

# Changes in actual arm-hand use in stroke patients during and after clinical rehabilitation

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## Introduction

After stroke the quality of performing daily activities strongly depends on the severity of arm-hand impairments. Poor arm-hand function (AHF) and poor arm-hand skill performance (AHSP) are negatively associated with participation and health-related quality of life. A study by Franck et al [2] showed that a majority of stroke patients across the whole arm-hand impairment severity spectrum, who were admitted to a specific rehabilitation program, called 'Concise Arm-hand Rehabilitation Approach in Stroke' (acronym: CARAS) [1] (Figure 1), significantly improved on AHF, arm-hand capacity and self-perceived AHSP [2]. However, the assumption that improved AHF and AHSP will lead to an increase in actual arm-hand use, and thereby will guarantee positive changes in daily life task performance of persons in the post-stroke phase, remains unclear.

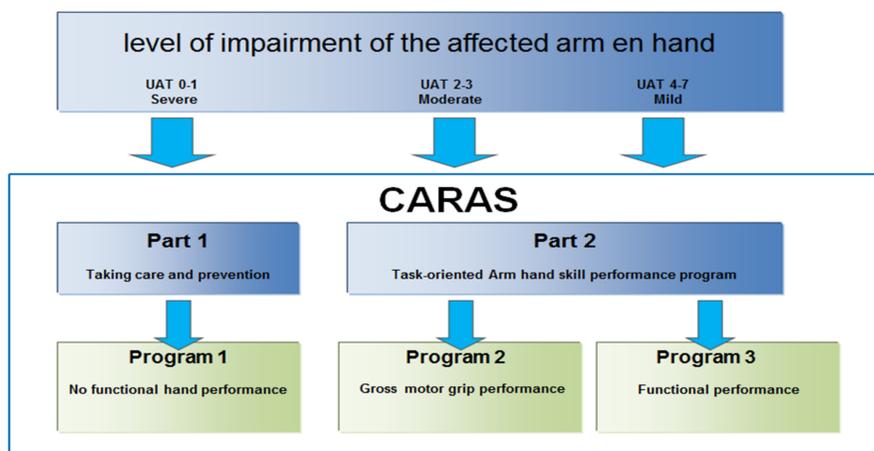


Figure 1. Schematic representation of CARAS and its constituting programs. UAT = Utrechtse Arm-hand Test.

## General research questions

1. To what extent does actual arm-hand use in stroke patients change during and after their rehabilitation involving a well-defined arm-hand rehabilitation program (CARAS)?
2. To what extent does the rate of improvement or deterioration (over time) of actual arm-hand use differ between three subgroups of stroke patients with either a severely, moderately or mildly affected arm-hand, during and after their rehabilitation involving a well-defined arm-hand rehabilitation program (CARAS)?

## Methods

### Study design

Single-armed prospective cohort study

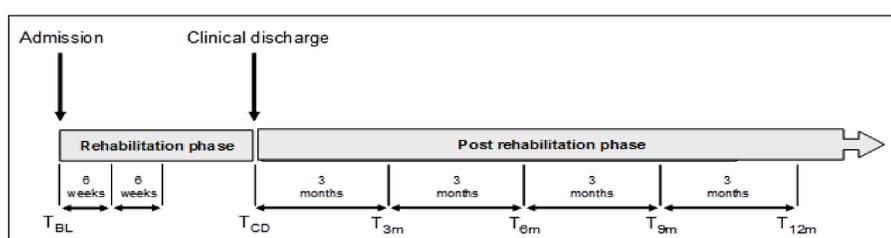


Figure 2: Overview of measurement dates.

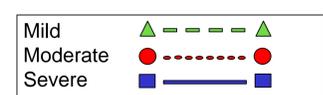
## Outcome measures and statistics

Primary outcome measure: Use of the affected arm-hand during unimanual and bimanual daily skills/tasks, gauged using accelerometry. This involved measuring: 1) *Intensity* and *Duration* of arm-hand use; 2) the *Ratio between the activity of the affected vs non-affected arm-hand* during waking hours (=uptime) during three consecutive days. Measurement dates: at admission ( $T_{BL}$ ), clinical discharge ( $T_{CD}$ ), and 3,6,9,12 months post-discharge ( $T_{3m}$ ,  $T_{6m}$ ,  $T_{9m}$ ,  $T_{12m}$ ). Statistics included 2-way repeated measures ANOVAs (factors: GROUP and TIME).

