VIRTUAL REALITY FOR UPPER LIMB REHABILITATION AFTER STROKE

Rationale – Patient and Therapist Experiences - Evidence

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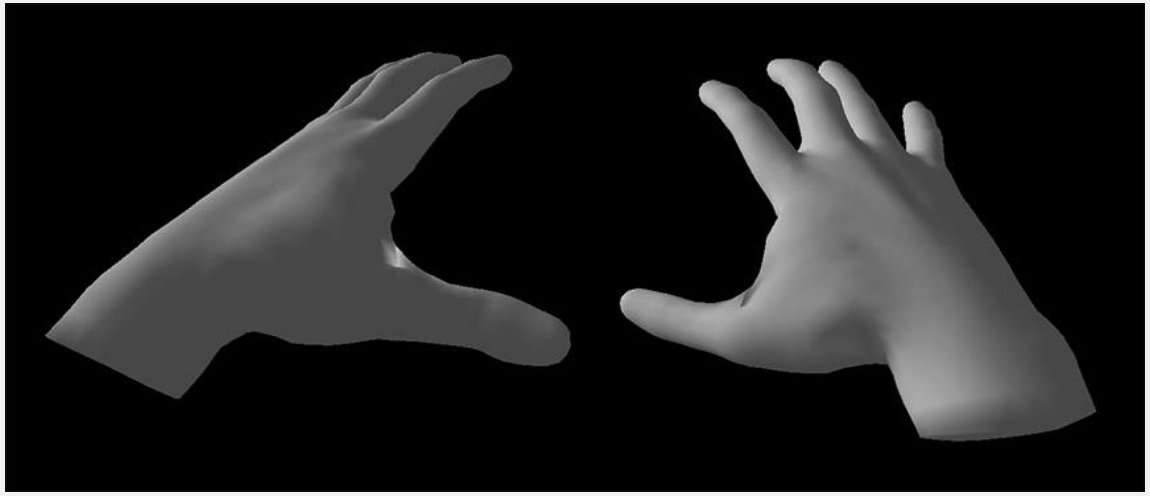


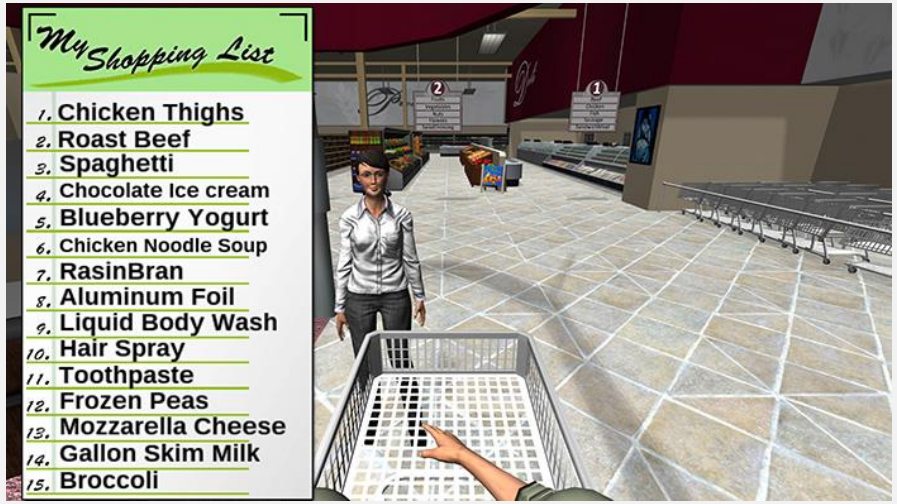
What is Virtual Reality (VR)?

