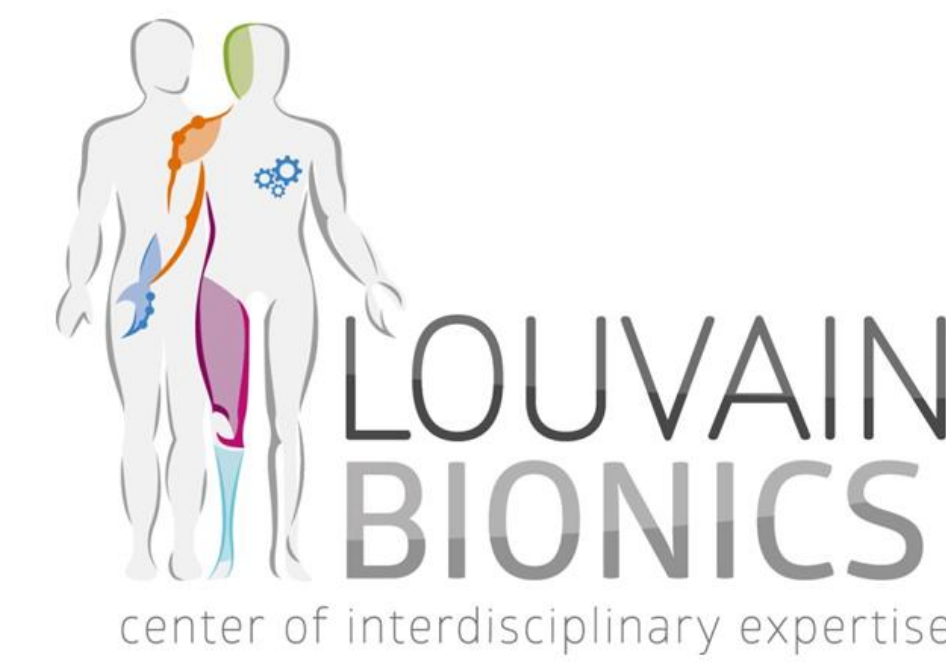


Pilot study: rhythmic upper-limb therapy improves both rhythmic and discrete movement features after stroke



Patricia Leconte & Renaud Ronsse
Center for Research in Energy and Mechatronics;
Institute of Mechanics, Materials, and Civil Engineering;
Louvain Bionics; Université catholique de Louvain; Belgium

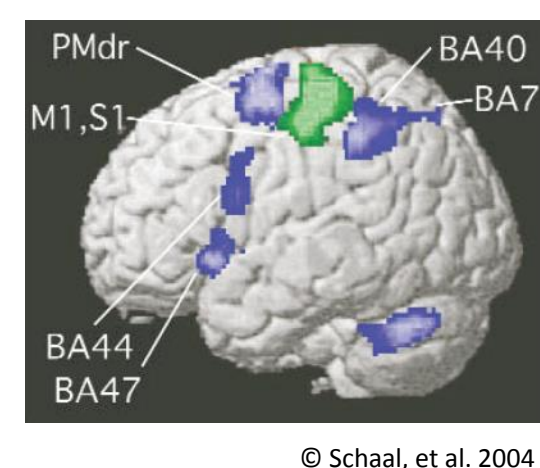


1. Context

Discrete movements



Rhythmic movements



In healthy subjects

- Rhythmic and discrete movements recruit, at least partially, distinct neural circuitries
- No or little learning transfer occurs from rhythmic to discrete movements and vice versa

In stroke patients

- Rhythmic movements are less affected than discrete ones (Leconte et al., submitted)
- Rhythmic movements are performed kinematically more like healthy discrete movements

Research question

Does a pure rhythmic arm movement training after stroke improve only rhythmic movement features, or also discrete ones?

Take-home message

Rhythmic upper-limb training in stroke survivors might improve the global arm motricity, therefore showing a possible transfer to discrete movements. This contrasts with reported results in healthy subjects.

