

TITLE: IpsiHand Device Use in Hemiparetic Stroke Population to Assess Efficacy of a Home Remote-Based EEG System for BCI Rehabilitation of the Upper Extremity: A Randomized Control Trial

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Study Synopsis:

The purpose of this research study is to **define the efficacy of fully remote home-based BCI therapy in chronic hemiparetic subcortical stroke patients**. A randomized controlled study using the integrated fully remote BCI system will be tested against standard exercise therapy to determine the efficacy of motor improvement in chronic stroke patients with an upper extremity hemiparesis.

Background:

Stroke is a leading cause of serious long-term disability in the United States. Every year, more than 795,000 people in the United States have a stroke [14]. Stroke costs the United States an estimated \$34 billion each year, which include the cost of healthcare services, medicines to treat stroke, and missed days of work [14]. Fundamental to reducing this individual and social burden is the ability for a patient to recover function. Historically, there is a significant barrier for stroke patients to get access to advanced forms of therapy to improve their outcomes [15, 16]. This is especially true in vulnerable minority and rural populations [2, 17-20]. Despite increasingly strong evidence for BCI-stroke rehabilitation [21-26], there are delays in implementation in clinical practice. This is due to the current need for patients to have access to tertiary academic centers that contain the full complement of clinicians, engineers, and scientists that can implement BCI methodologies. To date, these high technical and institutional requirements limit the scalability of these techniques to aid larger patient populations (especially vulnerable populations). More recently, this problem is further compounded by the COVID pandemic. Due to the vulnerability of stroke patients, research and clinical trials requiring in-person interactions in health care environments have largely been shut down. Further, there is a strong avoidance by stroke patients to enter health care environments even when such avoidance is to their own detriment [27-29]. Thus, creating technologies that enhance access to advanced rehabilitative care is not only fundamental to the core mission of the National Institute of Neurological Disorders and Stroke (NINDS), but also addresses NINDS strong priority in reducing the disproportionate burden of stroke borne by underserved groups of society, including racial and ethnic minorities, rural, and socioeconomically disadvantaged populations where access has historically been problematic [2, 17-20].

In the setting of chronic stroke, most therapeutic techniques are generally ineffective due to the severe reduction in ability to achieve recovery beyond 3 months post-stroke [30- 32]. Some promising techniques such as constraint-induced movement therapy (CIMT) have been successfully used to combat “learned non-use” of affected limbs [33-35]. These techniques, however, are not scalable to a broad stroke population due to many patients lacking the necessary level of motor function [33, 36, 37]. Brain-computer interface (BCI) based rehabilitation is a relatively new approach to post-stroke motor recovery. Generally, BCIs do not require patients to generate physical motor outputs. There is a *strong premise* that they can be used to develop treatments for patients who are unable to achieve recovery through more traditional methods [6, 8, 11]. Several recent BCI-based treatments have been shown to aid in motor recovery in chronic stroke patients through varied approaches, such as electrical stimulation or assistive robotic orthoses [8-11, 38, 39]. BCI-based approaches are thought to drive activity-dependent plasticity through training patients to associate self-generated patterns of brain activity with a desired motor output [13]. Classically, changes in the distribution and organization of neural activity have been identified as a potentially important factor in achieving motor recovery [36, 40]. Motor control is thought to shift to perilesional regions when the primary motor cortex is damaged. Local neural reorganization, however, may not be sufficient for recovery if cortical damage is too severe, or if the ipsilesional corticospinal tract (CST) is substantially transected [41-44]. Since rehabilitative BCIs often use perilesional or ipsilesional signals, they may not be as effective as rehabilitation systems for patients experiencing high levels of motor impairment [7, 8, 45, 46]. Our previous research has shown that signals acquired from EEG

electrodes placed over healthy contralesional motor cortex can be used for BCI control [46-48], and that the use of this system can induce robust functional improvements in chronic stroke patients (Preliminary Data) [3].

