**Disruption of Resting State Network Characterized by Cross Frequency Coupling (CFC) During Cortical Spreading Depression**

**Zhang T** and Nemoto EM

*University of New Mexico, Department of Neurosugery, Albuquerque, NM 87131*

*Corresponding Author:* [*Enemoto@salud.unm.edu*](mailto:Enemoto@salud.unm.edu)

**Abstract:** Cortical spreading depression (CSD) initially observed in 1940 by Leao have long been observed in animals (1). However, in the past 20 years efforts have been made to demonstrate the phenomenon in humans (Strong) which has been successfully and consistently demonstrated (2). CSD have been suspected of contributing to the severity of injury in the injured brain due to the marked increase in metabolism and oxygen demand at a time when perfusion and thereby oxygen delivery may be severely compromised as in stroke or traumatic brain injury. However, attributing worse outcome after brain injury whether traumatic brain injury (TBI) or cerebrovascular accidents (CVA) due to occurrence of CSD is difficult because although worse outcome may ensue after TBI or CVA with CSD, which is cause and effect cannot be determined. Therefore the question remains, is CSD in and of itself capable of injuring the brain and if so how many repetitive CSD will affect or alter brain function? Using electrically induced repetitive CSD, Male SD rats under urethane 1.5 g/kg, i.p. anesthesia, we placed Ag/AgCl ball electrodes over the parietal cortex covering the somatosensory cortex. Evoked potential (EP) electrodes were inserted into the region of the contralateral vibrissae region stimulating at 1.5 sec at 2 mA, 2 ms duration. The placement of the cortical recording electrodes via high input impedance bioamplifiers (BIOPAC, Goleta, CA). A craniotomy (3 mm diam) was made between the electrodes for the placement of a Ag/AgCl electrode for stimulation at 1.5 mA, 10 Hz, 2 sec duration. These electrical stimulations were made every 12-15 min to induce CSD. For cross frequency coupling analysis, we selected an approach that could handle a biphasic coupling mode. We selected lower delta waves at 0.1~2 Hz as a predictor in GLM procedure. The phases are wrapped to –. to .. We then study the phase of this low frequency band cross coupling to 4 physiological neuronal activity frequency bands, i.e., /(5~7 Hz), 0 (8~12 Hz), 1 (13~30 Hz) and 2 (30~80 Hz). The figure below shows the coupling strength between delta and theta, alpha beta and gamma frequencies showing the progressive decrement in delta-gamma and beta-gamma coupling with each CSD. Increased delta-gamma decoupling was observed with repeated CSD of up to 20 repetitive CSD.



**Fig.** CFC changes with repetitive CSD.