Novel, Real-Time Method for Brain Mapping

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Technology description

Neurologists at the University of California, San Francisco have developed an innovative method for accurately mapping cortical brain function that can be used for real-time analysis during surgical procedures. Using simple physiological activities, such as speaking, listening, hand button pressing and tactile somatosensation, the investigators were able to accurately map cortical regions in epilepsy patients within seconds. Neural activity is recorded using probes that are routinely employed for other clinical purposes. Furthermore, an average of only five trials was needed to produce a stable representation of cortical function. This novel technique and the associated algorithm allow for the safe, real-time localization of cortical function. Near-instantaneous visualization with clear spatial and temporal resolution is achieved through the use of a user-friendly graphical interface.
Current and future work is focused on continuing validation of the technology in human subjects, with plans to carry out a larger prospective clinical trial.
The ability to map important brain regions (e.g. sensory and motor cortex) is critical for surgical procedures that require precise information of neural activity so that neurosurgeons can safely operate. The current state of the art relies on electrical cortical stimulation that is not only inefficient but also relies on electric shock thereby generating non-physiologic activity from the areas sampled, and such stimulation can also cause dangerous seizures. Furthermore, electrical stimulation mapping frequently misrepresents and underestimates the extent of the functional cortex, leading to neurologic impairments in patients despite comprehensive mapping. Additionally, inaccurate mapping by electrical stimulation may also lead to incomplete resection of a tumor or epilepsy focus to preserve the tissue whose function is not clearly identified or incomplete, resulting in tumor regrowth or continued intractable seizures, respectively.
What neurologists and neurosurgeons need is a safe and efficient functional brain mapping tool that will allow them to accurately perform cortical tissue resections without compromising critical brain regions.

Additional Information

Related Materials

Cheung C, Chang EF. Real-time, time-frequency mapping of event-related cortical activation. J Neural Eng. 2012 Aug;9(4):046018. Epub 2012 Jul 19.

Application area

Real-Time Analysis: Spatial and temporal localization of cortical function. High resolution, user-friendly graphical interface.

Safe: Method does not use electrical stimulation. Neural activity is passively recorded while patients undergo normal behavior.

Speed: Algorithm generates a robust functional motor and sensory cortical map within seconds and may help to reduce operation times.

Accurate and Reproducible: Stable representation of physiologic cortical activity reached within a few repetitions.

Advantages

Clinical applications: Real-time cortical brain mapping during surgical procedures without the need for offline analysis.

Research applications: Comprehensive cortical mapping and neuroscience research. Extraction of multi-channel neural activity for real-time brain-machine interfaces.

Institution

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