While non-invasive BCI-rehabilitation technologies are promising for recovering motor function in chronic stroke patients, for these approaches to fully achieve their potential they must be made more accessible and scalable. Telehealth approaches have the ability to overcome the current accessibility barrier. Telehealth is the use of any communication modality (e.g., integrated video and audio, video conferencing, etc.), that enables physical separation of patient and practitioner while delivering health care services at a distance [49]. Telerehabilitation (TR) has received significant attention in recent years. TR is the use of telehealth technologies to provide distant support, assessment and information to people who have physical and/or neurological/cognitive impairments [50-52]. Prior to COVID telehealth delivery of care has been a growing trend, since the onset of the COVID pandemic telehealth has become an essential tool for continuing to deliver health care to patients [53, 54]. This is reflected by changing regulations and reimbursement policies at the federal and state level to support expansion of the application of telemedicine [55]. Even after the COVID pandemic has passed these changes are likely to remain [54].

Effective implementation of a TR program has been shown to increase access to service and result in improved rehabilitation outcomes for individuals with physical impairments after discharge to home. First, TR can benefit people with disabilities residing in rural, remote locations because these individuals face incomplete service networks that threaten their safety and independent functioning [18]. Rural individuals also face more barriers accessing care because they travel farther to medical and rehabilitation appointments and have more transportation problems than their urban counterparts. This situation is especially exasperated for severely affected stroke patients whose mobility is even more severely impaired. Indeed, the farther rehabilitation programs are from residents' homes, the less likely residents are to receive services [18, 19]. Second, TR can be provided at less cost than in-person services and can eliminate patients' travel time between their homes and the rehabilitation clinic [56, 57]. Third, TR reduces the need for therapists/technologists to travel to patients' homes while supporting real-time interactions with patients with physical disabilities in their home settings [50]. Fourth, an effective TR program can enhance continuity of care by enabling communication with the caregivers [58, 59]. Finally, there does not seem to be a tradeoff between remote versus in-clinic in regard to outcomes. Activity-based training produced substantial gains in arm motor function regardless of whether it was provided via home-based telerehabilitation or traditional in-clinic rehabilitation [60].

As it relates to advanced technologies such as BCIs, with the benefits of TR rigorously defined and strong trend for growing adoption, there is a strong need to further the development of new technologies to better implement their delivery. Our research team has strong experience in the creation and deployment of home- based BCI technologies for the treatment of chronic stroke (as reflected in the Preliminary Data) to support the aims of the project.

The current Neurolutions IpsiHand system, is used at home for treatment, but requires visits to a health care setting for screening/initiation of care, interval assessment and for completion of care has been shown to provide significant clinical benefit. Seventeen (17) chronic adult hemiparetic stroke survivors, enrolled at least 6 months after the onset of hemispheric stroke, have completed the study. None of the patients enrolled in the study were receiving active Occupational Therapy treatment at the time of enrollment. Two (2) baseline assessments were completed, interim assessments were completed at 4 weeks, 8 weeks and 12 weeks (Fig. 5). The primary outcome measure was the Fugl-Meyer, Upper Extremity (FMUE). From baseline to 12 weeks, patients (n=17) demonstrated a mean improvement of 9.18 with a SD of 5.836 (two-sided, one-sample t-test, p-value <.0001). This is well above the stated minimally clinically important difference (MCID) of 5.25 [64]. There are few comparators in the domain of UE rehabilitation interventions that yield this mean difference on the Fugl-Meyer assessment. *These*

findings support Aim 2 because they demonstrate that home- based use of the IpsiHand system can produce substantial clinical benefit.

Objectives:

The goal of this study is to **define the efficacy of fully remote home-based BCI therapy in chronic hemiparetic subcortical stroke patients**. A randomized controlled study using the integrated remote BCI system will be tested against standard exercise therapy to determine the efficacy of motor improvement in chronic stroke patients with an upper extremity hemiparesis. Specifically, the integrated BCI system will include 1) the remote motor assessment system (Digital Fugl-Meyer) and 2) the BCI-controlled robotic hand exoskeleton (i.e. IpsiHand).

Subject Selection:

PHI from records: Subjects will be recruited from patient populations of collaborators, and colleagues of the principal investigator. Subjects from previous research studies will also be recruited. Colleagues will provide study information to interested candidates, and candidates will contact the research team if they will to be screened by study staff. Subjects will also be asked to provide a current list of their medications. Other elements to be reviewed are CT and MRI imaging describing stroke locations and NIH Stroke Score.

PHI from Screening Process: Subjects to be interviewed regarding medical history and stroke symptoms to confirm inclusion criteria. It will be necessary to determine the location of the stroke and presence of hemiplegia to determine eligible candidates for study participation. Without this information, we will be unable to determine eligible patients. Only a small portion of stroke survivors will meet criteria for this study. It would not be practical to contact a stroke survivor without reviewing the chart. It may also be frustrating or disappointing for patients to be contacted about a treatment study for which they are completely ineligible.