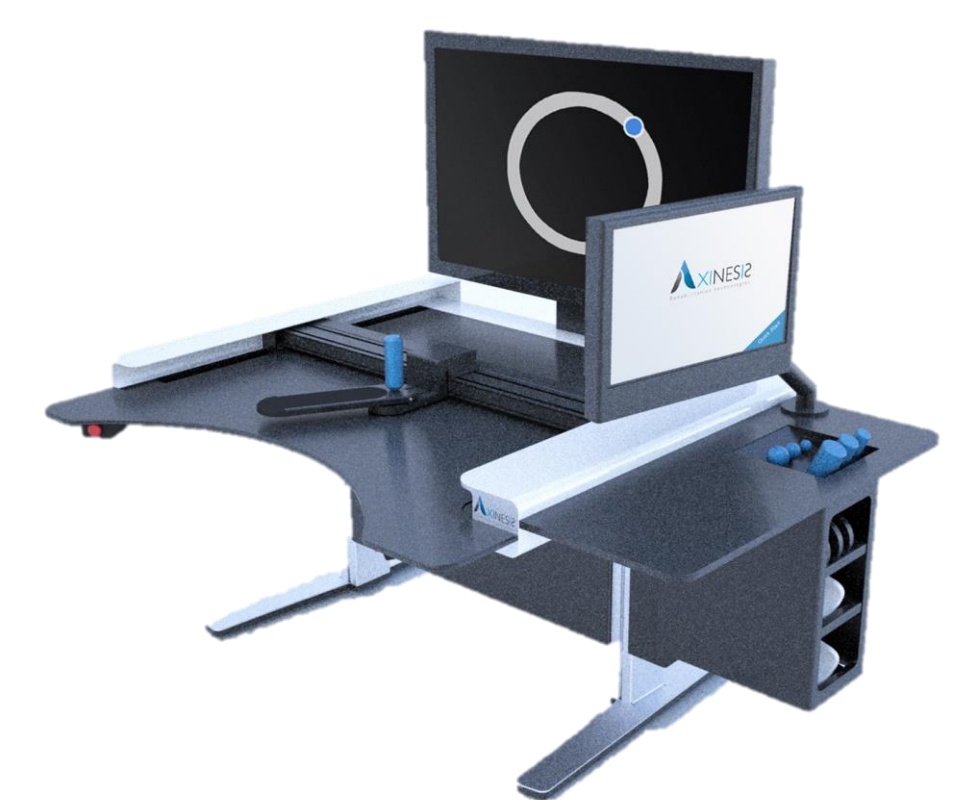
After 12 sessions of active rhythmic movement training, our 6 patients improved not only their abilities in rhythmic movements but also in untrained discrete movements and in clinical tests (FMA, Box and block, and Ashworth). Rhythmic movements likely recruit a more extended neural network after a stroke, which might explain the possible learning transfer from rhythmic to discrete movements.

2. Patients and material

Patients: 6 chronic non-cerebellar stroke patients

Age	57+/-6 years
Fugl-Meyer	32 +/- 17
Paretic side	3 left, 3 right
Time post-stroke	23+/-15 months

Material: Planar end-effector rehabilitation robot REAplan



REAplan V3 : UCL - CEREM

3. Protocol

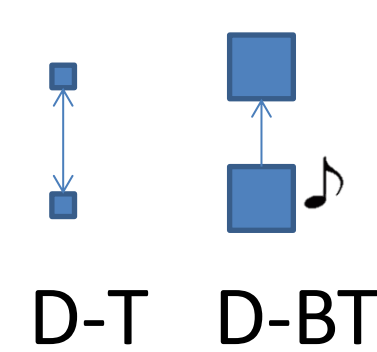
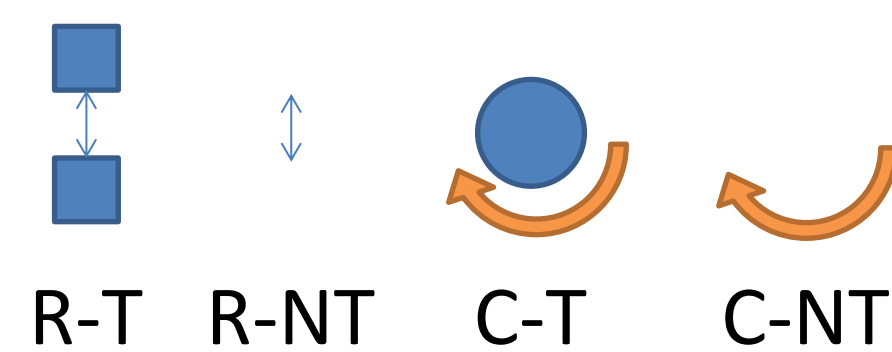