"Virtual reality typically refers to the use of interactive simulations created with computer hardware and software to present users with opportunities to engage in environments that appear to be and feel similar to real world objects and events" Weiss et al. 2004

Jintronix

Neuro@home

Saebo-VR- Activities of daily living



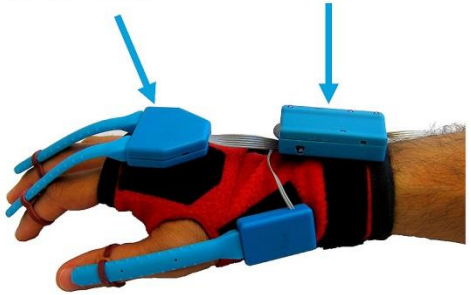
YouGrabber® Overview

YouRehab

1. Infra-red tracking camera
2. Adjustable data gloves
3. High-performance PC
4. Full HD graphics, 94 cm (37”)

Finger bending
Vibration feedback

Full 3D
movement



Rapid-fit, patient-optimized gloves (patent pending)


85
66


95
43

Why apply VR in upper limb rehabilitation?

- **Playful character**
- **Repetitions**
- **Salience**
- **Motivation**
- Multimodal stimulation and feedback
- Quantification of progress or decline
- Partially independent training

Intensity and repetitions – How much is enough?

- There is strong evidence for PT interventions favoring intensive high repetitive task-oriented and task-specific training. Effects are mostly restricted to the actually trained functions and activities. (Verbeek et al. 2014)

- More is better, generally speaking….(Lohse et al. 2014)

- Increasing the amount of usual rehabilitation improves activity after stroke (240%) (Schneider et al. 2016)

- Evidence from animal research suggests 300 – 800 repetitions a day to induce plastic changes (Nudo et al 1996, 2001)

What is intensive training?

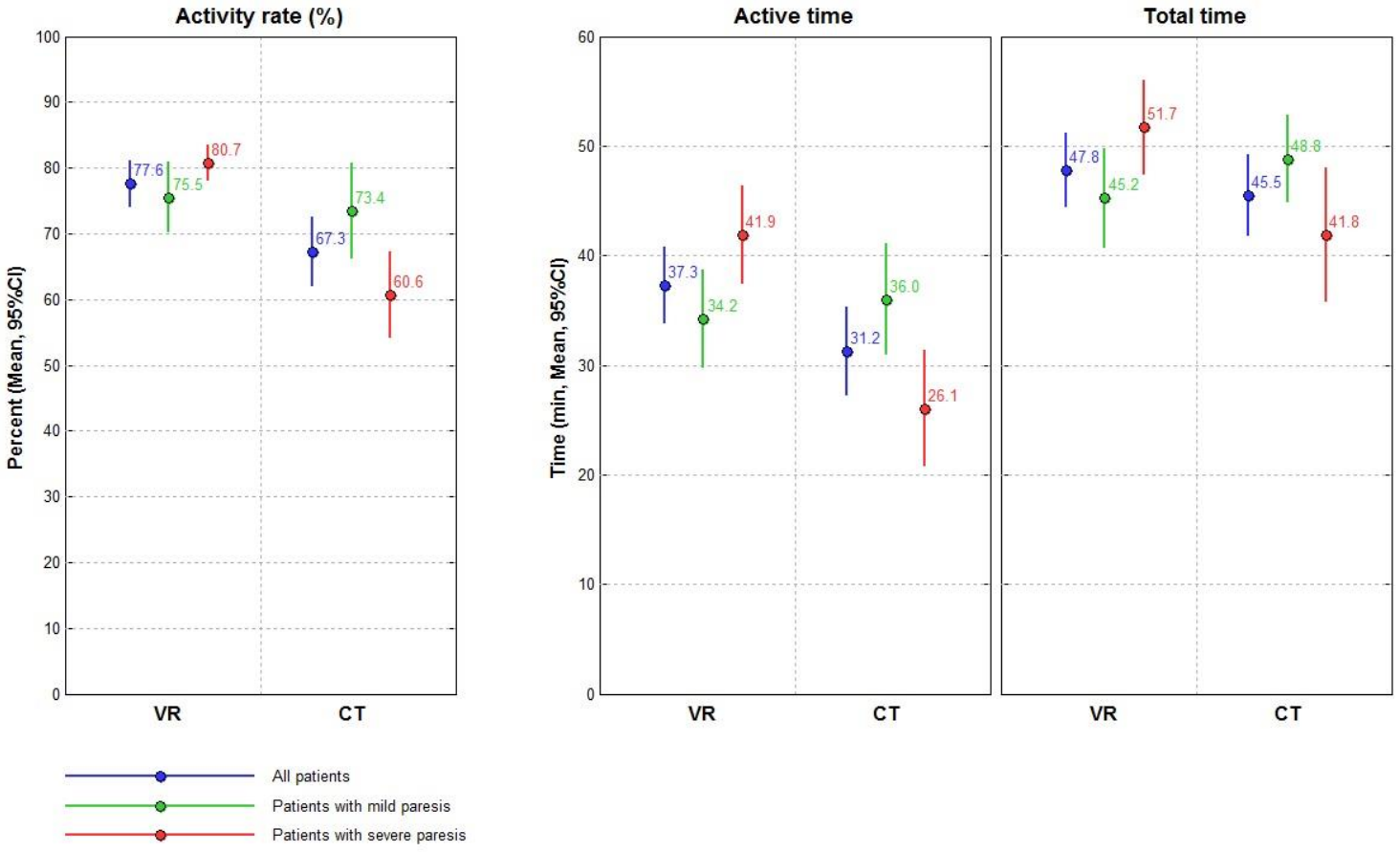
- Total amount of training
- Total amount of active time
- Number of repetitions
- Active time per time unit

