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MOTOR LEARNING IN ACUTE STROKE

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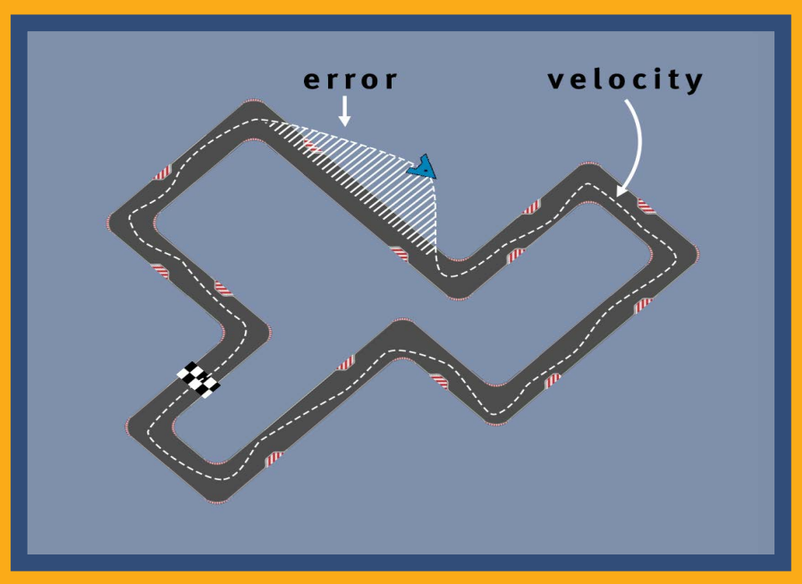
Background

The acute phase (post-stroke days 1-7 days) is characterized by an enhancement of neural plasticity which supports rapid motor recovery. However, it is currently unknown whether (sub) acute stroke patients can acquire new motor skills with their paretic upper limb (UL). This issue is critical because motor skill learning (MSkL) is a key component for post-stroke neurorehabilitation. The first aim of this study is to explore whether acute stroke patients can learn and retain a new motor skill with the paretic UL on a neurorehabilitation robot (REAplan®, AXINESIS, Belgium), compared to healthy individuals (HI). The second aim is to determine the influence of acute motor function on MSkL. The third aim is to explore the impact of the lesion characteristics (size and localization) on MSkL in acute stroke patients through Voxel-based Lesion Symptom Mapping (VLSM).

Methods

20 acute stroke patients and 34 HI were included. The patients (64.42years ± 14.4; mean±SD) were included during the acute phase of stroke (57h +/- 24 post-stroke). All the HI were older than 50 years old (59,31 ans ± 9.3). Over the three sessions (Day1-3), the participants trained on the REAplan® with the paretic UL (stroke patients) or with the non-dominant UL (HI) on a MSkL task involving a speed/accuracy trade-off (SAT), the CIRCUIT task. Generalization was evaluated by a NewCircuit.



Participants were instructed to navigate inside the Circuit with the cursor as fast and accurately (i.e. keeping the cursor within the track) as possible during 1 minute

Outcomes

SAT = Subject's speed/ Subject's error

LI = LI = (SAT(n) – SAT(b)) * 100 / SAT(b)
SAT(n)= SAT of each block
SAT(b)= SAT of first block

Composite Score = 1st dimension of PCA
(Fugl-Meyer Assesment,
Box and Block and Grip Force)

Results

Fig1 : Evolution of the SAT(a.u.: arbitrary unit) during all the training block and the newcircuit.

