recoverîX

Brain-Computer Interface Neurorehabilitation

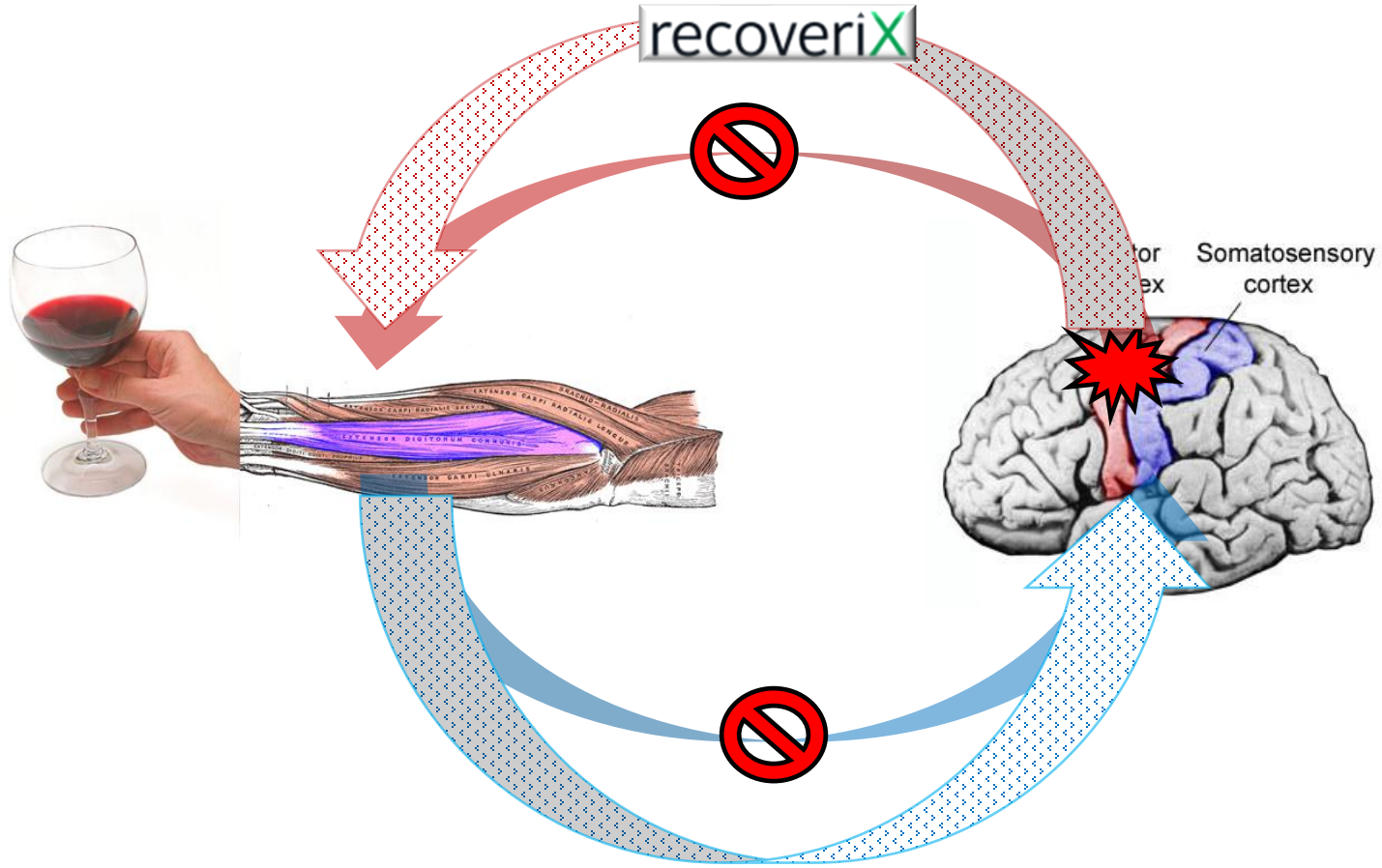
for Stroke and Patients with Multiple Sclerosis

recoverîX

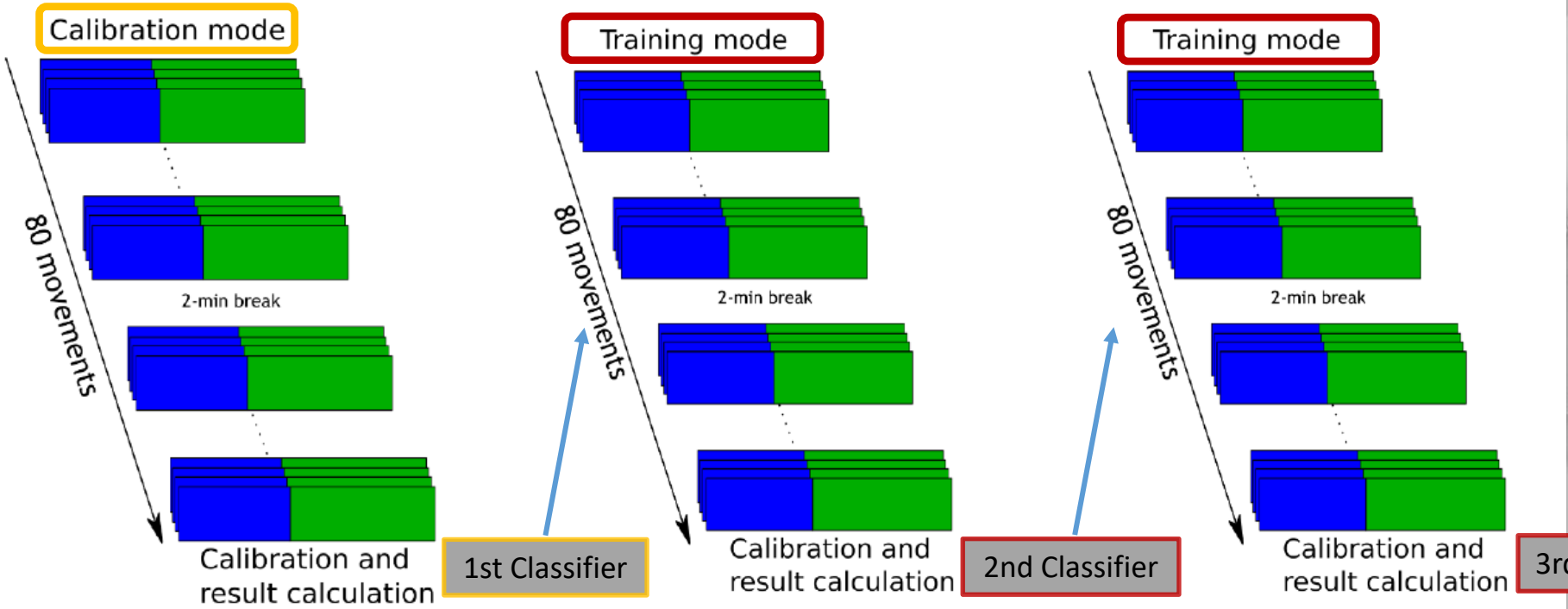
recoveriX Explained

recoveriX

Sensorimotor Feedback Loop



Exercises in Session



One Exercise (80 movements)