Is upper limb Virtual Reality training more intensive than conventional training for patients in the subacute phase after stroke?

An analysis of 50 video recordings

Brunner I, Skouen J, Hofstad H, Assmus J, Pallesen H, Becker F, Verheyden G.

Results


Activity rate (%)
Percent (Mean, 95%CI)
100
90
80
70
60
50
40
30
20
10
0
77.6
75.5
80.7
67.3
73.4
60.6
VR
CT
Active time
Time (min, Mean, 95%CI)
60
50
40
30
20
10
0
37.3
34.2
41.9
31.2
36.0
26.1
VR
CT
Total time
47.8
45.2
51.7
45.5
48.8
41.8
VR
CT
All patients
Patients with mild paresis
Patients with severe paresis


75.1

Is VR training for upper limb motivating?

Patients' and Health Professionals' Experiences of Using Virtual Reality Technology for Upper Limb Training after Stroke: A Qualitative Substudy

Pallesen H, Andersen BM, Hansen GM, Lundquist CB, and Brunner I

- Focus group interviews with patients and therapists
- Questionnaires for patients and therapists in the VR group

Conclusion:

Basically, yes

However, some frustration about technical issues

Some quotes

- Patients

- I played against myself and enjoyed that, like, to improve myself.

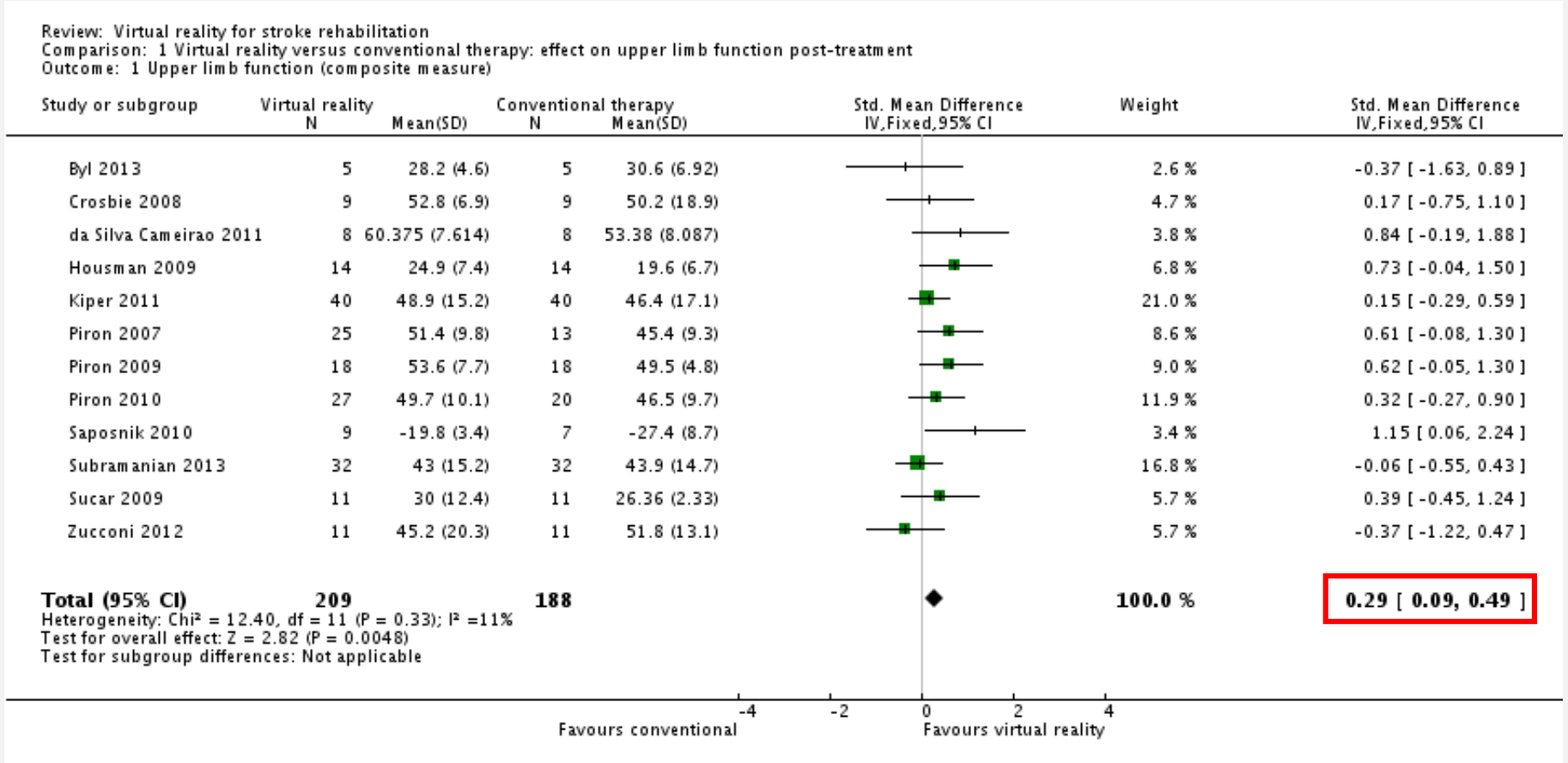
- Then, suddenly, the eggs appeared, and they gave points……Well, I was high for the rest of the day.

- *Therapists*

- *There were also several (patients) who said that they didn't notice that they had done so many repetitions, because they were engrossed in looking at the screen and playing the game*
- *The patients have that feeling that they themselves are making a difference in their training.*

EVIDENCE

Virtual reality for stroke rehabilitation Laver et al. 2015



Cochrane Database of Systematic Reviews
12 FEB 2015 DOI: 10.1002/14651858.CD008349.pub3
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008349.pub3/full#CD008349-fig-00101

Recent evidence

- Saposnik et al. 2016 – **EVREST trial**

Commercial gaming device «Wii» (n=141)

In patients who had a stroke within the 3 months before enrolment and had mild-to-moderate upper extremity motor impairment, **non-immersive virtual reality as an add-on therapy to conventional rehabilitation was not superior to a recreational activity intervention** in improving motor function

Virtual Reality

- Laver et al. 2017 **Virtual reality for stroke rehabilitation (Cochrane)**

We found evidence that the use of virtual reality and interactive video gaming was not more beneficial than conventional therapy approaches in improving upper limb function. Virtual reality may be beneficial in improving upper limb function and activities of daily living function when used as an adjunct to usual care (to increase overall therapy time).

