

Including upper extremity robotic therapy during early inpatient stroke rehabilitation does not lead to better outcomes compared with conventional treatment

Summary of: Masiero S, Armani M, Ferlini G, Rosati G, Rossi A (2013) Randomized trial of a robotic assistive device for the upper extremity during early inpatient stroke rehabilitation

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Synopsis:

Question: Does a robotic assistive device (NeReBot) lead to better upper extremity outcomes than standard upper limb rehabilitation among post-acute stroke inpatients? **Design:** randomised controlled trial and blinded outcome assessment. **Setting:** A rehabilitation unit in Italy. **Participants:** Adults in the post-acute phase of stroke, Mini-Mental State Examination score >18 and inability to move the upper limb against gravity or weak resistance were key inclusion criteria. Key exclusion criteria were cardiovascular instability, early appearance of marked spasticity (Ashworth Scale ≥ 3), use of functional electrical stimulation or Botox in the affected upper extremity. Randomisation of 34 participants allocated 16 to the experimental group and 18 to the control group. **Interventions:** All participants received a total of 120 minutes of upper limb therapy per day, 5 days a week for 5 weeks. The experimental group received NeReBot therapy for 35% of the exercise time, and standard upper limb rehabilitation for 65% of the time. The control group received standard upper limb rehabilitation only. **Outcome measures:** Main outcomes were Medical Research Council strength scale, Fugl-Meyer Assessment, Motor-Functional Independence Measure, Modified Ashworth Scale, Frenchay Arm test, and Box and Block Test of manual dexterity. Tolerability of treatment (as indicated by the number of complications) and the degree of acceptance of robotic training (visual analogue scale) were also evaluated. The outcomes were measured at baseline, at the end of the 5-week treatment period, 3 months, and 7 months after the end of treatment. **Results:** 30 participants completed the study. No significant between-group difference was found in any of the outcome measures at the four measurement time points. **Conclusion:** Incorporating NeReBot therapy into upper limb rehabilitation is not more efficacious than conventional upper limb rehabilitation in post-acute stroke inpatients.

Commentary

There are challenges to find more effective methods of neurorehabilitation to regain lost motor functions. Effective motor functional recovery depends on the intensive physical practice of the affected joints. With the advance in engineering-based technologies, robot-assisted rehabilitation has been applied in post-stroke training with advantages of high motion repeatability and training intensity. In a Cochrane meta-analysis, the efficacy of robotic-assisted arm training devices was compared with other therapeutic interventions in stroke rehabilitation (Mehrholz et al 2012). Results of the a systematic review of randomized controlled trials concluded that paretic arm function and activities of daily living can be improved but not arm muscle strength. However, only a few studies have been conducted in the early post-stroke phase.

The randomised trial conducted by Masiero and colleagues contributes an important clinical trial in early stroke rehabilitation (intervention started an average 8.4 days after stroke) with the NeReBot robotic system. The results did not show any better outcomes in motor function and activity rating scales when compared with conventional rehabilitation.

Different types of robotic systems have applied their own control methods and involve different arm movements. It is possible these factors may contribute to the effectiveness of the training. Another randomized controlled trial was conducted by Klamroth-Marganska and colleagues with ARMin robotic system. Patients were in the chronic phase post-stroke (≥ 6 months after stroke). Their results showed better motor function recovery with the use of the robotic system (Klamroth-Marganska et al 2014).

Whether the type of control system accounts for the effectiveness (or ineffectiveness) of robot-assisted therapy is a matter of debate. While a number of clinical studies have shown positive results with robotic training, it will be interesting to compare the effectiveness between different robotic systems in future studies. Moreover, the time window for arm training with different robotic systems can be further investigated.

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References:

Mehrholtz J et al (2012) *Cochrane Database Syst Rev* 6:CD006876.

Klamroth-Marganska V et al (2014) *Lancet Neurol.* 13(2):159-66