

TRANSIENT BETA EVENTS DIFFERENTIATE SUCCESSFUL COGNITIVE AGEING AND MILD COGNITIVE IMPAIRMENT

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Successful cognitive ageing appears to be associated with a distinct pattern of transient beta-band brain activity, and these event-based electroencephalography measures may be more sensitive markers of cognitive health than traditional average beta power measures.

INTRODUCTION

Successful cognitive ageing (SCA): preserved cognitive performance despite advanced age and age-related brain changes^{1,2}.

The **neurophysiological mechanisms** supporting cognitive resilience of SCA in the oldest-old, and their differences from pathological ageing, remain poorly understood.

Changes in resting-state beta-band oscillations (12-30 Hz)

Time-averaged spectral power may obscure underlying signal structure³.

Do transient beta-event dynamics reveal cognitive ageing differences³?

METHODS

Participants: 34 Spanish older adults (18 SCA and 16 with Mild Cognitive Impairment, MCI); 85 ± 2 years).

Electroencephalography (EEG): 5 min eyes-closed resting-state

Beta event expression characterised in **Precuneus** (brain region vulnerable to ageing and Alzheimer's disease).

Beta spectral event features were quantified^{3,4} (i.e., **event rate, duration, frequency span, and power**) and compared between groups.

RESULTS

Clear event-like patterns found in beta-band activity in Precuneus (PC), with significant group differences identified in their expression: Compared with the MCI group, the **SCA individuals showed a lower rate of beta events and a broader frequency span**, whereas no group differences were observed in event duration or power.

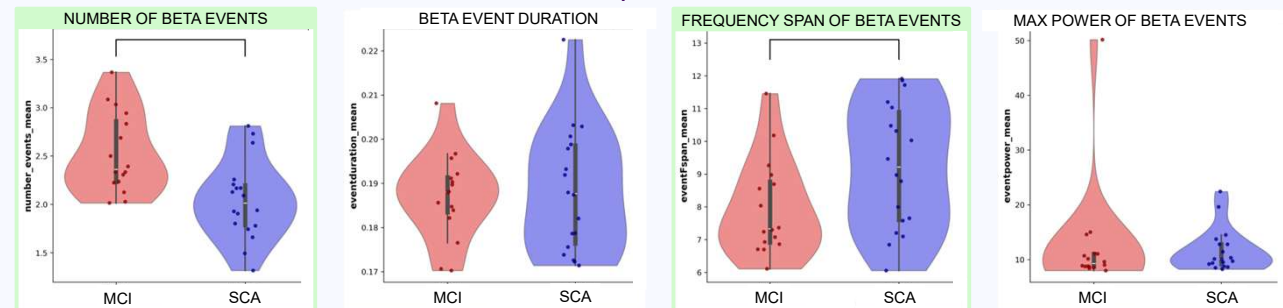


Figure 1. Beta event feature distribution. Mean and distribution of event features for successful cognitive ageing (SCA) and mild cognitive impairment (MCI) groups in beta [12-30] Hz frequency bands. T-test statistically significant p-values ($p < 0.05$) highlighted in green.

CONCLUSIONS

Divergent beta-band dynamics between successful and pathological cognitive ageing in the oldest-old, may indicate a potentially sensitive biomarkers of cognitive health in late life. Our findings highlight the value of event-based EEG analyses for identifying neural signatures of resilience in cognitive ageing.

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