Early mobilisation for elbow fractures in adults (Review)

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ABSTRACT

Background
A fall on the outstretched arm can result in an elbow fracture. Loss of elbow function is a common problem with these fractures and can have major implications for functional capabilities. It is unknown whether early mobilisation can improve functional outcome without increasing complications.

Objectives
To compare the effects (benefits and harms) of early mobilisation versus delayed mobilisation of the elbow after elbow fractures in adults.

Search strategy
We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (August 2010), the Cochrane Central Register of Controlled Trials (The Cochrane Library 2010, Issue 2), MEDLINE (1950 to August 2010), EMBASE (1980 to August 2010), CINAHIL (1982 to June 2010), PEDro (31 May 2010), and ongoing trials registers (April 2010).

Selection criteria
We included randomised and quasi-randomised controlled trials evaluating early mobilisation of the elbow joint after elbow fracture in adults.

Data collection and analysis
Two authors independently selected trials, assessed risk of bias and extracted data. There was no pooling of data.

Main results
We included one trial reporting outcome at follow-up times ranging between two and 47 months for 81 participants with Mason type 1 and 2 radial head fractures. This poorly-reported trial was at particular high risk of detection and reporting biases. The trial found no significant differences between early and delayed mobilisation in the numbers of participants with pain or limitations in their range of elbow motion. All participants were reported as being able to use their arms for full activities of daily living and none had changed their occupation or lifestyle. There was no mention of fracture complications.
Authors’ conclusions

There is a lack of robust evidence to inform on the timing of mobilisation, and specifically on the use of early mobilisation, after non-surgical or surgical treatment for adults with elbow fractures.

There is a need for high quality, well-reported, adequately powered, randomised controlled trials that compare early versus delayed mobilisation in people with commonly-occurring elbow fractures, treated with or without surgery. Trials should use validated upper limb function scales, and assessment should be both short-term (to monitor recovery and early complications) and long-term (at least one year).

**PLAIN LANGUAGE SUMMARY**

Early elbow movement compared to delayed elbow movement after a broken elbow in adults

The elbow plays an important role in any arm movement such as reaching or lifting. A broken bone, commonly referred to as a fracture, in the elbow can result from a simple fall onto an outstretched arm. A fracture may occur in one or more of the three bones that form the elbow joint. These parts are the upper sections of the two forearm bones (the radius and the ulna) and the lower section of the upper arm bone (the humerus). A well-documented problem after an injury to the elbow is elbow stiffness and loss of normal movement. After initial treatment, which may involve surgery for more serious fractures, treatment may involve immediate gentle movement of the elbow, using a sling for support only, or it may involve a period of time resting still in a sling or plaster cast. It is not known which approach results in better movement and function of the elbow after the fracture has healed.

We searched for randomised controlled trials that compared early movement with delayed movement of the elbow after elbow fracture. We included one trial reporting results at times ranging from two to 47 months for 81 people who had had an elbow fracture that involved the head of the radius. The evidence from this trial is of very low quality. The trial found no important differences between early and delayed mobilisation in the numbers of participants with pain or limitations in their range of elbow motion. All participants were reported as being able to use their arms for full activities of daily living and none had changed their occupation or lifestyle. There was no mention of fracture complications.

We concluded that there was a lack of reliable evidence to answer the question of whether early mobilisation improved function without increasing complications in adults with elbow fractures.

**BACKGROUND**

**Description of the condition**

The elbow joint acts mainly as a hinge joint connecting the bones of the upper (humerus) and lower (radius and ulna) arm. It has three distinct articulations (joint surfaces): the radiocapitellar, ulnotrochlear and the proximal radioulnar joints (Issack 2006). The movement at the elbow includes bending (flexion) and straightening (extension) that occur at the radiocapitellar and ulnotrochlear joint, and rotation enabling supination (turning palm up) and pronation (turning palm down) that occurs at the proximal radioulnar joint. Elbow fractures can include any or all of the distal (lower) humerus, the proximal (upper) radius or proximal ulna. Radial head (uppermost part of the radius) fractures account for 30% of elbow fractures in adults (Harrison 2007). Two per cent of fractures in adults are fractures of the distal humerus (Robinson 2003). In an epidemiological study in an urban setting in the United Kingdom the annual incidence of distal humerus fractures was 1.5 per 100,000 population; 75% of these injuries were due to falls from a standing height and they were most common in women over the age of 60 years (Watts 2007). The incidence of isolated fractures of the olecranon (proximal end of the ulna) in people older than 16 years old was reported as 1.15 per 10,000 persons in Karlsson 2002. The most common cause of elbow fractures is a fall onto an outstretched arm (Akesson 2006).

Loss of elbow function can have major implications for people’s functional capabilities. This includes difficulty returning to activities of daily living (Kim 2005; Rommens 2004), such as the inability to feed oneself or keep basic hygiene (Issack 2006). Jupiter 2003 describes how the post traumatic loss of elbow movement...
limits the ability to “put one’s hand in the volume of a sphere in space” leading to substantial disability. The range of elbow movement required for most functional tasks is a flexion arc of 30 to 130 degrees (Morrey 1981). However, this relates to activities of daily living and there may be additional functional limitation depending on occupation and hand dominance. Elbow fractures in older people can affect their ability to walk safely or independently if they rely on walking aids.

Description of the intervention

The goals of treatment include returning the patient to their previous levels of activity and function (Ring 1997). The choice of definitive treatment of elbow fractures is influenced by the degree of fracture displacement and involvement of articular surfaces. Undisplaced or minimally displaced fractures are generally managed conservatively. This usually involves a period of immobilisation via an arm immobiliser, collar and cuff sling, or U slab (plaster cast). Displaced fractures, unstable fractures or more complex fractures require surgery. The aim of operative treatment is to restore the anatomy, secure fixation of the fragments and potentially to allow early mobilisation to prevent joint stiffness (Ring 1997). However, a period of immobilisation is usually employed after surgery. Immobilisation is generally between four to six weeks depending on the type of the elbow fracture but usually two to four weeks for radial head fractures (McRae 1994). Subsequently, upon removal of the external immobiliser, the patient can start moving their elbow. Mobilisation is purposeful movement of the joint through any range of motion. Under some circumstances, a hinged elbow brace may remain in situ but be unlocked to allow bending and straightening of the elbow. Mobilisation involves graded passive or active movements of the elbow joint with the aim of preventing joint stiffness, soft tissue contracture and gradual restoration of normal movement.