Website: www.neurolutions.com or www.clinicaltrials.org

Existing Registry: Subjects from previous research studies of colleagues of the principal investigator will also be recruited. Colleagues will provide study information to interested candidates, and candidates will contact the research team if they wish to be screened by study staff. Specifically, subjects from the prior study, “Comparison in Performance of Physical Motor Assessment of In-Person Fugl-Meyer Compared to a Remote Based Evaluation of the Fugl-Meyer” will be recruited. The Washington University Subject Registry, Centerwatch, and Research Match registries will also be used for patient recruitment.

Study Methods

Study staff will screen subjects virtually or in person for eligibility after completing the informed consent process and documentation. After screening for study eligibility, the subject will be randomly assigned to **Group 1** or **Group 2**. Both groups will complete a phase 1 and phase 2 of the trial.

Screening for Eligibility

After the subject agrees to participate and completes the informed consent process and documentation, the subject will be screened for cognitive and language processing, motor function and visual attention using the following assessments.

Cognitive Function and Language Screening:

- Short Blessed Test for individuals without aphasia
- AD8 for individuals with aphasia
- MS Aphasia Test (Reading Instructions subtest only)

Motor Function Screening

- Active and passive range of motion measurement for upper extremities to confirm the patient has range of motion to comfortably fit and wear the hand orthosis.
- Modified Ashworth Scale of Elbow Flexion of the affected upper extremity.

Visual Attention

- Mesulam Cancellation Test (Unstructured)

Should the subject meet inclusion and exclusion criteria in the above screening process; the subject will be assigned to either **Group 1 or Group 2**.

Inclusion and Exclusion Criteria Applicable to Group 1 and Group 2

Subjects included for this study include:

1. Adults age (18-85)
2. Adults who sustained a CVA
3. Have upper extremity hemiparesis/hemiplegia

Group 1 Inclusion/Exclusion Criteria

1. Stroke survivors who have moderate functional impairment of the right or left upper extremity as evidenced by screening assessments completed may be included.
2. Adults who have sustained a stroke six or more months prior to enrollment may be included.
3. Subjects who are not receiving Botox Injections for the upper extremity may be included. Should a subject be receiving Botox injections for the upper extremity, they may be included but Botox administration must be timed to coincide within a week of the beginning of training.
4. Subjects who are too cognitively impaired to understand the task or provide informed consent will be excluded. A Short-Blessed Test score of 8 or more will be excluded.
5. Subjects who have contractures in the affected wrist and digits will be excluded, as the device will not comfortably fit.
6. Subjects who have receptive aphasia and unable to follow simple written directions will be excluded. A score of 6 or less on the MS Aphasia Screening Test will be excluded.
7. Subjects receiving any formal upper extremity therapy will be excluded.
8. Subjects with a Modified Ashworth Scale of elbow flexion in their affected upper extremity must not be 3 or greater.
9. Subjects who have unilateral visual inattention (neglect) will be excluded. The Mesulam Cancellation Test (MCT) – unstructured version will be completed. Subjects who obtain a score of 6 omissions or more unilaterally will be excluded.

10. Subjects with ataxia, apraxia, or severe psychiatric illness (other than post stroke depression) will be excluded.
11. Subjects who have nerve or sensory impairment that may limit or interfere with their ability to sense pain will be excluded.

Group 2 Inclusion / Exclusion Criteria

1. Stroke survivors who have moderate functional impairment of the right or left upper extremity as evidenced by screening assessments completed may be included.
2. Adults who have sustained a stroke six or more months prior to enrollment may be included.
3. Subjects who are not receiving Botox Injections for the upper extremity may be included. Should a subject be receiving Botox injections for the upper extremity, they may be included but Botox administration must be timed to coincide within a week of the beginning of training.
4. Subjects who are too cognitively impaired to understand the task or provide informed consent will be excluded. A Short-Blessed Test score of 8 or more will be excluded.
5. Subjects who have contractures in the affected wrist and digits will be excluded, as the device will not comfortably fit.
6. Subjects who have receptive aphasia and unable to follow written directions will be excluded. A score of 6 or less on the MS Aphasia Screening Test will be excluded.
7. Subjects receiving any formal upper extremity therapy will be excluded.
8. Subjects with a Modified Ashworth Scale of elbow flexion in their affected upper extremity must not be 3 or greater.
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10. Subjects with ataxia, apraxia, or severe psychiatric illness (other than post stroke depression) will be excluded.
11. Subjects who have nerve or sensory impairment that may limit or interfere with their ability to sense pain will be excluded.