One Exercise (80 movements)

One Exercise (80 movements)

One Session

(3 Exercises = 3 x 80 movments = 240 movements = 120 Left movements + 120 Right movements)

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Results of Upper Extremity

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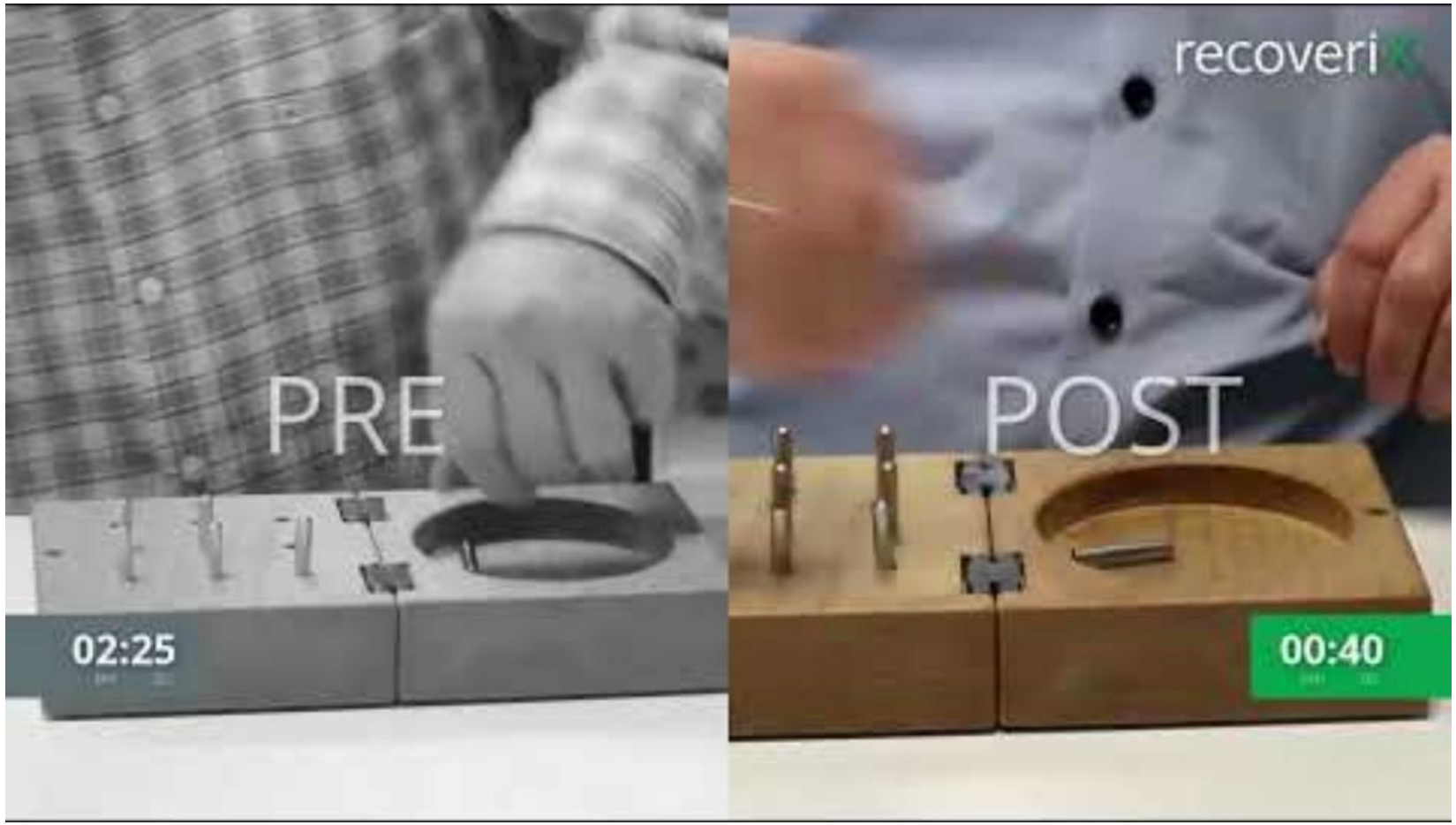
Results in Upper Extremity



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Results in Upper Extremity

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recoveriX Stroke Results

ID: S0008	Age: 38	Female	Affected Side: Right	Time since stroke: 14 months

Interview

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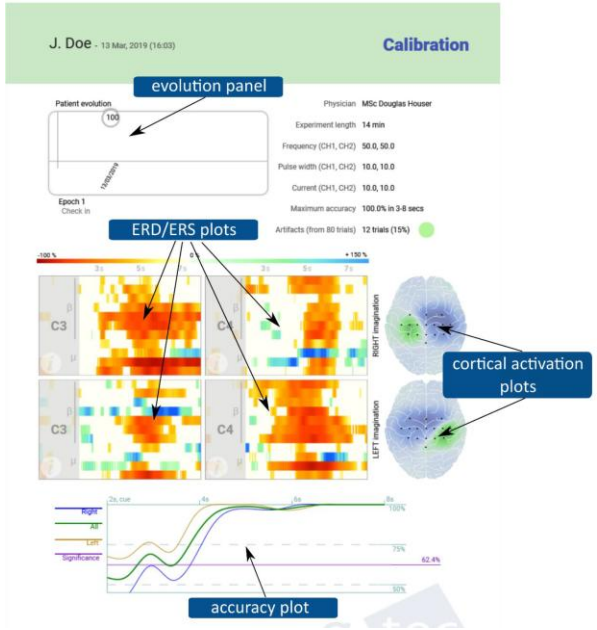
recoveriX Stroke Results

ID: S0008	Age: 38	Female	Affected Side: Right	Time since stroke: 14 months

Performance Report



In every session, therapists have access to accuracy and brain activation reports which allow them to provide active feedback to the patient and stimulate more effective therapeutic recovery.