## Results

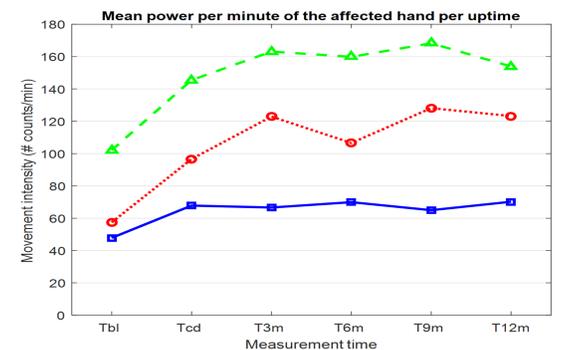
76 patients (M/F:63/23; mean age:57.6yr (+/-10.6); post-stroke time:29.8 days (+/-20.1) participated.

Factor: GROUP (=AHF status)



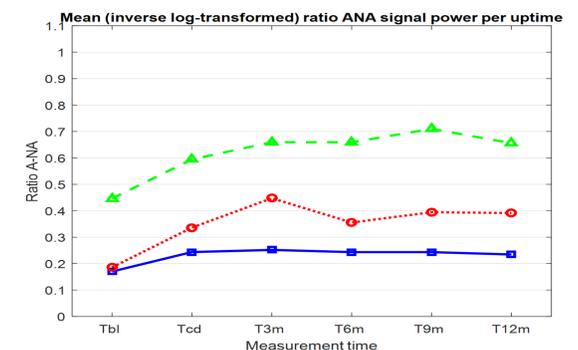
Intensity of use (affected hand)

TIME: Main effect ( $p < .000$ )  
 $T_{BL}$ - $T_{CD}$  ( $p < .000$ )  
 $T_{CD}$ - $T_{12m}$  ( $p < .014$ )  
 GROUP: Main effect ( $p < .000$ )  
 $T_{BL}$ - $T_{CD}$  ( $p < .000$ )  
 $T_{CD}$ - $T_{12m}$  ( $p < .000$ )  
 TIME x GROUP: main effect ( $p < .002$ )



Ratio between intensity affected/non-affected(ANA)hand

TIME: Main effect ( $p < .000$ )  
 $T_{BL}$ - $T_{CD}$  ( $p < .000$ )  
 $T_{CD}$ - $T_{12m}$  ( $p < .196$ )  
 GROUP: Main effect ( $p < .000$ )  
 $T_{BL}$ - $T_{CD}$  ( $p < .000$ )  
 $T_{CD}$ - $T_{12m}$  ( $p < .000$ )  
 TIME x GROUP: Main effect ( $p < .060$ )

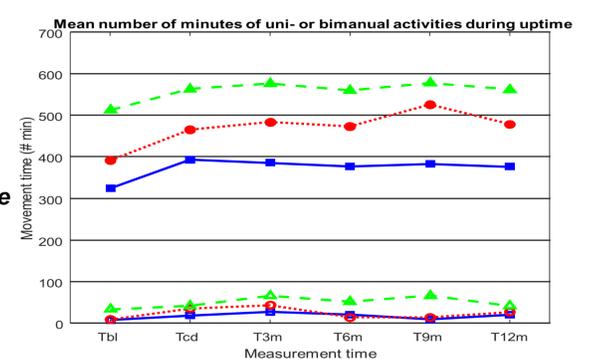


Duration of bimanual arm-hand use

TIME: Main effect ( $p < .000$ )  
 GROUP: Main effect ( $p < .000$ )  
 TIME x GROUP: Main effect ( $p < .862$ )

Duration of unimanual use of the affected hand

TIME: Main effect ( $p < .000$ )  
 GROUP: Main effect ( $p < .019$ )  
 TIME x GROUP: Main effect ( $p < .209$ )



## Conclusion

Stroke survivors with a moderately or mildly affected arm-hand showed significant improvements in actual arm-hand use during the initial rehabilitation phase. *Intensity of use* and *Duration of use* significantly improved in both unimanual and bimanual tasks/skills. These improvements were maintained until at least 1 year post-discharge.

## References

- [1] Franck J, Halfens J, Smeets R, Seelen H. OJOT 2015;3(4), Art. 10
- [2] Franck J, Smeets R, Seelen H. Plos One 2017; 12 (6)



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