All Subjects (Group 1 & Group 2):

Phase 1: All subjects will complete an EEG signal intent screening. Subjects will undergo an EEG signal intent screening protocol to ensure that a consistent control signal will be present to control the IpsiHand device. Each subject will complete a minimum of 1 and up to 3 EEG signal intent screenings. During each of these sessions, EEG signals will be collected while patients perform a visually-cued motor screening task consisting of 1) rest, 2) unaffected hand motor imagery, 3) affected hand motor imagery, and 4) bilateral motor imagery. During each EEG signal intent screening, subjects will wear a commercial EEG headset which is placed on the subject's head. After placing the headset on the subject, proper connection will be verified using impedance testing and/or signal inspection. Initially 7.5 minutes of baseline data will be recorded. Secondly, an overt motor screening task will be completed in which subjects will receive visual cues/prompts on a computer screen to perform random finger tapping movements of the left, right or both hands for a period of 5-10 seconds per cue. Subjects will be instructed to imagine movements of the affected hand if they are unable to perform movements overtly.

Each EEG signal intent screening session will consist of 12 repetitions of each (rest, left hand only, right hand only, both hands). After an EEG signal intent screening session is complete, the subjects screening data will be analyzed to ensure that sufficient cortical signals are present. EEG signal intent screenings will take place in person, while all therapeutic use of the system will be completed and monitored remotely. Spectral power changes will be examined to ensure that the subject has neural activity present in the unaffected hemisphere allowing for dissociation of movement of the affected hand from rest using an r-squared analysis. Furthermore, subjects with significant power changes but with power changes not located at electrode locations of the motor and premotor cortical areas. If consistent signals are found, the subject will be randomized to either group 1 or group 2. Once randomized to their group, they will then continue to phase 2.

Phase 2, Group 1 Subjects: Group 1 subjects will be provided with a Neuroolutions IpsiHand BCI system, which combines a novel powered exoskeleton with a commercial EEG amplifier and active electrode system. The exoskeleton opens and closes the patient's hand in a three-finger pinch grip. The system will use spectral power changes to control the hand position [41]. During movement trials subjects will try to open their hand by performing motor imagery, and to close their hand they will rest. Patients will use the BCI system on a minimum of 5 days per week for 12 weeks. Subjects will complete five or more 10-minute runs of the BCI task per day.

Phase 2, Group 2 Subjects

After being assigned to Group 2, subjects will serve as the control group in the study. Subjects will receive a customized home range of motion exercise program. Subjects will be recommended to complete their exercises daily, 5 out of 7 days per week for 12 weeks to control for the non-specific motor and sensory effects of BCI training. To help ensure compliance with the at-home portion of the protocol in the control group, subjects will receive a daily log to track the dates they complete their home range of motion exercise program.

Baseline Motor Assessments – All Subjects (Group 1 and Group 2)

(Overview) All subjects (Group 1 and Group 2) will complete therapy baseline measures. After baseline scores are established, subjects will receive training to their specific assigned group. Group 1 subjects will receive training on how to safely use the IpsiHand BCI System. They are to utilize the device for daily training 5 out of 7 consecutive days for a minimum duration of 12 weeks. Group 2 subjects will receive training to address how to safely complete the standardized home exercise program. They are to complete their standardized exercise program 5 out of 7 consecutive days for a duration of 12 weeks.

Baseline Assessments (All Subjects)

After Phase 1 – EEG signal intent screenings are complete. Subjects randomized in Group1 or Group 2 will complete baseline motor assessments in office. The baseline measures include:

- **Primary Outcome Measure:** Fugl-Meyer – Upper Extremity (UEFM) , Manual Long Form
- Remote Fugl-Meyer (Digital Fugl-Meyer)
- Modified Ashworth Scale (Elbow Flexion)
- Pinch force (Dynamometer)
- Gross Grasp Force (Dynamometer)
- Motricity Index (Shoulder, Elbow, Pinch)
- Western Aphasia Battery (Bedside Record Form)
- Timed Up and Go Test
- 10 Meter Walking Test
- Arm Motor Ability Test (4 Subtests Only)
- Trails A & B
- Modified Rankin Scale

- PHQ-9

After the baseline motor assessments have been completed, the subject will receive full training and skilled education addressing the set-up, management, and use of the BCI device for home therapy or standard of care home exercise programs. The robotic orthosis will be fitted to the subject. All questions will be addressed from the subject. The subject will also receive detailed education regarding how to properly clean and store the device when not in use. The subject will be advised to utilize the device a minimum of five out of 7 consecutive days weekly for a total minimum duration of 12 weeks. The clinical specialist will also issue a home exercise program customized to the subject.