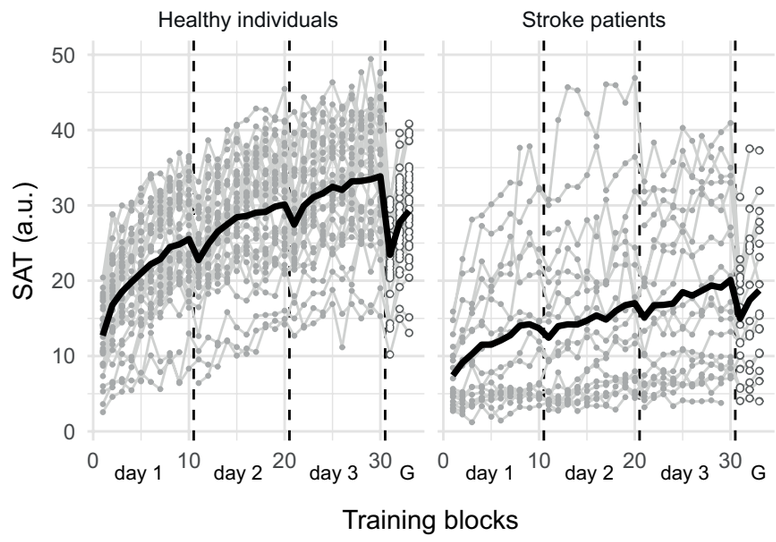
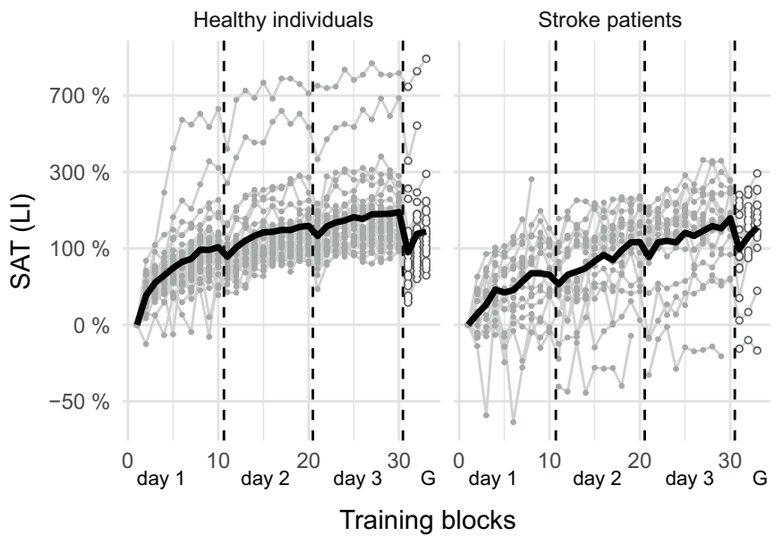


Fig2 : Improvement of the Learning index (LI) expressed as a % of the first block of Day 1.



Thick black line : group mean, grey line = individual participants, G = NewCircuit

Fig 3: Evolution of the SAT (a.u.). Red line: patients with Composite score ≤ 0.23 ; Blue line: patients with Composite score › 0.23

Fig 4. Correlation between the SAT (a.u.) and the Composite Score (R= .75)

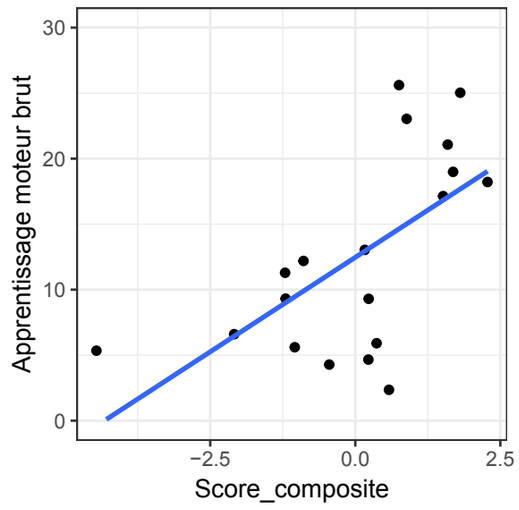
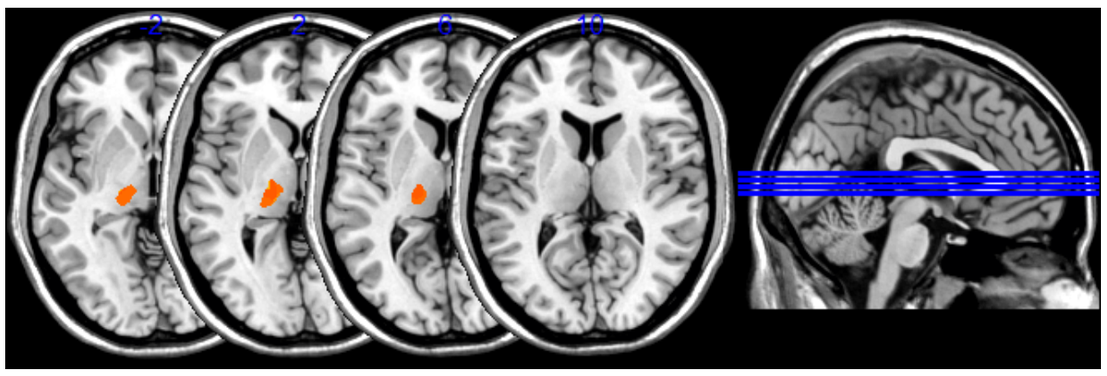


Fig 5: VLSM results (Bonferonni Test with Voxels damages in at least 10% of patients, 8 flipped). The results are projected on the MNI-chi² volume.



Conclusion

Most of the acute stroke patients were able to improve and retain from day to day a new motor skill with their paretic UL in a way similar to HI. Residual motor function (composite score) correlated with the overall amount of MSkL (SAT). VLSM suggested that (sub)acute stroke involving the thalamus deteriorated MSkL.

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