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• **Supplementary File** •

Dysfunctional resting-state EEG microstate correlated with the severity of cigarette exposure in nicotine addiction

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Appendix A Methods

Appendix A.1 Demographic and clinical characteristics

Table A1 Demographic and clinical characteristics.

characteristic	The smoking group	The control group	P-value
Education, years	15.5(2.2)	15.3(1.1)	0.66
Pack-years	4.5(2.7)	-	-
FTND score	4.7(2.3)	-	-
PANAS			
Positive	29.10(6.6)	31.71(6.0)	0.19
Negative	19.75(8.8)	24.62(8.2)	0.07

Values are means (1 standard deviation). PANAS, Positive and Negative Affect Schedule.

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† Yan Cheng and Junjie Bu have the same contribution to this work.

Appendix A.2 inclusion criteria and exclusion criteria

Inclusion criteria in the experiment:the participants who met the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) criteria for nicotine addiction as the smoker group, as well as smoked 10 or more cigarettes per day for at least two years; right-handed; aging between 18 and 30 years; with normal vision or corrected normal vision, aging between 18 and 30 years [mean = 24.4 and SD = 2.8], education years [mean = 15.5 and SD = 2.2]. All participants were in good mental and physical health evaluated by a short diagnostic interview through Mini-International Neuropsychiatric Interview [1]. The exclusion criteria included: chronic neurological, medical conditions, or psychiatric; received any medical treatment in the past 3 months. The study is a single-blind, randomized, healthy controlled design. In our experiment, participants came to the lab. According to their own wills, participant could choose whether to smoke a cigarette or not. If they choose to smoke a cigarette, they will be asked to withdraw for two hours. After that the EEG data was collected. Participants were instructed to sit on a soft sofa and asked to remain awake with eyes closed in the recording room with a proper lighting brightness. For each Participant, considering that the resting 'state' is a dynamic mixture of wakefulness and different sleep stages. 30% of subjects do not maintain wakefulness for over 3 minutes in resting state [2], the first 60s long continuous data were selected for the microstate analysis. The research program was approved by Human Ethics Committee of the University of Science and Technology of China.

