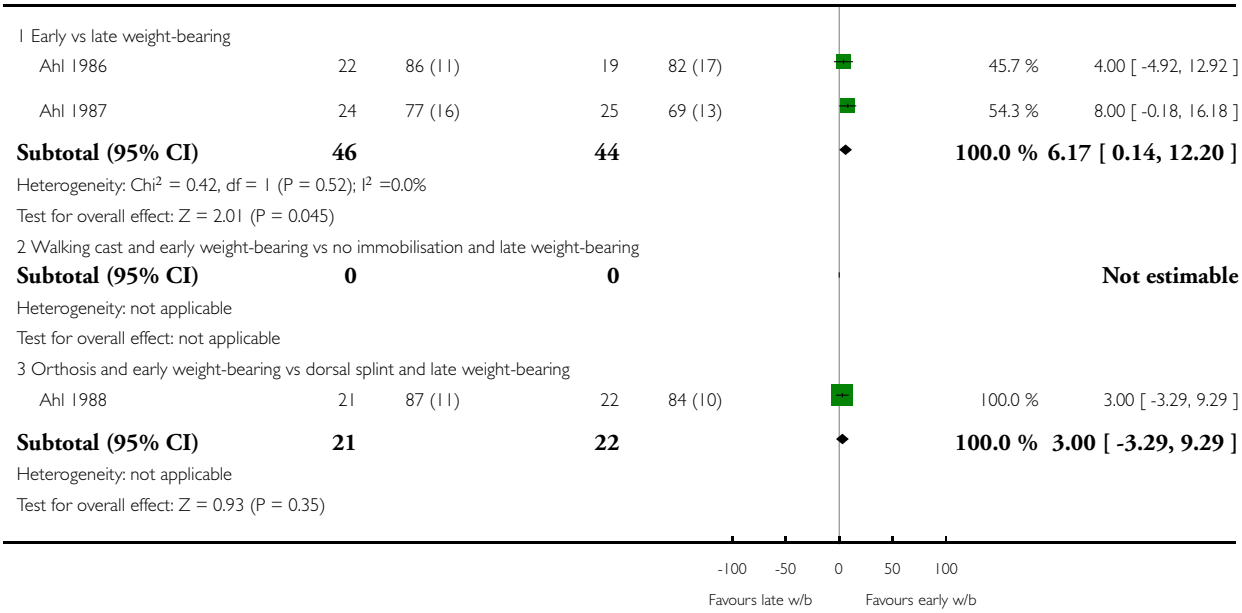
Analysis 6.2. Comparison 6 Weight-bearing during immobilisation after surgical fixation, Outcome 2 Ankle dorsiflexion range of motion (% of non-fractured side) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 6 Weight-bearing during immobilisation after surgical fixation

Outcome: 2 Ankle dorsiflexion range of motion (% of non-fractured side) at end of follow-up

Study or subgroup	Early weight-bearing N	Mean(SD)	Late weight-bearing N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Early vs late weight-bearing							
Ahl 1986	22	86 (11)	19	82 (17)		45.7 %	4.00 [-4.92, 12.92]
Ahl 1987	24	77 (16)	25	69 (13)		54.3 %	8.00 [-0.18, 16.18]
Subtotal (95% CI)	**46**		**44**			**100.0 %**	**6.17 [0.14, 12.20]**
Heterogeneity: Chi^2 = 0.42, df = 1 (P = 0.52); I^2 =0.0%							
Test for overall effect: Z = 2.01 (P = 0.045)							
2 Walking cast and early weight-bearing vs no immobilisation and late weight-bearing							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							
3 Orthosis and early weight-bearing vs dorsal splint and late weight-bearing							
Ahl 1988	21	87 (11)	22	84 (10)		100.0 %	3.00 [-3.29, 9.29]
Subtotal (95% CI)	**21**		**22**			**100.0 %**	**3.00 [-3.29, 9.29]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.93 (P = 0.35)							

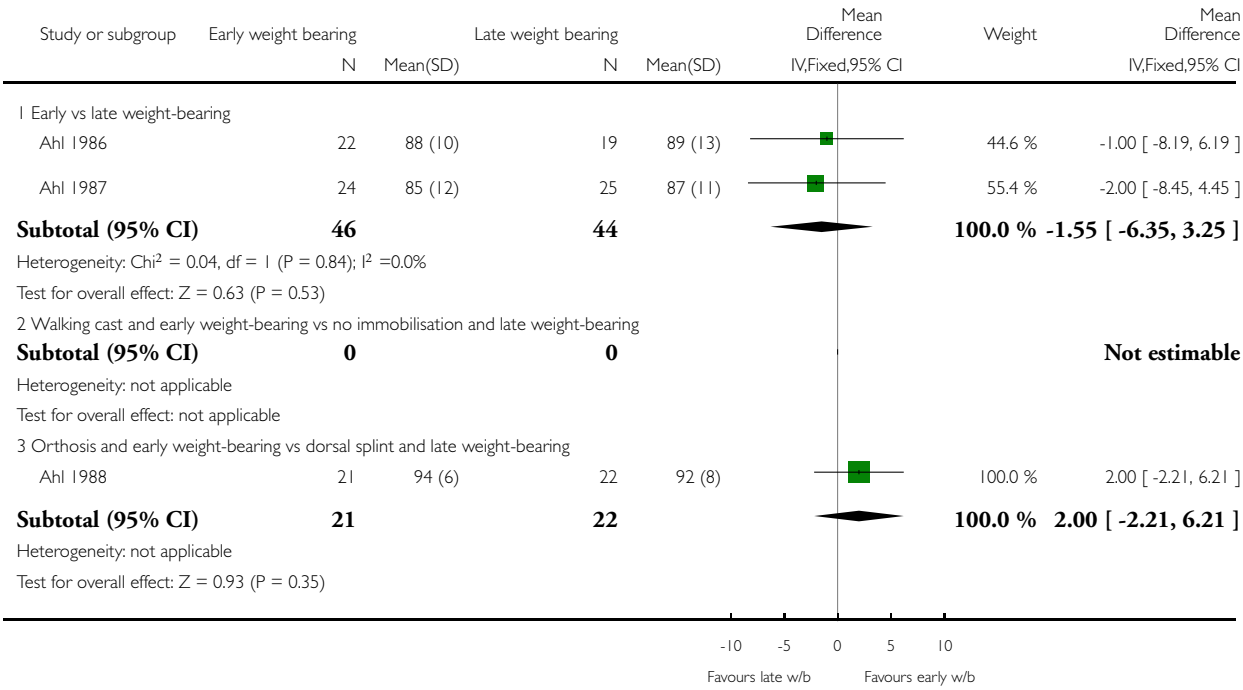


Analysis 6.3. Comparison 6 Weight-bearing during immobilisation after surgical fixation, Outcome 3 Ankle plantarflexion range of motion (% of non-fractured side) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 6 Weight-bearing during immobilisation after surgical fixation

Outcome: 3 Ankle plantarflexion range of motion (% of non-fractured side) at end of follow-up



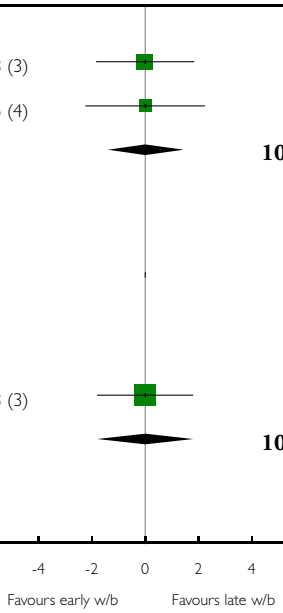
Analysis 6.4. Comparison 6 Weight-bearing during immobilisation after surgical fixation, Outcome 4 Swelling (% of non-fractured side) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 6 Weight-bearing during immobilisation after surgical fixation

Outcome: 4 Swelling (% of non-fractured side) at end of follow-up

Study or subgroup	Early weight bearing N	Mean(SD)	Late weight bearing N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Early vs late weight-bearing							
Ahl 1986	22	103 (3)	19	103 (3)		59.7 %	0.0 [-1.84, 1.84]
Ahl 1987	24	105 (4)	25	105 (4)		40.3 %	0.0 [-2.24, 2.24]
Subtotal (95% CI)	**46**		**44**			**100.0 %**	**0.0 [-1.42, 1.42]**
Heterogeneity: Chi^2 = 0.0, df = 1 (P = 1.00); I^2 =0.0%							
Test for overall effect: Z = 0.0 (P = 1.0)							
2 Walking cast and early weight-bearing vs no immobilisation and late weight-bearing							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							
3 Orthosis and early weight-bearing vs dorsal splint and late weight-bearing							
Ahl 1988	21	103 (3)	22	103 (3)		100.0 %	0.0 [-1.79, 1.79]
Subtotal (95% CI)	**21**		**22**			**100.0 %**	**0.0 [-1.79, 1.79]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.0 (P = 1.0)							

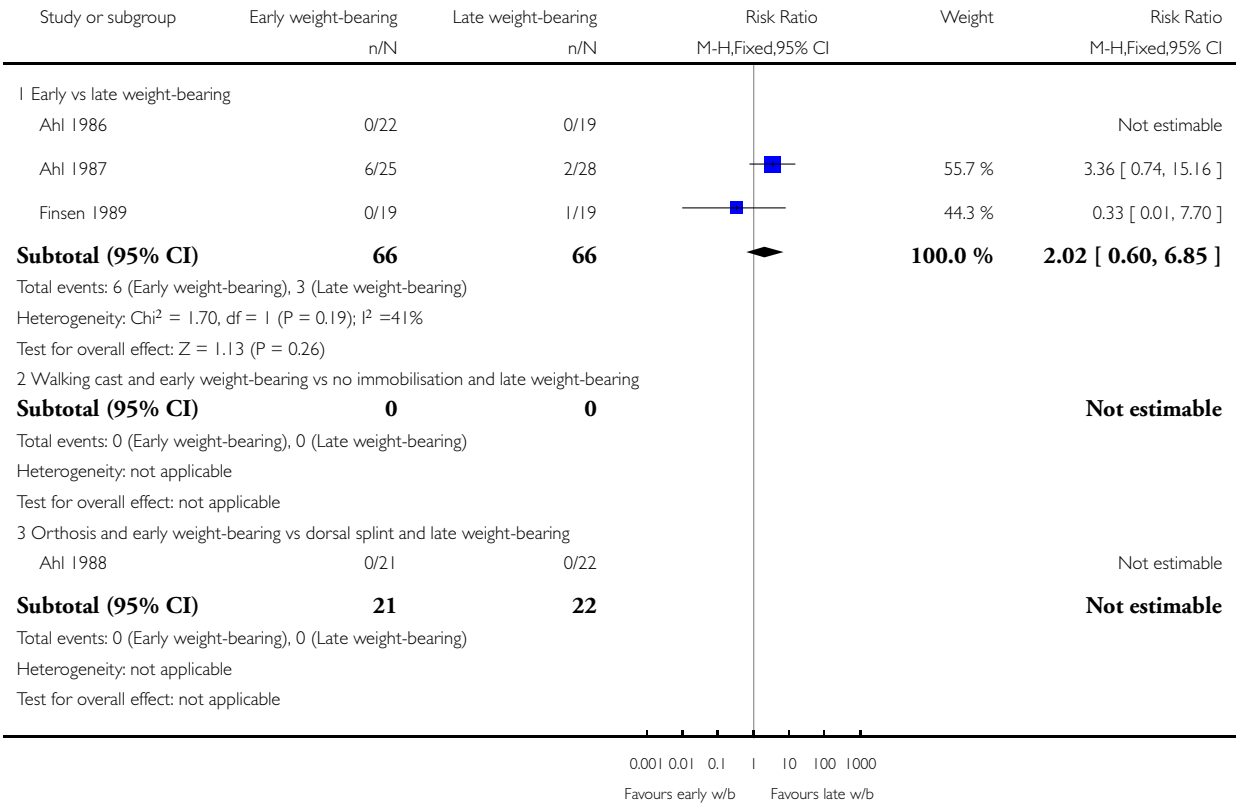


Analysis 6.5. Comparison 6 Weight-bearing during immobilisation after surgical fixation, Outcome 5 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 6 Weight-bearing during immobilisation after surgical fixation

