Study Title:

The Study on the effectiveness of the Integration of a Device
Based on a Neural Interface and Neurostimulation of the Spinal Cord
in the Rehabilitation of Patients With Upper Limb Movement Impairments
Due to Neurological Disorders.

Date of the document:

17 August 2021

Content of the document:

Information Flyer and informed consent for the study participant

Information Flyer and informed consent for the study participant (patient)

The study on the effectiveness of the integration of an existing rehabilitation device based on a neural interface and devices for neurostimulation of the spinal cord in the rehabilitation of patients with upper limb movement impairments due to neurological disorders

1. Where and by whom is the research carried out?

The study is being conducted by the V. Zelman Center for Neurobiology and Brain Restoration of the Skolkovo Institute of Science and Technology (Skoltech) and its partner laboratories at the Kazan Federal University, the Institute of Pavlov Institute of Physiology, Russian Academy of Sciences (Saint Petersburg), Samara State Medical University, Far Eastern Federal University and the EirMED rehabilitation center (Saint Petersburg).

2. Purpose of the study

The aim of the study is to investigate the effectiveness of a new rehabilitation technology for paralysis that occurs after stroke or spinal cord injury. The research will jointly use a prototype neurorehabilitation exerciser, in which a robotic device moves a paralyzed arm at the command of a non-invasive brain-computer interface to perform a game life-like task in virtual reality (for example, aiming a hand-held virtual toy gun at a target), as well as an electrical stimulation device that activates the spinal cord and/or muscles of the paralyzed arm.
We expect that a portion of the patients participating in the study will have an improvement in arm mobility by the end of the study. In both patients and healthy volunteers, no adverse effects are expected.

3. What is expected of a participant in this study

The study participants will receive up to 12 rehabilitation procedures, each lasting about one hour, within two-four weeks. During the procedure, the activity of the brain (electroencephalogram) and muscles (electromyogram) will be recorded using non-invasive electrodes placed on the scalp and body. Also, during the study, electrical stimulation will be performed with non-invasive electrodes placed on the body.
During the exercise, the participant is required to imagine the movement of the paralyzed arm towards the goal, or concentrate on this goal (for example, a coloured balloon). If the task is completed correctly, the robot will move the arm towards the target. This movement can additionally be accompanied with functional electrical stimulation using disposable electrodes glued to the skin on the back and/or the arms. The strength of the stimulation will be adjusted so as not to cause pain.
Participants will be randomly assigned to groups, and participants in some groups will receive stimulation and some will not.

All participants will also undergo neurological testing 3 to 6 times, during which they will need to answer questions or perform various movements.
Participants who express their special written consent will have venous blood tests conducted three times for subsequent analysis of lipid biomarkers, in order to further evaluate the effectiveness of rehabilitation methods based on biochemical analysis.

4. Criteria for inclusion in the study

You should not participate in the study if you have been diagnosed with the following diseases or manifestations:

1. Severe cognitive impairment (<10 points on the Montreal Cognitive Assessment Scale).
2. The score on the Hamilton scale is above 18 points.
3. The rating on the Rankin scale is higher than 4 points.
4. Concomitant diseases that cause a decrease in muscle strength or an increase in muscle tone in the upper limbs (for example, cerebral palsy, brain damage as a result of trauma) or rigidity (for example, Parkinson's disease, contracture).
5. Late stages of arthritis or significant limitation of range of motion.
6. The absence of a part of the upper limb due to amputation caused by various reasons.
7. Any medical condition, including mental illness or epilepsy, that may affect the interpretation of the test results, the conduct of the test, or the safety of the patient.
8. Alcohol abuse, medical marijuana use, or light drug use in the previous 12 months.
9. Use of experimental drugs or medical devices within the previous 30 days prior to Visit 1.
10. Inability to comply with research procedures, according to the researcher.
11. The severity of the patient's condition according to the data of the neurological or somatic status, which does not allow full rehabilitation
12. Visual acuity less than 0.2 in the weakest eye according to the table of visual acuity of Sivtsev.
13. Unstable angina and / or heart attack during the previous month
14. History of stroke (for patients with spinal cord injury) or recurrent stroke (for patients with acute cerebrovascular accident).
15. Uncontrolled arterial hypertension.
16. Ataxia.
17. Pacemaker and / or other implanted electronic devices.
18. Taking muscle relaxants.
19. Peripheral neuropathy.
20. Concomitant diseases in the stage of exacerbation or decompensation, requiring active therapy.
21. The presence of allergic reactions and / or other skin lesions at the place of application of the heart rate electrodes at the time of the study.

22. Acute urinary tract infections.
23. Acute thrombophlebitis.
24. All forms of epilepsy.
25. Benign and malignant neoplasms.