How the intervention might work

Immobilisation post injury has traditionally been used in the belief that it aids recovery, decreases pain and swelling, helps the fracture to heal and prevents radiological deformity (Nash 2004). Immobilisation of the elbow post surgery is often employed to ensure stability of the internal fixation and fracture fragments. However, the most common post injury complication for these fractures is elbow stiffness, particularly loss of extension (Issack 2006; Keschner 2007; Kim 2005). According to studies reported by Kim 2005, up to 25% of distal humerus fractures result in elbow stiffness. The increased susceptibility of the elbow to joint contracture from immobilisation is well known (Issack 2006; Keschner 2007; Kim 2005; Morrey 2005). As well as restricting function, elbow joint contracture may require surgical intervention. The management of post traumatic elbow stiffness, however, poses a challenge to surgeons and surgery may not result in successful outcome. The best management approach for elbow stiffness is thus prevention (Kim 2005; Morrey 2005); and some (Kim 2005) have recommended starting range of motion exercises after the resolution of swelling. However, aggressive mobilising may contribute to the development of complications post injury. For instance, forced passive manipulation of the elbow can result in trauma to the brachialis muscle of the arm and to the elbow joint capsule resulting in further swelling and heterotopic ossification (overgrowth of bone) (Issack 2006).

Why it is important to do this review

The ideal length of time to immobilise the elbow following fracture, or conversely when to start elbow mobilisation, to ensure safe recovery of function and fracture healing is not known. However, there are well-established risks of poor functional outcome, elbow stiffness and other adverse outcomes that are challenging to treat. To date there has not been a systematic review of the literature to determine whether early mobilisation results in better outcomes than delayed mobilisation.

Objectives

To assess the effects (benefits and harms) of early mobilisation of the elbow after initial definitive treatment of elbow fractures in adults.

Early mobilisation of the elbow was compared to later mobilisation after a period of immobilisation. Early mobilisation was based on the investigator’s definition. We planned separate comparisons for surgical as opposed to non-surgical definitive treatment.

Methods

Criteria for considering studies for this review

Types of studies

We included randomised controlled trials and quasi-randomised trials (method of allocating participants to a treatment which is not strictly random, e.g. by date of birth, hospital record number or alternation) evaluating early mobilisation of the elbow joint after elbow fracture in adults.
Types of participants

We included adults (skeletally mature, typically ≥ 18 years of age) who had sustained isolated elbow fractures (including radial head fractures), which were treated surgically or conservatively (non-surgically).

We stipulated that we would exclude mixed population trials including participants with other upper limb injuries or multi-trauma injuries, such as accompanying head injuries; and trials including more than five per cent of participants with open elbow fractures, unless separate data were available for participants with closed fractures. This latter was because mobilisation may be delayed due to the wound rather than the fracture in open fractures.

Types of interventions

All interventions that promoted movement of the elbow joint (i.e. mobilisation) were eligible for inclusion. These include:

- Active movement: the elbow is moved by the patient through active contraction of the arm muscles without aids or assistance.
- Active assisted movement: the elbow is moved by the patient through a combination of an active contraction of the arm muscles and assistance applied externally such as support by the patient’s other arm or by a therapist.
- Passive movement: the elbow is moved by the therapist, the patient (using their other arm) or via a continuous passive movement machine. No active muscle contraction from the patient occurs during this movement of the elbow.

Where possible, the precise nature of the intervention (direction of movement, i.e. flexion/extension or pronation/supination, or both; the type of exercise and its intensity, frequency and duration) was documented.

The comparison examined was between early mobilisation versus delayed mobilisation, as defined by the investigators of the included studies. Typically, elbow immobilisation is achieved by a plaster cast, by rigid splinting that may have included a hinged elbow brace that is locked to block elbow movement, or by a sling strapped to the waist with instructions given to the patient not to remove the sling or move the elbow.

Types of outcome measures

Primary outcomes

The primary outcomes were:

- patient-reported upper limb function (such as the Upper Extremity Function Scale (Pransky 1997), and Disabilities of the Arm Shoulder and Hand (DASH) outcome measure (Beaton 2001));
- pain (e.g. visual analogue scale);
- adverse outcomes: including joint contracture, myositis ossificans, fixation failure, malunion, delayed or non-union, and nerve injuries.

Secondary outcomes

The secondary outcome measures included:

- range of motion: flexion/extension, pronation/supination (goniometry, measured in degrees);
- grip strength (e.g. Jamar device);
- return to work and/or sport, activities of daily living;
- quality of life (e.g. Short Form 36).

Information regarding the time frames for outcome measurement was sought.

Search methods for identification of studies

Electronic searches

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (August 2010), the Cochrane Central Register of Controlled Trials (The Cochrane Library 2010, Issue 2), MEDLINE (1950 to August 2010), EMBASE (1980 to August 2010), CINAHL (1982 to June 2010), and PEDro - the Physiotherapy Evidence Database (31 May 2010). Current Controlled Trials and the World Health Organisation’s International Clinical Trials Registry Platform were also searched (24 April 2010) for ongoing and recently completed trials. No language restrictions were applied.

For MEDLINE, we modified the CRD/Cochrane Highly Sensitive Search Strategy (2005 revision) reported in Glanville 2006, and combined this with a subject-specific search strategy (see Appendix 1). Search strategies for EMBASE, The Cochrane Library, CINAHL, PEDro, Current Controlled Trials, and the International Clinical Trials Registry Platform are also shown in Appendix 1.

Searching other resources

We searched the reference lists of relevant articles and the the titles of posters and presentations from relevant conference proceedings identified on the Internet (Appendix 2).

Data collection and analysis

Selection of studies

Two authors (PH and TR) independently examined the titles, abstracts and keywords to identify potentially relevant trials from
the search results. Full text reports were obtained for all potentially eligible studies. Based on the full text reports, the two authors independently decided on the studies for inclusion. Disagreements were resolved by discussion or arbitrated by an independent third author (AH). A full record of decisions was kept.