Outcome: 5 Adverse events



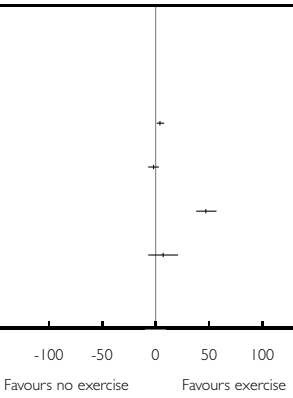
Analysis 7.1. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 1 Activity limitation questionnaire at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 1 Activity limitation questionnaire at end of treatment

Study or subgroup	Exercise		No exercise		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
2 No immobilisation and exercise vs cast and no exercise						
3 Removable type of immobilisation and exercise vs cast and no exercise						
Egol 2000	27	56.5 (7.6)	28	52.4 (5.3)		4.10 [0.63, 7.57]
Lehtonen 2003	50	52 (14)	50	54 (13)		-2.00 [-7.30, 3.30]
Rasmussen 2000	20	87.3 (8)	20	40 (20)		47.30 [37.86, 56.74]
Tropp 1995	15	77 (19)	15	70 (21)		7.00 [-7.33, 21.33]



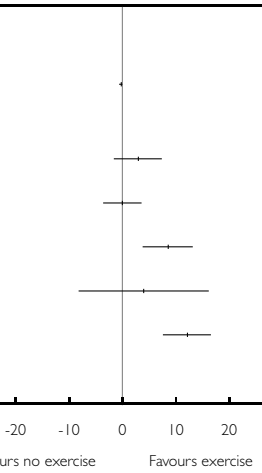
Analysis 7.2. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 2 Activity limitation questionnaire at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 2 Activity limitation questionnaire at end of follow-up

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
2 No immobilisation and exercise vs cast and no exercise						
Finsen 1989 (1)	13	3.6 (0.5)	15	3.9 (0.4)		-0.30 [-0.64, 0.04]
3 Removable type of immobilisation and exercise vs cast and no exercise						
Egol 2000	27	93.1 (8)	28	90.2 (8.7)		2.90 [-1.51, 7.31]
Lehtonen 2003	46	87 (9)	42	87 (8)		0.0 [-3.55, 3.55]
Rasmussen 2000	20	93 (5.9)	19	84.5 (8.8)		8.50 [3.77, 13.23]
Tropp 1995	15	92 (10)	15	88 (22)		4.00 [-8.23, 16.23]
Vioreanu 2007	33	93.17 (8.76)	29	81.07 (9.56)		12.10 [7.51, 16.69]



(1) Group allocation for dropouts not reported; assumed to be 5 versus 4 in this analysis

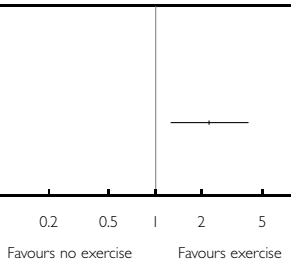
Analysis 7.3. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 3 Activity limitation questionnaire (able to climb 12 steps independently) at the end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 3 Activity limitation questionnaire (able to climb 12 steps independently) at the end of follow-up

Study or subgroup	Exercise n/N	No exercise n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise				
2 No immobilisation and exercise vs cast and no exercise				
3 Removable type of immobilisation and exercise vs cast and no exercise				
Losch 2002	19/19	6/14		2.25 [1.26, 4.03]



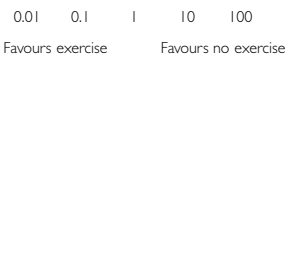
Analysis 7.4. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 4 Pain (numbers with pain) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 4 Pain (numbers with pain) at end of treatment

Study or subgroup	Exercise n/N	No exercise n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise				
2 No immobilisation and exercise vs cast and no exercise				
3 Removable type of immobilisation and exercise vs cast and no exercise				
Rasmussen 2000	2/20	17/20		0.12 [0.03, 0.44]

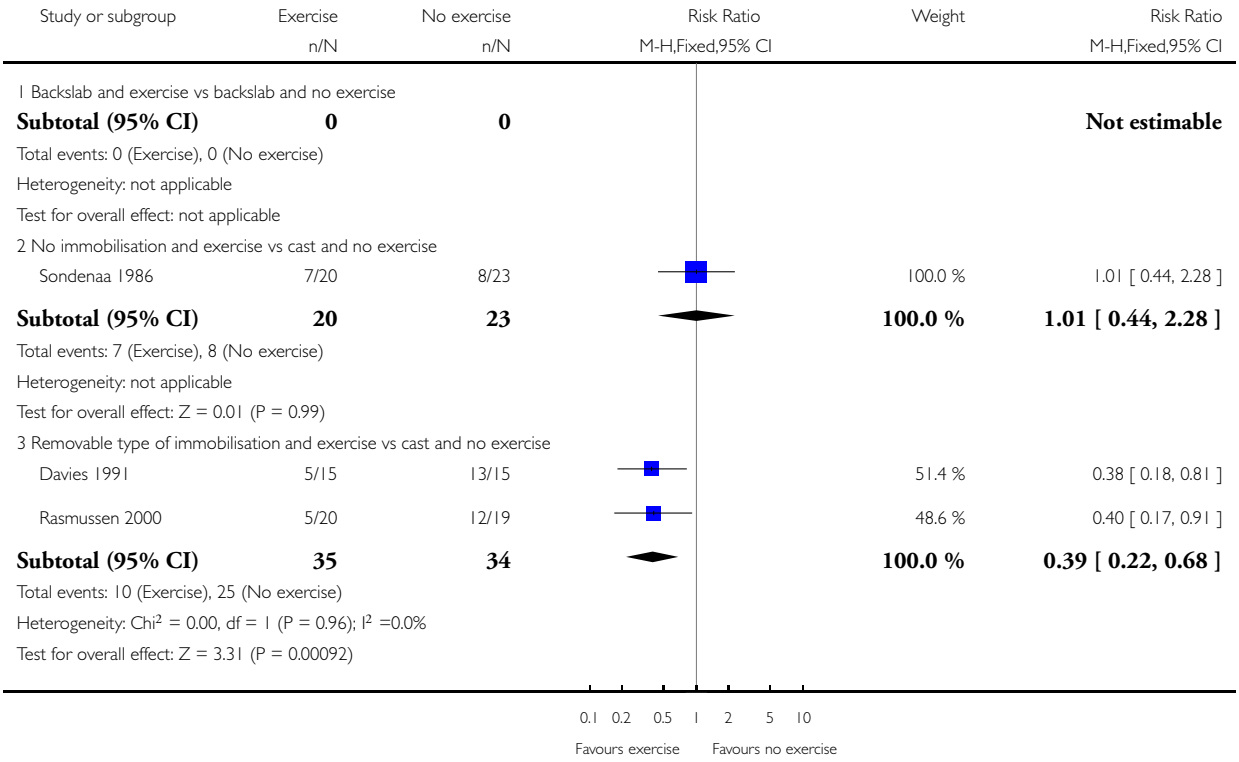


Analysis 7.5. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 5 Pain (numbers with pain) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 5 Pain (numbers with pain) at end of follow-up



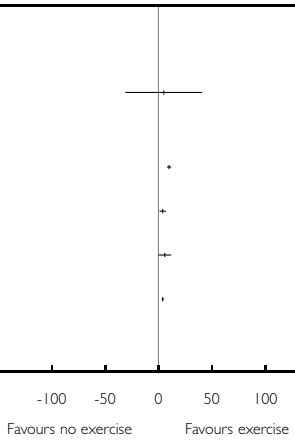
Analysis 7.6. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 6 Ankle dorsiflexion range of motion at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 6 Ankle dorsiflexion range of motion at end of treatment

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
2 No immobilisation and exercise vs cast and no exercise						
Sondenaa 1986 (1)	20	-10 (40.25)	23	-15 (76.73)		5.00 [-30.98, 40.98]
3 Removable type of immobilisation and exercise vs cast and no exercise						
Lehtonen 2003	50	15 (5)	50	5 (4)		10.00 [8.23, 11.77]
Stockle 2000	20	-13 (5.9)	20	-17 (3.4)		4.00 [1.02, 6.98]
Tropp 1995	15	24 (10)	15	18 (6)		6.00 [0.10, 11.90]
Vioreanu 2007	33	10.69 (2.05)	29	7.04 (1.88)		3.65 [2.67, 4.63]



(1) SD imputed from standard error (exercise group 9; no exercise group 16)

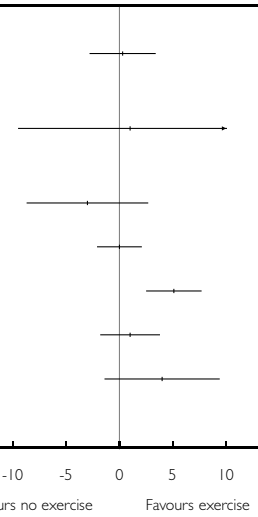
Analysis 7.7. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 7 Ankle dorsiflexion range of motion at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 7 Ankle dorsiflexion range of motion at end of follow-up

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
Dogra 1999	26	-8.7 (6.6)	26	-9 (4.7)		0.30 [-2.81, 3.41]
2 No immobilisation and exercise vs cast and no exercise						
Sondenaa 1986 (1)	20	-3 (8.94)	23	-4 (23.98)		1.00 [-9.55, 11.55]
3 Removable type of immobilisation and exercise vs cast and no exercise						
Hedstrom 1994	26	91 (12)	21	94 (8)		-3.00 [-8.74, 2.74]
Lehtonen 2003	46	14 (5)	42	14 (5)		0.0 [-2.09, 2.09]
Losch 2002	19	-6.5 (2.1)	14	-11.6 (4.7)		5.10 [2.46, 7.74]
Stockle 2000	20	-7 (5.2)	20	-8 (3.7)		1.00 [-1.80, 3.80]
Tropp 1995	15	24 (8)	15	20 (7)		4.00 [-1.38, 9.38]



(1) SD imputed from standard error (exercise group 2; no exercise group 5)

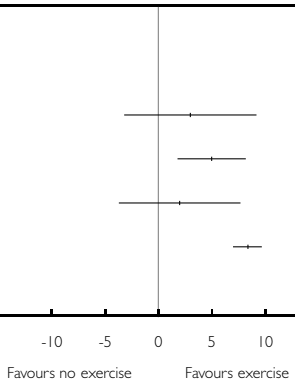
Analysis 7.8. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 8 Ankle plantarflexion range of motion at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 8 Ankle plantarflexion range of motion at end of treatment

