(1) Presentation Title: Assessment of Possible Salt Bridge Shorting Between Tripolar Concentric Ring Electrode Recording Surfaces Using Linear and Nonlinear Signal Synchrony Measures on Resting Human Electroencephalogram Data

(2) Research Focus: Biomedical Engineering

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(7) Presentation Preference Type: Poster

(8) Abstract:

Despite being a necessary direction of future work, the possibility of salt bridge shorting in concentric ring electrodes (CREs) is yet to be studied extensively. This study assessed salt bridge shorting by directly comparing signals from individual recording surfaces of a tripolar CRE to each other on resting human electroencephalogram (EEG) dataset from [1], [2], [3] using both linear and nonlinear signal synchrony measures. For a baseline to compare aforementioned synchrony measures against, previous studies [1], [2], [3] on the same human EEG dataset were used where same signal synchrony measures were applied to the outer ring of tripolar CRE and a separate conventional disc electrode, making salt bridge shorting impossible.

To record the resting EEG activity of six human subjects (ages 24-40, one female) they were instructed to remain motionless while seated, reducing induced movement artifacts. From tripolar CREs and conventional disc electrodes, some monopolar/recording surface signals (e.g. from the outer ring) and differential signals (from pairs of recording surfaces for tripolar CRE only), were concurrently recorded at location P4 of the standard 10-20 system with reference and ground at the right mastoid process. Middle ring and central disc channels were not recorded directly, obtained through addition and subtraction of other monopolar and bipolar channels. All the channels compared were normalized once to zero mean and unit standard deviation. For linear signal synchrony measures, time domain cross-correlation [1] and frequency domain coherence [2] were used. For nonlinear signal synchrony measure, normalized mutual information was used [3].

All performed comparisons between recording surface pairs of a CRE resulted in signal synchrony measures with values of less than 1. Some were even lower than the baseline values

obtained for two separate electrodes [1], [2], [3]. This allowed demonstrating for the first time that signals recorded by different recording surfaces of a tripolar CRE were not identical thus confirming that there was no salt bridge shorting for this electrode on this dataset.

Acknowledgement: The authors gratefully acknowledge Dr. Yacine Boudria for collecting the human data in [1], [2], [3].

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