Exercise therapy for arm function in stroke patients: a systematic review of randomized controlled trials

Authors' objectives
To assess any evidence of exercise therapy to improve the arm function of patients suffering from stroke, and to explain heterogeneity of the results.

Searching
The following sources were searched up to August 2000: MEDLINE, EMBASE, CINAHL, the database of the Knowledge Centre for Professions Allied to Health (Nederlands Paramedisch Instituut), and the database of the Cochrane Rehabilitation and Related Therapies Field. The keywords used were 'stroke', 'cerebrovascular disorders', 'hemiplegia', 'hemiparesis', 'upper extremity', 'arm', 'rehabilitation', 'therapy', 'exercise therapy', 'physical therapy', 'physiotherapy' and 'occupational therapy'. The studies were limited to those published in English, French, Dutch or German.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were included.

Specific interventions included in the review
Exercise therapy to ameliorate motor function of the hemiparetic or hemiplegic arm in stroke patients. Studies concerning pharmacological interventions, biofeedback techniques or electrical stimulation, were excluded.

Participants included in the review
Patients with hemiparetic or hemiplegic arm following stroke. The mean age of the patients ranged from 59 to 73.8 years in 8 studies. The median age in 4 studies ranged from 59 to 73 years, and 1 study reported an age range of 53 to 73 years.

Outcomes assessed in the review
Measures of impairment and/or disability on the affected arm. The outcomes were measured using the Barthel Index (7 studies), the Action Research Arm test (4 studies), and the Fugl-Meyer assessment scale (4 studies). The outcomes were measured at both an impairment level and a disability level in all studies.

How were decisions on the relevance of primary studies made?
The articles were selected on the basis of the title and abstract; the full text was read in cases of uncertainty. It was not stated how many of the authors selected the studies for the review.

Assessment of study quality
The validity of the studies was assessed according to a standardised list of 19 methodology criteria. This included 11 for internal validity, 6 for descriptive criteria, and 2 relating to statistical criteria. The reviewers were not blinded. Two independent raters assessed the primary studies, and any discrepancies were resolved through discussion with a third reviewer. The reviewers worked independently but were not blinded.

Data extraction
The following data were extracted: patient characteristics (severity of impairment, age, and acute or chronic impairment), study design (blinding, concealment of allocation and follow-up), and intervention (type of intervention and period of exposure).
Methods of synthesis
How were the studies combined?
A narrative synthesis was undertaken. Each study was assigned a positive score or a score of no-difference, except for one study in which no statistical test was applied. Positive results were defined by a p-value of less than 0.05.

How were differences between studies investigated?
Some attempt was made to describe those aspects of study population and design which may cause heterogeneity, but these were not directly related to the study results. The relationships between three study characteristics and the reported short-term effects on an arm function test were presented in a table. These study characteristics were: the presence or absence of a contrast in the amount or duration of exercise therapy between groups; and the methodological criteria concerning concealed allocation of treatment and the blinding of the outcome assessor.

Results of the review
Thirteen RCTs with a total of 939 patients. The number of patients in the included RCTs ranged from 9 to 282.

The methodological scores ranged from 5 to 15, and the raters disagreed on 15.8% of the items assessed.

In 6 of the 13 studies, positive short-term results were reported for arm function tests. In 3 of these 6 studies, the effect was still positive after 6 weeks, 1 year or 2 years. Only 2 studies assessing the activities of daily living reported positive results for both short- and long-term follow-up. In 5 of these 6 studies reporting positive short-term results, there was a contrast in the amount or duration of exercise therapy between the groups.

Authors' conclusions
The authors concluded that there was insufficient evidence to draw definitive conclusions about the effectiveness of exercise therapy on arm function in stroke patients. The difference in the results between studies with and without contrast in the amount or duration of exercise therapy between groups, suggests that more exercise therapy may be beneficial.

CRD commentary
The authors of this review presented a clearly defined question of importance to stroke rehabilitation. Their search methodology was comprehensive, although some studies might have been missed: the search was limited to publications in four languages, handsearching was not performed, and experts in the field were not contacted. In addition, unpublished studies or abstracts were not sought or included. The data extraction and validity assessment were well described, and the latter was performed independently by two reviewers. Their conclusions appear reasonable based on the limited evidence in the papers. However, it is unclear why some interventions such as electrical stimulation were excluded. Also, there were no details of who, or how many of the authors selected the studies.

The results were described narratively and with vote-counting. It might have been possible to combine some of the many outcome scales using pooled standardised mean differences. Some attempt was made to examine the relationship between study quality and the characteristics of the intervention (i.e. intensity of exercise between the intervention and control groups) on the outcomes. The authors of the review stated that they were not able to identify the primary outcomes in some of the individual studies; this could have led to some selective reporting of positive outcomes. Furthermore, the method of vote-counting did not provide a category for negative findings, and from the information presented in the tables it was not always clear what assessment tools the outcome data represented.

Implications of the review for practice and research
Practice: The authors state that the findings of this review do not enable a definitive conclusion to be drawn about the effectiveness of exercise therapy to improve the arm motor function in stroke patients. However, the difference in results between studies with and without contrast in the amount or duration of exercise therapy between groups suggests that more intensive exercise therapy may be beneficial. The authors recommend that, in daily practice, these patients should be offered extensive opportunity and encouragement to exercise the affected arm.
Research: The authors of the review did not state any implications for research.

Reviewer's statement: Future trials are needed to determine the effectiveness of different types of exercise therapy for stroke patients with different levels of arm motor function loss. An agreement needs to be made on the most appropriate outcome measure and assessment tool to determine this.

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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.