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
2 No immobilisation and exercise vs cast and no exercise						
3 Removable type of immobilisation and exercise vs cast and no exercise						
Lehtonen 2003	50	40 (10)	50	37 (20)		3.00 [-3.20, 9.20]
Stockle 2000	20	-18 (6.4)	20	-23 (3.7)		5.00 [1.76, 8.24]
Tropp 1995	15	35 (8)	15	33 (8)		2.00 [-3.73, 7.73]
Vioreanu 2007	33	19.63 (3.06)	29	11.25 (2.32)		8.38 [7.04, 9.72]



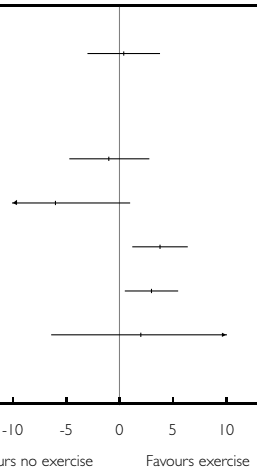
Analysis 7.9. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 9 Ankle plantarflexion range of motion at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 9 Ankle plantarflexion range of motion at end of follow-up

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
Dogra 1999	26	-12.3 (5.3)	26	-12.7 (7.1)		0.40 [-3.01, 3.81]
2 No immobilisation and exercise vs cast and no exercise						
3 Removable type of immobilisation and exercise vs cast and no exercise						
Hedstrom 1994	26	95 (8)	21	96 (5)		-1.00 [-4.75, 2.75]
Lehtonen 2003	46	65 (8)	42	71 (22)		-6.00 [-13.04, 1.04]
Losch 2002	19	-8 (3.2)	14	-11.8 (4.2)		3.80 [1.17, 6.43]
Stockle 2000	20	-9 (4.8)	20	-12 (3)		3.00 [0.52, 5.48]
Tropp 1995	15	48 (9)	15	46 (14)		2.00 [-6.42, 10.42]



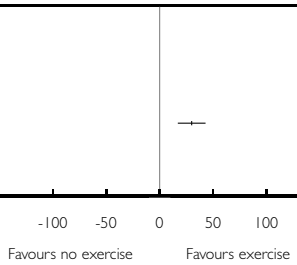
Analysis 7.10. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 10 Ankle dorsiflexion and plantarflexion combined range of motion (degrees) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 10 Ankle dorsiflexion and plantarflexion combined range of motion (degrees) at end of treatment

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
2 No immobilisation and exercise vs cast and no exercise						
3 Removable type of immobilisation and exercise vs cast and no exercise						
Rasmussen 2000	20	57.5 (25.9)	20	27.5 (12.4)		30.00 [17.42, 42.58]



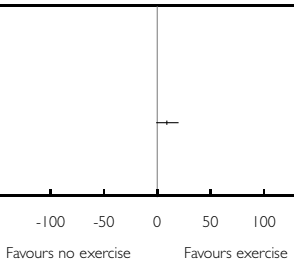
Analysis 7.11. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 11 Ankle dorsiflexion and plantarflexion combined range of motion (degrees) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 11 Ankle dorsiflexion and plantarflexion combined range of motion (degrees) at end of follow-up

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
2 No immobilisation and exercise vs cast and no exercise						
3 Removable type of immobilisation and exercise vs cast and no exercise						
Rasmussen 2000	20	73 (16.3)	19	63.7 (17.5)		9.30 [-1.33, 19.93]



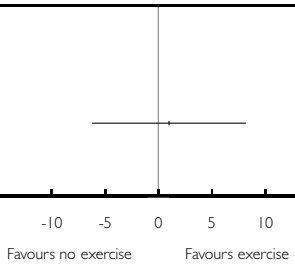
Analysis 7.12. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 12 Strength (peak torque in Nm) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 12 Strength (peak torque in Nm) at end of treatment

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
2 No immobilisation and exercise vs cast and no exercise						
3 Removable type of immobilisation and exercise vs cast and no exercise						
Tropp 1995	15	23 (11)	15	22 (9)		1.00 [-6.19, 8.19]



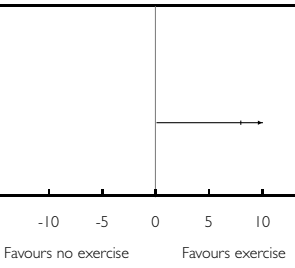
Analysis 7.13. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 13 Strength (peak torque in Nm) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 13 Strength (peak torque in Nm) at end of follow-up

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise						
2 No immobilisation and exercise vs cast and no exercise						
3 Removable type of immobilisation and exercise vs cast and no exercise						
Tropp 1995	15	37 (11)	15	29 (11)		8.00 [0.13, 15.87]



Analysis 7.14. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 14 Swelling (difference in ankle circumference between sides in cm) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 14 Swelling (difference in ankle circumference between sides in cm) at end of treatment

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							
2 No immobilisation and exercise vs cast and no exercise							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							
3 Removable type of immobilisation and exercise vs cast and no exercise							
Lehtonen 2003	50	1.8 (1.4)	50	2 (1.9)		19.0 %	-0.20 [-0.85, 0.45]
Tropp 1995	15	1.5 (1)	15	1.6 (1.2)		13.0 %	-0.10 [-0.89, 0.69]
Vioreanu 2007	33	1.87 (0.62)	29	1.85 (0.75)		68.0 %	0.02 [-0.33, 0.37]
Subtotal (95% CI)	**98**		**94**			**100.0 %**	**-0.04 [-0.32, 0.25]**
Heterogeneity: $Chi^2 = 0.37$, df = 2 (P = 0.83); $I^2 = 0.0\%$							
Test for overall effect: Z = 0.26 (P = 0.80)							

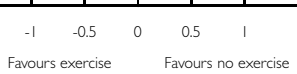
Analysis 7.15. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 15 Swelling (difference in ankle circumference between sides in cm) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 15 Swelling (difference in ankle circumference between sides in cm) at end of follow-up

Study or subgroup	Exercise N	Mean(SD)	No exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Backslab and exercise vs backslab and no exercise							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							
2 No immobilisation and exercise vs cast and no exercise							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							
3 Removable type of immobilisation and exercise vs cast and no exercise							
Lehtonen 2003	46	0.6 (1.1)	42	0.9 (0.9)		62.3 %	-0.30 [-0.72, 0.12]
Tropp 1995	15	0.5 (0.7)	15	0.5 (0.8)		37.7 %	0.0 [-0.54, 0.54]
Subtotal (95% CI)	**61**		**57**			**100.0 %**	**-0.19 [-0.52, 0.14]**
Heterogeneity: Chi^2 = 0.74, df = 1 (P = 0.39); I^2 =0.0%							
Test for overall effect: Z = 1.11 (P = 0.27)							

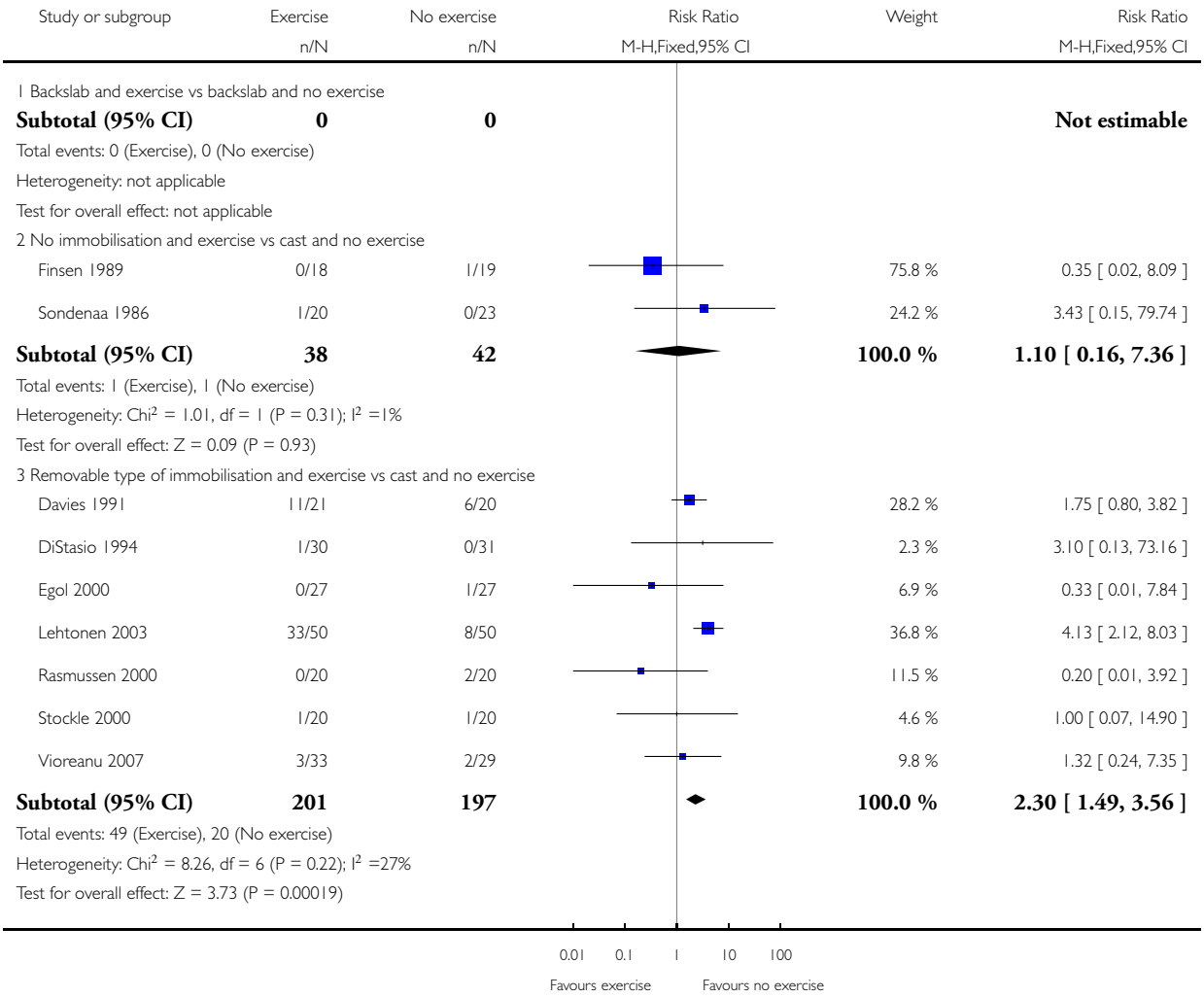


Analysis 7.16. Comparison 7 Exercise during immobilisation after surgical fixation, Outcome 16 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 7 Exercise during immobilisation after surgical fixation

Outcome: 16 Adverse events



Analysis 8.1. Comparison 8 Weight-bearing and exercise during immobilisation after surgical fixation, Outcome 1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100).

Review: Rehabilitation for ankle fractures in adults

Comparison: 8 Weight-bearing and exercise during immobilisation after surgical fixation

Outcome: 1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100)

Study or subgroup	W/b and exercise N	Mean(SD)	No w/b or exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Franke 2008 (1)	13	95 (0.001)	11	75 (22.2)		20.00 [6.88, 33.12]

(1) SD imputed from interquartile ranges on graph (95 to 95 versus 65 to 95). SD entered as 0.001 for intervention group for 95% CI

Analysis 8.2. Comparison 8 Weight-bearing and exercise during immobilisation after surgical fixation, Outcome 2 Quality of life (SF-12 physical subscale).

