Comparative Efficacy of BEAM EEG and MMSE in Early Detection of Mild Cognitive Impairment:

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Introduction: Alzheimer's disease (AD) is a progressive neurodegenerative disease. AD and its precursor state, mild cognitive impairment (MCI), is often screened for using tools such as the Mini-Mental State Examination (MMSE). However, its efficacy at identifying early stages of MCI is inconsistent. BEAMTM (Biomarker-based Electrophysiology for Advanced Monitoring) is a novel platform utilizing neurotechnology to evaluate electroencephalograms (EEGs) administered under neurocognitive testing to identify event-related potential (ERPs) that are early biomarkers of MCI.

Objective To evaluate the effectiveness of BEAMTM in predicting MCI by analyzing the correlation between BEAMTM biomarkers and age, compared to MMSE scores and expected values for MCI patients.

Methods A retrospective chart review was conducted at Hawaii Pacific Neuroscience for patients who underwent BEAMTM testing from March to June 2024. We identified 104 patients diagnosed with MCI based on current MMSE scores who completed EEG testing under resting state (eyes-open and eyes-closed, 5-minutes each) and three scenarios: Auditory Oddball (AO), 3-Choice Vigilance Test (3CVT), and Standard Image Recognition (SIR).

Results Mean MMSE was 24.47 and negatively correlated with age ($r = -0.31$, $p < 0.05$). Resting state peak alpha scores were weakly indirectly correlated with age ($r = -0.20$, $p < 0.05$). AO N1 peak latency exhibited a stronger direct correlation with age ($r = 0.34$, $p < 0.05$). AO P300 max latency was weakly directly correlated with age ($r = 0.23$, $p < 0.05$). 3CVT P2 peak latency was positively correlated with age ($r = 0.40$, $p < 0.05$). Accuracy was indirectly correlated with age in 3CVT ($r = -0.24$, $p < 0.05$) and SIR ($r = -0.33$, $p < 0.05$).

Conclusion BEAMTM parameters, particularly AO N1 peak latency and 3CVT P2 peak latency, can be useful biomarkers for cognitive decline. The significant correlations between BEAMTM biomarkers and age highlight its potential in clinical settings for diagnosing MCI.