Non-invasive vagus nerve stimulation attenuates the burnout

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Introduction

Many neuropsychiatric disorders (depression, emotional burnout, alexitia, etc) are accompanied by emotional problems. From a neurophysiological point of view, both depression [Li et al, 2019; Li et al, 2020] and burnout [Golkar et al, 2014; Tei et al, 2014] can arouse from the disturbances in neural networks associated with emotional regulation and recognition of emotional states.

Promising neuromodulation therapy technique:

Invasive vagus nerve stimulation

- for treatment-resistant depression [Ghanem, & Early, 2006].

Transcutaneous auricular vagus nerve stimulation (tVNS)

- for treatment major depressive disorder (MDD):

1. by the modulation the activity and connectivity of a wide range of neural networks, including the default mode network, the executive network, and networks involved in emotional and reward circuits [Li et al, 2020].
2. by the increases amygdala and dorsolateral prefrontal cortex connectivity, which is associated with a decrease in the severity of depression [Li et al, 2019].

Objective

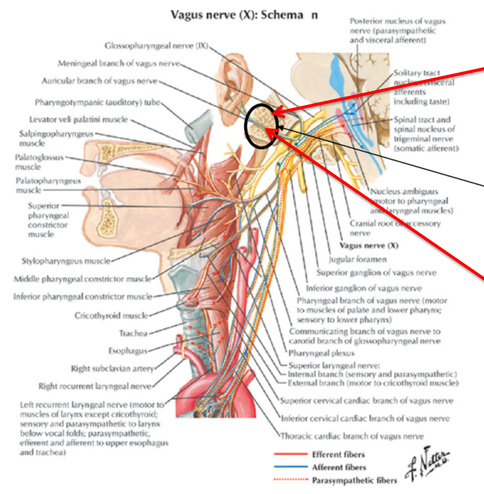
The aim of the current study was to evaluate the effects of the non-invasive transcutaneous vagus nerve stimulation on emotional burnout

Subjects

11 healthy men volunteers (stimulation (6 persons) and Sham/control (5 persons) groups) first-third year biology students of the Taras Shevchenko National University of Kyiv, aged 18 to 22 years (Mage = 19.5, SD = 1.36 years) participated in the study of the effects of the non-invasive transcutaneous vagus nerve stimulation on emotional burnout.

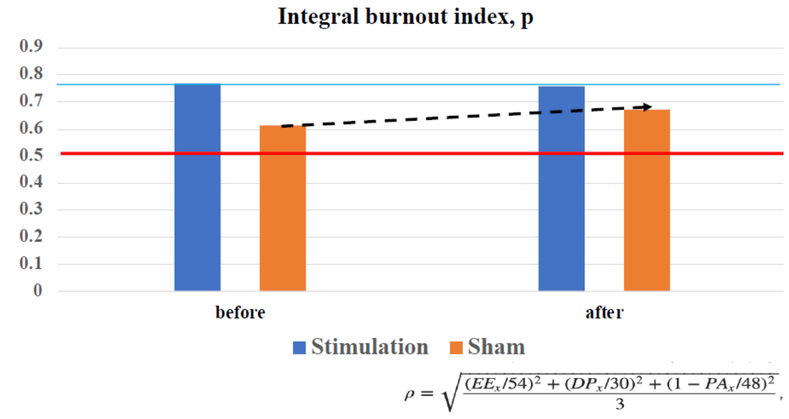
Methods

We used the combination of pleasant meditative classical music and a slow bi-polar wave (0.1-0.2 Hz) of electrical non-invasive transcutaneous auricular vagus nerve stimulation for 5 minutes (BrainPatch platform for non-invasive stimulation). The set of 4 VNS was performed at intervals of 3 days. EEG was registered during the rest state (3 min, closed eyes condition).
To measure the severity of emotional burnout in students, we used the 22-item Maslach Burnout Inventory.



BrainPatch platform for non-invasive stimulation https://www.brainpatch.ai/

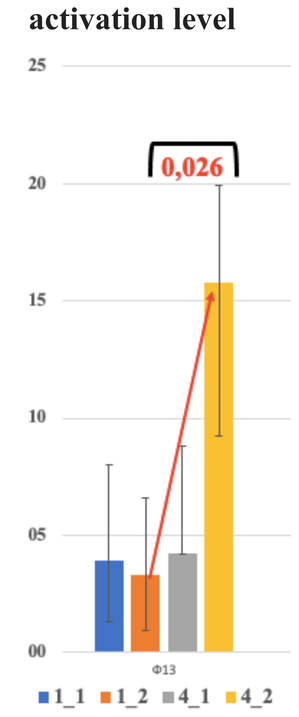
Results



1/4 Session changes (= before stimulation/after stimulation)