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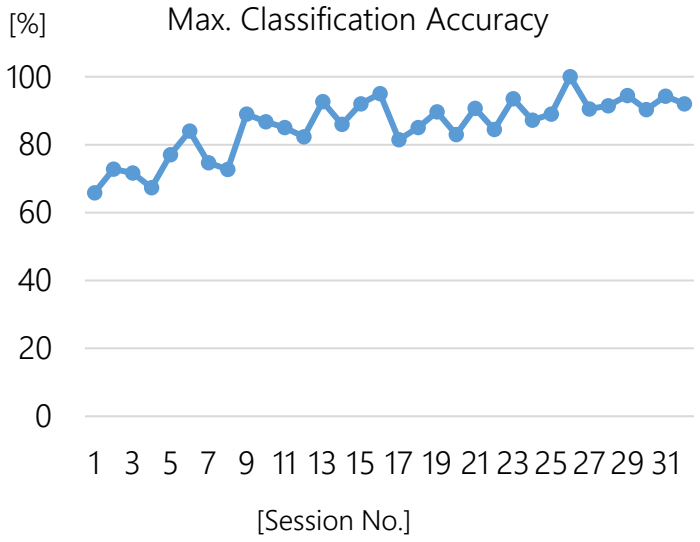
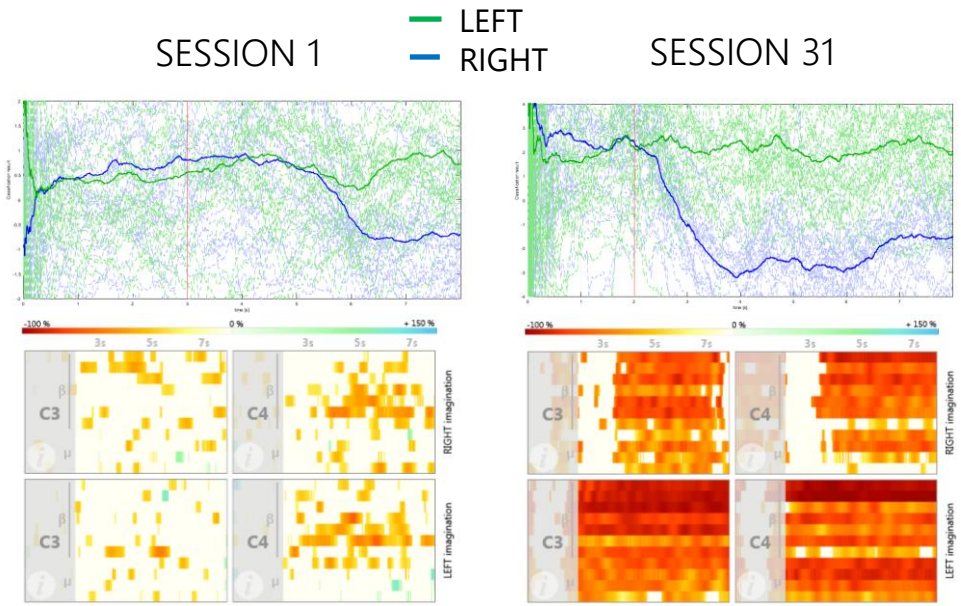
recoveriX Stroke Results

ID: S0008	Age: 38	Female	Affected Side: Right	Time since stroke: 14 months

Performance Report





In every session, therapists have access to accuracy and brain activation reports which allow them to provide active feedback to the patient and stimulate more effective therapeutic recovery.

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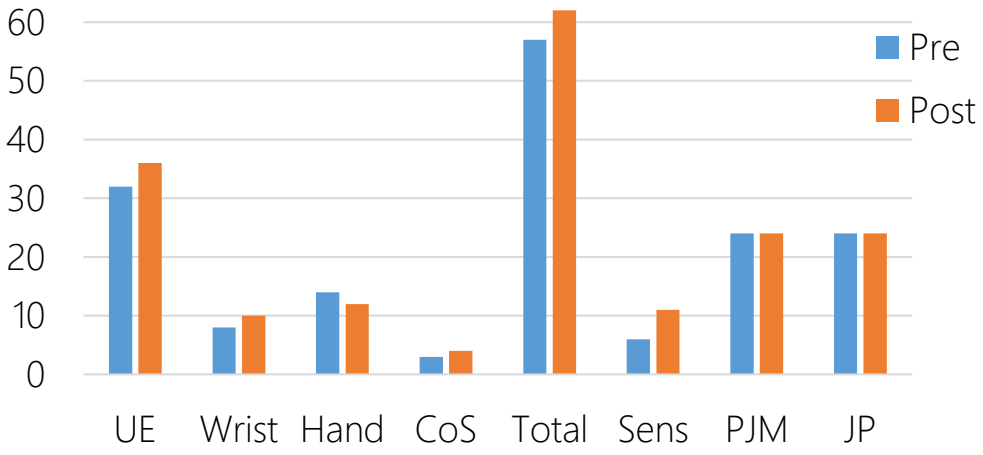
recoveriX Stroke Results

ID: S0008	Age: 38	Female	Affected Side: Right	Time since stroke: 14 months

Clinical Assessment Report

Upper-Extremity Fugl Meyer Assessment



UE: Upper Extremity | CoS: Coordination and Speed | Sens: Sensation
PJM: Passive Joint Motion | JP: Joint Pain

9-Hole PEG test		
Session	Left	Right
1	00:17	07:26
3	00:15	03:21
5	00:14	01:34
13	00:16	01:48
26	00:15	01:24
28	00:13	01:25
Post	00:14	01:14
Improvement	16%	603%

Assessment	Pre2	Post1
Barthel Index	100	100
Fahn Tremor Rating Scale	2	2
Modified Aschworth Scale (wrist)	1.5	0.5
Modified Aschworth Scale (hand)	1	0.5

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Therapy Reports

Patients are clinically assessed throughout treatment progression – before rehabilitation, every 5 sessions and at the end of the rehabilitation process.

Therapy report cards illustrate the patient's progess and achievements.


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THERAPY REPORT

for

John Doe

Sessions in Total: 25

recoveriX Accuracy: 85 %

Montreal Cognitive Assessment: 26 (25)

Modified Ashworth Scale: 0 (0)

Fugl-Meyer Assessment: 35 (30)

Fugl-Meyer Assessment: 24 (22)

Timed Up and Go: 15.2 s (17.5 s)

10-Meter Walk Test: 9.3 s (10.9 s)

Barthel Index: 85 (85)

Assessment Date

11. 02. 2022 (before Therapy)

15. 05. 2022 (after Therapy)

P. Smith (Therapist)

Remarks

The patient said he could walk uphill by himself and felt less spasticity in the ankle after 20 recoveriX sessions

P. Smith (Signature)

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Clinical Study: Upper Extremity

Scale	n	Baseline Median [IQR]	Post1 Median [IQR]	Delta Median [IQR]	Delta Mean (SD)	P
MAS-Wrist	51	2.5	1	-0.5	-0.72	<0.001
MAS-Fingers	51	2.5	2	-0.5	-0.63	<0.001
FMA-UE	51	19	22	4	4,68	<0.001