Review: Rehabilitation for ankle fractures in adults

Comparison: 8 Weight-bearing and exercise during immobilisation after surgical fixation

Outcome: 2 Quality of life (SF-12 physical subscale)

Study or subgroup	W/b and exercise N	Mean(SD)	No w/b or exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Honigmann 2007 (1)	22	39 (10.37)	22	38 (11.11)		1.00 [-5.35, 7.35]
2 At end of follow-up						
Honigmann 2007 (2)	21	48 (4.44)	22	49 (7.41)		-1.00 [-4.63, 2.63]

(1) SD imputed from interquartile range obtained from graph (w/b and exercise group 14; no w/b and exercise group 15)

(2) SD imputed from interquartile range obtained from graph (w/b and exercise group 6; no w/b and exercise group 10)

Analysis 8.3. Comparison 8 Weight-bearing and exercise during immobilisation after surgical fixation, Outcome 3 Patient satisfaction (visual analogue scale, /10).

Review: Rehabilitation for ankle fractures in adults

Comparison: 8 Weight-bearing and exercise during immobilisation after surgical fixation

Outcome: 3 Patient satisfaction (visual analogue scale, /10)

Study or subgroup	W/b and exercise N	Mean(SD)	No w/b or exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Honigmann 2007	22	9 (1.48)	22	10 (0.74)		-1.00 [-1.69, -0.31]
2 At end of follow-up						
Honigmann 2007	21	9 (1.11)	22	9 (1.48)		0.0 [-0.78, 0.78]

Analysis 8.4. Comparison 8 Weight-bearing and exercise during immobilisation after surgical fixation, Outcome 4 Pain (visual analogue scale, /10).

Review: Rehabilitation for ankle fractures in adults

Comparison: 8 Weight-bearing and exercise during immobilisation after surgical fixation

Outcome: 4 Pain (visual analogue scale, /10)

Study or subgroup	W/b and exercise N	Mean(SD)	No w/b or exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Honigmann 2007 (1)	22	0 (1.11)	22	0 (0.74)		0.0 [-0.56, 0.56]
2 At end of follow-up						
Honigmann 2007 (2)	21	1 (1.48)	22	0 (1.04)		1.00 [0.23, 1.77]

(1) SD imputed from interquartile range obtained from graph (w/b and exercise group 1.5; no w/b and exercise group 1)

(2) SD imputed from interquartile range obtained from graph (w/b and exercise group 2; no w/b and exercise group 1.4)

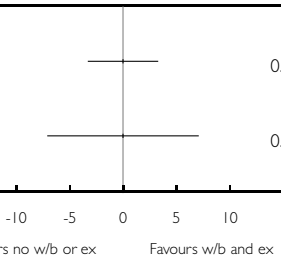
Analysis 8.5. Comparison 8 Weight-bearing and exercise during immobilisation after surgical fixation, Outcome 5 Ankle dorsiflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 8 Weight-bearing and exercise during immobilisation after surgical fixation

Outcome: 5 Ankle dorsiflexion range of motion (degrees)

Study or subgroup	W/b and exercise		No w/b or exercise		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
1 At end of treatment						
Honigmann 2007 (1)	22	15 (2.96)	22	15 (7.41)		0.0 [-3.33, 3.33]
2 At end of follow-up						
Honigmann 2007 (2)	21	17 (11.11)	22	17 (12.59)		0.0 [-7.09, 7.09]



(1) SD imputed from interquartile range obtained from graph (w/b and exercise group 4; no w/b and exercise group 10)

(2) SD imputed from interquartile range obtained from graph (w/b and exercise group 15; no w/b and exercise group 17)

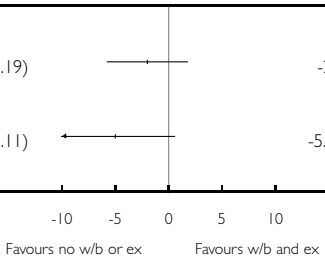
Analysis 8.6. Comparison 8 Weight-bearing and exercise during immobilisation after surgical fixation, Outcome 6 Ankle plantarflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 8 Weight-bearing and exercise during immobilisation after surgical fixation

Outcome: 6 Ankle plantarflexion range of motion (degrees)

Study or subgroup	W/b and exercise N	Mean(SD)	No w/b or exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Honigmann 2007 (1)	22	38 (7.41)	22	40 (5.19)		-2.00 [-5.78, 1.78]
2 At end of follow-up						
Honigmann 2007 (2)	21	40 (7.41)	22	45 (11.11)		-5.00 [-10.62, 0.62]



(1) SD imputed from interquartile range obtained from graph (w/b and exercise group 10; no w/b and exercise group 7)

(2) SD imputed from interquartile range obtained from graph (w/b and exercise group 10; no w/b and exercise group 15)

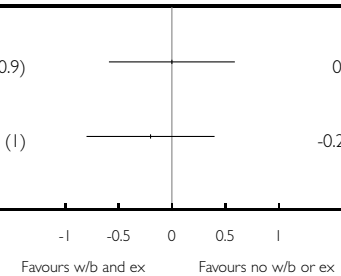
Analysis 8.7. Comparison 8 Weight-bearing and exercise during immobilisation after surgical fixation, Outcome 7 Swelling (difference in ankle circumference between sides in cm).

Review: Rehabilitation for ankle fractures in adults

Comparison: 8 Weight-bearing and exercise during immobilisation after surgical fixation

Outcome: 7 Swelling (difference in ankle circumference between sides in cm)

Study or subgroup	W/b and exercise N	Mean(SD)	No w/b or exercise N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Honigmann 2007	22	1 (1.1)	22	1 (0.9)		0.0 [-0.59, 0.59]
2 At end of follow-up						
Honigmann 2007	21	1 (1)	22	1.2 (1)		-0.20 [-0.80, 0.40]



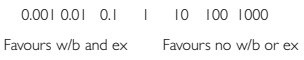
Analysis 8.8. Comparison 8 Weight-bearing and exercise during immobilisation after surgical fixation, Outcome 8 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 8 Weight-bearing and exercise during immobilisation after surgical fixation

Outcome: 8 Adverse events

Study or subgroup	W/b and exercise n/N	No w/b or exercise n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Franke 2008	2/13	1/11		1.69 [0.18, 16.25]
Honigmann 2007	0/21	0/22		Not estimable



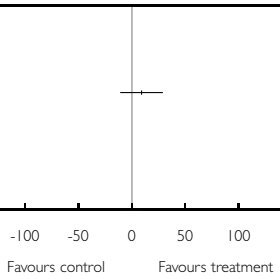
Analysis 9.1. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100) at end of treatment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	52.5 (22.63)	11	43.64 (23.46)		8.86 [-10.86, 28.58]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						



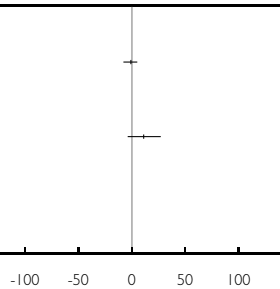
Analysis 9.2. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 2 Activity limitation questionnaire (Olerud Molander Ankle Score, /100) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 2 Activity limitation questionnaire (Olerud Molander Ankle Score, /100) at end of follow-up

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
Handolin 2005a	8	95 (6.61)	8	96.25 (6.5)		-1.25 [-7.67, 5.17]
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	69 (14.49)	11	57.73 (21.26)		11.27 [-4.17, 26.71]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						



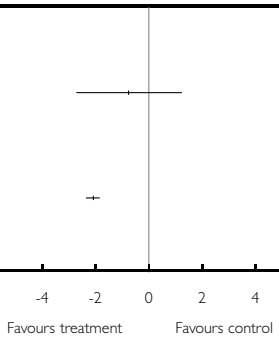
Analysis 9.3. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 3 Pain (visual analogue scale, /10) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 3 Pain (visual analogue scale, /10) at end of treatment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	2.7 (2.11)	11	3.45 (2.54)		-0.75 [-2.74, 1.24]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						
Gorodetskyi 2010 (1)	30	0 (0.001)	30	2.1 (0.73)		-2.10 [-2.36, -1.84]



(1) SD for control group was 0.0; entered as 0.001 to calculate 95% CI

Analysis 9.4. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 4 Pain (visual analogue scale, /10) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 4 Pain (visual analogue scale, /10) at end of follow-up

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	2.4 (1.78)	11	3.45 (1.78)		-1.05 [-2.57, 0.47]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						

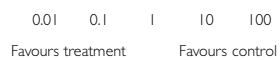
Analysis 9.5. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 5 Pain (numbers with pain) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 5 Pain (numbers with pain) at end of follow-up

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Ultrasound for bone healing				
Handolin 2005a	3/8	1/8		3.00 [0.39, 23.07]
2 Electrical stimulation for muscle strength				
3 Interferential therapy				
4 Non-invasive interactive neurostimulation				



Analysis 9.6. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 6 Ankle dorsiflexion range of motion (ratio of fractured over non-fractured side) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 6 Ankle dorsiflexion range of motion (ratio of fractured over non-fractured side) at end of treatment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	0.26 (0.2)	11	0.24 (0.47)		0.02 [-0.28, 0.32]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						

Analysis 9.7. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 7 Ankle dorsiflexion range of motion (ratio of fractured over non-fractured side) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 7 Ankle dorsiflexion range of motion (ratio of fractured over non-fractured side) at end of follow-up

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	0.69 (0.6)	11	0.6 (0.34)		0.09 [-0.33, 0.51]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						

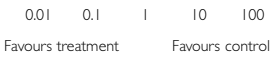
Analysis 9.8. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 8 Ankle dorsiflexion range of motion (mild restriction, yes/no).

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 8 Ankle dorsiflexion range of motion (mild restriction, yes/no)

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Ultrasound for bone healing				
Handolin 2005a	2/8	1/8		2.00 [0.22, 17.89]
2 Electrical stimulation for muscle strength				
3 Interferential therapy				
4 Non-invasive interactive neurostimulation				



Analysis 9.9. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 9 Ankle plantarflexion range of motion (ratio of fractured over non-fractured side) at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 9 Ankle plantarflexion range of motion (ratio of fractured over non-fractured side) at end of treatment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	0.53 (0.2)	11	0.49 (0.21)		0.04 [-0.14, 0.22]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						

Analysis 9.10. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 10 Ankle plantarflexion range of motion (ratio of fractured over non-fractured side) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 10 Ankle plantarflexion range of motion (ratio of fractured over non-fractured side) at end of follow-up

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	0.85 (0.36)	11	0.78 (0.15)		0.07 [-0.17, 0.31]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						

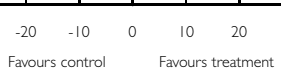
Analysis 9.11. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 11 Ankle range of motion (dorsi- and plantarflexion combined, degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 11 Ankle range of motion (dorsi- and plantarflexion combined, degrees)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						
Gorodetskyi 2010	30	46 (9.3)	30	28 (4.3)		18.00 [14.33, 21.67]



Analysis 9.12. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 12 Swelling at end of treatment.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 12 Swelling at end of treatment

Study or subgroup	Favours treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	1.08 (0.06)	11	1.09 (0.21)		-0.01 [-0.14, 0.12]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation (mm)						
Gorodetskyi 2010	30	16.3 (1.3)	30	27.3 (2.1)		-11.00 [-11.88, -10.12]

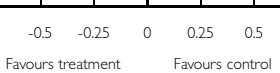
Analysis 9.13. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 13 Swelling (ratio of fractured over non-fractured side) at end of follow-up.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 13 Swelling (ratio of fractured over non-fractured side) at end of follow-up

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Ultrasound for bone healing						
2 Electrical stimulation for muscle strength						
Hernandez 2006	10	1.1 (0.03)	11	1.07 (0.04)		0.03 [0.00, 0.06]
3 Interferential therapy						
4 Non-invasive interactive neurostimulation						



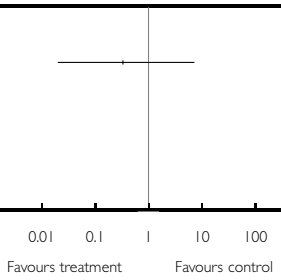
Analysis 9.14. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 14 Swelling (yes/no).