VIRTUES

Virtual Reality Training for Upper Extremity after Stroke

Brunner I, Skouen JS, Hofstad H, Aßmus J, Becker F, Sanders AM, Pallesen H, Qvist Kristensen L, Michielsen M , Thijs L, Verheyden G

Single-blinded multicenter RCT

120 patients randomized to

Virtual Reality training

or

Conventional training

16-20 sessions within 4 weeks + standard rehabilitation

Primary end point:

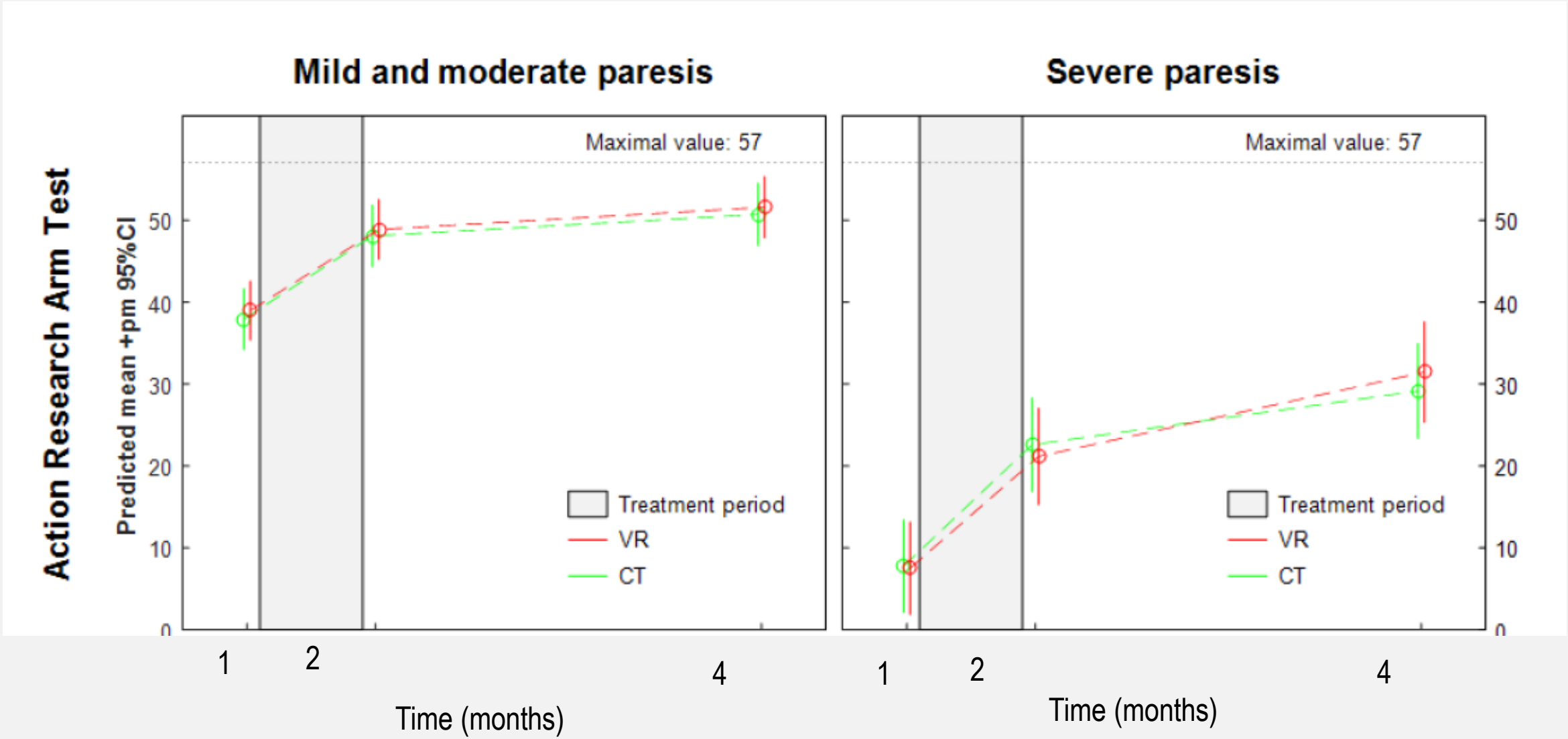
Action Research Arm Test at 3 months

Assessments at
- baseline
- post intervention
- 3 months post intervention follow up

Secondary:
Box and Blocks
FIM
ABILHAND
Questionnaires

	VR	CT	
ARAT	**Mean (SD)**	**Mean (SD)**	**p-value**
Baseline	25.8 (18.3)	24.2 (18.6)	-
Post intervention	37.7 (19.5)	36.8 (18.8)	0.705
Follow-up	43.0 (17.7)	41.5 (18.0)	0.770
BBT	**Mean (SD)**	**Mean (SD)**	**p-value**
Baseline	14.15 (14.23)	13.46 (14.85)	-
Post intervention	26.00 (18.71)	24.98 (19.12)	0.740
Follow-up	33.22 (18.74)	29.25 (18.74)	0.154