Data extraction and management
Trial information and results were extracted independently by two reviewers (PH and TR) using a piloted data extraction form before being entered into Review Manager by the primary reviewer (PH). Data entry was checked by TR. Disagreement was resolved by discussion or, if necessary, arbitration by another author (AH). Where there was incomplete reporting of data or if additional information was required the reviewers (TR and PH) attempted to contact the authors.

Assessment of risk of bias in included studies
Two authors (PH and TR) independently assessed risk of bias using the tool outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2008) (see Appendix 3). This tool incorporates assessment of randomisation (sequence generation and allocation concealment), blinding (of participants, treatment providers and outcome assessors), completeness of outcome data, selection of outcomes reported and other sources of bias. We considered patient-rated and clinician-rated outcomes separately in our assessment of blinding and completeness of outcome data. Our other source of bias was performance bias where we checked for comparability in the experience of care providers and provision of treatment interventions such as advice on activity. Disagreements were resolved by consensus or third-party arbitration (AH).

Measures of treatment effect

Dichotomous data
Risk ratios (relative risks) and 95% confidence intervals for each outcome were calculated.

Continuous data
Where such data were available, we planned to record either the mean changes from baseline or the mean post-intervention values together with standard deviations for each group. We planned to calculate mean differences for outcomes measured with the same metrics or standardised mean differences for outcomes measured with different metrics and 95% confidence intervals in both cases.

Dealing with missing data
Two authors (PH and TR) attempted unsuccessfully to contact authors for additional information. We stipulated that we would be alert to potential mislabelling or non identification of standard errors and standard deviations. Additionally, unless missing standard deviations could be derived from confidence intervals, P values or standard errors, we stated that we would not assume values in order to present these in the analyses. We planned to perform intention-to-treat analyses to include all people randomised to the intervention groups and to conduct worst and best scenario analyses to investigate effects of dropouts and exclusions. However, insufficient data regarding dropouts were available.

Assessment of heterogeneity
Should pooling be possible in a future update, we plan to assess heterogeneity by visual inspection of the forest plot along with consideration of the I² statistic, Chi² test and study characteristics.

Assessment of reporting biases
Insufficient data were available to construct funnel plots, as a way of assessing publication bias.

Data synthesis
A pooled quantitative analysis was not performed. If sufficient numbers of clinically homogeneous trials are available in future updates, a pooled quantitative analysis will be performed. A fixed-effect or random effects model will be used depending on the assessment of heterogeneity.

Subgroup analysis and investigation of heterogeneity
There were insufficient data to perform subgroup analyses. Should such data become available in future, we plan subgroup analyses by fracture type (intra-articular versus extra-articular fractures), type of mobilisation (active versus passive) and allocation concealment (yes or no). We would use the test for subgroup differences available in RevMan 5 for the fixed-effect model to determine if the results for subgroups were statistically significantly different.

Sensitivity analysis
Should sufficient data be available in future, we plan to perform sensitivity analysis in order to determine whether there are differences in outcome that could be attributable to the presence or absence of allocation concealment, assessor blinding or use of intention-to-treat analysis.
RESULTS

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

Results of the search
The electronic search identified 1031 references. No eligible studies were found by handsearching conference proceedings. Titles and abstracts were screened, and full-text copies of 16 potentially eligible papers obtained. Ten studies were put forward for study selection. One trial was included and nine studies were excluded. No ongoing trials were identified.

Included studies
We included one randomised controlled trial (Unsworth-White 1994) with 98 participants (see Characteristics of included studies for details). Unsworth-White 1994 compared early versus delayed mobilisation of conservatively managed radial head fractures (Mason type 1 and 2).

Setting
Unsworth-White 1994 was conducted between 1987 and 1990 in the public hospital setting in the United Kingdom. All patients were recruited from the emergency department and reviewed at a fracture clinic.

Sample size
Unsworth-White 1994 recruited 98 participants but only 81 participants could be traced for follow-up.

Participants
Unsworth-White 1994 included people with isolated Mason type 1 and type 2 radial head fractures. Of the 81 participants available at follow-up, 58 were female and 23 were male. The mean age of the 81 participants was 50.5 years, range 14 to 87 years. It was clear that only a few participants were in the 14 to 17 year category.

Intervention
Unsworth-White 1994 compared three interventions: immediate mobilisation of the elbow post fracture (N = 29), immobilisation of the elbow in 90 degrees flexion by plaster of Paris for two weeks (N = 29), and immobilisation of the elbow in extension by plaster of Paris for two weeks (N = 23).

Outcomes
Unsworth-White 1994 described a standard pro forma that assessed residual pain (classified as either pain or no pain), disability (measure not reported), range of elbow movements (classified as either limited or full) and patients' opinions on the method of treatment. Outcomes were measured at one point in time, on average 25 months after fracture (range 2 to 47 months).

Excluded studies
Nine studies were excluded for reasons given in the Characteristics of excluded studies. Six were excluded because they were not randomised trials; this included Liow 2002, which “did not follow a formal randomisation procedure”. Two of the other three randomised trials compared different methods of surgery and the remaining trial excluded elbow fractures.

Risk of bias in included studies
Unsworth-White 1994 had methodological limitations (see Figure 1 for a summary of the risk of bias judgements); and was judged at high risk of bias in terms of blinding and selective reporting, and at 'unclear' risk of bias for the other domains.
Figure 1. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

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<td><strong>Incomplete outcome data (attrition bias): Patient-rated outcomes e.g. pain</strong></td>
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<td><strong>Incomplete outcome data (attrition bias): Clinician-rated outcomes e.g. non-union, range of motion</strong></td>
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<tr>
<td><strong>Selective reporting (reporting bias)</strong></td>
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<td><strong>Free of other sources of bias (performance bias)</strong></td>
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Allocation
Unsworth-White 1994 did not describe the process of randomisation nor any attempt to conceal allocation of interventions prior to assignment.

Blinding
Blinding of the participants in this trial was not practical, due to the physical nature of the interventions. The assessors were reported as being blinded to the intervention groups for clinician-rated outcomes such as range of motion measures.

Incomplete outcome data
Unsworth-White 1994 failed to provide a complete set of data. Seventeen patients could not be traced by telephone or letter, but the authors stated that these patients were equally divided amongst the three groups and, based on their medical records, none had suffered fracture complications. It was not described at what stage post fracture the medical records of these missing participants were accessed.