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 14 Swelling (yes/no)

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Ultrasound for bone healing				
Handolin 2005a	0/8	1/8		0.33 [0.02, 7.14]
2 Electrical stimulation for muscle strength				
3 Interferential therapy				
4 Non-invasive interactive neurostimulation				



Analysis 9.15. Comparison 9 Electrotherapy during immobilisation after surgical fixation, Outcome 15 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 9 Electrotherapy during immobilisation after surgical fixation

Outcome: 15 Adverse events

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Ultrasound for bone healing				
Handolin 2005a	0/8	0/8		Not estimable
2 Electrical stimulation for muscle strength				
Hernandez 2006	1/10	0/11		3.27 [0.15, 72.23]
3 Interferential therapy				
4 Non-invasive interactive neurostimulation				

Analysis 10.1. Comparison 10 Stretching post-immobilisation after conservative or surgical orthopaedic management, Outcome 1 Activity limitation questionnaire (Lower Extremity Functional Scale, /80).

Review: Rehabilitation for ankle fractures in adults

Comparison: 10 Stretching post-immobilisation after conservative or surgical orthopaedic management

Outcome: 1 Activity limitation questionnaire (Lower Extremity Functional Scale, /80)

Study or subgroup	Stretching N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Moseley 2005	93	54.38 (13.59)	48	52.1 (14.12)		2.28 [-2.58, 7.14]
2 End of follow-up						
Moseley 2005	90	66.57 (12)	46	65.76 (13.59)		0.81 [-3.83, 5.45]

Analysis 10.2. Comparison 10 Stretching post-immobilisation after conservative or surgical orthopaedic management, Outcome 2 Activity limitation test (walking speed, m/s).

Review: Rehabilitation for ankle fractures in adults

Comparison: 10 Stretching post-immobilisation after conservative or surgical orthopaedic management

Outcome: 2 Activity limitation test (walking speed, m/s)

Study or subgroup	Stretching N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Moseley 2005	92	1.09 (0.38)	47	1.09 (0.33)		0.0 [-0.12, 0.12]
2 End of follow-up						
Moseley 2005	88	1.38 (0.32)	45	1.39 (0.3)		-0.01 [-0.12, 0.10]

Analysis 10.3. Comparison 10 Stretching post-immobilisation after conservative or surgical orthopaedic management, Outcome 3 Patient satisfaction (100-mm visual analogue scale).

Review: Rehabilitation for ankle fractures in adults

Comparison: 10 Stretching post-immobilisation after conservative or surgical orthopaedic management

Outcome: 3 Patient satisfaction (100-mm visual analogue scale)

Study or subgroup	Stretching N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 At end of treatment						
Moseley 2005	92	86.42 (15.83)	46	84.22 (19.71)		2.20 [-4.35, 8.75]

Analysis 10.4. Comparison 10 Stretching post-immobilisation after conservative or surgical orthopaedic management, Outcome 4 Pain (on stair descent, 100 mm visual analogue scale).

Review: Rehabilitation for ankle fractures in adults

Comparison: 10 Stretching post-immobilisation after conservative or surgical orthopaedic management

Outcome: 4 Pain (on stair descent, 100 mm visual analogue scale)

Study or subgroup	Stretching N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Moseley 2005	92	15.45 (20.2)	47	22.17 (22.63)		-6.72 [-14.39, 0.95]
2 End of follow-up						
Moseley 2005	89	7.75 (16.25)	46	9.85 (17.07)		-2.10 [-8.08, 3.88]

Analysis 10.5. Comparison 10 Stretching post-immobilisation after conservative or surgical orthopaedic management, Outcome 5 Ankle dorsiflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 10 Stretching post-immobilisation after conservative or surgical orthopaedic management

Outcome: 5 Ankle dorsiflexion range of motion (degrees)

Study or subgroup	Stretching N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Moseley 2005	92	10.97 (7.62)	46	10.5 (6.89)		0.47 [-2.06, 3.00]
2 End of follow-up						
Moseley 2005	88	11.49 (7.81)	46	11.18 (8.28)		0.31 [-2.59, 3.21]

Analysis 10.6. Comparison 10 Stretching post-immobilisation after conservative or surgical orthopaedic management, Outcome 6 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 10 Stretching post-immobilisation after conservative or surgical orthopaedic management

Outcome: 6 Adverse events

Study or subgroup	Stretching n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Moseley 2005	3/88	1/46		1.57 [0.17, 14.66]

Analysis 11.1. Comparison 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management, Outcome 1 Activity limitation questionnaire.

Review: Rehabilitation for ankle fractures in adults

Comparison: 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome: 1 Activity limitation questionnaire

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 End of treatment						
Lin 2008b	47	54.06 (13.54)	47	56.47 (13.14)		-0.18 [-0.58, 0.23]
Wilson 1991	5	83 (9.92)	5	62 (23.55)		1.05 [-0.32, 2.42]
2 End of follow-up						
Lin 2008b	47	69.89 (11.89)	47	71.89 (12.59)		-0.16 [-0.57, 0.24]

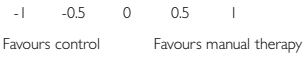
Analysis 11.2. Comparison 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management, Outcome 2 Activity limitation test (walking speed, m/s).

Review: Rehabilitation for ankle fractures in adults

Comparison: 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome: 2 Activity limitation test (walking speed, m/s)

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Lin 2008b	47	1.37 (0.36)	47	1.42 (0.48)		-0.05 [-0.22, 0.12]
2 End of follow-up						
Lin 2008b	47	1.72 (0.31)	47	1.78 (0.55)		-0.06 [-0.24, 0.12]



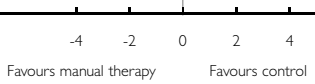
Analysis 11.3. Comparison 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management, Outcome 3 Quality of life (Assessment of Quality of Life, /45).

Review: Rehabilitation for ankle fractures in adults

Comparison: 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome: 3 Quality of life (Assessment of Quality of Life, /45)

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Lin 2008b	47	5.34 (4.16)	47	4.17 (3.89)		1.17 [-0.46, 2.80]
2 End of follow-up						
Lin 2008b	47	3.43 (3.73)	47	1.94 (2.89)		1.49 [0.14, 2.84]



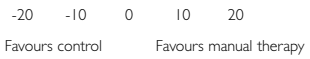
Analysis 11.4. Comparison 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management, Outcome 4 Patient satisfaction (100-mm visual analogue scale).

Review: Rehabilitation for ankle fractures in adults

Comparison: 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome: 4 Patient satisfaction (100-mm visual analogue scale)

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Lin 2008b	47	89 (13.4)	47	82.5 (19.5)		6.50 [-0.26, 13.26]



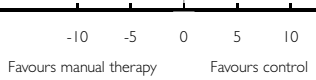
Analysis 11.5. Comparison 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management, Outcome 5 Pain (on equal weight bearing, 100-mm visual analogue scale).

Review: Rehabilitation for ankle fractures in adults

Comparison: 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome: 5 Pain (on equal weight bearing, 100-mm visual analogue scale)

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Lin 2008b	47	11.7 (14.8)	47	11.5 (14.6)		0.20 [-5.74, 6.14]
2 End of follow-up						
Lin 2008b	47	5.9 (12.8)	47	4.8 (11.9)		1.10 [-3.90, 6.10]



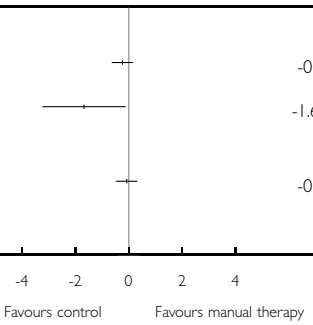
Analysis 11.6. Comparison 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management, Outcome 6 Ankle dorsiflexion range of motion.

Review: Rehabilitation for ankle fractures in adults

Comparison: 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome: 6 Ankle dorsiflexion range of motion

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Std. Mean Difference IV,Fixed,95% CI
1 End of treatment						
Lin 2008b	47	20.7 (41.9)	47	31.3 (48.3)		-0.23 [-0.64, 0.17]
Wilson 1991 (1)	5	0 (0.001)	5	4.2 (3.2)		-1.68 [-3.23, -0.12]
2 End of follow-up						
Lin 2008b	47	54.5 (37.7)	47	57.9 (47)		-0.08 [-0.48, 0.33]



(1) SD imputed from graph of individual patient data. SD for manual therapy group = 0.0; entered as 0.001 for 95% CI

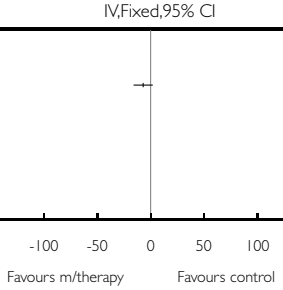
Analysis 11.7. Comparison 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management, Outcome 7 Ankle plantarflexion range of motion (difference between sides in degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome: 7 Ankle plantarflexion range of motion (difference between sides in degrees)

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Wilson 1991 (1)	5	1 (2)	5	8.4 (10)		-7.40 [-16.34, 1.54]
2 End of follow-up						



(1) SD imputed from individual patient data given in graph.

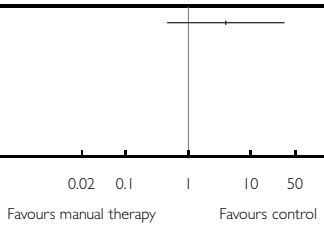
Analysis 11.8. Comparison 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management, Outcome 8 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 11 Manual therapy post-immobilisation after conservative or surgical orthopaedic management

Outcome: 8 Adverse events

Study or subgroup	Manual therapy n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Lin 2008b	4/47	1/47			4.00 [0.46, 34.47]
Test for subgroup differences: Not applicable					



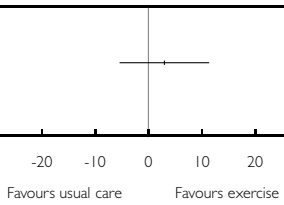
Analysis 12.1. Comparison 12 Exercise post-immobilisation after surgical fixation, Outcome 1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100).

Review: Rehabilitation for ankle fractures in adults

Comparison: 12 Exercise post-immobilisation after surgical fixation

Outcome: 1 Activity limitation questionnaire (Olerud Molander Ankle Score, /100)

Study or subgroup	Exercise N	Mean(SD)	Usual care N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of follow-up						
Nilsson 2009	48	74.4 (19.7)	48	71.4 (22.3)		3.00 [-5.42, 11.42]



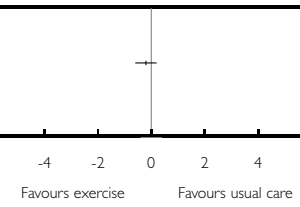
Analysis 12.2. Comparison 12 Exercise post-immobilisation after surgical fixation, Outcome 2 Activity limitation test (9-meter walking test, seconds).

Review: Rehabilitation for ankle fractures in adults

Comparison: 12 Exercise post-immobilisation after surgical fixation

Outcome: 2 Activity limitation test (9-meter walking test, seconds)

Study or subgroup	Exercise N	Mean(SD)	Usual care N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of follow-up						
Nilsson 2009	48	4.4 (1)	48	4.6 (1)		-0.20 [-0.60, 0.20]



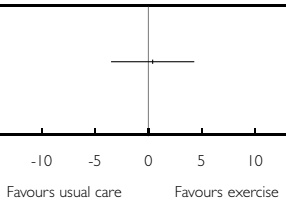
Analysis 12.3. Comparison 12 Exercise post-immobilisation after surgical fixation, Outcome 3 Quality of life (SF-12 physical subscale).

