

# Towards the integration of ArmAssist, a system for post-stroke robotic upper-limb quantitative telerehabilitation, in the clinical practice.

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## Introduction

Research shows that better results in post-stroke rehabilitation are obtained when patients receive more intensive therapy. However, the increasing affected population and the limited healthcare resources prevent the provision of intense rehabilitation care in the traditional way. Thus, there is a need for more autonomous and scalable care that can also be transferred out of the clinic. Robot assisted rehabilitation may provide it; in fact, an increasing effort in this field has been seen over the last years in both scientific and commercial areas. Nevertheless, commercial success is still limited and very few clinics in Spain have access to those systems and include them in their rehabilitation protocols. The solutions available are either too expensive, complicated, incomplete or need to probe their effectiveness to be considered useful by both therapists and patients. ArmAssist, a low-cost robotic system for post-stroke upper-limb quantitative rehabilitation, aims to address that lack. We present here preliminary results of an ongoing clinical testing of the system.

## Methods

A clinical study is being conducted in the Clinic for Rehabilitation 'Dr Miroslav Zotović' in Belgrade, Serbia. Patients included in this study are 40 to 70-year-old stroke survivors in the sub-acute phase with unilateral paresis, able to understand simple instructions, and with some voluntary movements in elbow and shoulder joints. The program lasts four weeks during which patients have at least one hour of conventional therapy and at least thirty minutes of additional therapy per day, five days per week. The additional therapy consists of training with ArmAssist for the experimental group, and properly matched work therapy for the control group. Each group comprises 15 patients. All patients are assessed at the beginning and the end of the program. An experimental psychologist interviews patients to evaluate usability and motivation aspects. Motor performance is assessed using both ArmAssist and a complete set of standard tests as the Fugl-Meyer Assessment, the Action Research Arm Test and the Wolf Motor Function test. In addition, cognitive performance, spasticity and pain are also evaluated.

## Results

For the time being, only qualitative data from the first group of 5 patients and 2 therapists has been gathered and analyzed. Based on their answers to the Intrinsic Motivation Inventory and the ArmAssist Usability Evaluation questionnaires, the following may be concluded:

- Both therapists and patients found the system use easy to learn and beneficial for patient recovery.
- Therapists are familiar with this kind of technology, feel that the system is adequate for training, enjoyable and motivating for patients and the outcome results of the training are sufficient and clearly presented.
- Patients reported a high level of interest/enjoyment, perceived competence, effort/importance, value/usefulness and perceived choice and a very low level of felt pressure and tension while using the system.

Some technical problems were detected at the beginning of the testing due to the shipping of the systems to Serbia. It is crucial that every technical problem is solved so that the experience of users is not diminished and every aspect of usability can be properly evaluated.

## Conclusion

Preliminary qualitative results show that a first step in the integration of ArmAssist in the clinical practice may have been achieved, demonstrating that it integrates well in the clinical setting and that it is considered useful by both patients and therapists. However, further data is needed in order to confirm this conclusion. Next, quantitative results will be analyzed in order to probe the effectiveness of both assessment and training performed by ArmAssist, correlating them with the assessment scales and physical therapy performed at the clinic.