MODULE 3-P1: A longitudinal study on upper limb recovery of stroke survivors using novel assistive technologies

Eva Josse[1,2], Hsiao-ju Cheng[1], Monika Zbytniewska-Mégret[1,2], Christoph M. Kanzler[1,2], Christopher Kuah[1,3], Seng Kwee Wee[1,3], Phyllis Liang[4], Karen S. G. Chua[1,3,4], Nicole Wenderoth[1,5], Roger Gassert[1,2], Olivier Lambercy[1,2]

[1] Singapore-ETH Centre, Future Health Technologies Programme, CREATE Campus, Singapore; [2] Rehabilitation Engineering Laboratory, Department of Health Sciences and Technology, ETH Zurich, Switzerland; [3] Tan Tock Seng Hospital Rehabilitation Centre, Centre of Rehabilitation Excellence, Singapore; [4]Rehabilitation Research Institute of Singapore, Nanyang Technological Institute, Singapore; [5] Neural Control of Movement Laboratory, Department of Health Sciences and Technology, ETH Zurich, Switzerland

1 Post-stroke recovery: limitations

- Existing studies documenting post-stroke recovery do not fully capture the **complexity of stroke-related deficits.**
- Underlying mechanisms motivating post-stroke recovery outcomes are **not well understood.**
- Therapy programs **dependent on therapists' expertise.**
- Quantify recovery: Clinical assessments of impairments **lacking sensitivity & objectivity** [1].
- No clinical tests assessing the **quality of movement** or **somatosensory impairments**.

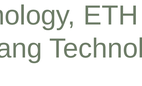
2 Goals

A longitudinal study on up to 400 stroke survivors to **monitor upper limb recovery until 3 years post-stroke.**

Aims:

A better understanding of **long-term post-stroke upper limb recovery** using a **multi-modal** dataset.

Develop **data-driven models** predicting upper limb recovery & find **early prognosis factors**



Identify **subgroups** of people with **different recovery patterns**

Impact/Outlook:

Support clinical decision making

Personalize therapy content & intensity

A control group to RehabGym interventions

3 Protocol

Timepoint		Inpatient Phase (TTSH Rehab Ward)				Outpatient Phase (Time Post-Stroke)				
		T0	T1	T2	T3	T4	T5	T6	T7	T8
		<1-2 weeks	Week 3	Week 4	Discharge	Week 12 post-stroke	6 months post-stroke	1 year post-stroke	2 years post-stroke	3 years post-stroke
Description	Evaluation Tool									
Global disability level	Modified Rankin Scale (mRS)						X	X	X	
Upper limb motor impairments	Fugl-Meyer Assessment of the Upper Extremity (FMA-UE)	X	X	X	X	X	X	X	X	X
	Shoulder abduction and finger extension (SAFE) score	X	X	X	X	X	X	X	X	X
	Grip strength	X	X	X	X	X	X	X	X	X
Upper limb activity capacity	Action Research Arm Test (ARAT)	X	X	X	X	X	X	X	X	X
Upper limb sensory impairments	Erasmus version of the Nottingham Sensory Assessment (NSA)	X	X	X	X	X	X	X	X	X
Upper limb spasticity	Modified Ashworth Scale (MAS)	X	X	X	X	X	X	X	X	X
Upper limb pain	Visual analogue scale (VAS)	X	X	X	X	X	X	X	X	X
Confidence in upper limb use	Upper Limb Self-Efficacy Test (UPSET)	X			X	X	X	X	X	X
Neglect	Bells Test	X			X	X	X	X	X	X
Trunk impairment	Trunk Impairment Scale (TIS)	X			X	X	X	X	X	X
Functional Independence	Functional Independence Measure (FIM)	X			X			X		
Cognitive impairments	Montreal Cognitive Assessment (MOCA)					X	X	X	X	X
Quality of life	EQ-5D					X	X	X	X	X
	Stroke Specific Qualify of Life (SSQOL)					X	X	X	X	X
Neurophysiology	Motor evoked potentials (MEPs)	X								
Technology-aided assessments	Virtual Peg Insertion Test (VPIT)	X			X	X	X	X	X	X
	ETH MIKE	X			X	X	X	X	X	X
	Wearable sensors	X			X	X	X	X	X	X
Semi-structured interviews							X	X	X	

Table 1. Overview of the assessments and the assessment time-points.

Technology-aided assessments: Key points

Wearable sensors: To quantify upper limb usage **in daily life.**

VPIT: Assess **quality of movement** (critical to identify restitution from compensation [2]).

ETH MIKE: Assess **proprioception** impairments (somatosensory biomarkers are missing in clinical assessments).

4 Immediate next steps

- **Dry runs** (until now, only done on able-bodied subjects).
- Solidifying the **data analysis pipeline**.
- Finalisation of the **database software platform**.

References:

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(SEC) SINGAPORE-ETH CENTRE CREATE ETH zürich RELAB Neural Control of Movement Tan Tock Seng Hospital National Healthcare Group NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE National Healthcare Group