Appendix A.3 Microstate analysis methods

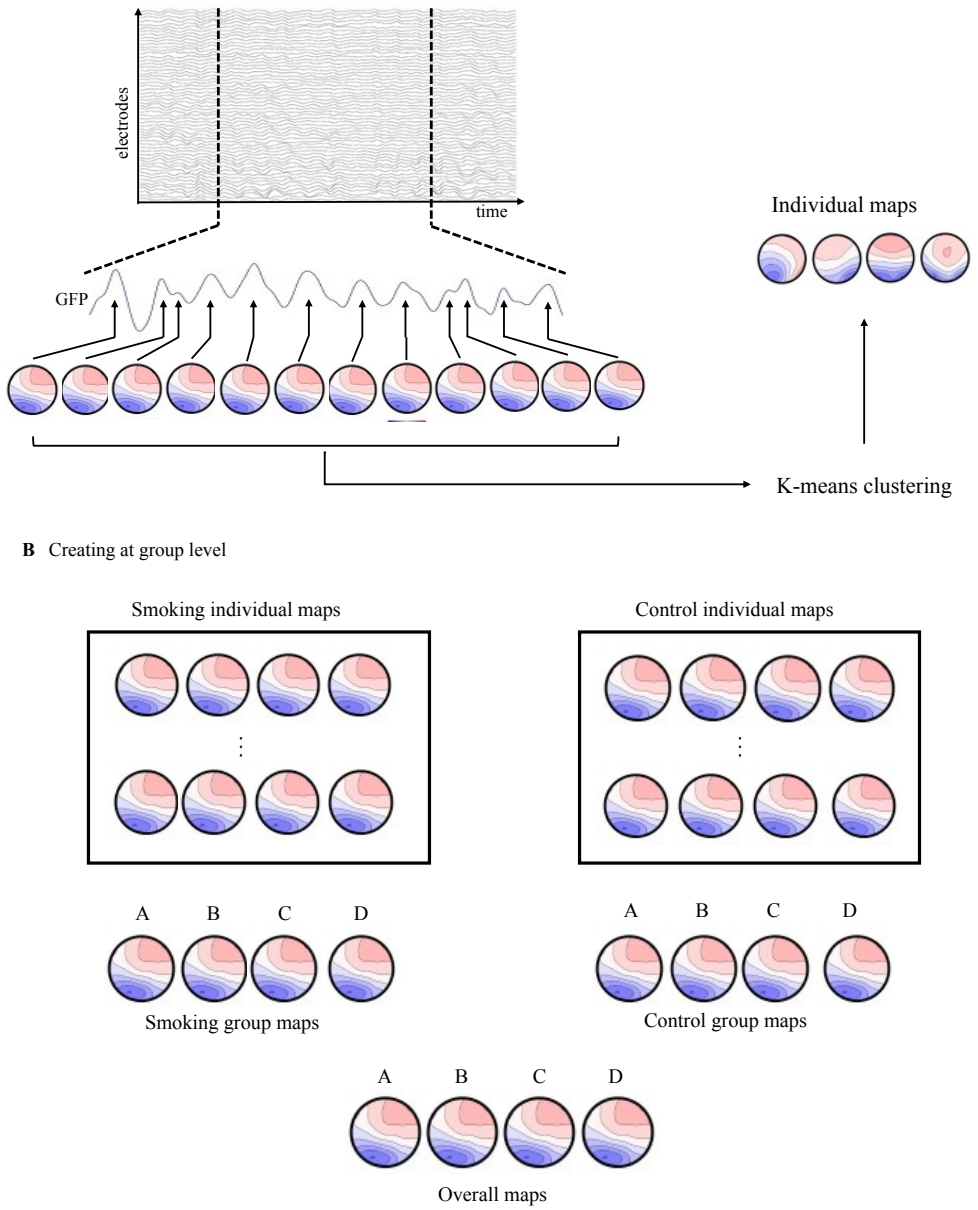

Figure A1 Microstate analysis methods

Appendix A.3.1 *GEV criterion*

Table A2 GEV criterion.

Clusters	3	4	5	6	7	8
Overall GEV	0.73(0.07)	0.76(0.06)	0.77(0.06)	0.79(0.06)	0.8(0.06)	0.8(0.06)
	4-3	5-4	6-5	7-6	8-7	
	p=0.05	p=0.49	p=0.27	p=0.42	p=0.70	

Values are means (1 standard deviation).
One-way analysis of variance. 4-3 means compared 4 clusters to 3 clusters.

Appendix B Statistics and Results

Appendix B.1 Microstate analysis and statistics

EEGLAB microstate plugin (microstate 1.1 in MATLAB R2019a) was used to conduct EEG microstate analysis in continuous data (http://www.thomaskoenig.ch/index.php/software/microstates-in-eeglab). The different microstate topography maps were compared between the two groups using topographical analysis of variance (TANOVA) with the Rugu software [3]. The effect of microstate class as the within-subject factor and the effect of group as the between-subject factor were analyzed using nonparametric randomization test. Microstate duration, occurrence, and coverage were compared between the smoking group and the control group by independent sample t-test with Matlab (MATLAB R2019a). During the t-test, we found group difference in the above measures for microstate class B but not for the other classes. Thus, we next specifically conducted Pearson correlation analysis between the duration of microstate class B and FTND and pack-years within the smoking group.

Appendix B.2 Microstate parameters characteristics of microstate class B

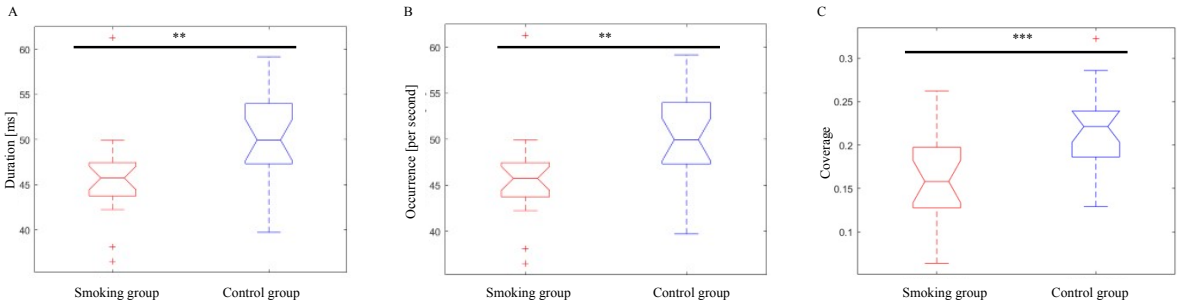

Figure B1 Microstate parameters characteristics of microstate class B

Appendix B.3 Microstate parameters characteristics of microstate class A, C and D

Table B1 Microstate parameters characteristics of microstate class A, C and D.

	Control group	Smoking group	t-test
Duration			
Mean	55.7(0.79)	59.2(1.64)	$t(39)$ = -0.88
			p = 0.38
A	56.2(1.14)	53.9(0.57)	$t(39)$ = 0.83
			p = 0.41
C	57.8(1.07)	61.7(1.28)	$t(39)$ = -1.05
			p = 0.30
D	54.3(1.28)	63.8(3.73)	$t(39)$ =-1.10
			p = 0.28
Occurrence			
Mean	18.27(2.34)	17.70 (3.25)	$t(39)$ = 0.65
			p = 0.53
A	4.54(0.90)	4.44(1.15)	$t(39)$ = 0.30
			p = 0.77
C	4.86(0.79)	4.89(0.95)	$t(39)$ = -0.11
			p = 0.91
D	4.52(1.01)	4.84 (0.82)	$t(39)$ = -1.13
			p = 0.27
Coverage			
A	0.25(0.06)	0.24(0.07)	t(39) = 0.75
			p = 0.46
C	0.28(0.06)	0.30 (0.09)	$t(39)$ = -0.89
			p = 0.34
D	0.25(0.08)	0.30(0.13)	$t(39)$ = -1.52
			p = 0.14

Values are means (1 standard deviation)

References

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