Selective reporting
There was no trial protocol available for Unsworth-White 1994, and no results were presented for the short-term follow-up. Results for dichotomous data such as pain or no pain, limited range or full range of motion had to be extracted from the graphs provided in the trial report. No data were provided for disability other than a descriptive statement that no patients had to change their occupation or lifestyle and that all were able to use their arms for full activities of daily living. The investigators did not report results of patients’ opinions on the method of treatment.

Other potential sources of bias
Unsworth-White 1994 did not provide any information about the details of the intervention, such as the instructions and exercise protocol given to the patient for mobilisation, dosage and frequency of mobilisation, level of supervision when mobilising the elbow, how many different clinicians were involved or the level of experience of the clinicians involved. It was thus hard to judge on whether there was performance bias resulting from differences in care provided to the three groups other than the trial interventions.

The assessment of participants in Unsworth-White 1994 ranged from two to 47 months. The results of the study may have been influenced by the large range in months, post fracture, that the assessment was completed.

Effects of interventions

Primary outcomes

Upper limb function
No measure for upper limb function was described in Unsworth-White 1994. However, it was reported that “no patients had to change their occupation or lifestyle and all were able to use their arms for full activities of daily living”.

Pain
Unsworth-White 1994 did not find any significant difference in pain results between early mobilisation (immediate) compared with immobilisation in a plaster of Paris cast (POP) in either flexion or extension for two weeks. Results for the number of people with pain are shown in Analysis 1.1.

- early mobilisation (immediate) versus delayed mobilisation (POP for two weeks) (risk ratio (RR) 0.64, 95% CI 0.26 to 1.60)
- early mobilisation (immediate) versus delayed mobilisation (flexion POP for two weeks) (RR 0.45; 95% CI 0.18 to 1.14)
- early mobilisation (immediate) versus delayed mobilisation (extension POP for two weeks) (RR 1.32; 95% CI 0.35 to 4.96)

Unsworth-White 1994 reported that two patients from the delayed mobilisation group (one each from flexion and extension POP groups) had severe pain at follow-up.

Adverse outcomes
Unsworth-White 1994 reported that, based on medical records, none of 17 participants lost to follow-up had had a fracture complication. However, there was no report on complications for the participants included in the analyses.

Secondary outcomes

Range of motion
Unsworth-White 1994 reported that 62 out of 81 patients (77%) had full range of elbow motion at an average of 25 months after their injury. There were no statistically significant differences between early and delayed mobilisation in participants having a limited range of motion.

Results for the number of people with a limited range of motion are shown in Analysis 1.2.
• early mobilisation (immediate) versus delayed mobilisation (POP for two weeks) (RR 0.83; 95% CI 0.35 to 1.94)
• early mobilisation (immediate) versus delayed mobilisation (flexion POP for two weeks) (RR 0.55; 95% CI 0.23 to 1.28)
• early mobilisation (immediate) versus delayed mobilisation (extension POP for two weeks) (RR 2.38; 95% CI to 0.53 to 10.70)

Seventeen participants, all belonging to the early mobilisation and flexion POP groups, had a loss of 10 degrees or more extension; two of these participants also had either limited flexion or rotation. The two participants with limited range of motion in the extension POP group had limited flexion but full extension.

Grip strength
Grip strength was not reported by Unsworth-White 1994.

Return to work
Unsworth-White 1994 reported that “no patients had to change their occupation or lifestyle”.

Quality of life
This was not reported by Unsworth-White 1994.

**DISCUSSION**

Despite a comprehensive search, only one small, poorly reported and methodologically flawed study was identified that met the inclusion criteria for this review.

**Summary of main results**

One trial reported findings for 81 patients with isolated Mason type 1 and type 2 radial head fractures at follow-up times ranging between two and 47 months. The trial found no significant differences between early and delayed mobilisation in the numbers of participants with pain or limitations in range of elbow motion. All participants were reported as being able to use their arms for full activities of daily living and none had changed their occupation or lifestyle. Complications were not reported.

**Overall completeness and applicability of evidence**

The objective of the review was to assess the effects of early mobilisation on all types of elbow fractures, including those of the olecranon and distal humerus, and intra-articular elbow fractures. However, only one randomised controlled trial testing the comparison in less severe radial head fractures was included. Additionally, no randomised controlled trials were identified that compared early versus delayed mobilisation of the elbow after surgical intervention. Thus considerations of applicability are limited to the fracture population of the included trial.

Unsworth-White 1994 provided inadequate details on their trial interventions, such as a lack of information on the type and frequency of mobilisation in the immediate mobilisation group. The definition of the outcome measurement was poor and thus unrepeatable. The measurement and reporting of outcome were also inadequate. The presentation of dichotomous data by Unsworth-White 1994 for pain (rated as pain or no pain) and range of motion (rated as limited or not) has limited applicability to clinical practice. Lastly, the clinical significance of a loss of 10º elbow extension, and whether this should be considered an adverse outcome, is unclear. It may be of greater clinical significance when the dominant arm is affected and when occupations, sports or hobbies demand a high level of upper limb function. There was, moreover, no further information regarding the extent of elbow extension loss.

Although Unsworth-White 1994 occurred over 20 years ago, the use of plaster cast for immobilisation of radial head fractures is still used by some health professionals today. Thus the questions asked in this trial remains relevant.

**Quality of the evidence**

The quality of the available evidence is very low. The included trial was poorly reported and at high risk of detection and reporting biases, and at unknown risk for other biases. One key fault with this trial is that the follow-up was conducted at a specific time point by the investigators rather than at set time points after injury. This resulted in individual trial participants being followed up at times ranging from two to 47 months. It is very likely that this assessment process was not included in the trial protocol, should there have been one available.

**Potential biases in the review process**

We attempted to reduce the possibility of bias by comprehensive searching of a large number of electronic databases, and of conference proceedings. For future updates, we will attempt to identify non-published studies by contacting content area experts. Attempts were made to contact the authors of the included study to obtain all relevant data but without success, perhaps reflecting that the publication of this trial was over 16 years ago. Publication bias was minimised by obtaining partial translations of studies that were not published in English.
AUTHORS’ CONCLUSIONS

Implications for practice

There is a lack of robust evidence to inform on the timing of mobilisation, and specifically on the use of early mobilisation, after non-surgical or surgical treatment for adults with elbow fractures.

