The IEEE Pittsburgh Section Signal Processing and Engineering in Medicine & Biology Society Chapters Present:

Skin-Screw Electrodes for EEG Recordings

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11:45 to 12:00 – Refreshments
12:00 to 1:00 - Presentation

The electroencephalogram (EEG), as a commonly utilized clinical diagnostic tool, provides a unique window to observe the functional activity within the brain. Recent technological advances in electronic and computer systems have allowed over one-hundred EEG channels to be recorded simultaneously and modern signal processing techniques have provided new insights into the recorded data in both the temporal and spatial domains. Despite these technological advances, affixing EEG electrodes on the human scalp requires a manual procedure which is a long, painstaking process for both the EEG technician and the person being studied. The labor and facility usage costs for electrode installation have been a significant portion of the total cost of clinical EEG study and have significantly hindered the acceptance of large-array EEG in clinical applications.

Our group has developed a new electrode, called skin screw electrode, which can be installed within the hairy regions of scalp in a second. The body of the electrode is made of metal and shaped like a thin-wall cup. The bottom rim of the electrode has numerous microscopic, razor sharp teeth in a small incident angle to the skin. When the electrode is lightly pressed and twisted clockwise on skin, the teeth penetrate through the stratum corneum, reaching the low-resistant portion of the skin, and then move horizontally under the stratum corneum. The penetration depth is tightly controlled by the shape design of the teeth without causing pain and adverse effects. This electrode requires no applications of electrolyte gel and adhesive. The electrode impedance is on the order of $5K\Omega$ and is very stable over time. The skin contact part of the electrode or the entire electrode is of low cost and disposable. This electrode is also suitable for electrophysiological studies on animals.

Wenyan Jia, Ph.D., received a Ph.D. in biomedical engineering from Tsinghua University in 2005. She joined the University of Pittsburgh as a post-doctoral associate focused on brain function analysis using electroencephalography/magneto-encephalography(EEG/MEG) and image processing. Currently she is a Research Assistant Professor of Neurosurgery. Her research interests include biomedical signal/image processing and brain-computer interface.