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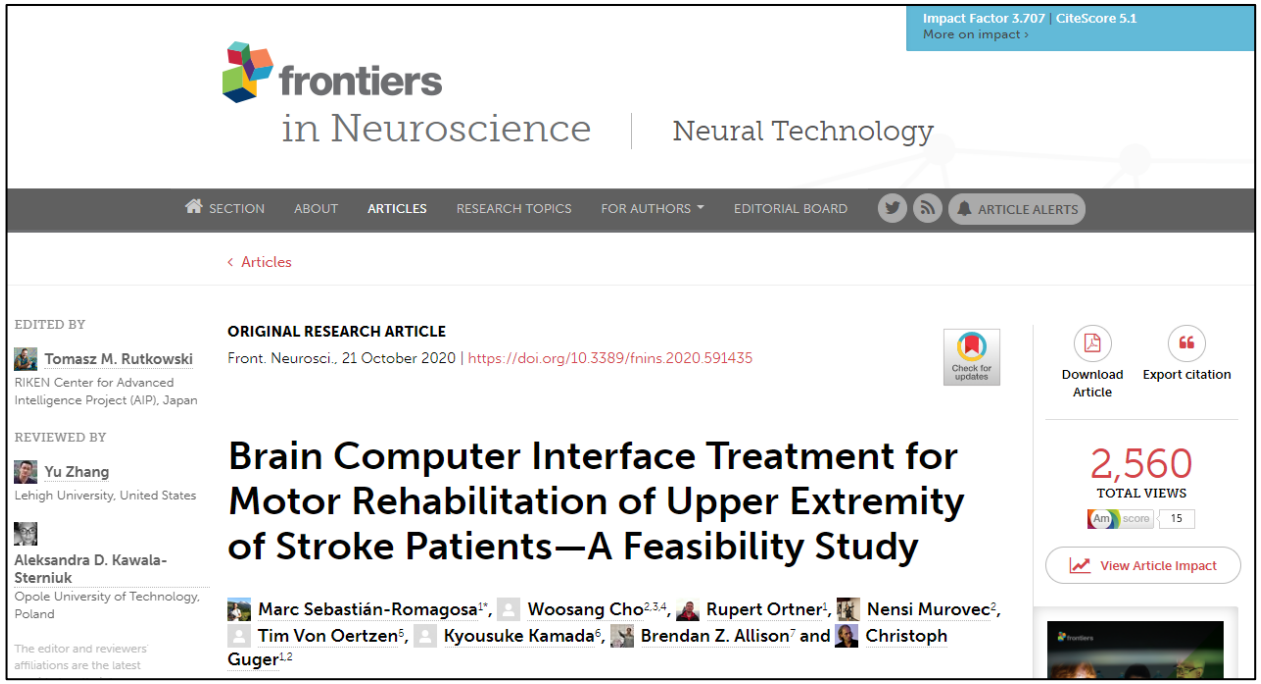
recoveriX Publications Online

- recoverix.com/stroke-study-results/
- recoverix.com/ms-study-results/



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frontiers in Neuroscience | Neural Technology

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Brain Computer Interface Treatment for Motor Rehabilitation of Upper Extremity of Stroke Patients—A Feasibility Study

Marc Sebastián-Romagosa[1*], Woosang Cho[2,3,4], Rupert Ortner[1], Nensi Murovec[2], Tim Von Oertzen[5], Kyousuke Kamada[6], Brendan Z. Allison[7] and Christoph Guger[1,2]

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Results of Lower Extremity

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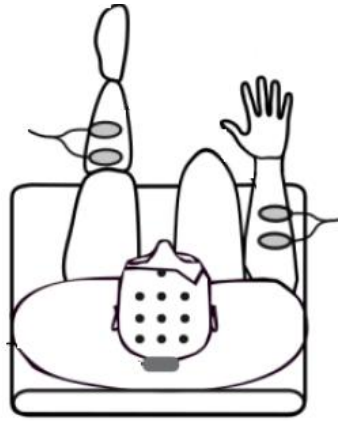
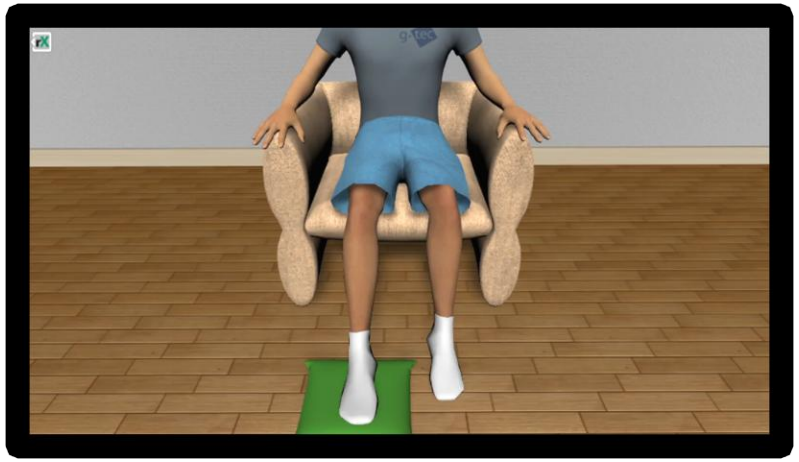
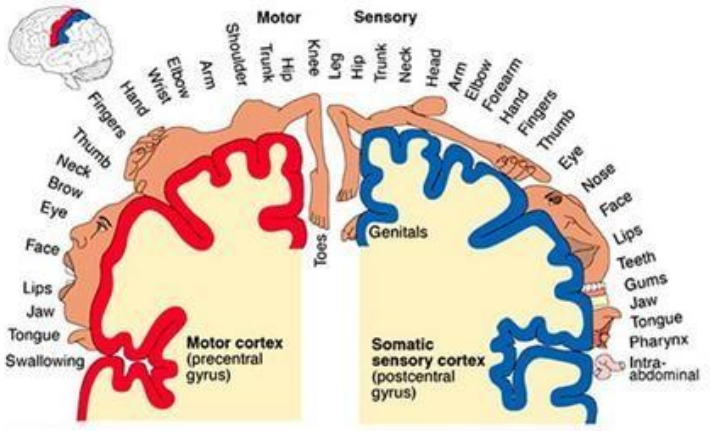
Lower Extremity





The motor and sensory humunculi



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Results in Lower Extremity

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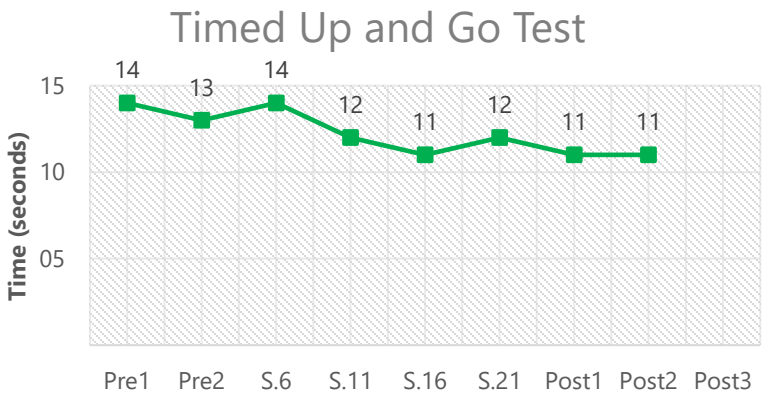
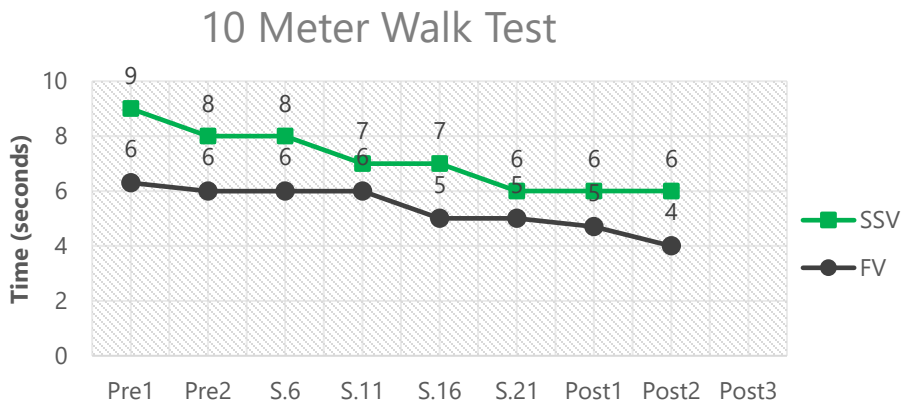
Results in Lower Extremity

