Alzheimer's & Dementia®
THE JOURNAL OF THE ALZHEIMER'S ASSOCIATION

BIOMARKERS

POSTER PRESENTATION

BIOMARKERS (NON-NEUROIMAGING)

What a single electroencephalographic (EEG) channel can tell us about Alzheimer's disease patients with mild cognitive impairment

Federico Tucci[1] | Claudio Del Percio[1] | Susanna Lopez[1] | Giuseppe Noce[2] |
Roberta Lizio[1] | Andrea Soricelli[3] | Raffaele Ferri[4] | Flavio Nobili[5] |
Dario Arnaldi[5] | Francesco Famà[6] | Carla Buttinelli[1] | Franco Giubilei[1] |
Moira Marizzoni[7] | Bahar Güntekin[8] | Görsev Yener[9] | Fabrizio Stocchi[10] |
Laura Vacca[11] | Giovanni B Frisoni[12] | Claudio Babiloni[1,13]

[1]Sapienza University of Rome, Rome, Italy

[2]IRCCS Synlab SDN, Naples, Italy

[3]University of Naples Parthenope, Naples, Italy

[4]Oasi Research Institute - IRCCS, Troina, Italy

[5]University of Genoa, Genoa, Italy

[6]Dipartimento di Neuroscienze, Oftalmologia, Genetica, Riabilitazione e Scienze Materno-infantili (DiNOGMI), Università di Genova, Genova, Italy

[7]Laboratory of Alzheimer's Neuroimaging and Epidemiology (LANE), IRCCS Istituto Centro San Giovanni di Dio Fatebenefratelli, Brescia, Italy

[8]Istanbul Medipol University, Istanbul, Turkey

[9]Izmir Biomedicine and Genome Center, Izmir, Turkey

[10]IRCSS San Raffaele Pisana, Rome, Italy

[11]IRCCS San Raffaele Pisana, Rome, Italy

[12]University Hospitals of Geneva, Geneva, Switzerland

[13]Department of Physiology and Pharmacology, Sapienza University of Rome, Rome, Italy

Correspondence
Federico Tucci, Sapienza University of Rome, Rome, Italy.
Email: federico.tucci@uniroma1.it

Abstract

Background: Abnormalities in the neurophysiological oscillatory mechanisms generating dominant resting-state eyes closed electroencephalographic (rsEEG) rhythms portray the Alzheimer's disease (AD) continuum, from the preclinical to the dementia stage. Here, we tested whether these abnormalities may be reproducible by analyzing the rsEEG signals acquired in bipolar configuration with a montage consisting of only four centro-parietal and parieto-occipital channels (C3-P3, C4-P4, P3-O1, and P4-O2) in patients with mild cognitive impairment (MCI) due to AD (ADMCI).

Method: To evaluate the study hypotheses, clinical, neuropsychological, anthropometric, genetic, cerebrospinal fluid (CSF), MRI, and rsEEG data in 70 Nold and 75 ADMCI subjects from an international archive were used in the present study. The subgroups were matched for age, gender, and education. In all subjects, rsEEG recordings lasted about 3-5 minutes. The rsEEG data were recorded with a sampling frequency of 128-512 Hz and related antialiasing bandpass between 0.01 Hz and 60-100 Hz. Electrode montage included 19 scalp monopolar sensors placed following 10-20 System. The rsEEG rhythms were investigated at individual delta, theta, and alpha frequency bands as well as fixed beta (14-30 Hz) and gamma (30-40 Hz) bands.

Result: Results confirmed previous evidence about the abnormalities of the delta, theta, and alpha rhythms in ADMCI patients compared to Nold subjects. Moreover, as compared to the Nold group, the ADMCI group showed increased delta power density and decreased alpha power density at the C3-P3, C4-P4, P3-O1, and P4-O2 bipolar channels. Increased theta power density for ADMCI patients was observed only at the C3-P3 bipolar channel. Best classification accuracy between the ADMCI and Nold individuals reached 81% (area under the receiver operating characteristic curve) using Alpha2/Theta power density computed at the C3-P3 bipolar channel.

