Interventions for improving coordination of reach to grasp following stroke: a systematic review
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CRD summary
The authors concluded that there was insufficient evidence on the effectiveness of interventions to improve hand and arm coordination, during reach to grasp, after stroke. This appears to have been a well-conducted review. The authors’ conclusion and recommendations for further research, correspond with the findings presented and appear reliable.

Authors’ objectives
To evaluate the effectiveness of treatments to improve coordination of reach to grasp, after stroke.

Searching
Ten databases, including MEDLINE and Cochrane Central Register of Controlled Trials (CENTRAL), were searched for articles from 1950 to April 2010, in English. Search terms were reported; reference lists of identified articles were handsearched. Five additional sources, including clinical trial registers and conference proceedings, were searched for relevant grey literature.

Study selection
Experimental studies and observational studies, with an intervention or manipulation that aimed to improve upper limb coordination, during reach and grasp, in adults (aged 18 years or older), with a clinical diagnosis of stroke, were eligible for inclusion. Any measure of upper limb coordination was eligible for assessing the effectiveness of interventions. Studies could occur in any setting. Studies examining shoulder and elbow coordination were excluded if they did not involve the hand in an aspect of the task. Interventions could include reach and grasp or could be delivered as a separate treatment, as long as the aim was to improve hand and arm coordination for reach and grasp. Studies of bilateral arm training were included, but only if they involved measures of intra-limb coordination on the affected side.

Where reported, the mean age of patients ranged from 56.38 to 67 years; most studies contained more males than females (range 42% to 83% males). Just over half of the studies reported the type of stroke that patients had experienced, and most were ischaemic. Lesion locations varied across the study populations. The mean time since stroke at baseline varied from 5.3 to 54.7 months (where reported). The interventions were functional training, robot therapy, computerised training, biofeedback, or electrical stimulation.

Two reviewers independently selected studies; any discrepancies were resolved through discussion with a third reviewer.

Assessment of study quality
Standardised checklists from the Joanna Briggs Institute were used to assess the quality of the studies, according to their design. Common quality aspects for all studies were assessed using criteria from the Downs and Black tool. Two reviewers independently assessed the quality of the studies.

Data extraction
Two reviewers independently extracted data on the content of the interventions and their effectiveness in improving hand and arm coordination after stroke.

Methods of synthesis
The data were categorised according to prespecified types of intervention or manipulation, and presented in a narrative synthesis.

Results of the review
Seven studies were included in the review, with 123 patients (range four to 47): one was a randomised controlled trial (32 patients), two were experimental case-control studies (51 patients), and four were experimental studies without
controls (40 patients). Five studies had high methodological quality because they met more than 65% of criteria; the remaining two studies met less than 60% of criteria. The quality of most studies was limited by participant sampling, failure to control for confounding variables, and a lack of follow-up.

There was a lack of empirical data for the effectiveness of the interventions. Improvements in hand and arm coordination were reported in four studies, following functional therapy, electrical stimulation, or computerised training interventions. One study delivering a robot therapy intervention and reported no improvement. Two studies did not report the specific effects of functional therapy or robot therapy interventions on hand and arm coordination.

The randomised controlled trial was the only one of the four studies that showed improvements that had a control group; the benefits it reported were comparable to those of the group receiving traditional therapy. Among these four studies, only one statistically significant result was reported, in an experimental study, without controls, and with electrical somatosensory stimulation as its intervention.

**Authors' conclusions**
There was insufficient evidence on the effectiveness of the interventions to improve hand and arm coordination, during reach to grasp, after stroke.

**CRD commentary**
The review question was clear and the inclusion criteria were sufficiently reproducible. A large range of relevant data sources was searched, but the restriction to articles in English increased the risk of language bias. The included studies were all published, but the search did include attempts to locate grey literature, reducing the likelihood that unpublished studies were missed. Efforts were made to minimise reviewer error and bias throughout the review process. Suitable and standardised checklists were used to assess study quality, and the quality of their evidence. Most studies appeared to be of good quality. Study characteristics were presented and the narrative method of synthesis was appropriate, given the clinical and methodological diversity of the studies.

This appears to have been a well-conducted review. The authors' conclusion and recommendations for further research, correspond with the findings presented and appear to be reliable.

**Implications of the review for practice and research**
**Practice:** The authors stated that the evidence was insufficient to make strong recommendations on the effects of interventions to improve hand and arm coordination, during reach to grasp, after stroke.

**Research:** The authors stated that randomised controlled trials, with sufficient power and standardised outcome measures, were required for future meta-analysis. These trials should have impartial randomisation, adequate blinding and allocation concealment, similar groups at the start, comparable intervention experiences, use suitable statistics and intention-to-treat analysis, and report functional performance and detailed kinematic measures of hand and arm coordination.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.