Implications for research

There is a need for high quality, well-reported, adequately powered, randomised controlled trials that compare early versus delayed mobilisation in people with commonly-occurring elbow fractures, treated with or without surgery. Specifically, a multi-centre trial that replicates the current variations in the clinical management of conservatively managed radial head fractures would be useful to determine which practice (early versus delayed mobilisation) has greatest influence on function, pain and adverse events. Clinical trials for other fractures of the elbow should also be considered, including displaced elbow fractures that are internally fixed and assessed as stable post-operatively. Both short-term (to monitor recovery and early complications) and long-term (at least one year) measurement of outcome is required. Validated, well-defined upper limb functional outcomes measures and quality of life measures should be used in addition to pain, adverse effects and range of motion. The design and reporting of trials should meet the contemporary standards of the CONSORT statement (Schultz 2010).

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Keschn 2007

Kim 2005

McRae 1994

Morrey 1981

Morrey 2005

Nash 2004

Pransky 2005

Ring 1997

Robinson 2003

Rommens 2004

Schultz 2010

**Watts 2007**


* Indicates the major publication for the study
### Characteristics of included studies  
*ordered by study ID*

#### Unsworth-White 1994

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Methods</strong></td>
<td>A randomised controlled trial of three treatments (participants randomised at presentation)</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>Hospital setting, United Kingdom, between 1987 and 1990. 98 consecutive patients with Mason type 1 and type 2 isolated radial head fractures attending the Accident and Emergency department. 81 participants were available for follow-up: 58 female, 23 male. Mean age 50.5, range 14 to 87 years. Inclusion criteria: Mason type 1 fractures (marginal fissure with no displacement) and type 2 (marginal sector with displacement). Exclusion criteria: Mason type 3 fractures, radial neck fractures, other concurrent upper limb injuries, previous elbow injuries, or generalised joint pathology.</td>
</tr>
<tr>
<td><strong>Interventions</strong></td>
<td>Three treatment regimens with no routine physiotherapy: 1. Immediate mobilisation (with a triangular support sling): N = 29 (24 female, 5 male, mean age 50.8 (range 14 to 87 years), 22 type 1 fractures and 7 type 2 fractures). 2. Initial immobilisation for 2 weeks in a plaster of Paris cast in 90 degrees of flexion: N = 29 (19 female, 10 male, mean age 51.0 (range 14 to 80 years), 20 type 1 fractures and 7 type 2 fractures). 3. Initial immobilisation for 2 weeks in a plaster of Paris cast in an extended position: N = 23 (15 female, 8 male, mean age 49.7 (range 18 to 80 years), 16 type 1 fractures and 7 type 2 fractures). There are no details of what immediate mobilisation involved including the type and frequency of mobilisation or exercise.</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Patients were reviewed at 2 and 6 weeks in a fracture clinic, but outcomes from these assessments are not reported. One assessment was conducted at 2 to 47 months after injury (mean 25 months). A standard pro forma was used to assess: Pain: pain or no pain Disability: not reported how this was assessed nor how impact on occupation or lifestyle was assessed Range of elbow movement: limited range or full range Patient’s opinion on method of treatment: not reported how this was assessed</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td>17 participants could not be traced by phone or letter; however, records indicate they were evenly distributed amongst treatment groups and did not suffer any fracture complications. Sources of funding not stated. Separate data were not available for patients ≥ 18 years old (nominal age threshold for adults given in review protocol inclusion criteria).</td>
</tr>
<tr>
<td>Bias</td>
<td>Authors’ judgement</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Blinding (performance bias and detection bias) Patient-rated outcomes e.g. pain</td>
<td>High risk</td>
</tr>
<tr>
<td>Blinding (performance bias and detection bias) Clinician-rated outcomes e.g. non-union, range of motion</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias) Patient-rated outcomes e.g. pain</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias) Clinician-rated outcomes e.g. non-union, range of motion</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Selective reporting (reporting bias)</td>
<td>High risk</td>
</tr>
</tbody>
</table>
Free of other sources of bias (performance bias)

Unclear risk

No information available in the paper about the instructions provided to immediate mobilisation group, or by whom. The degrees of extension the arm was immobilised in plaster of Paris was not reported.
**DATA AND ANALYSES**

**Comparison 1. Early mobilisation (sling: immediate) versus delayed mobilisation (POP cast: 2 weeks)**

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Number of people with pain (mean 25 months (range 2 to 47))</td>
<td>1</td>
<td></td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>1.1 Both cast groups</td>
<td>1</td>
<td></td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>1.2 Flexion cast group</td>
<td>1</td>
<td></td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>1.3 Extension cast group</td>
<td>1</td>
<td></td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>2 Number of people with limited range of elbow motion (mean 25 months (range 2 to 47))</td>
<td>1</td>
<td></td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>2.1 Both cast groups</td>
<td>1</td>
<td></td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>2.2 Flexion cast group</td>
<td>1</td>
<td></td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>2.3 Extension cast group</td>
<td>1</td>
<td></td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
</tbody>
</table>

**Analysis 1.1. Comparison 1 Early mobilisation (sling: immediate) versus delayed mobilisation (POP cast: 2 weeks), Outcome 1 Number of people with pain (mean 25 months (range 2 to 47)).**

Review: Early mobilisation for elbow fractures in adults

Comparison: 1 Early mobilisation (sling: immediate) versus delayed mobilisation (POP cast: 2 weeks)

Outcome: 1 Number of people with pain (mean 25 months (range 2 to 47))

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Early mobilisation</th>
<th>Delayed mobilisation</th>
<th>Risk Ratio M-H (Fixed, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Both cast groups</td>
<td>Unsworth-White 1994</td>
<td>5/29</td>
<td>14/52</td>
</tr>
<tr>
<td>2 Flexion cast group</td>
<td>Unsworth-White 1994</td>
<td>5/29</td>
<td>11/29</td>
</tr>
<tr>
<td>3 Extension cast group</td>
<td>Unsworth-White 1994</td>
<td>5/29</td>
<td>3/23</td>
</tr>
</tbody>
</table>
Analysis 1.2. Comparison 1 Early mobilisation (sling: immediate) versus delayed mobilisation (POP cast: 2 weeks), Outcome 2 Number of people with limited range of elbow motion (mean 25 months (range 2 to 47)).