Review: Rehabilitation for ankle fractures in adults

Comparison: 12 Exercise post-immobilisation after surgical fixation

Outcome: 3 Quality of life (SF-12 physical subscale)

Study or subgroup	Exercise N	Mean(SD)	Usual care N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of follow-up						
Nilsson 2009	48	46.8 (10.3)	48	46.4 (9.4)		0.40 [-3.54, 4.34]



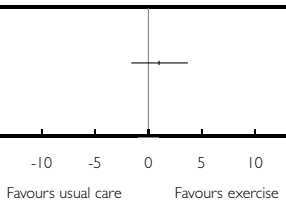
Analysis 12.4. Comparison 12 Exercise post-immobilisation after surgical fixation, Outcome 4 Ankle dorsiflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 12 Exercise post-immobilisation after surgical fixation

Outcome: 4 Ankle dorsiflexion range of motion (degrees)

Study or subgroup	Exercise N	Mean(SD)	Usual care N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of follow-up						
Nilsson 2009	48	30 (6.1)	48	29 (7.1)		1.00 [-1.65, 3.65]



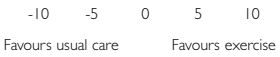
Analysis 12.5. Comparison 12 Exercise post-immobilisation after surgical fixation, Outcome 5 Ankle plantarflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 12 Exercise post-immobilisation after surgical fixation

Outcome: 5 Ankle plantarflexion range of motion (degrees)

Study or subgroup	Exercise N	Mean(SD)	Usual care N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of follow-up						
Nilsson 2009	48	47 (6.1)	48	45 (5.7)		2.00 [-0.36, 4.36]



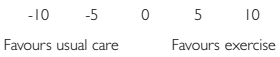
Analysis 12.6. Comparison 12 Exercise post-immobilisation after surgical fixation, Outcome 6 Strength (number of toe rises performed).

Review: Rehabilitation for ankle fractures in adults

Comparison: 12 Exercise post-immobilisation after surgical fixation

Outcome: 6 Strength (number of toe rises performed)

Study or subgroup	Exercise N	Mean(SD)	Usual care N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of follow-up						
Nilsson 2009	48	27 (12.6)	48	24 (9)		3.00 [-1.38, 7.38]



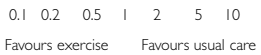
Analysis 12.7. Comparison 12 Exercise post-immobilisation after surgical fixation, Outcome 7 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 12 Exercise post-immobilisation after surgical fixation

Outcome: 7 Adverse events

Study or subgroup	Exercise n/N	Usual care n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 End of follow-up				
Nilsson 2009	11/48	12/48		0.92 [0.45, 1.87]



Analysis 13.1. Comparison 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation, Outcome 1 Pain (100-mm visual analogue scale).

Review: Rehabilitation for ankle fractures in adults

Comparison: 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation

Outcome: 1 Pain (100-mm visual analogue scale)

Study or subgroup	Thermal N	Mean(SD)	Non-thermal N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Seiger 2009	5	0.9 (1.1)	7	0.7 (0.8)		0.20 [-0.93, 1.33]

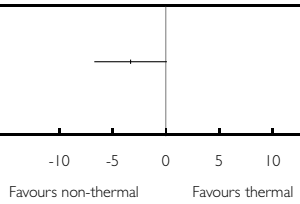
Analysis 13.2. Comparison 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation, Outcome 2 Ankle dorsiflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation

Outcome: 2 Ankle dorsiflexion range of motion (degrees)

Study or subgroup	Thermal N	Mean(SD)	Non-thermal N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Seiger 2009	6	11.3 (3.6)	7	14.6 (2.4)		-3.30 [-6.69, 0.09]



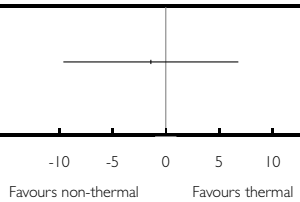
Analysis 13.3. Comparison 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation, Outcome 3 Ankle plantarflexion range of motion (degrees).

Review: Rehabilitation for ankle fractures in adults

Comparison: 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation

Outcome: 3 Ankle plantarflexion range of motion (degrees)

Study or subgroup	Thermal N	Mean(SD)	Non-thermal N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Seiger 2009	6	49.2 (9.6)	7	50.6 (3.8)		-1.40 [-9.58, 6.78]



Analysis 13.4. Comparison 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation, Outcome 4 Swelling (volumetric displacement, ml).

Review: Rehabilitation for ankle fractures in adults

Comparison: 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation

Outcome: 4 Swelling (volumetric displacement, ml)

Study or subgroup	Thermal N	Mean(SD)	Non-thermal N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 End of treatment						
Seiger 2009	6	1061.2 (216.6)	7	843.5 (138.5)		217.70 [16.29, 419.11]

Analysis 13.5. Comparison 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation, Outcome 5 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 13 Thermal versus non-thermal pulsed shortwave diathermy post-immobilisation after surgical fixation

Outcome: 5 Adverse events

Study or subgroup	Thermal n/N	Non-thermal n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 End of treatment				
Seiger 2009	0/6	0/7		Not estimable

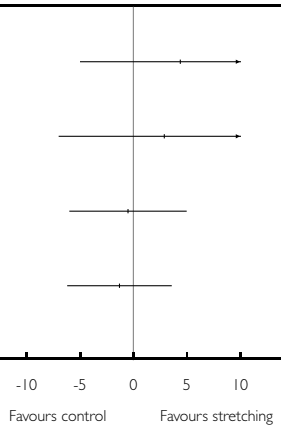
Analysis 14.1. Comparison 14 Subgroup analysis (conservative versus surgical treatment, Outcome 1 Effect of stretching on activity limitation questionnaire (Lower Extremity Functional Scale, /80).

Review: Rehabilitation for ankle fractures in adults

Comparison: 14 Subgroup analysis (conservative versus surgical treatment

Outcome: 1 Effect of stretching on activity limitation questionnaire (Lower Extremity Functional Scale, /80)

Study or subgroup	Stretching N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
1 Participants with conservative orthopaedic management at end of treatment						
Moseley 2005	45	58.6 (13.06)	17	54.18 (18.03)		4.42 [-4.96, 13.80]
2 Participants with conservative orthopaedic management at end of follow-up						
Moseley 2005	45	68.69 (12.8)	16	65.81 (18.66)		2.88 [-7.00, 12.76]
3 Participants with surgical orthopaedic management at end of treatment						
Moseley 2005	48	50.42 (12.98)	31	50.97 (11.63)		-0.55 [-6.05, 4.95]
4 Participants with surgical orthopaedic management at end of follow-up						
Moseley 2005	45	64.44 (10.87)	30	65.73 (10.32)		-1.29 [-6.16, 3.58]



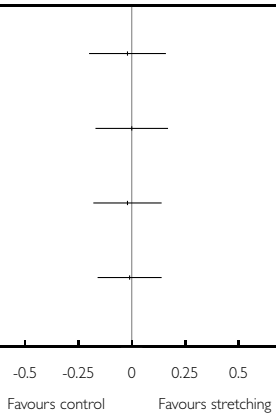
Analysis 14.2. Comparison 14 Subgroup analysis (conservative versus surgical treatment, Outcome 2 Effect of stretching on activity limitation test (walking speed, m/s).

Review: Rehabilitation for ankle fractures in adults

Comparison: 14 Subgroup analysis (conservative versus surgical treatment

Outcome: 2 Effect of stretching on activity limitation test (walking speed, m/s)

Study or subgroup	Stretching N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
1 Participants with conservative orthopaedic management at end of treatment						
Moseley 2005	45	1.18 (0.39)	17	1.2 (0.28)		-0.02 [-0.20, 0.16]
2 Participants with conservative orthopaedic management at end of follow-up						
Moseley 2005	44	1.4 (0.34)	16	1.4 (0.28)		0.0 [-0.17, 0.17]
3 Participants with surgical orthopaedic management at end of treatment						
Moseley 2005	47	1.01 (0.36)	30	1.03 (0.34)		-0.02 [-0.18, 0.14]
4 Participants with surgical orthopaedic management at end of follow-up						
Moseley 2005	44	1.37 (0.3)	29	1.38 (0.32)		-0.01 [-0.16, 0.14]



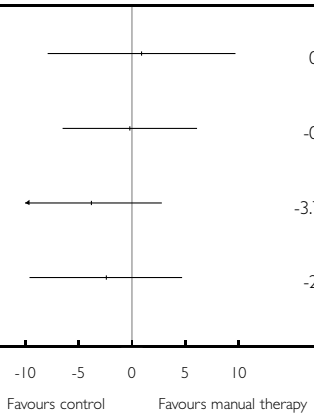
Analysis 14.3. Comparison 14 Subgroup analysis (conservative versus surgical treatment, Outcome 3 Effect of manual therapy on activity limitation questionnaire (Lower Extremity Functional Scale, /80).

Review: Rehabilitation for ankle fractures in adults

Comparison: 14 Subgroup analysis (conservative versus surgical treatment

Outcome: 3 Effect of manual therapy on activity limitation questionnaire (Lower Extremity Functional Scale, /80)

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Participants with conservative orthopaedic management at end of treatment						
Lin 2008b	17	59.29 (13.1)	21	58.43 (14.57)		0.86 [-7.95, 9.67]
2 Participants with conservative orthopaedic management at end of follow-up						
Lin 2008b	17	74.24 (10.69)	21	74.43 (8.67)		-0.19 [-6.48, 6.10]
3 Participants with surgical orthopaedic management at end of treatment						
Lin 2008b	30	51.1 (13.08)	26	54.88 (11.92)		-3.78 [-10.33, 2.77]
4 Participants with surgical orthopaedic management at end of follow-up						
Lin 2008b	30	67.43 (11.99)	26	69.85 (14.9)		-2.42 [-9.58, 4.74]



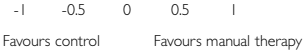
Analysis 14.4. Comparison 14 Subgroup analysis (conservative versus surgical treatment, Outcome 4 Effect of manual therapy on activity limitation test (walking speed, m/s).

Review: Rehabilitation for ankle fractures in adults

Comparison: 14 Subgroup analysis (conservative versus surgical treatment

Outcome: 4 Effect of manual therapy on activity limitation test (walking speed, m/s)

Study or subgroup	Manual therapy N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Participants with conservative orthopaedic management at end of treatment						
Lin 2008b	17	1.46 (0.33)	21	1.51 (0.42)		-0.05 [-0.29, 0.19]
2 Participants with conservative orthopaedic management at end of follow-up						
Lin 2008b	17	1.73 (0.25)	21	1.79 (0.36)		-0.06 [-0.25, 0.13]
3 Participants with surgical orthopaedic management at end of treatment						
Lin 2008b	30	1.32 (0.38)	26	1.36 (0.52)		-0.04 [-0.28, 0.20]
4 Participants with surgical orthopaedic management at end of follow-up						
Lin 2008b	30	1.72 (0.34)	26	1.77 (0.66)		-0.05 [-0.33, 0.23]



Analysis 15.1. Comparison 15 Sensitivity analysis (on Analysis 7.16.3), Outcome 1 Adverse events.