Intermittent Remote Motor Assessments (All Subjects):

All subjects (Group 1 and Group 2) will complete the Digital Fugl-Meyer every two weeks for the 12-week duration of their study participation.

Final Visit – Completion Visit (12 Week Time point)

All subjects (Group 1 and Group 2) subjects will be seen at their 12-week time point to assess post-treatment outcomes. They will complete a 12-week completion data of the following assessments:

- **Primary Outcome Measure:** Fugl-Meyer – Upper Extremity (UEFM) , Manual Long Form
- Remote Fugl-Meyer (Digital Fugl-Meyer)
- Modified Ashworth Scale (Elbow Flexion)
- Pinch force (Dynamometer)
- Gross Grasp Force (Dynamometer)
- Motricity Index (Shoulder, Elbow, Pinch)
- Western Aphasia Battery (Bedside Record Form)
- Timed Up and Go Test
- 10 Meter Walking Test
- Arm Motor Ability Test (4 Subtests Only)
- Trails A & B
- Modified Rankin Scale
- PHQ-9

For the subjects final Motor Assessment Visit (12 weeks), each subject will also be asked to complete a patient experience survey as it relates to user experience of the device.

Group 1 - At final visit, all subjects in group 1 will also be asked to complete the EEG Signal Intent Test which was completed at enrollment to be compared to baseline screening data.

Group 2- After final visit, all subjects in group 2 will be provided with a voucher in which they can obtain and use the Neurolutions Ipsihand commercially for 12 weeks. Education on process will be provided at this time. The use of the Neurolutions Ipsihand post 12 week assessment will not be part of this study and will not be part of data collection. The choice to use the device is up to the participant.

All visits in Phase 2 will be video recorded for research purposes only.

Reimbursement for Participation

Monetary reimbursement will be provided for all subjects (Group 1 and Group 2). Each subject will be provided with \$200 compensation in the form of a Visa gift card at completion of 12-week protocol.

Risk / Safety Information (IpsiHand Device Use):

Likely: None

Less Likely: Fatigue from repetitive computer tasks and/or frustration. Eyestrain and fatigue could result from prolonged attempts, watching the computer screen throughout.

Rare: Minor discomfort associated with muscle stimulation.

A trained research staff member will be available while the subject is participating in any portion of the research study. During experimentation, subjects will be reminded that they may stop the study at any time and they can delay or terminate any sessions if they are experiencing discomfort. From a technical standpoint, in Phase 1 the data recording equipment is a research-grade EEG headset. Given its extremely low battery requirements there is no risk associated with its use. The robotic hand orthosis will be operated to move the subject's hand within their physiologic range of motion and will not exert forces great enough to physically harm the patient.

Additionally, participation is voluntary, and the individual may choose to terminate at any time.

Study Oversight:

The decision to participate in this study is voluntary. The subject may choose to not participate or may withdraw from the study for any reason without penalty or loss of benefits to which are otherwise entitled and without any effect on future medical care.

The principal investigator or the sponsor can stop one's participation at any time without the subject's consent for any reason. Some reasons may include, but are not limited to:

- If it appears to be medically harmful to the subject.
- If the subject fails to follow directions for participating in the study.
- If it is discovered that the subject does not meet the study requirements.
- If the study is canceled; or
- For administrative reasons, including competitive enrollment – the target number of subjects has entered the study

The study physician / principal investigator of the study will provide oversight throughout the clinical trial.

