

An Individualized Approach for Upper Extremity Training Post-Stroke Based on Neurophysiological Markers: Procedures & Preliminary Observations

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Background

- Training of the affected limb (UL) after a stroke is part of the Canadian Stroke Best Practice guidelines to boost recovery [1].
- Training interventions often produce variable outcomes [2-3] because they are mainly designed based on a clinical score that often do not reflect the recovery potential of survivors [4].
- The integrity of the corticospinal tract, as reflected in the amplitude of motor evoked potentials (MEPs) elicited by transcranial magnetic stimulation (TMS), could help better predict an individual potential for recovery [4].

Objective

- Determine if an individualized strengthening program, based on each subject MEP amplitude, could lead to more optimal UL function in chronic stroke patients.

Methods

- In this stratified randomized trial, a clinical (Fugl-Meyer Assessment /FMA) and a neurophysiological (MEPs (μ V)) evaluations of the affected UL were performed.
- Based on their MEPs amplitude at the affected First Dorsal Interosseous, participants were assigned into one of three groups of training intensity levels:
 - 1) low intensity (LI): MEPs $<25\mu$ V
 - 2) moderate intensity (MI): MEP between 50-120 μ V
 - 3) high intensity (HI): MEP $>120\mu$ V
- Training intensity was based on the one-repetition maximum (1RM). Low, moderate and high intensity groups trained at 35-50%, 50-65% and 70-80% 1RM, respectively.
- Training protocol consisted of:
 - 60 minutes/session, 3 sessions/week for 4 weeks
 - Shoulder & elbow flexors, wrist extensors & grip muscles



- Post-training, subjects rated their UL's perceived change on a Likert scale ranging from 1 to 7 (1 = very much improved; 7 = very much worse).

Results

- Preliminary observations from three participants (1 subject per training group) who completed the training are presented.

1) Change in strength (in pounds) following the training program

	Shoulder		Elbow		Wrist		Grip	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
S1 (LI)	13	21	19	34	0.7	4	6	9
S2 (MI)	40	45	43	43	15	19	45	46
S3 (HI)	12	30	31	35	12	17	42	43

- On average, subjects gained 5 \pm 4 pounds at the UL.

2) Change in FMA score (/66) following the training program

	Pre	Post
S1 (LI)	21	31
S2 (MI)	65	66
S3 (HI)	63	66

- On average, subjects gained 5 \pm 5 points at the FMA.

3) Subjects' perceived change in UL following the training program

S1 (LI)	Very much improved (score = 1)
S2 (MI)	Much improved (score = 2)
S3 (HI)	Very much improved (score = 1)

- All subjects reported subjective improvement in UE function.

Conclusion

- Although still preliminary, these results suggest that adjusting intensity of training based on neurophysiological markers of corticospinal tract integrity rather than on a clinical score could lead to more optimal outcomes in terms of gains in strength and arm function post-stroke.
- A total of 80 subjects is expected to be recruited for this project.

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References:

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