Review: Early mobilisation for elbow fractures in adults

Comparison: 1 Early mobilisation (sling: immediate) versus delayed mobilisation (POP cast: 2 weeks)

Outcome: 2 Number of people with limited range of elbow motion (mean 25 months (range 2 to 47))

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Early mobilisation</th>
<th>Delayed mobilisation</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Both cast groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsworth-White 1994</td>
<td>6/29</td>
<td>13/52</td>
<td>0.83 [ 0.35, 1.94 ]</td>
<td></td>
</tr>
<tr>
<td>2 Flexion cast group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsworth-White 1994</td>
<td>6/29</td>
<td>11/29</td>
<td>0.55 [ 0.23, 1.28 ]</td>
<td></td>
</tr>
<tr>
<td>3 Extension cast group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsworth-White 1994</td>
<td>6/29</td>
<td>2/23</td>
<td>2.38 [ 0.53, 10.70 ]</td>
<td></td>
</tr>
</tbody>
</table>

Appendices

Appendix 1. Search strategies

MEDLINE (Ovid interface)
1. Elbow/in,su or Elbow Joint/in,su
2. (Elbow Joint/ or Elbow/) and exp Fractures, Bone/
3. (radius or radial) and (head or neck) and fracture*.ab,hw,ti.
4. (proximal and (ulna or ulnar or radius or radial) and fracture*).ab,hw,ti.
5. ((coronoid or olecranon) and fracture*).ab,hw,ti.
6. (capitell* or capitul*) and fracture*.ab,hw,ti.
7. ((trochlea* or distal) and (humer* or humor*) and fracture*).ab,hw,ti.
8. ((epicondyl* or condyl* or transcondyl* or unicondyl* or intercondyl* or supracondyl*) and (humer* or humor*) and fracture*).ab,hw,ti.
9. (elbow* and fracture*).ab,hw,ti.
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11. exp Rehabilitation/ or exp Movement/ or exp "Range of Motion, Articular"/ or exp Exercise Movement Techniques/ or "Recovery of Function"/
12. Physical Therapy Department, Hospital/ or exp Physical Therapy Modalities/ or "Physical Therapy (specialty)"/
13. (mobilit* or rehabilit* or movement or exercis*).ti,ab,hw.
14. (motion or function or functional).ti,ab,hw.
15. (physiotherap* or (physical adj therap*)).ti,ab,hw.
16. 11 or 12 or 13 or 14 or 15
17. 10 and 16
18. limit 17 to (“all infant (birth to 23 months)” or “all child (0 to 18 years)"
19. limit 17 to “all adult (19 plus years)"
20. 18 not 19
21. 17 not 20
22. clinical trial*.af.
23. random*.ti,ab,hw.
24. placebo.ti,ab.
25. (trial or trials).ti,ab.
26. groups.ti,ab.
27. 22 or 23 or 24 or 25 or 26
28. 21 and 27

EMBASE (Ovid interface)
1. Elbow Injury/
2. Elbow/ and exp Fracture/
3. exp Elbow Fracture/ or exp Humerus Supracondylar Fracture/ or exp Olecranon Fracture/ or exp Radius Head Fracture/
4. ((radial or radius) and (head or neck) and fracture*).ab,hw,ti.
5. (proximal and (ulna or ulnar or radius or radial) and fracture*).ab,hw,ti.
6. ((coronoid or olecranon) and fracture*).ab,hw,ti.
7. ((capitell* or capitol*) and fracture*).ab,hw,ti.
8. ((trochlea* or distal) and (humer* or humor*) and fracture*).ab,hw,ti.
9. ((epicondyl* or condyl* or transcondyl* or unicondyl* or intercondyl* or supracondyl*) and (humer* or humor*) and fracture*).ab,hw,ti.
10. (elbow* and fracture*).ab,hw,ti.
11. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
12. exp Rehabilitation/ or exp Convalescence/ or Mobilization/ or exp "Movement (Physiology)"/
13. exp "Joint Characteristics and Functions"/ or Muscle Stretching/ or exp Exercise/
14. Physiotherapy Practice/ or exp Physiotherapy/ or Physiotherapist/ or exp Kinesiotherapy/
15. (mobili* or rehabilit* or movement or exercis*).ti,ab,hw.
16. (motion or function or functional).ti,ab,hw.
17. (physiotherapist* or (physical adj therapi*)).ti,ab,hw.
18. 12 or 13 or 14 or 15 or 16 or 17
19. 11 and 18
20. limit 19 to (infant or child or preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>)
21. limit 19 to (adult <18 to 64 years> or aged <65+ years>)
22. 20 not 21
23. 19 not 22
24. clinical trial*.af.
25. random*.ti,ab,hw.
26. placebo.ti,ab.
27. (trial or trials).ti,ab.
28. groups.ti,ab.
29. 24 or 25 or 26 or 27 or 28
30. 23 and 29

The Cochrane Library (Wiley Online Library)
#1. MeSH descriptor Elbow explode all trees with qualifiers: IN,SU
#2. MeSH descriptor Elbow Joint explode all trees with qualifiers: IN,SU
#3. MeSH descriptor Elbow Joint explode all trees
#4. MeSH descriptor Elbow explode all trees
#5. MeSH descriptor Fractures, Bone explode all trees
#6. ((#3 OR #4) AND #5)
#7. (radial or radius):ti,ab,kw and (head or neck):ti,ab,kw and (fracture*:ti,ab,kw
#8. (ulna or ulnar or radius or radial):ti,ab,kw and (proximal):ti,ab,kw and (fracture*:ti,ab,kw
#9. (coronoid or olecranon):ti,ab,kw and (fracture*:ti,ab,kw
#10. (capitel* or capitul*):ti,ab,kw and (fracture*:ti,ab,kw
#11. (trochlea* or distal):ti,ab,kw and (humer* or humor*):ti,ab,kw and (fracture*:ti,ab,kw
#12. (epicondyl* or condyl* or transcondyl* or unicondyl* or intercondyl* or supracondyl*):ti,ab,kw and (humer* or humor*):ti,ab,kw and (fracture*:ti,ab,kw
#13. (elbow*:ti,ab,kw and (fracture*:ti,ab,kw
#14. (#1 OR #2 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13)
#15. MeSH descriptor Rehabilitation explode all trees
#16. MeSH descriptor Movement explode all trees
#17. MeSH descriptor Range of Motion, Articular explode all trees
#18. MeSH descriptor Exercise Movement Techniques explode all trees
#19. MeSH descriptor Recovery of Function explode all trees
#20. MeSH descriptor Physical Therapy Department, Hospital explode all trees
#21. MeSH descriptor Physical Therapy Modalities explode all trees
#22. MeSH descriptor Physical Therapy (Specialty) explode all trees
#23. (mobili* or rehabilit* or movement or exercis*:ti,ab,kw
#24. (motion or function or functional):ti,ab,kw
#25. (physical NEXT therapy*:ti,ab,kw
#26. (#15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)
#27. (#14 AND #26)