Assessments : at T1 – T2 – T3 – T4

Rhythmic movements

Discrete movements

Robot-assisted



Clinical scales

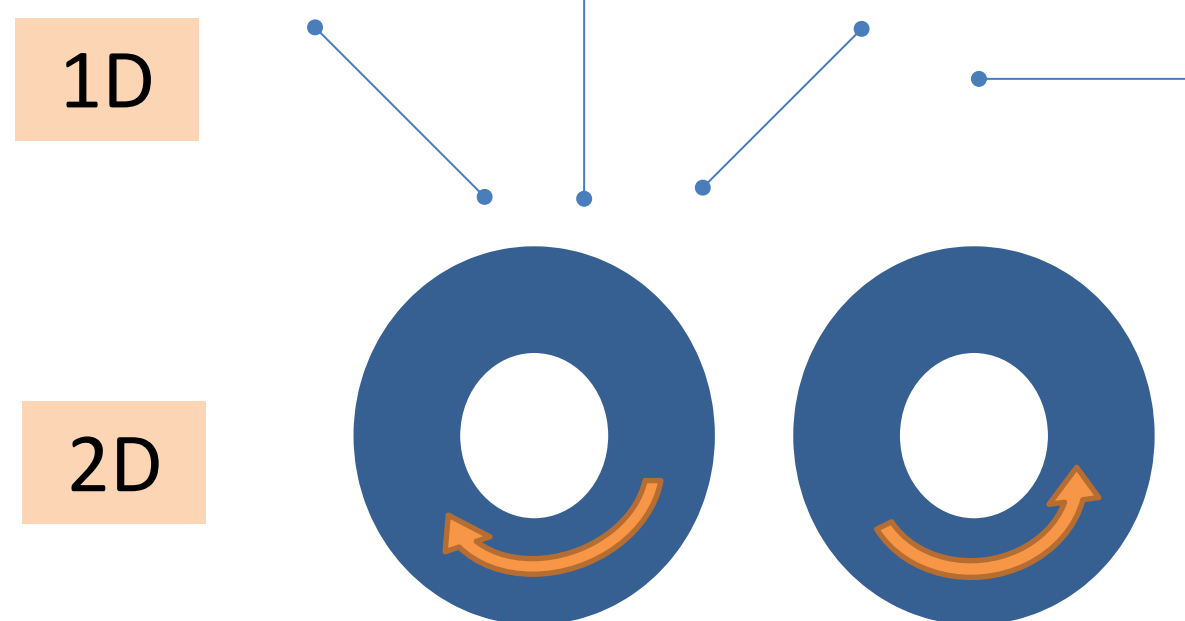
- Fugl-Meyer
- Box and block test
- Ashworth