BEFORE **AFTER**





Results in Lower Extremity

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Clinical Study: Lower Extremity

Scale	Acronym	Short description
Modified Ashworth Scale	MAS	Spasticity Knee & Ankle
Video Recording	VR	Join movements and walking tests
Timed Up and Go	TUG	Coordination and balance
10 Meter Walking Test	10MWT	Gait speed
Stroop Color Word Test	SCWT	Concentration performance
Range of motion Ankle	ROM Ankle	Measured in degrees
Range of Motion Knee	ROM Knee	Measured in degrees
Barthel Index	BI	Daily activities

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Clinical Study: Lower Extremity

Scale	n	Baseline Median [IQR]	Post1 Median [IQR]	Delta Median [IQR]	Delta Mean (SD)	P
MAS Ankle	22	3	2.5	0	-0.42	0,038
TUG	22	14,1	11,7	-2.59	-5.73	<0.001
10MWT	22	8.5	6.81	-1.58	-3.89	<0.001
SCWT	22	24	26	1.5	2.9	0.024
ROM Ankle	22	7.7	17.7	5.95	7.02	0.008
ROM Knee	22	128.9	135.3	2.95	7.35	0.043
BI	22	90	90	1.25	2.73	0.021

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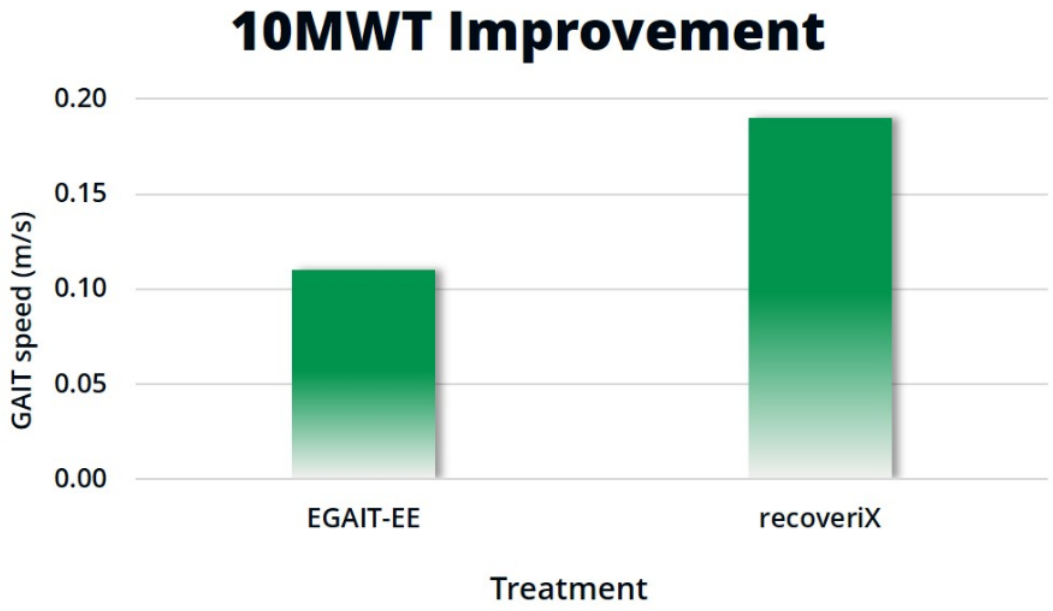
Clinical Investigation Report

recoveriX is compared with most effective treatment: Electromechanical training with end effector (EGAIT-EE)

95 controlled studies with 4458 patients



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Results of Multiple Sclerosis

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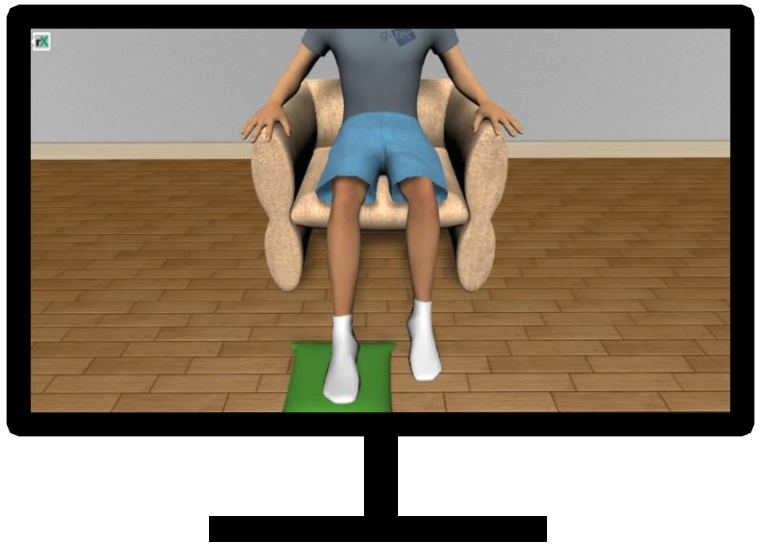
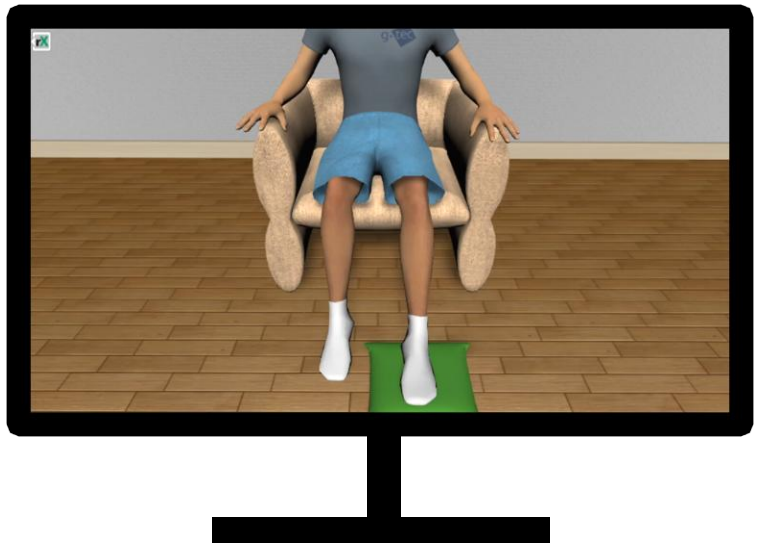
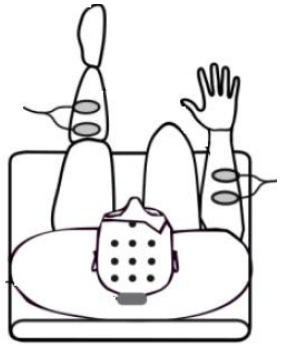
MS Therapy Protocol



Right Hand (RH) and Left Foot (LF)



Left Hand (LH) and Right Foot (RF)