Review: Rehabilitation for ankle fractures in adults

Comparison: 15 Sensitivity analysis (on Analysis 7.16.3)

Outcome: 1 Adverse events

Study or subgroup	Exercise n/N	No exercise n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Low risk random sequence generation					
Egol 2000	0/27	1/27		12.5 %	0.33 [0.01, 7.84]
Lehtonen 2003	33/50	8/50		66.7 %	4.13 [2.12, 8.03]
Rasmussen 2000	0/20	2/20		20.8 %	0.20 [0.01, 3.92]
Subtotal (95% CI)	**97**	**97**		**100.0 %**	**2.83 [1.59, 5.04]**
Total events: 33 (Exercise), 11 (No exercise)					
Heterogeneity: Chi^2 = 6.04, df = 2 (P = 0.05); I^2 =67%					
Test for overall effect: Z = 3.54 (P = 0.00040)					
2 Low risk allocation concealment					
Egol 2000	0/27	1/27		12.5 %	0.33 [0.01, 7.84]
Lehtonen 2003	33/50	8/50		66.7 %	4.13 [2.12, 8.03]
Rasmussen 2000	0/20	2/20		20.8 %	0.20 [0.01, 3.92]
Subtotal (95% CI)	**97**	**97**		**100.0 %**	**2.83 [1.59, 5.04]**
Total events: 33 (Exercise), 11 (No exercise)					
Heterogeneity: Chi^2 = 6.04, df = 2 (P = 0.05); I^2 =67%					
Test for overall effect: Z = 3.54 (P = 0.00040)					
3 Low risk blinding					
Egol 2000	0/27	1/27		12.5 %	0.33 [0.01, 7.84]
Lehtonen 2003	33/50	8/50		66.7 %	4.13 [2.12, 8.03]
Rasmussen 2000	0/20	2/20		20.8 %	0.20 [0.01, 3.92]
Subtotal (95% CI)	**97**	**97**		**100.0 %**	**2.83 [1.59, 5.04]**
Total events: 33 (Exercise), 11 (No exercise)					
Heterogeneity: Chi^2 = 6.04, df = 2 (P = 0.05); I^2 =67%					
Test for overall effect: Z = 3.54 (P = 0.00040)					
4 Low risk incomplete outcome data					
DiStasio 1994	1/30	0/31		3.4 %	3.10 [0.13, 73.16]
Egol 2000	0/27	1/27		10.3 %	0.33 [0.01, 7.84]
Lehtonen 2003	33/50	8/50		54.7 %	4.13 [2.12, 8.03]
Rasmussen 2000	0/20	2/20		17.1 %	0.20 [0.01, 3.92]
Vioreanu 2007	3/33	2/29		14.6 %	1.32 [0.24, 7.35]

(*Continued . . .*)

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Study or subgroup	Exercise n/N	No exercise n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**160**	**157**	◆	**100.0 %**	**2.62 [1.53, 4.48]**
Total events: 37 (Exercise), 13 (No exercise)					
Heterogeneity: Chi^2 = 6.92, df = 4 (P = 0.14); I^2 =42%					
Test for overall effect: Z = 3.53 (P = 0.00042)					

ADDITIONAL TABLES

Table 1. Air-stirrup versus orthosis (conservative treatment) (in Comparison 1)

Outcome	Study	Air-stirrup group *	Other immobilisation group *	Between-group difference
1. Activity limitation questionnaire ("Inflammatory score", /48) at end of treatment	Brink 1996	Median = 16	Median = 10	P value < 0.01
2. Activity limitation questionnaire ("Inflammatory score", /48) at end of follow-up	Brink 1996	Median = 5	Median = 2	Not reported
3. Patient satisfaction (/5) at end of treatment	Brink 1996	Median = 5	Median = 4	P value < 0.05
4. Pain (/10) at end of treatment	Brink 1996	Median = 0.9	Median = 0.3	P value < 0.05
5. Ankle dorsiflexion and plantarflexion combined range of motion (difference between sides in degrees) at end of treatment	Brink 1996	Median = 16.5	Median = 10.0	P value < 0.05
6. Ankle dorsiflexion and plantarflexion combined range of motion (difference between sides in degrees) at end of follow-up	Brink 1996	Median = 4.5	Median = 3.5	Not reported

Table 1. Air-stirrup versus orthosis (conservative treatment) (in Comparison 1) (*Continued*)

7. Swelling (difference between sides in cm) at end of treatment	Brink 1996	Median = 2.2	Median = 2.0	Reported as "not statistically significant"
8. Swelling (difference between sides in cm) at end of follow-up	Brink 1996	Median = 1.6	Median = 1.4	Not reported

* No measures of dispersion reported for all outcomes shown.

Table 2. Type of immobilisation after surgical fixation (Comparison 4)

Outcome	Sub-category	Study	Air-stirrup group *	Other immobilisation group *	Between-group difference
1. Activity limitation questionnaire (/10) at end of treatment	2. Pneumatic brace versus cast	Wetzler 1991	Mean = 8.7	Mean = 6.8	Mean = 1.9 (unable to calculate 95% CI), reported as statistically significant
2. Activity limitation questionnaire (/10) at end of follow-up	2. Pneumatic brace versus cast	Wetzler 1991	No data reported	No data reported	Reported as not statistically significant
3. Pain (/10) at end of treatment	2. Pneumatic brace versus cast	Wetzler 1991	Mean = 3.2	Mean = 5.5	Mean = 2.3 (unable to calculate 95% CI), reported as statistically significant
4. Pain (/10) at end of follow-up	2. Pneumatic brace versus cast	Wetzler 1991	No data reported	No data reported	Reported as not statistically significant
5. Ankle dorsiflexion range of motion (% of non-fractured side) at end of treatment	2. Pneumatic brace versus cast	Wetzler 1991	Mean = 75.8	Mean = 41.4	No data reported
6. Ankle dorsiflexion range of motion (% of non-fractured side) at end of follow-up	2. Pneumatic brace versus cast	Wetzler 1991	No data reported	No data reported	Mean = 34.4 (unable to calculate 95% CI), reported as not statistically significant

Table 2. Type of immobilisation after surgical fixation (Comparison 4) *(Continued)*

7. Ankle plantarflexion range of motion (% of non-fractured side) at end of treatment	2. Pneumatic brace versus cast	Wetzler 1991	Mean = 79.1	Mean = 39.0	No data reported
8. Ankle plantarflexion range of motion (% of non-fractured side) at end of follow-up	2. Pneumatic brace versus cast	Wetzler 1991	No data reported	No data reported	Mean = 40.1 (unable to calculate 95% CI), reported as not statistically significant
9. Swelling (circumference of injured ankle, mm)	1. Bandage versus backslab	Romero Zepeda 2008	Mean = 265.54	Mean = 271.00	Reported as not statistically significant (P value ≤0.36)

* No measures of dispersion reported for all outcomes shown.

Table 3. Weight-bearing during immobilisation after surgical fixation (Comparison 6)

Outcome	Sub-category	Study	Early weight-bearing group *	Late weight-bearing group *	Between-group difference
1. Activity limitation questionnaire (Olerud-Molander ankle score, /100) at end of treatment	2. Walking cast and early weight-bearing versus no immobilisation and late weight-bearing	van Laarhoven 1996	Median = 65	Median = 50	P value = 0.03
2. Activity limitation questionnaire (Olerud-Molander ankle score, /100) at end of follow-up	2. Walking cast and early weight-bearing versus no immobilisation and late weight-bearing	van Laarhoven 1996	Median = 95, range = 0 to 100	Median = 95, range = 35 to 100	P value = 0.94
2. Activity limitation questionnaire (Olerud-Molander ankle score, /100) at end of follow-up	3. Orthosis and early weight-bearing versus dorsal splint and late weight-bearing	Ahl 1993	Mean = 90	Mean = 86	Mean = 4 (unable to calculate 95% CI)
3. Ankle dorsiflexion range of motion (loss of degrees) at end of treatment	2. Walking cast and early weight-bearing versus no immobilisa-	van Laarhoven 1996	Median = 25	Median = 23	P value = 0.16

Table 3. Weight-bearing during immobilisation after surgical fixation (Comparison 6) (*Continued*)

	tion and late weight-bearing				
4. Ankle dorsiflexion range of motion (loss of degrees) at end of follow-up	2. Walking cast and early weight-bearing versus no immobilisation and late weight-bearing	van Laarhoven 1996	Median = 8	Median = 7	P value = 0.97
5. Ankle dorsiflexion range of motion (% of non-fractured side) at end of follow-up	3. Orthosis and early weight-bearing versus dorsal splint and late weight-bearing	Ahl 1993	Mean = 80	Mean = 84	Mean = 4 (unable to calculate 95% CI)
6. Ankle plantarflexion range of motion (% of non-fractured side) at end of follow-up	3. Orthosis and early weight-bearing versus dorsal splint and late weight-bearing	Ahl 1993	Mean = 93	Mean = 94	Mean = 1 (unable to calculate 95% CI)

* For all outcomes shown, no measures of dispersion reported to allow imputation of standard deviations.

Table 4. Removable type of immobilisation and exercise versus cast and no exercise (Comparison 7)

Outcome	Study	Exercise group*	No exercise group*	Between-group difference
1. Activity limitation (Maryland Foot Score, /100) at end of follow-up	DiStasio 1994	Mean = 93	Mean = 87	P value = 0.027
2. Activity limitation (Olerud-Molander ankle score, /100) at end of follow-up	Hedstrom 1994	Median = 100, range = 80 to 100	Median = 88, range = 55 to 100	Reported as not statistically significant
3. Ankle dorsiflexion range of motion (% of non-fractured side) at end of follow-up	Davies 1991	Mean = 89	Mean = 59	Mean = 30 (unable to calculate 95% CI), P value < 0.05
4. Ankle plantarflexion range of motion (% of non-fractured side) at end of follow-up	Davies 1991	Mean = 98	Mean = 91	Mean = 7 (unable to calculate 95% CI), P value < 0.05

Table 4. Removable type of immobilisation and exercise versus cast and no exercise (Comparison 7) (*Continued*)

5. Swelling (% of non-fractured side) at end of follow-up	Davies 1991	Mean = 5	Mean = 5	Mean = 0 (unable to calculate 95% CI), reported as not statistically significant

* For all outcomes shown, no measures of dispersion reported to allow imputation of standard deviations.