CINAHL (EBSCO host)
S1 (MH "Elbow Injuries+)
S2 (MH "Elbow Joint/IN/SU") or (MH "Elbow/IN/SU")
S3 ( MH "Elbow") or (MH "Elbow Joint") and (MH "Fractures+")
S4 ((AB (radial or radius) and (head or neck) and (fractur*)) or (TI (radial or radius) and (head or neck) and (fractur*)))
S5 ((AB (ulna or ulnar or radial or radius) and (proximal) and (fractur*)) or (TI (ulna or ulnar or radial or radius) and (proximal) and (fractur*))
S6 ((TI (coronoid or olecranon) and (fractur*)) or (AB (coronoid or olecranon) and (fractur*)) or (MW (coronoid or olecranon) and (fractur*))
S7 ((TI capitel* or capitul* and (fractur*)) or (AB capitel* or capitul* and (fractur*)) or (MW capitel* or capitul* and (fractur*))
S8 ((TI trochlea* or distal) and (humer* or humor*) and (fractur*)) or (AB (t)rochlea* or distal) and (humer* or humor*) and (fractur*)) or (MW (t)rochlea* or distal) and (humer* or humor*) and (fractur*))
S9 ((TI epicondyl* or condyl* or transcondyl* or unicondyl* or intercondyl* or supracondyl*) and (humer* or humor*) and (fractur*)) or (AB epicondyl* or condyl* or transcondyl* or unicondyl* or intercondyl* or supracondyl*) and (humer* or humor*) and (fractur*)) or (MW epicondyl* or condyl* or transcondyl* or unicondyl* or intercondyl* or supracondyl*) and (humer* or humor*) and (fractur*))
S10 ((TI elbow* and (fractur*)) or (AB elbow* and (fractur*)) or (MW elbow* and (fractur*))
S11 S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10
S12 (MH "Rehabilitation") or (MH "Movements") or (MH "Range of Motion") or (MH "Recovery")
S13 (MH "Physical Therapy Practice") or (MH "Physical Therapists") or (MH "Physical Therapy Service")
S14 (MH "Exercise") or (MH "Early Intervention")
S15 ((TI (mobili* or rehabilit* or movement or exercis*)) or (AB mobili* or rehabilit* or movement or exercis*)) or (MW (mobili* or rehabilit* or movement or exercis*))
S16 ((TI (motion or function or functional)) or (AB (motion or function or functional)) or (MW (motion or function or functional))

Early mobilisation for elbow fractures in adults (Review)
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S17 ((TI (physiotherap*) or (physical therap*)) or (AB (physiotherap*) or (physical therap*)) or (MW (physiotherap*) or (physical therap*))
S18 S12 or S13 or S14 or S15 or S16 or S17
S19 S11 and S18 Limiters - Age Groups: Infant, Newborn 0-1 month, Infant, 1-23 months, Child, Preschool 2-5 years, Child, 6-12 years, Adolescence, 13-18 years
S20 S11 and S18 Limiters - Age Groups: Adult, 19-44 years, Middle Age, 45-64 years, Aged, 65+ years, Aged, 80 and over
S21 S11 and S18
S22 S20 not S21
S23 S19 not S22
S24 "clinical trial*"
S25 TI random* or AB random* or MW random*
S26 TI placebo or AB placebo
S27 ((TI (trial) or (trials)) or (AB (trial) or (trials)))
S28 TI groups or AB groups
S29 S24 or S25 or S26 or S27 or S28
S30 S23 and S29

**PEDro**

Simple search strategy selected
Each line refers to a separate search
1. elbow
2. head of radius
3. radial head
4. olecranon
5. distal humer
6. distal humor
7. proximal radius
8. proximal ulna
9. trochlea
10. coronoid
11. capitel
12. capitul
13. upper limb fractur
14. early mobili and fractur
15. late mobili and fractur
16. delayed mobili and fractur

**Current Controlled Trials**

'All registers' selected
Each line refers to a separate search
1. elbow
2. "head of radius"
3. radial head
4. olecranon
5. (humer% OR humor%) AND distal
6. (radius OR ulna%) AND proximal
7. (trochlea OR coronoid OR capitel% OR capitul%)
8. upper limb% AND fractur%
9. early AND mobili%
10. (late OR delayed) AND mobili%
International Clinical Trials Registry Platform

Each line refers to a separate search

1. elbow
2. head of radius
3. radial head
4. olecranon
5. distal humer*
6. distal humor*
7. proximal radius
8. proximal ulna*
9. trochlea
10. coronoid
11. capitel*
12. capitul*
13. upper limb AND fractur*
14. early mobili*
15. late mobili*
16. delayed mobili*