Conclusion: The current findings provide evidence in the potential use of rsEEG low-channel portable devices as a topographic biomarker of cognitive decline within the extensive screening of in elderly population at risk of developing AD- or other dementia-related disorders. Moreover, the confirmation of this hypothesis would have exciting applications in the framework of telehealth home monitoring of global brain functions.

Composite biomarkers of bipolar rsEEG spectral power density
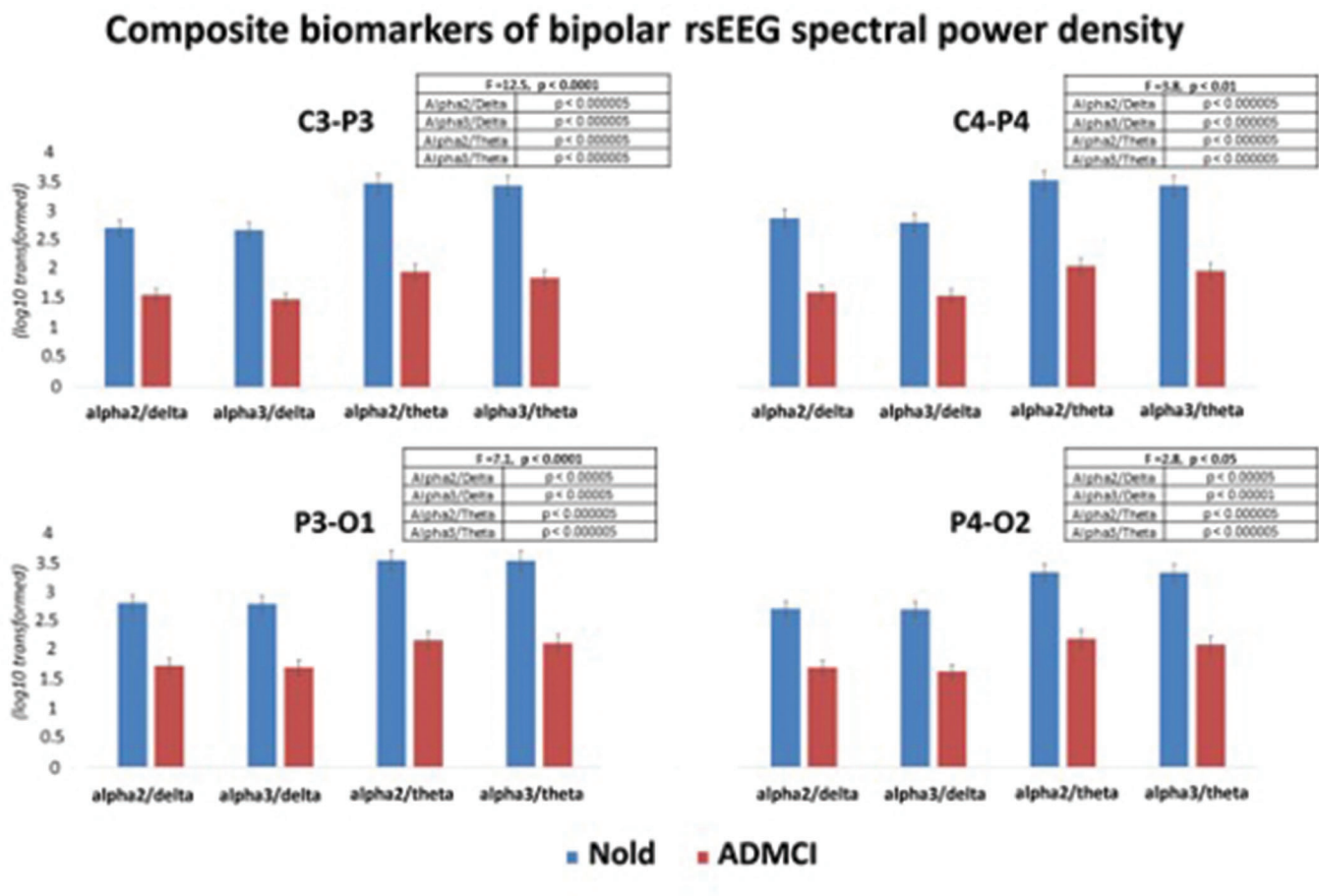
ROC curves of ADMCI vs Nold individuals classification