Data Analysis / Management:

The data will be analyzed with multiple techniques:

1. Multiple mathematical algorithms will be used to translate raw analog electrocortical activity into a statistically significant signal profile. These would include such approaches as the autoregressive analysis, fast fourier transforms, analysis of variance, SNR technique, Cross Correlation Signal Technique, Etc. These methods would primarily be used for offline analysis of signals.
2. Online signal profiles would then be utilized to generate control output activity by the brain computer interface software/computer. The correlation between intended activity by the subject and the output activity from the brain computer interface program would be compared to assess the efficacy of the interface system.
3. Various task templates for a given signal profile could be utilized to assess which template provides output activity with the highest efficacy.

4. In phase 2, tests of motor function (UEFM, Motricity Index, Modified Ashworth, Dynamometer gross grasp at baseline, during use of the device, and post using the device will be used to test the impact of the device on the rehabilitative effects of upper extremity function.
5. In phase 2, baseline and post treatment scores on the Digital Fugl-Meyer and UEFM will be used to test the functional impact of the device on rehabilitation goals.
6. Also in phase 2, a subject experience/subjective questionnaire will be completed post treatment to assess user experience and collect subjective input.

The in-person Fugl-Meyer (UEFM) will serve as the primary measure of statistical success. Because we will use baseline tests before treatment begins, we will use a repeated measures test, such as paired t-test assuming a normal distribution of scores. The Upper Extremity portion of the Fugl-Meyer Assessment (UEFM) assesses motor impairment in the affected upper extremity. The key statistical outcome will be based on the subtest grasp as the device has the greatest potential impact on this domain. Power estimates suggest that 10 subjects will be sufficient for significant results in a paired T-test; up to 80 patients will be enrolled to allow for attrition.

The number of subjects utilized for evaluation of BCI control and BCI-based rehabilitation are similar to other peer-reviewed research studies within these areas of research; therefore, the number of subjects should be adequate to meet the aims of the study.

Confidentiality:

All clinical and experimental data will be de-identified by being assigned a randomly generated code. Additionally, all traceable data from copied medical records will also be removed.

- Paper / Hardcopy records will be kept in a locked cabinet in a locked office suite. Only study staff will have access.
- Electronic records will be stored on a lab computer in a password-protected file with access restricted to study team members only. All clinical and experimental data will be given a randomly generated code. All traceable information from copied electronic medical records will be removed. All information will be saved on a lab computer in a password-protected folder. The home exercise usage data that is wirelessly uploaded will be coded with the subject's study number – rather than PHI.

PHI from Screening Process: All identifying information will be stored in a password-protected file at the study site of the principal investigator or collaborators and will not be accessed at any offsite location. Only study team members will have access to the password.

After the research project is completed, the principal investigator will delete all electronic files and shred any paper forms containing identifiers.

The research team agrees that the requested information will not be reused or disclosed to any other person or entity, except as required by law, for authorized oversight of the study, or for other research for which the use of disclosure of the requested information would be permitted by HIPAA Privacy Rule.

A member of the research team may discuss the study with the subject in person or by phone to describe the study to the patient and determine if they are willing to participate. However, the patient will be consented in person.

Intended Use of the Data:

The ultimate goal of this project is to develop a functioning and clinically feasible method for restoring function to motor impaired stroke survivors. This ultimate goal is to develop a system that allows for enhanced functional capability and works consistently over a long-term basis.

In developing a new rehabilitation method, we hope to create a system that allows for closed loop feedback through a robotic hand orthosis on the motor impaired side of stroke patients in response to intended movements of the muscles. The method, if successful, would represent an ideal, non-invasive method of promoting motor learning and recovery in stroke survivors. The initial stages of development would be identical to that of the brain computer interfaces, as both methods involve decoding ipsilateral motor intent and processing the intent in real-time.

Moreover, the techniques themselves provide a substantive advance in decoding the electrical signals associated with stroke that are produced in the brain. Using the information acquired and decoded from the BCI rehabilitation experiments also provides substantive insight into fundamental location and dynamic working of the human cortex in cases of severe strokes. This improves neuroscience insights and has direct and practical benefits. This new time of information provides the potential to significantly improve the resolution of brain mapping and the opportunity to further understand the role of the cortex in controlling motor activity in both healthy individuals and stroke survivors.

The ability to operate robotic hand orthosis using electrical signals of the brain is rapidly leaving the realm of science fiction and becoming a realistic goal of the clinical community. The current advances in BCI controlled neuroprosthetics could have immeasurable influence on adult patients with severe motor impairments from stroke. Even further on the horizon the insights developed from such work could substantively alter the way all stroke patients are treated and rehabilitated.

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