FIM	**Mean (SD)**	**Mean (SD)**	**p-value**
Baseline	94.27 (19.56)	96.29 (19.47)	-
Post intervention	107.66 (14.63)	108.69 (14.31)	0.563
Follow-up	111.24 (20.64)	112.73 (15.99)	0.570
FIM-motor	**Mean (SD)**	**Mean (SD)**	**p-value**
Baseline	65.68 (15.91)	66.89 (17.52)	-
Post intervention	78.09 (12.65)	78.96 (13.13)	0.672
Follow-up	86.90 (12.56)	85.46 (15.07)	0.269

Action Research Arm Test

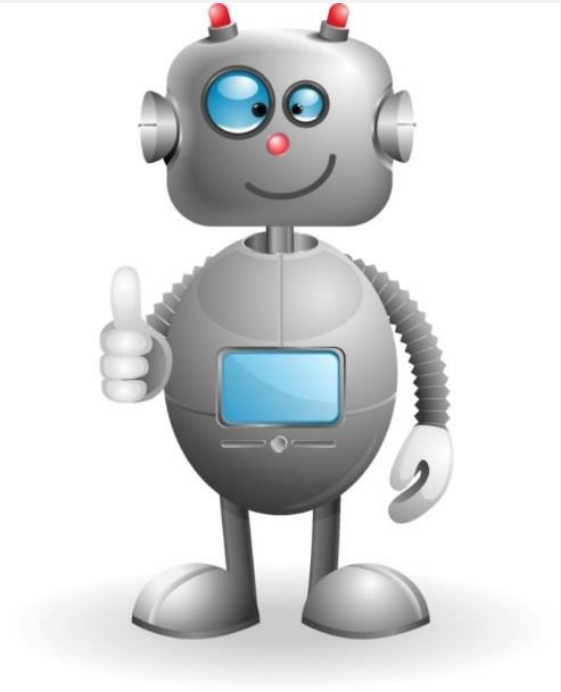


Conclusions

- VR was not superior to CT
- VR and CT were equally effective
- Increased intensity for severly impaired patients in VR didn’t result in better UL function compared to CT
- VR may constitute a motivating training alternative as a supplement to CT

To sum up

- VR provides the opportunity for many repetittions
- Is motivating
- Improves upper limb function
- Is not better than conventional training
- Can increase overall intensity of training



Thank you for your attention!

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