5. Voluntary participation and use of data

Your participation in the study is voluntary, and only you decide whether to participate or not. We do not pay participants any fees.
You can decide to leave the study at any stage without giving a reason. The data obtained with your participation before the early withdrawal from the study can be used in scientific publications, presentations, and reports, without mentioning your name, surname, or other personal data.

If you consent to the use of photo and video materials, they can also be used in scientific publications, presentations, and reports, but your face will be hidden.

Upon your special consent, you can take three venous blood tests for the further analysis of the biomarkers contained in it.

6. Possible inconveniences during the experiment, side effects, risks.

During exercise, you may experience discomfort and dizziness from wearing virtual reality goggles (in this case, a computer monitor will be used), a feeling of stiffness when placing your arm in a robotic device.

There may be unpleasant and painful sensations in the skin and muscles during electrical stimulation, sweating, fever, a slight increase in blood pressure, an increase in muscle tone, in which case you need to inform a researcher.

When taking blood from a patient for biochemical monitoring, weakness, dizziness, cold sweat, fainting, pain during venipuncture are possible.

7. Possible benefits of participating in the study, costs of participation

Participation in the study does not involve payment neither from your nor from our side. Participants may experience improved motor function as a result of the experimental rehabilitation course, but we cannot guarantee or promise it.

8. Estimated results and their use, familiarization with the research results.

The results of the study, including assessment of the effectiveness of the experimental method, will be published in leading scientific journals. You will have the opportunity to review these results.

9. Confidentiality.

Your personal information will only be available to members of the research team directly working with you. All results and data will be stored in anonymized form on a secure server.

10. The research protocol was approved by the Ethics Commission of the Skolkovo Institute of Science and Technology (Skoltech), protocol _____ dated _____ 2021.

11. Before signing your informed consent, you can ask any additional questions in regard to this study.

12. Contact information for additional questions and complaints:

Address: Skolkovo Institute of Science and Technology, Territory of the Skolkovo Innovation Center, Bolshoy Boulevard 30, building 1, Moscow 121205, Russia,
To: Bioethics Commission.
Email: IRB@skoltech.ru.

INFORMED CONSENT

Study participant (patient)

I, the undersigned

_____

(Full name, in block letters)

voluntarily give my informed consent to participate in **"The study on the effectiveness of the integration of an existing rehabilitation device based on a neural interface and devices for neurostimulation of the spinal cord in the rehabilitation of patients with upper limb movement impairments due to neurological disorders".**

I have read the Study Participant Information Flyer and have had the opportunity to ask questions. I have received satisfactory answers to all the questions asked. I was given sufficient time to decide whether to participate in the study or to opt out. I understand that at any time before the end of the study, I have the right to refuse further participation, which will not entail any undesirable consequences for me.

I voluntarily agree to the subsequent use of the data obtained with my participation in **"The study on the effectiveness of the integration of an existing rehabilitation device based on a neural interface and devices for neurostimulation of the spinal cord in the rehabilitation of patients with upper limb movement impairments due to neurological disorders"**, for scientific purposes (its publication, presentation at conferences) subject to confidentiality. I understand that data identification can only be done with my consent.

	Please put any sign in this box if you agree that video recording will be made during rehabilitation procedures. If you do not agree with the shooting, do not put anything.
	Please put any sign in this box if you agree that a venous blood sample will be taken from you to analyze the biomarkers it contains. If you do not agree with blood sampling, do not put anything.

I have received a copy of the Study Participant Information Leaflet and Informed Consent of the Study Participant.

_____ _____

(signature of the participant or representative) (date)

Information flyer and informed consent for the study participant (healthy volunteer)

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We expect that a portion of the patients participating in the study will have an improvement in arm mobility by the end of the study. In both patients and healthy volunteers, no adverse effects are expected.

3. What is expected of a participant in this study

Participants in the study will receive one rehabilitation procedure lasting approximately from one to two hours. During the procedure, the activity of the brain (electroencephalogram) and muscles (electromyogram) will be recorded using non-invasive electrodes placed on the scalp and body. Also, during the study, electrical stimulation will be performed with non-invasive electrodes placed on the body.

During the exercise, the participant is required to imagine the movement of the paralyzed arm towards the goal, or concentrate on this goal (for example, a coloured balloon). If the task is completed correctly, the robot will move the arm towards the target. This movement can additionally be accompanied with functional electrical stimulation using disposable electrodes glued to the skin on the back and/or the arms. The strength of the stimulation will be adjusted so it is not painful.

Participants will be randomly assigned to groups, and participants in some groups will receive stimulation and some will not.

All participants will also undergo neurological testing 3 to 6 times, during which they will need to answer questions or perform various movements.

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