

Concentric Ring Electrodes and Epilepsy

Kevin Sylvestre - University of Rhode Island - Biomedical Engineering

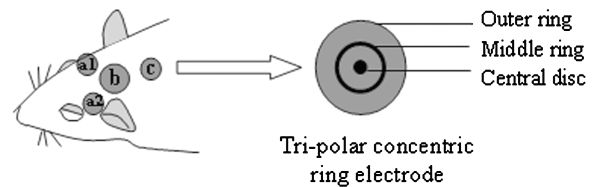
Intractable seizures are seizures which are difficult to control, despite medical treatment. Often, these types of seizures must be treated with invasive surgeries to attain some seizure control. About 25% of epilepsy patients suffer from intractable seizures. One of the major results of untreated seizures is a condition known as status epilepticus (SE), a continuous unremitting seizure lasting more than 30 minutes. This can lead to behavioral disturbance, as well as accidental death.

However, researchers have begun testing ways to interrupt SE, and eliminate electrographic and behavioral seizure activity, effectively curing the untreatable seizures. One of the most promising methods for this interruption is by transcutaneous electrical stimulation (TcES), via tripolar concentric ring electrodes, developed by our own Dr. Walter Besio.

The traditional disc electrode consists of a metal disc, which provides high temporal resolution in recording neural activity, but low spatial resolution. Since it is important to pinpoint the source of seizure activity, spatial resolution had to be improved. The concentric ring electrodes provide increased spatial resolution as it can resolve reference electrode problems and orientation problems. Its unique configuration allows for more precise locating of signals, and consequently, more precise TcES.

In an experiment carried out in 2007, Besio et al. experimented with 16 rats, 8 in a control group and 8 in the experimental group. Both groups would be injected with pilocarpine HCl to induce a seizure. The experimental group would receive TcES with the concentric ring electrodes, and the control group would not. It was determined that the control group

progressed through all of the stages of classical pilocarpine-induced SE, and expired within an average of 15 hours. The experimental group, however, experienced reduced electrographic activity in all cases. In 7 of 8 cases, the activity returned to the baseline after 1-3 TcES applications. In the other case, there was mostly baseline activity, with some spiking activity for several hours.



Unlike with transcranial electrical stimulation (TES), there were no tonic contractions, aversion responses or escape behavior elicited by the rats experiencing TcES, indicating the process was probably painless.

This is potentially a great step toward a cure for epilepsy, and could, one day, be particularly helpful for treating those patients who suffer from intractable seizures.

References:

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