upper-limb motricity
global dexterity
spasticity



Therapy: 12 sessions during one month

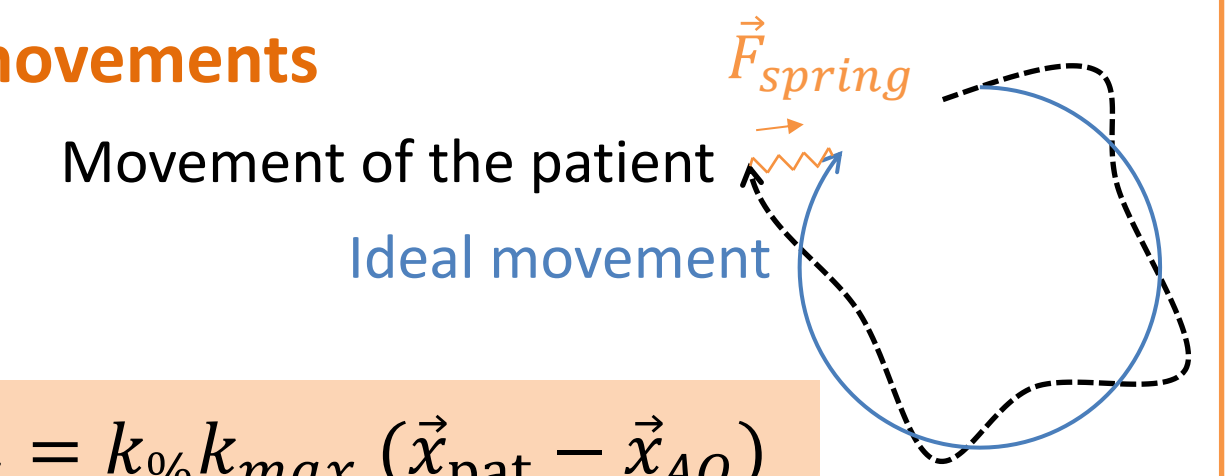
Movements: 3 x 1min per exercise (18min)



The desired frequency, amplitude and offset were determined before starting the exercises based on the patient's actual performances