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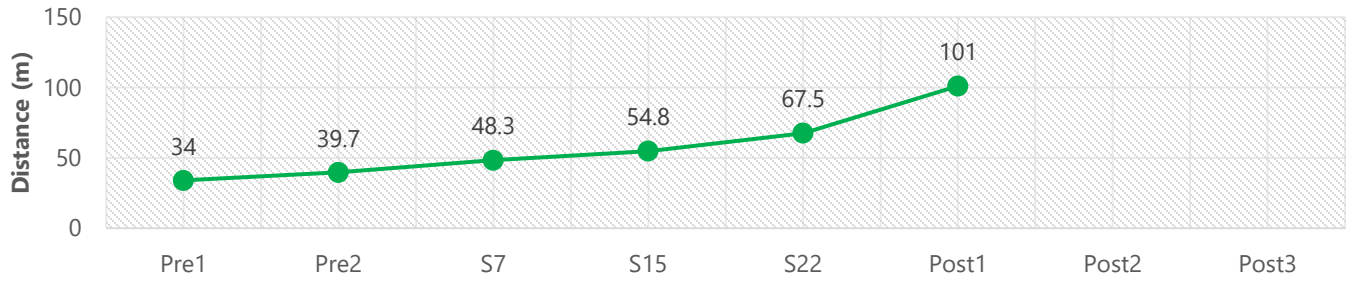
Clinical Study: MS



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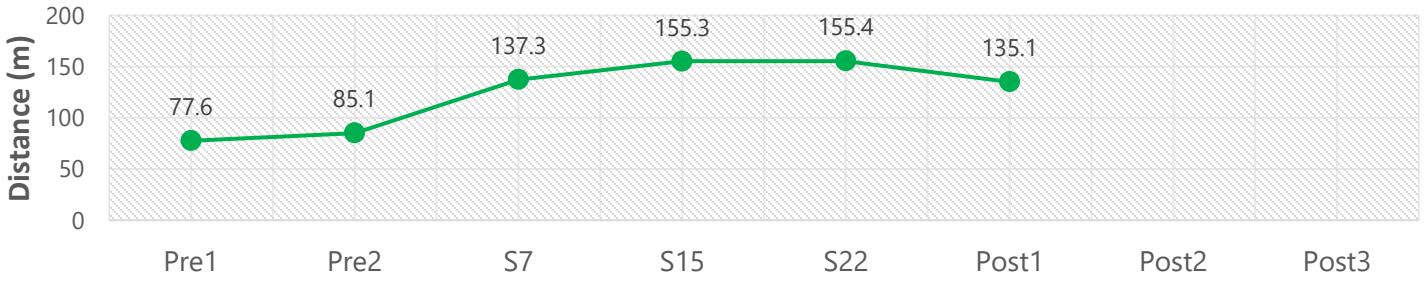
Clinical Study: MS



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Clinical Study: MS

Scale	Acronym	Short description
Modified Ashworth Scale	MAS	Spasticity Knee & Ankle – Bilateral
Video Recording	VR	Join movements and walking tests
Timed Up and Go	TUG	Coordination and balance
Timed 25-Foot Walk	T25FW	Gait speed
6-minute walk test	6MWT	Gait ability and endurance
Multiple Sclerosis Impact Scale	MSIS-29	Daily living activities performance
Modified Fatigue Impact Scale	MFIS	Physical tiredness and lack of energy

recoveriX

Clinical Study: MS

Scale	n	Baseline Median [IQR]	Post1 Median [IQR]	Delta Median [IQR]	Delta Mean (SD)	P
Timed Up and Go	24	18,76	16,96	-2.3	-4.53	<0,001
6-Minute walk test	24	205,06	263,4	30,5	37,29	<0,001
Multiple Sclerosis Impact Scale	24	72,25	59,50	-9	-10,15	<0,001
Modified Fatigue Impact Scale	24	37,25	29,50	-6,25	-7,23	0,003
Timed 25-Foot Walk	24	9,89	8,08	-0,85	-3,21	0,001
Modified Ashworth Scale	22	2,88	2	-0,50	-0,64	0,014

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Multiple Sclerosis Therapy

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recoveriX MS Results

ID: MSS0013	Age: 63	Male	Affected Side: Both	MS Time: 26 years

Timed 25-Foot Walk

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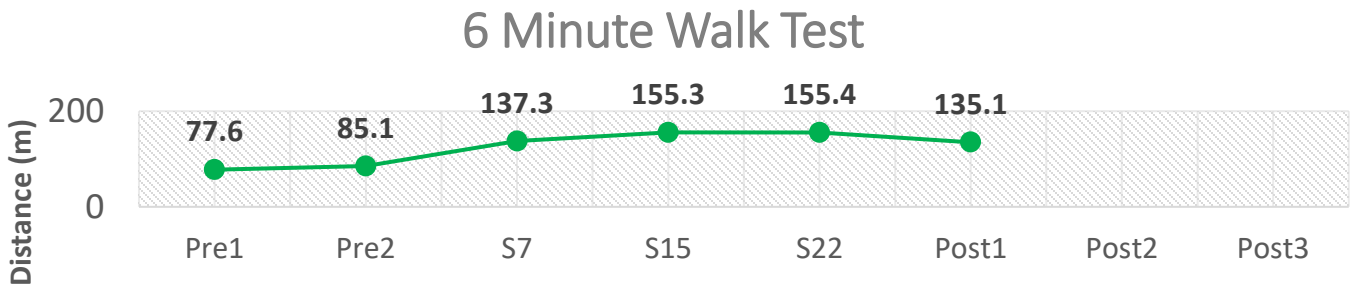
recoveriX MS Results

ID: MSS0013	Age: 63	Male	Affected Side: Both	MS Time: 26 years

6-Minute Walk Test



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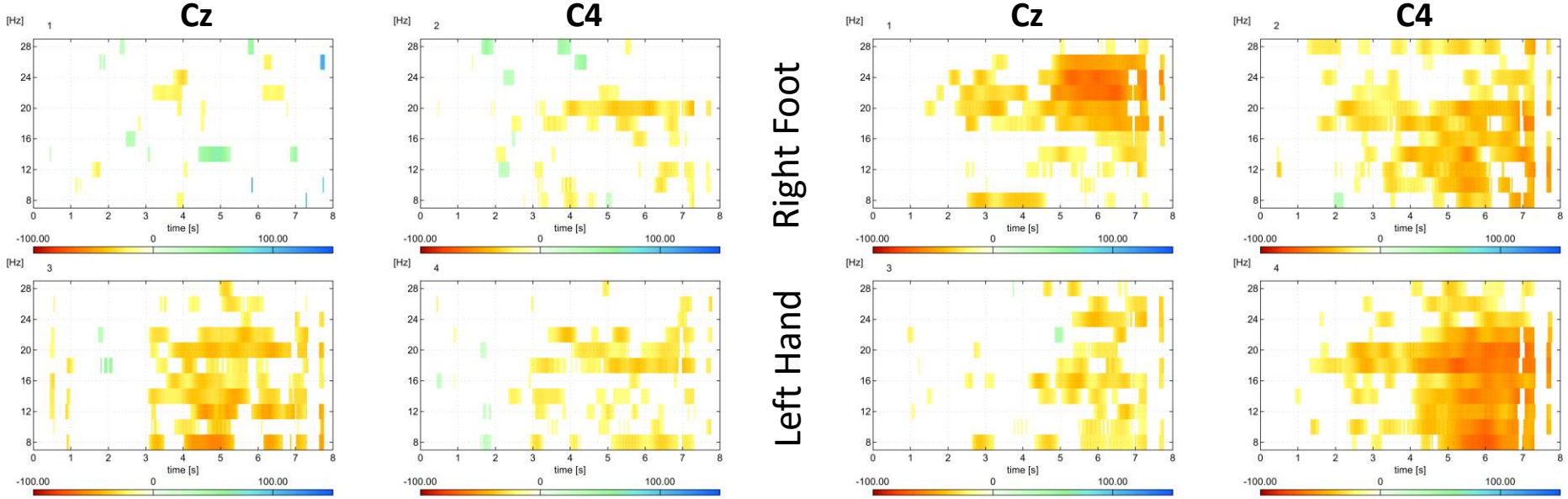
recoveriX MS Results