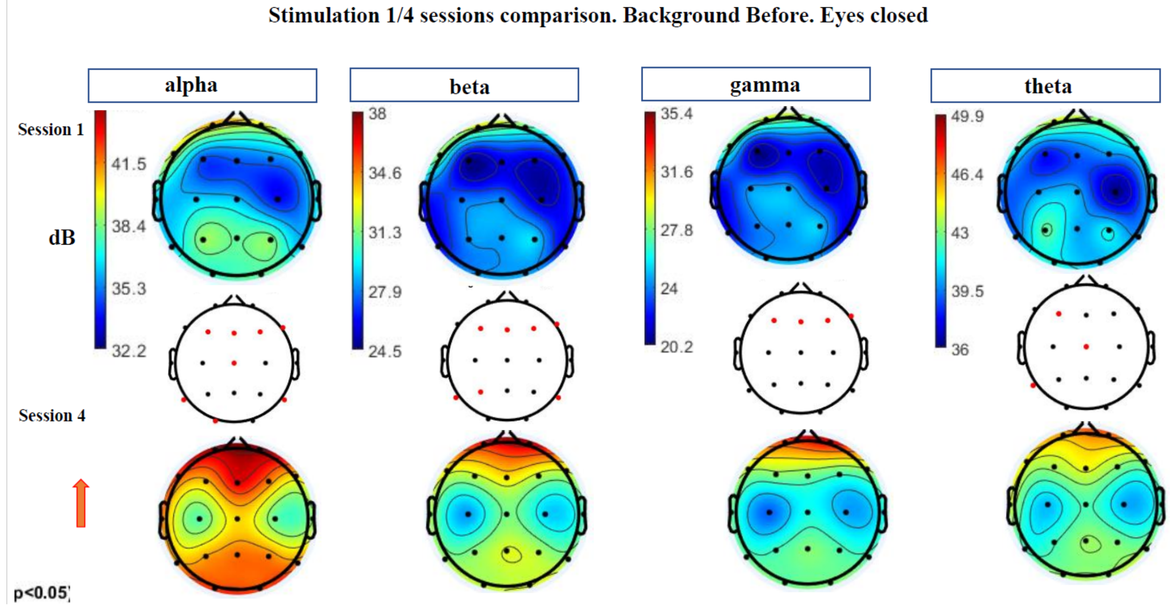
	Zung Self-Rating Depression Scale	Oxford Happiness Inventory	PSM-25	Maslach Burnout Inventory				Life orientation test
				Emotional Exhaustion (EE)	Depersonalization (DP)	Personal Accomplishment (PA)	Integral burnout index, p	
Stimulation	-9,04	-7,79	+4,08	4,19	-10,71	-3,26	-0,007	3,37
Sham	-10,67	+8,33	-8,2	7,81	22,4	12,99	0,056	-1,45

VNS significantly improve the depersonalization and reduction of personal achievements (components of the emotional burnout). Changes in the psychoemotional state of the respondents were accompanied by the increase in the theta-Fz/alpha-Pz ratio, that reflects an enhancement of the activation level. A set of non-invasive stimulation of the auricular branch of the vagus nerve leads to an increase in the level of activation (the ratio of beta / alpha rhythms). The changes in the power EEG rhythms may relate to improving of mental process, creativity, creative thinking. An increase in alpha rhythm may reflect internally oriented attention in creative activities.

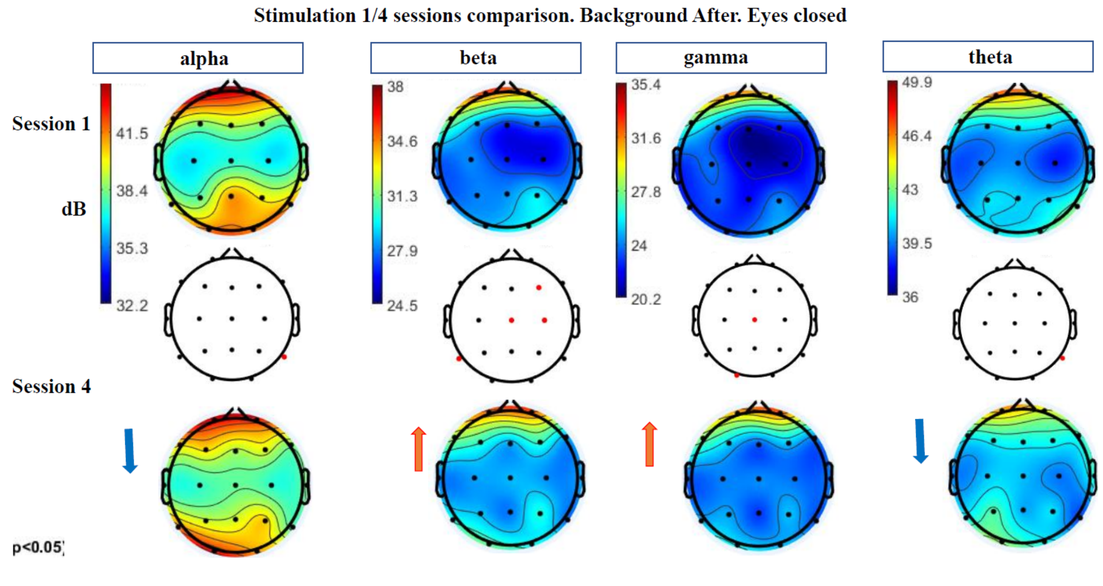


1.1 – control (Sham) (1 session),
1.2. - stimulation (1 session),
4.1 – control (Sham) (4 session),
4.2. - stimulation (4 session)

Stimulation 1/4 sessions comparison. Background Before. Eyes closed



Stimulation 1/4 sessions comparison. Background After. Eyes closed



Conclusion

The preliminary data collected in this pilot study suggests that the novel mastoid stimulation device may have a prolonged stimulating effect on the brain processes while attenuating the burnout at the same time. The set of stimulations suggested a series of trends in markers of brain activation, added available brain resources and enhancement of the cognitive abilities of respondents.

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