Assistance-as-needed

1. Jerky movements

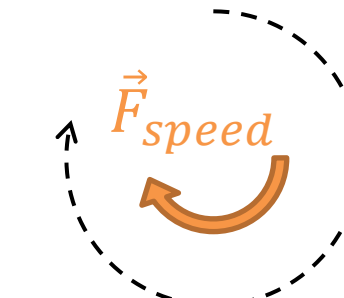


$$\vec{F}_{fluidity} = k_{\%} k_{max} (\vec{x}_{pat} - \vec{x}_{AO})$$

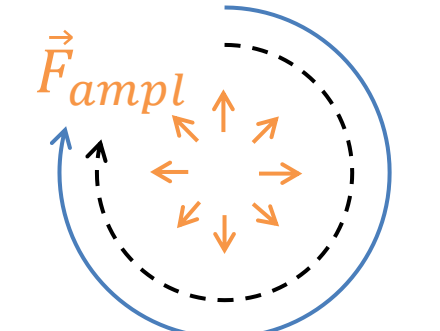
Few saccades
A lot of saccades

$$k_{\%} = 0$$
$$k_{\%} = k_{max}$$

2. Slow movements



3. Small movements



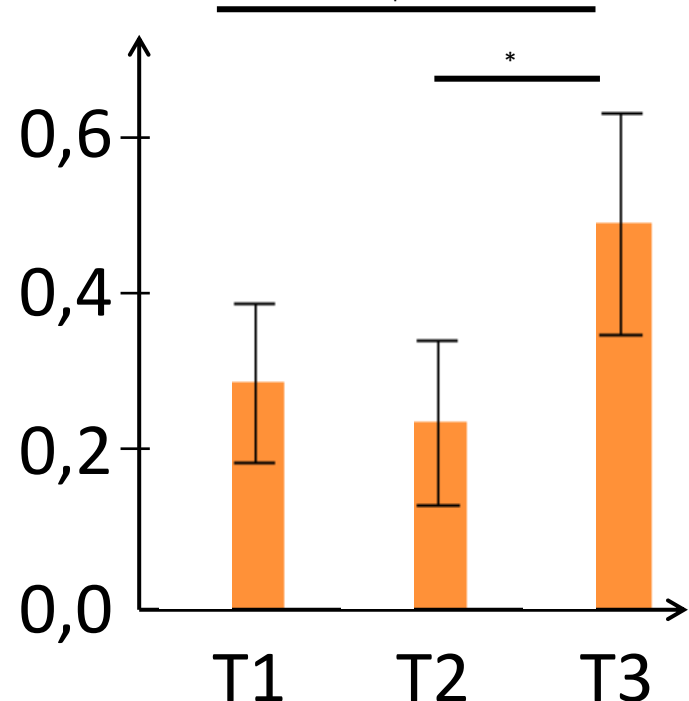
4. Results

Rhythmic movements

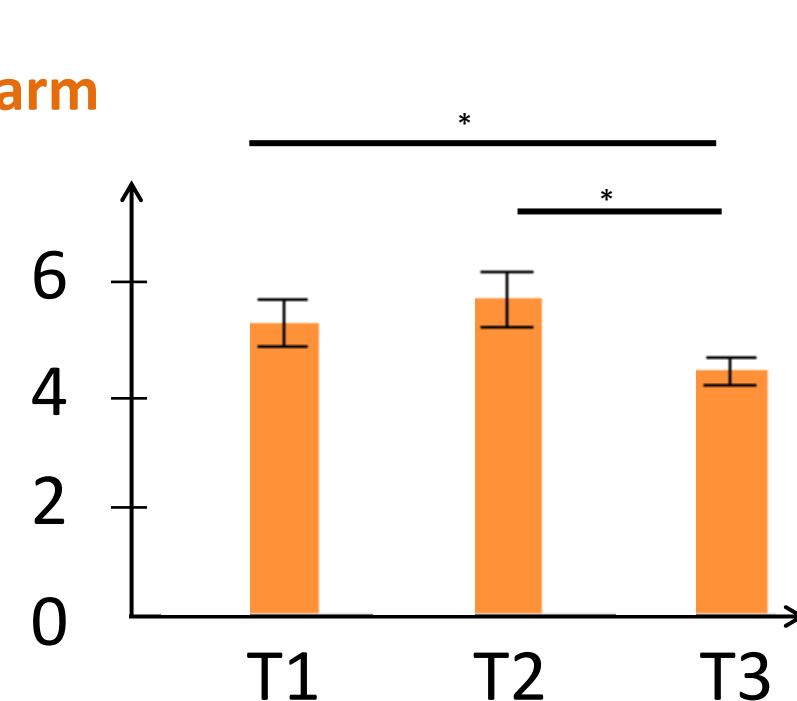
Improvement of the harmonicity and fluidity

R-NT

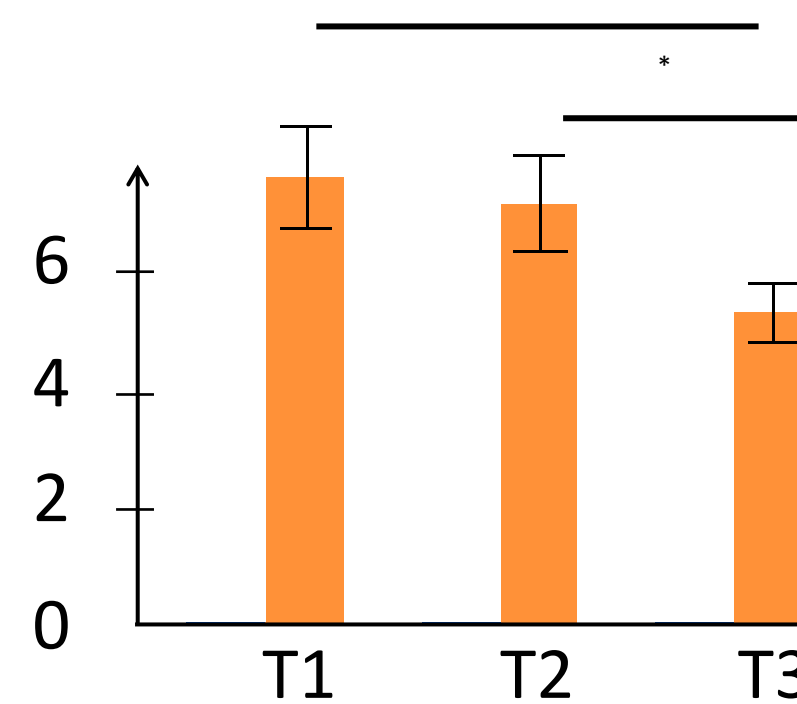
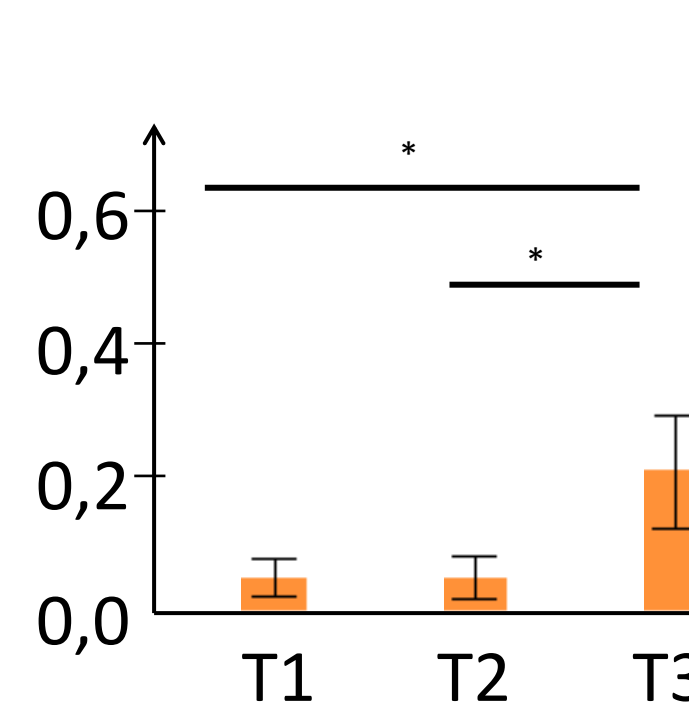
Harmonicity (H)