ID: MSS0013	Age: 63	Male	Affected Side: Both	MS Time: 26 years

Event-Related (De)synchronization (ERD/S) Maps:
after therapy more brain activity on both hemispheres.

Session 1

Session 30



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recoveriX MS Results

ID: MSS0013	Age: 63	Male	Affected Side: Both	MS Time: 26 years

After therapy the patient reported:

- Better posture when standing
- Less spasticity
- Can dorsiflex the right foot again

recoveriX MS Results

ID: MSS0013	Age: 63	Male	Affected Side: Both	MS Time: 26 years

Patient Statements

- 25-Feet Walking Test: Before recoveriX: 25 seconds; After recoveriX: 15 seconds
- 6-Minutes Walking Test: Before recoveriX: 85 meters; After: 135 meters
- Spasticity in left leg: Much less which leads to better gait pattern and more balance
- Neuroplasticity changes: lot of more activation of the sensorimotor cortex after therapy

"During the first 7 sessions I thought I am just wasting my time. In session 8 suddenly my left leg started to move again. It's the best thing I ever did" said the patient. "I can stand up again more easily, my concentration improved, standing up and sitting down is easier due to more stability and balance. My wife drove me to recoveriX therapy but after the third session, I could drive myself." he continued.

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recoveriX MS Results

ID: MSS0014	Age: 47	Female	Affected Side: Both	MS Time: 24 years

Timed 25-Foot Walk Test

recoveriX

recoveriX MS Results

ID: MSS0014	Age: 47	Female	Affected Side: Both	MS Time: 24 years

6 Minute Walk Test

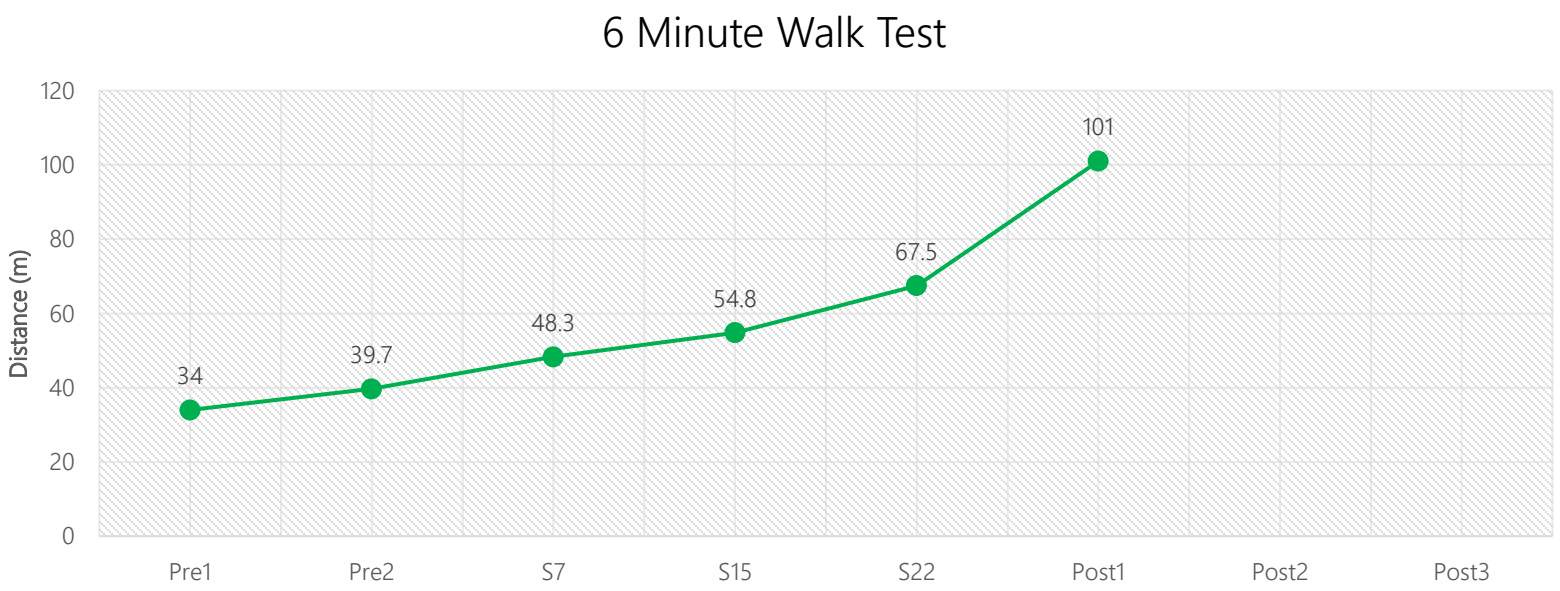
recoveriX

recoveriX MS Results

ID: MSS0014	Age: 47	Female	Affected Side: Both	MS Time: 24 years

6 Minute Walk Test

Pre: 39 meter; Post: 101 meter



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recoveriX MS Results

ID: MSS0014	Age: 47	Female	Affected Side: Both	MS Time: 24 years

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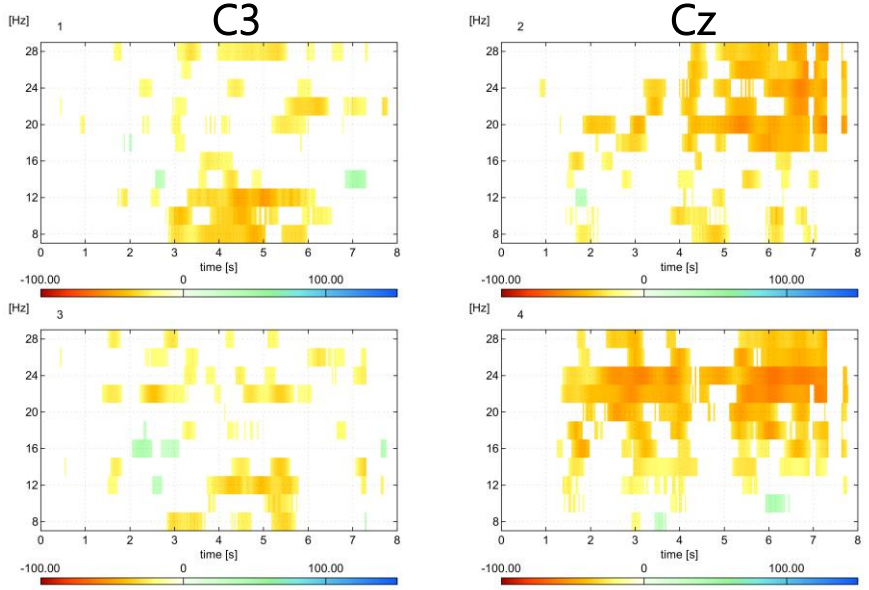
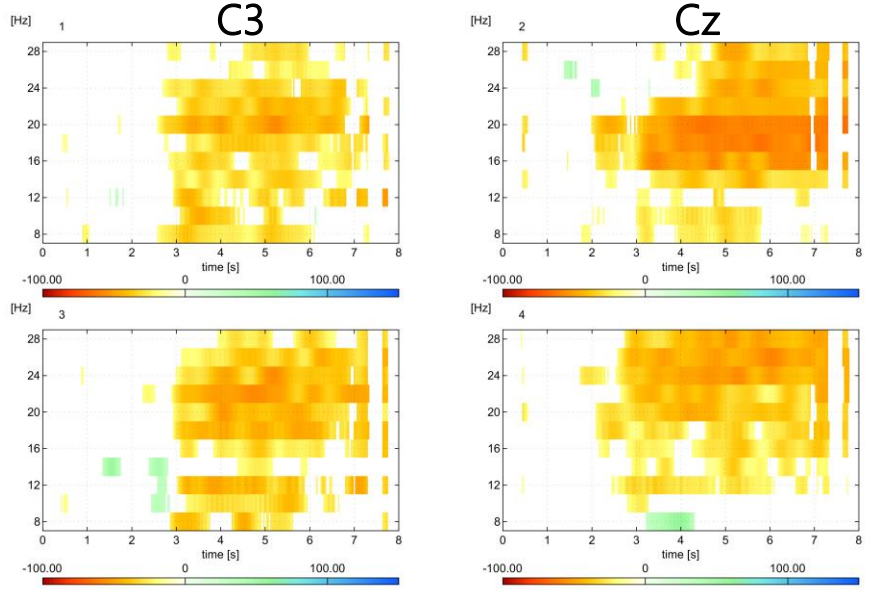
Session 1



Last Session



recoveriX

recoveriX MS Results

ID: MSS0014	Age: 47	Female	Affected Side: Both	MS Time: 24 years

After therapy the patient reported:

- Could only walk 20 meters at a time then had to take a break – now less easily fatigued
- Improved gait
- Better balance
- Going outside more often


recoveriX THERAPY REPORT

MSS0014

Sessions in Total 30

recoveriX Accuracy 70,5 %

Modified Ashworth Scale L: 1,5 R: 1,5 — 1,5 : 2

Modified Ashworth Scale L: 1,0 : 1,0 — 1,5 : 1,75

Timed Up and Go 40,5 s — 56,1

Timed 25-Foot Walk 18,8 s — 47,8

6-Minute Walk Test 101 m — 36,3

Multiple Sclerosis Impact Scale 78 — 18

Modified Fatigue Impact Scale 19 — 25,5

Assessment Date
20.10.2022 (Before Therapy)
01.02.2023 (After Therapy)

ChO (Therapist)

Remarks: Could only walk 20m at a time then had to take a break → Now less easily fatigued
Better gait and balance, goes outside more often

recoveriX

recoveriX Results

ID: MSS0014	Age: 47	Female	Affected Side: Both	MS Time: 24 years

Patient Statements

- She is now so confident that she no longer needs her walking stick.
- The posture of her entire body appears healthier.
- She stands up and sits down more quickly.
- She walks more quickly.
- She looks healthy when she is sitting.
- The tremor in her paretic hand has decreased.
- She claimed that although she could only walk 300 meters before recoveriX treatment, she can now walk 1000 meters.
- She used a rollator prior to recoveriX, but now that she is so self-confident that she doesn't even use it anymore.
