

Brain Computer-Interface System – The Benefits of it for Patients with Amyotrophic Lateral Sclerosis

Evan Salo Kochumman

Tbilisi, Georgia

Purpose

To explore and analyze how the Brain-Computer Interface aids patients with Amyotrophic lateral sclerosis (ALS) afflicted with Locked-In Syndrome (LIS) by enabling them in their movement and communication.

Introduction

Amyotrophic lateral sclerosis is a rare terminal neurodegenerative disorder that affects the motor neurons in the brain and spinal cord, resulting in progressive weakening and atrophy of the muscles. Brain-Computer Interface (BCI) was used as a communication method for a patient with late-stage ALS characterized by aphonia and quadriplegia, with retention of normal cognitive function. The use of the implanted device combined with automated decoding software, enabled independent communication in patients with the use of typing software.

Method

A 58 year-old female with late-stage ALS was able to communicate with her eyes with the help of an eye tracker. She is completely paralyzed and indicates a score of 2 on the ALS functional rating scale on a scale of 0 (high impairment) to 40 (low impairment). A BCI device of subdural electrode strips were implanted through burr holes over the sensorimotor prefrontal cortex by functional MRI and neuro-navigation. The elements of the BCI system also include the transmitter, receiving antenna, receiver and a tablet. After 28 weeks of implantation, the patient was asked to do computer tasks by trying to move the hand on the side opposite the implanted electrodes. The patient was also able to spell words correctly on the screen by selecting each letter.

Result

The performance of the patient doing algorithm tests and spelling on the tablet, improved over time showing a correct mean of over 90%. Consistent functional MRI activity was observed in the left sensorimotor hand area when the patient tried to move her hand. The patient was also asked to rate the visual-analogue scores for mood which consistently showed below 30% (lower limit for depression). She was able to use the system at home with minimal assistance and reported high levels of satisfaction with the device.

Conclusion

The patient, with the help of a completely implanted BCI system, was able to control a typing communication software, although at a slow rate. Hence, this system is seen to be effective in the long-term management of ALS patients.

Keyword

Brain-Computer Interface System, Amyotrophic Lateral Sclerosis, Functional magnetic resonance imaging, Locked-In Syndrome