Fluidity (LDJ)



C-T

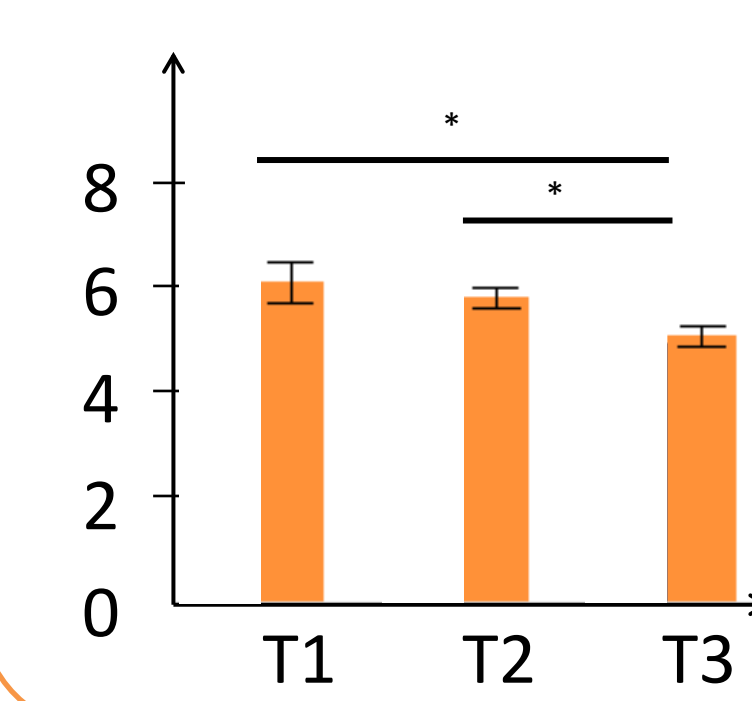


Discrete movements

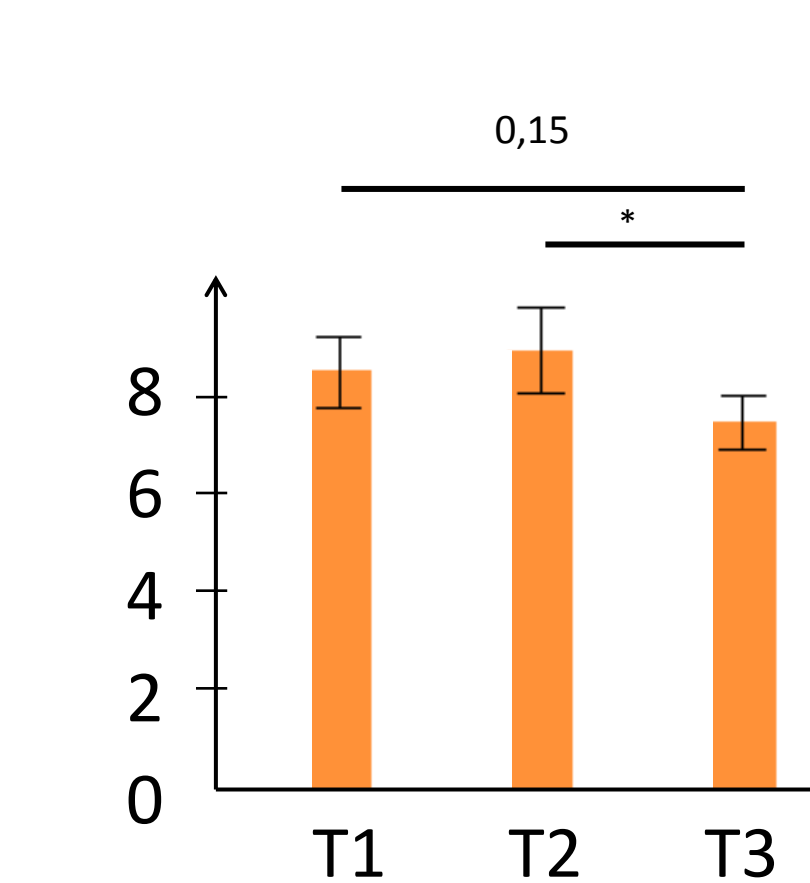
Improvement of the fluidity

D-BT

Fluidity (LDJ)



