

Patient motivation in robot-assisted upper limb rehabilitation following stroke: Initial findings from subgroup analysis within a randomized controlled trial in the ReHyb project

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Background: Robot-assisted training has become a standard tool for inpatient stroke rehabilitation, recognized for its ability to enhance repetitive exercise phases and improve various body functions, including hand and arm movements, strength, and activities of daily living [1]. Despite the varying and inconsistent use of affecting factors in motor learning [2], the role of motivation in therapy outcomes seems to be crucial, with motivated patients demonstrating superior recovery compared to their less motivated counterparts [3, 4]. While recent research initiatives aim to develop a comprehensive scale for assessing patient motivation during rehabilitation [5], there remains a notable dearth of studies investigating motivation specifically within the context of robot-assisted therapy.

Objective: This study aims to investigate the level of patient motivation during robot-assisted therapy for upper limbs in stroke rehabilitation.

Method: Throughout three sessions, participants actively engaged in wrist movement exercises facilitated by an active wrist robot device. This task involved tracking a

moving target displayed on a screen through flexion and extension movements of the wrist (see **Figure 1**). After randomizing for intervention (support by Functional Electrical Stimulation, Robot, or Robot and FES combined), participants in the robot-assisted group underwent two sequential phases within each session, performing the task with and without the device's assistance following a cross-over design. Motivation levels were evaluated after each training phase using a five-point Likert scale reaching from 'Strongly disagree' to 'Strongly agree' and including the items 'Using the device was pleasant', 'I enjoyed the activity', and 'I would like to use the device in my therapy'. Differences in the level of motivation between both support modalities were analyzed by the paired sample t-test or the Wilcoxon test with an α -level of 5% in R.

Preliminary Results: Six patients (3 females; mean age: 73 [SD: 6]) participated in the wrist motion exercises. Irrespective of the support condition, 78% expressed enjoyment of the activity, while 83% indicated a willingness to integrate the device into their therapeutic regimen. Moreover, 78% strongly concurred that the device contributed to a pleasant experience across both assistance modalities (see **Figure 2**). Upon analysis using the Wilcoxon test, no significant differences were observed in the perceived pleasantness of device use, enjoyment of the activity, or desire to incorporate the device into therapy across both support settings ('Using the device was pleasant': $p > .999$; 'I enjoyed the activity': $p > .999$; 'I would like to use this device in my therapy': p incalculable as all rank sums yield zero). Furthermore, when participants received actual assistance from the device, 66% reported perceiving such assistance. Conversely, in the absence of assistance, 44% perceived assistance even after its deactivation, 45% did not perceive any assistance, and 11% remained neutral.

Conclusion: In conclusion, the preliminary findings from this study indicate a positive response to the wrist



Figure 1. Experimental setup. Participants follow a dynamic target (blue dot on the screen) with and without device support through flexion and extension of the wrist (green dot on the screen)

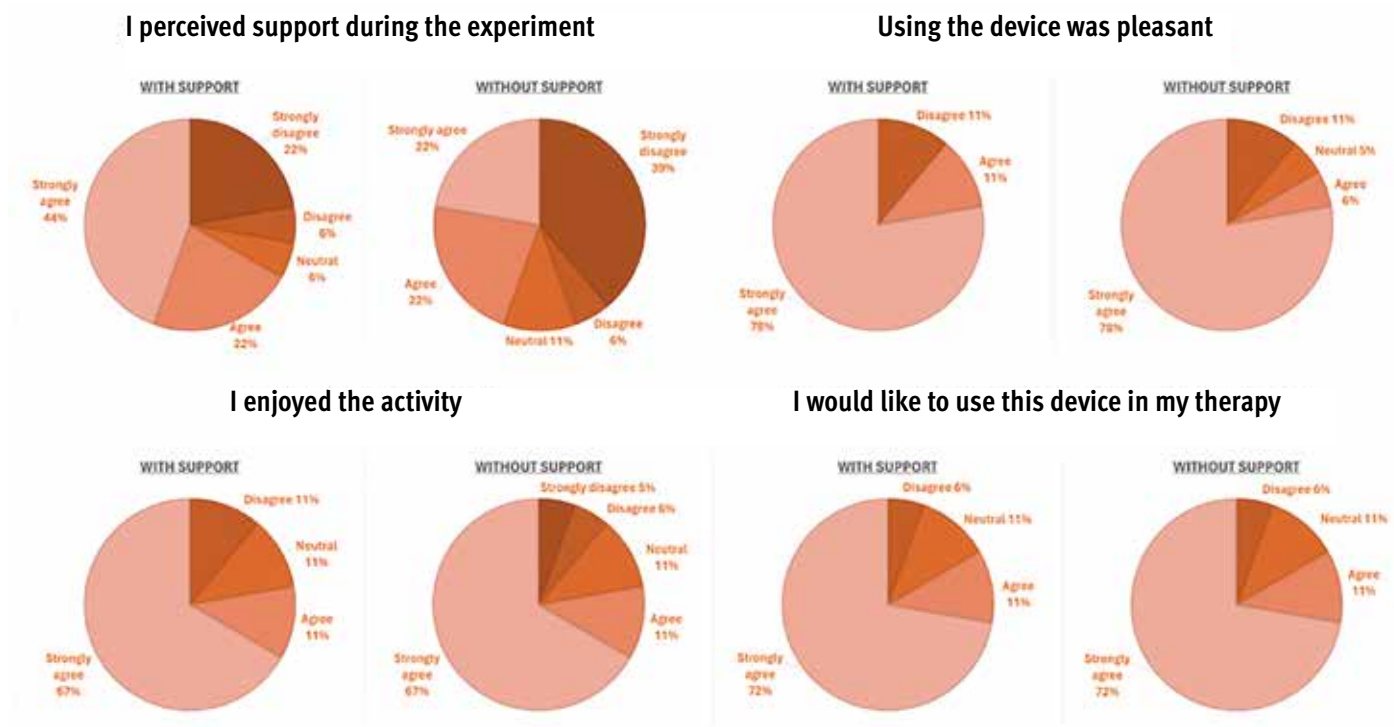


Figure 2. Questionnaire outcomes comparing responses with and without device assistance

motion exercise regardless of the support setting, with participants indicating a willingness to incorporate the device into their regular therapy regimen. The absence of discernible differences in motivation levels, as measured by the device's perceived pleasantness, activity enjoyment, and integration into therapy routines, may be attributed to challenges some patients faced in distinguishing between support modalities after modal switching. However, further investigation is warranted, utilizing standardized scales to enhance comprehension within this domain and to assess motivation levels throughout robotic-assisted therapy in comparison with alternative therapy forms. Additionally, there is a need for further research to elucidate patients' perceptions of the support provided by the device to delineate disparities in motivation levels associated with different support modalities.

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Keywords: robot-assisted therapy, stroke, rehabilitation, motivation

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