Appendix 2. Conference proceedings searched

1. TraumaCare 2004. Australasian Trauma Society and Trauma Care International; 2004 October 15-17; Sydney, Australia
2. Trauma Melbourne Conference Trauma Research and Clinical Management Conference 2008. National Trauma Institute; 2008 November 21-22; Melbourne, Australia
3. Trauma Melbourne. Trauma Research and Clinical Management Conference 2009. National Trauma Institute; 2009 November 20-21; Melbourne, Australia
4. AUSTRAUMA™ Trauma and Critical Care Conference; 2007 February 23-24; Sydney, Australia
5. AUSTRAUMA™ Trauma, Critical Care & Emergency Surgery Conference; 2008 February 14; Sydney, Australia
6. SWAN X Trauma Conference; 2002 August 2-3; Liverpool, Australia
7. Southern Trauma Symposium. A Joint Meeting of the Australasian Trauma Society Victorian Major Trauma Services; 2002 November 8-9; Melbourne, Australia
8. Trauma Research Symposium. National Trauma Research Institute; 2005 November 3; Melbourne, Australia
9. Trauma Research Symposium. National Trauma Research Institute; 2006 December 5; Melbourne, Australia
10. Trauma 2006. Annual Scientific Meeting of the Australasian Trauma Society; 2006 September 28-1 October; Gold Coast, Australia
11. Trauma 2007. Annual Scientific Meeting of the Australasian Trauma Society; 2007 October 13-14; Melbourne, Australia
12. Trauma 2009 Combined Australasian Trauma Society and Trauma Association Canada Annual Scientific Meeting; 2009 March 5-7; Auckland, New Zealand
13. Allied Health Trauma Research Symposium: Allied Health Intervention with Trauma Patients, When, How and Why? National Trauma Research Institute; 2006 May 8; Melbourne, Australia
14. Allied Health and Rehabilitation Trauma Seminar. Institute of Trauma and Injury; 2005 September 14; Hornsby, Australia
15. 11th International Congress of Shoulder and Elbow Surgery; 2010 September 5-8; Edinburgh, Scotland

1-15 were searched as hard copies and 16-17 electronically
### Appendix 3. Risk of bias assessment tool

<table>
<thead>
<tr>
<th>Domain</th>
<th>Review authors’ judgement*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sequence generation</strong></td>
<td>Was the allocation sequence adequately generated?</td>
</tr>
<tr>
<td></td>
<td>YES / NO / UNCLEAR</td>
</tr>
<tr>
<td><strong>Allocation concealment</strong></td>
<td>Was allocation adequately concealed?</td>
</tr>
<tr>
<td></td>
<td>YES / NO / UNCLEAR</td>
</tr>
<tr>
<td><strong>Blinding of participants, personnel and outcome assessors</strong></td>
<td>Was knowledge of the allocated intervention adequately prevented during the study?</td>
</tr>
<tr>
<td>Outcome: Patient-rated outcomes e.g. DASH, pain</td>
<td>YES / NO / UNCLEAR</td>
</tr>
<tr>
<td><strong>Blinding of participants, personnel and outcome assessors</strong></td>
<td>Was knowledge of the allocated intervention adequately prevented during the study?</td>
</tr>
<tr>
<td>Outcome: Clinician-rated outcomes e.g. non-union, deformity, range of motion</td>
<td>YES / NO / UNCLEAR</td>
</tr>
<tr>
<td><strong>Incomplete outcome data</strong></td>
<td>Were incomplete outcome data adequately addressed?</td>
</tr>
<tr>
<td>Outcome: Patient-rated outcomes e.g. DASH, pain</td>
<td>YES / NO / UNCLEAR</td>
</tr>
<tr>
<td><strong>Incomplete outcome data</strong></td>
<td>Were incomplete outcome data adequately addressed?</td>
</tr>
<tr>
<td>Outcome: Clinician-rated outcomes e.g. non-union, deformity, range of motion</td>
<td>YES / NO / UNCLEAR</td>
</tr>
<tr>
<td><strong>Selective outcome reporting</strong></td>
<td>Are reports of the study free of suggestion of selective outcome reporting?</td>
</tr>
<tr>
<td></td>
<td>YES / NO / UNCLEAR</td>
</tr>
<tr>
<td><strong>Other sources of bias</strong></td>
<td>Was the study apparently free of other problems that could put it at a high risk of bias?</td>
</tr>
<tr>
<td>Performance bias: for instance, provision of other interventions that should be comparable in both groups (e.g. advice on activity, exercises undertaken, timing of intervention; or clear differences in experience of personal characteristics of treatment providers, especially experience).</td>
<td>YES / NO / UNCLEAR</td>
</tr>
</tbody>
</table>

**Footnotes**

DASH: Disabilities of the Arm Shoulder and Hand outcome measure

* In the Risk of bias table, a ‘Yes’ equates to ‘low risk’; and a ‘No’ equates to ‘high risk’. 
HISTORY
Protocol first published: Issue 4, 2009
Review first published: Issue 6, 2011

CONTRIBUTIONS OF AUTHORS
P Harding conceived and designed the protocol, and coordinated its development. She assisted in the development of the search strategies and wrote and entered the protocol into RevMan. She was the first independent reviewer of the studies resulting from the search strategy and was the primary author of the review.

T Rasekaba assisted with the design and co-ordination of the protocol development. He assisted in the development of the search strategies (PEDro) and assisted with the writing of the protocol, was the second independent reviewer of the studies and contributed to writing the review.

L Smirneos developed the search strategies for MEDLINE, CINAHL, EMBASE, The Cochrane Library and assisted with the PEDro database, Current Controlled Trials and WHO International Clinical Trials Registry Platform. She also commented on drafts of the protocol.

A Holland reviewed the design and co-ordination of the protocol development, search strategies and commented on drafts of the protocol and provided expert oversight on the review methodology and review editing.

DECLARATIONS OF INTEREST
None known.

SOURCES OF SUPPORT
Internal sources
- The Alfred, Melbourne, Australia.
  Support provided from the Physiotherapy Department and The Ian Potter Library

External sources
- No sources of support supplied

DIFFERENCES BETWEEN PROTOCOL AND REVIEW
The following clarification has been added to the Background - Description of the condition: “The range of elbow movement required for functional tasks is a flexion arc of 30 to 130 degrees (Morrey 1981).”

In the risk of bias assessment tool in our protocol we included ‘selection bias’ resulting from major imbalances in baseline characteristics under the heading of ‘Other sources of bias’. However, this item was not included in the review as ‘selection bias’ was assessed already in the first two domains of the risk of bias tool.
INDEX TERMS

Medical Subject Headings (MeSH)
Elbow [*injuries]; Movement [*physiology]; Radius Fractures [*rehabilitation]; Recovery of Function; Time Factors

MeSH check words

Adult; Humans