D-T

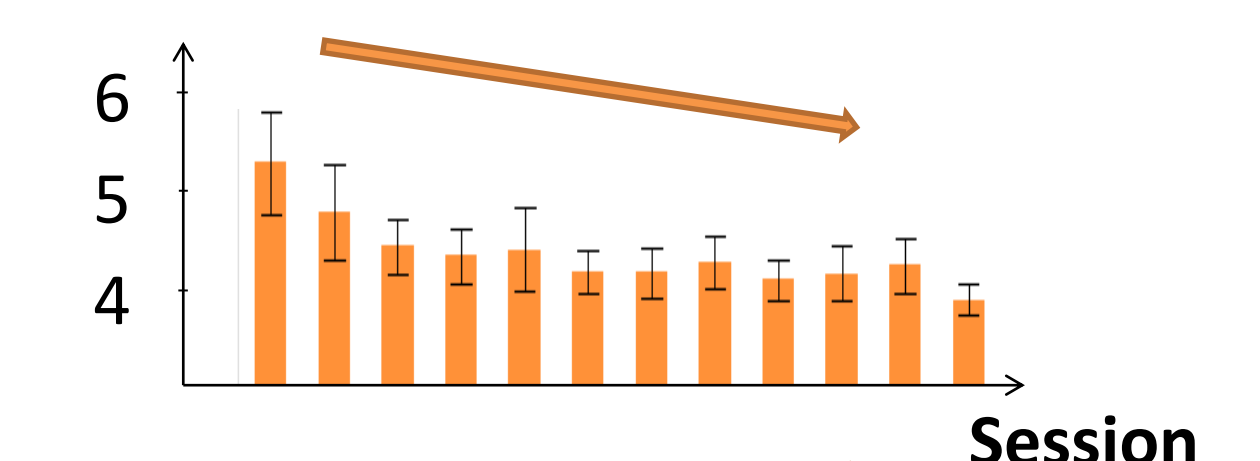


During the therapy

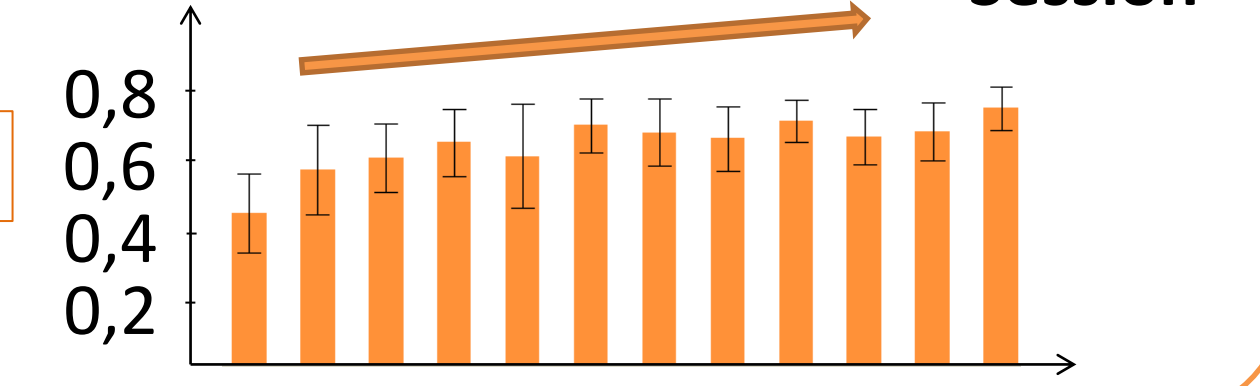
Improvement of the fluidity and harmonicity in all tasks

Intern diagonal

Fluidity (LDJ)



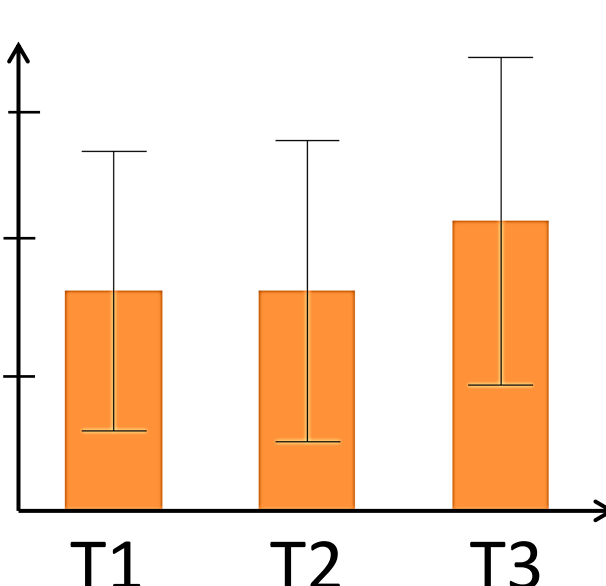
Harmonicity (H)



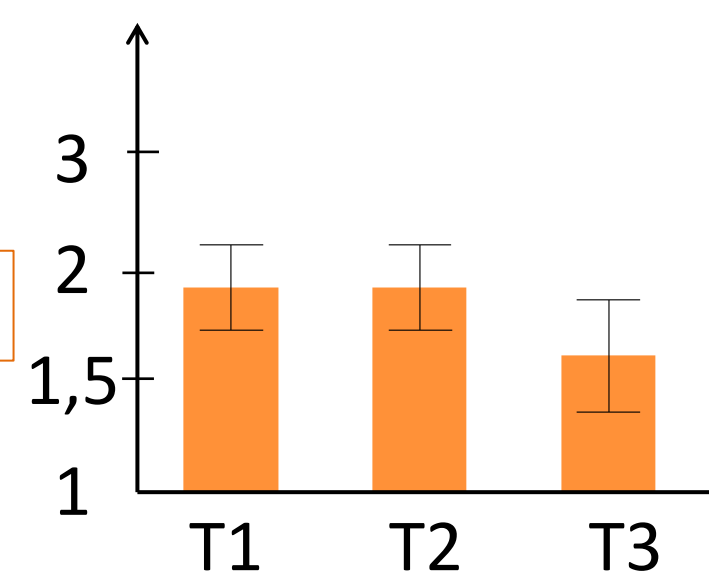
Clinical tests

Trend towards an improvement of the global motricity - we need more patients to reach the statistical threshold.

Box and Block



Ashworth



Fugl-meyer

