Electromechanical and Robot-Assisted Arm Training for Improving Arm Function and Activities of Daily Living After Stroke

Jan Mehrholz, DrPH; Thomas Platz, MD; Joachim Kugler, MD; Marcus Pohl, MD

More than two thirds of all patients after stroke have difficulties with reduced arm function. Electromechanical and robot-assisted arm training uses specialized machines to assist rehabilitation in practice and this type of training might improve arm function after stroke.

**Objectives**

This systematic review examined the effectiveness of electromechanical and robot-assisted arm training for improving activities of daily living and arm function and motor strength of patients after stroke and the acceptability and safety of the therapy.

**Methods**

We searched the Cochrane Stroke Group Trials Register (last searched October 2007), the Cochrane Central Register of Controlled Trials (The Cochrane Library, Issue 3, 2007), MEDLINE (1950 to October 2007), EMBASE (1980 to October 2007), CINAHL (1982 to October 2007), AMED (1985 to October 2007), SPORTDiscus (1949 to October 2007), PEDro (searched October 2007), COMPENDEX (1972 to October 2007), and INSPEC (1969 to October 2007). We also hand-searched relevant conference proceedings, searched trials and research registers, checked reference lists, and contacted trialists, experts, and researchers in our field and manufacturers of commercial devices. Two review authors independently selected trials for inclusion, assessed trial quality, and extracted the data. The primary outcome was activities of daily living; secondary outcomes were impairments such as motor function and motor strength. To minimize bias, we included only randomized, controlled trials comparing electromechanical and robot-assisted arm training for recovery of arm function with other rehabilitation interventions or no treatment.

**Main Results**

This review identified 11 trials, which included 328 participants. Electromechanical and robot-assisted arm training did not improve activities of daily living (standardized mean difference, 0.29; 95% CI, −0.47 to 1.06; \( P = 0.45; \) \( I^2 = 85\% \)). Arm motor function and arm motor strength improved (standardized mean difference, 0.68; 95% CI, 0.24 to 1.11; \( P = 0.002; \) \( I^2 = 56\% \) and standardized mean difference, 1.03; 95% CI, 0.29 to 1.78; \( P = 0.007; \) \( I^2 = 79\% \) respectively). Electromechanical and robot-assisted arm training did not increase the risk of patients to dropout (fixed-effect model, 0.01; 95% CI, −0.05 to 0.06; \( P = 0.77; \) \( I^2 = 0\% \) and adverse events were rare.

**Conclusions**

Patients who receive electromechanical and robot-assisted arm training after stroke are not more likely to improve their activities of daily living, but arm motor function and strength of the paretic arm may improve. However, the results must be interpreted with caution because there were variations between the trials in the duration, amount of training and type of treatment, and in the patient characteristics.

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**Figure.** Electromechanical and robotic-assisted training versus all other intervention. Activities of daily living at the end of intervention phase.

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Implications for Clinical Practice and Future Research

Our results were not conclusive. We did not find that patients who receive electromechanical-assisted arm training after stroke are more likely to improve their activities of daily living. One could argue that this might be due to the limited contrast between control and experimental interventions in the amount of repetition or due to insensitive outcome assessment tools. Our results indicate, however, that motor strength of the paretic arm and motor function are more likely to improve when patients after stroke train with electromechanical devices or robots.

There is still a need for well-designed large-scale multicenter studies to evaluate benefits and harms of electromechanical-assisted arm training after stroke. Further research should address specific questions about the type, timing, frequency, and duration of electromechanical and robot-assisted arm training.

Full details and all graphical plots are available in the version of this review published in the Cochrane Library.¹

Disclosures

None.

Reference


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