- Her ability to focus also became better

recoveriX

recoveriX MS Results

ID: MSS0014	Age: 47	Female	Affected Side: Both	MS Time: 24 years

Patient Statements

In Post1-Assessment Meeting:

At the beginning the patient came into the therapies in her wheelchair and could only walk 20 meters. Furthermore, she had to take a short break or pause after each step.

Now after the therapy, she is walking with a stick, she goes outside more often, is more joyful (more zest for life), a lot less sleepy, is able to lift off her foot better, while standing the foot sticks a lot better to the ground. She liked it here in the gym “super cool here”. Coordination also improved, whereas the concentration and memory always were good according to her. 6MWT performance doubled. She switched out her 3-point stick with a “LEKI” Nordic walking stick which she can use. Finally, she also stated increased strength in her hand.

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recoveriX Gyms Worldwide

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American Stroke Association

Stroke

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RESEARCH ARTICLE

Guidelines for Adult Stroke Rehabilitation and Recovery

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

Carolee J. Winstein, Joel Stein, Ross Arena, Barbara Bates, Leora R. Cherney, Steven C. Cramer, Frank Deruyter, Janice J. Eng, Beth Fisher, Richard L. Harvey, Catherine E. Lang, ... See all authors and on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research

PDF/EPUB

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Jump to

Abstract

Introduction

June 2016
Vol 47, Issue 6

recoveriX

Evidence based Neuro-Rehabilitation: recoveriX includes many things

Categories	Recommendations	Class	Level of evidence
Therapy-based	Task-specific training	I	A
	Constraint-induced movement therapy	IIa	A
	Mental practice	IIa	A
	Strengthening exercises	IIa	A
	Bilateral training	IIb	B
Technology-based	Virtual reality	IIa	B
	Robotic therapy	IIa	A
Sensorimotor stimulation	Function electrical stimulation	IIa	A
Complementary therapies	Acupuncture	III	A

A: Multiple populations evaluated, B: Limited population evaluated. C: very limited
I: Treatment shoud be administered, IIa: Reasonable, IIb: May be done, III: No benefit

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Canadian Stroke Recommendations: recoveriX includes many things

Categories	Recommendations	<6 months	>6 months
Therapy-based	Mirror neuron	A	A
	Mental practice	A	B
	Constraint-induced movement therapy	A	A
	Strength training	A	A
	Bilateral arm training	A	A
	Training of active movements	B	C
	Functional dynamic training	B	B

A: Evidence from meta-analysis
B: Evidence from single/two sources. Desired effect outweighs unwanted effects
C: Limited evidence. Desired effects closely balance to undesired effects

recoveriX

Canadian Stroke Recommendations: recoveriX includes many things

Categories	Recommendations	<6 months	>6 months
Therapy-based	Range of motion exercise	C	C
Technology-based	Virtual Reality training	A	A
Sensorimotor stimulation	FES	A	A
	tDCS, acupuncture, biofeedback	B	B
Non-invasive brain stimulation	rTMS	A	
	tDCS		B

A: Evidence from meta-analysis
B: Evidence from single/two sources. Desired effect outweights unwanted effects
C: Limited evidence. Desired effects closely balance to undesired effects

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Brain-Computer Interfaces Neurorehabilitation

for Stroke and Patients with Multiple Sclerosis

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