Table 5. Weight-bearing and exercise during immobilisation after surgical fixation (Comparison 8)

Outcome	Study	Weight-bearing and exercise group	No weight-bearing or exercise group	Between-group difference*
1. Activity limitation (Olerud-Molander ankle score, /100) at end of treatment	Honigmann 2007	Median = 72, range = 35 to 95	Median = 70, range = 45 to 90	Mean difference = 1.9, unable to calculate 95% CI
2. Activity limitation (Olerud-Molander ankle score, /100) at end of follow-up	Honigmann 2007	Median = 80, range = 40 to 100	Median = 85, range = 40 to 100	Mean difference = -5.0, unable to calculate 95% CI
3. Quality of Life (SF-12, mental health component, /100) at end of treatment	Franke 2008	Median = 59.9	Median = 52	Mean = 7.2 (unable to calculate 95% CI), P = 0.008)

*Mean difference based on medians, P-value as reported by the authors

APPENDICES

Appendix 1. Search strategies (2007 to present)

The Cochrane Library (Wiley InterScience)

1. MeSH descriptor Ankle Joint, this term only
2. MeSH descriptor Ankle Injuries explode all trees
3. MeSH descriptor Ankle, this term only
4. MeSH descriptor Fractures, Bone explode all trees
5. fracture*
6. ((#1 OR #2 OR #3) AND (#4 OR #5))
7. (distal near tibia* near fracture*) or (distal near fibula* near fracture*) or (low near tibia* near fracture*) or (low near fibula* near fracture*) or ((ankle or malleol*) near fracture*)

8. (#6 OR #7)
9. MeSH descriptor Complementary Therapies explode all trees
10. MeSH descriptor Physical Therapy Modalities explode all trees
11. MeSH descriptor Exercise explode all trees
12. MeSH descriptor Ambulatory Care, this term only
13. MeSH descriptor Rehabilitation explode all trees
14. MeSH descriptor Recovery of Function, this term only
15. MeSH descriptor Patient Education as topic, this term only
16. Any MeSH descriptor with qualifier: RH
17. exercis* or physiotherap* or (physical therap*) or rehabilitat* or therap* or training or mobili* or immobili*
18. (#9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17)
19. (#8 AND #18)

MEDLINE (PubMed)

1. (ankle joint [mh] OR ankle injuries [mh] OR ankle [mh] OR ankle [tw] OR malleol* [tw] OR ((distal [tw] OR low [tw]) AND (tibia [mh] OR tibia* [tw] OR fibula [mh] OR fibula* [tw]))) AND (fractures, bone [mh] OR fracture* [tw]) AND adult [mh]
2. (complementary therapies [mh] OR "Physical Therapy Modalities"[Mh] OR "Exercise"[Mh] OR ambulatory care [mh] OR rehabilitation [mh] OR rehabilitation [subheading] OR recovery of function [mh] OR Patient Education as Topic [mh] OR exercis* [tw] OR physiotherap* [tw] OR physical therap* [tw] OR rehabilitat* [tw] OR therap* [tw] OR training [tw] OR mobili* [tw] OR immobili* [tw])
3. (randomized controlled trial [pt] OR controlled clinical trial [pt] OR randomized [tiab] OR placebo [tiab] OR drug therapy [sh] OR randomly [tiab] OR trial [tiab] OR groups [tiab]) NOT (animals [mh] NOT humans [mh])
4. #1 and #2 and #3

EMBASE (EMBASE.com)

1. 'ankle fracture'/exp OR 'distal tibia fracture'/exp OR 'ankle NEAR/3 fracture' OR 'malleol NEAR/3 fracture'
2. (distal OR low) AND ('fibula NEAR/3 fracture' OR 'tibia NEAR/3 fracture')
3. 'adult'/exp OR 'aged'/exp
4. (#1 OR #2) AND #3
5. 'conservative treatment'/exp OR 'acupuncture'/exp OR 'manipulative medicine'/de OR 'physical medicine'/exp OR 'occupational therapy'/de OR ' kinesiotherapy'/exp OR 'exercise'/exp OR 'training'/de OR 'mobilization'/de OR 'alternative medicine'/de OR 'patient education'/de OR 'rehabilitation'/exp OR rehabilitat* OR training OR therap* OR physiotherap* OR physical therap* OR exercis* OR mobili* OR immobili*
6. ('clinical trial'/exp OR 'clinical trial' OR 'major clinical study'/exp OR 'prospective study'/exp OR 'single blind procedure'/exp OR 'double blind procedure'/exp OR 'randomization'/exp OR random* OR control* OR ((singl* OR doubl* OR trebl* OR tripl*) AND (blind* OR mask*))) AND 'human'/exp
7. #4 AND #5 AND #6

CINAHL (EBSCOhost)

1. (MH Ankle Fractures) OR (MH Tibial Fractures) OR (MH Fibula Fractures)
2. ((MH Ankle injuries) OR (MH Ankle) OR (MH Ankle Joint) OR (MH Tibia) OR (MH Fibula)) AND (MH Fractures)
3. TX ankle* n3 fracture* or TX malleol* n3 fracture*
4. TX ((distal n3 tibia*) OR (distal n3 fibula*) OR (low n3 tibia*) or (low n3 fibula*)) and TX Fracture*
5. S1 or S2 or S3 or S4
6. (MH Rehabilitation+) OR (MH Exercise+) OR (MH Alternative Therapies+) OR (MH Taping and Strapping+) OR (MH Patient Education+) OR (MH Therapeutic Exercise+) OR (MH Physical Medicine) OR (MH Physical Therapy+)
7. TX exercis* or physiotherap* or physical therap* or rehabilitat* or training or mobili* or immobili*
8. MW rh
9. S6 or S7 or S8
10. (MH Clinical Trials+)

11. (MH Evaluation Research+)
12. (MH Comparative Studies+)
13. (MH Crossover Design)
14. PT Clinical Trial
15. (MH Random Assignment)
16. S10 or S11 or S12 or S13 or S14 or S15
17. TX ((clinical or controlled or comparative or placebo or prospective or randomi?ed) AND (trial or study))
18. (random* AND (allocat* or allot* or assign* or basis* or divid* or order*))
19. TX ((singl* or doubl* or trebl* or tripl*) AND (blind* or mask*))
20. S20. TX (crossover* or 'cross over') or TX cross n1 over
21. TX ((allocat* or allot* or assign* or divid*) AND (condition* or experiment* or intervention* or treatment* or therap* or control* or group*))
22. S17 or S18 or S19 or S20 or S21
23. S16 or S22
24. S5 and S9 and S23

AMED (OVID)

1. (Ankle injuries/ or Ankle/ or Ankle Joint/ or Tibia/ or Fibula/) and Fractures Bone/
2. Tibial Fractures/
3. ((ankle$ or malleol$) adj3 fracture$).tw.
4. ((distal or low) adj3 (tibia$ or fibula$) adj3 fracture$).tw.
5. or/1-4
6. exp Rehabilitation/ or exp Complementary Therapies/ or exp Physical Therapy Modalities/ or exp Exercise/ or Ambulatory Care/ or exp Patient Education/
7. (exercis$ or physiotherap$ or physical therap$ or rehabilitat$ or training or mobili$ or immobili$).tw.
8. or/6-7
9. exp Clinical Trials/ or Comparative Study/ or Double Blind Method/ or Random Allocation/
10. ((clinical or controlled or comparative or placebo or prospective or randomi#ed) adj3 (trial or study)).tw.
11. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw.
12. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw.
13. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw.
14. or/9-13
15. and/5,8,14

SPORTDiscus (EBSCOhost)

1. DE "ANKLE -- Fractures"
2. (DE "ANKLE" OR DE "ANKLE -- Wounds & injuries" OR DE "ANKLEBONE" OR DE "TIBIA" OR DE "FIBULA") and DE "FRACTURES"
3. TX ankle* N3 fracture* or TX malleol* N3 fracture*
4. TX ((distal N3 tibia*) or (distal N3 fibula*) or (low N3 tibia*) or (low N3 fibula*) AND TX fracture*
5. S1 or S2 or S3 or S4
6. ((((((DE "EXERCISE" OR DE "EXERCISE therapy" OR DE "MUSCLE strength" OR DE "STRENGTH training") AND (DE "ALTERNATIVE medicine" OR DE "ACUPUNCTURE")) OR (DE "AMBULATORY medical care")) OR (DE "REHABILITATION" OR DE "AQUATIC exercises -- Therapeutic use" OR DE "MEDICAL rehabilitation")) OR (DE "MANIPULATION (Therapeutics)")) OR (DE "MEDICINE, Physical")) OR (DE "MEDICINE, Physical" OR DE "PHYSICAL therapy")
7. TX exercis* or physiotherap* or physical therap* or rehabilitat* or training or mobili* or immobili*
8. S6 or S7
9. TX ((clinical or controlled or comparative or placebo or prospective or randomi?ed) and (trial or study))
10. TX (random* and (allocat* or allot* or assign* or basis* or divid* or order*))

11. TX ((singl* or doubl* or trebl* or tripl*) and (blind* or mask*))
12. TX (crossover* or 'cross over') or TX cross n1 over
13. TX ((allocat* or allot* or assign* or divid*) and (condition* or experiment* or intervention* or treatment* or therap* or control* or group*))
14. S9 or S10 or S11 or S12 or S13
15. S5 and S8 and S14

WHAT'S NEW

Last assessed as up-to-date: 5 October 2011.

Date	Event	Description
1 October 2012	New citation required and conclusions have changed	1. New evidence on electrotherapy during and after the immobilisation period, and manual therapy and exercise after the immobilisation period necessitated changes to the conclusions. 2. Three new authors were added to the review team.
1 October 2012	New search has been performed	For this update, published in Issue 11, 2012, the following changes were made: 1. The search was updated to 5 July 2011. 2. Seven new studies were included 3. New evidence on electrotherapy during and after the immobilisation period, and manual therapy and exercise after the immobilisation period necessitated changes to the results and conclusions. 4. In line with Collaboration policy, included trials were assessed using the 'Risk of bias' tool. Since the studies included in the previous version of this review were originally assessed using the PEDro scale, analyses using the 'Risk of bias' tool were included for these studies in this update

HISTORY

Protocol first published: Issue 1, 2006

Review first published: Issue 3, 2008

Date	Event	Description
9 May 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

CL coordinated the review and liaised with the Cochrane Bone, Joint and Muscle Trauma Group. CL and ND performed searches, retrieved papers, wrote to study authors for additional information and entered data into RevMan. All review authors performed screening of search results, assessed risk of bias, extracted data, and analysed and interpreted the data. CL and ND drafted the review. All review authors contributed to the writing of the review, read and approved the final manuscript. CL is the guarantor of the review.

DECLARATIONS OF INTEREST

Some members of the review team are authors of two included studies (Lin 2008b; Moseley 2005) but were not involved in the screening, risk of bias assessment and data extraction of these studies. Some review authors are also authors of an ongoing study (Moseley).

SOURCES OF SUPPORT

Internal sources

- The George Institute for Global Health, The University of Sydney, Australia.
- Faculty of Health, Medicine and Life Sciences, Maastricht University, Netherlands.
- Faculty of Health Sciences, The University of Sydney, Australia.

External sources

- National Health and Medical Research Council, Australia.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

There were the following differences between the protocol and this update:

1. Grouping of studies

The grouping of the included studies differs from that stated in the protocol, but follows the format of the original review (Lin 2008a). This change was made after considering the included studies and upon consultation with the Cochrane Bone, Joint and Muscle Trauma Group.

2. Search methods

As stated in the update, we amended our original search strategies slightly with assistance from the Cochrane Bone, Joint and Muscle Trauma Group due to changes in MeSH terms or keywords (for CENTRAL, MEDLINE, EMBASE and AMED) or the database platform (for CINAHL and SPORTDiscus). We used the new WHO International Clinical Trials Registry Platform (ICTRP) to search for unpublished trials, which encompasses the clinical trial registers we planned to search as stated in the protocol.

3. Risk of bias assessment

In line with Collaboration policy, included trials were assessed using the 'Risk of bias' tool instead of the PEDro scale, and 'methodological quality' was replaced with 'risk of bias'.

4. Sensitivity analysis

The planned sensitivity analysis was based on four risk of bias features (true versus quasi-randomisation, concealed versus non-concealed allocation, blind versus non-blind outcome assessment and minimal (< 15%) versus significant (≥ 15%) dropouts). Due to changes in the risk of bias tool used, this was amended to: random sequence generation, allocation concealment, blinding and incomplete outcome data. In this update, studies rated as having a low risk of bias on these features were included in the sensitivity analysis.

INDEX TERMS

Medical Subject Headings (MeSH)

Ankle Injuries [*rehabilitation; surgery]; Fibula [injuries]; Fracture Fixation [adverse effects; *methods]; Fractures, Bone [*rehabilitation; surgery]; Randomized Controlled Trials as Topic; Range of Motion, Articular; Resistance Training [methods]; Tibial Fractures [rehabilitation; surgery]

MeSH check words

Adult; Female; Humans; Male