

Trigeminal Nerve Stimulation for the Treatment of Mild Traumatic Brain Injury Jean-Philippe Langevin MD; Esther Choi; Drorit Gaines; Scott Krahl PhD; Daniel Silverman; Gholam Berenji Greater Los Angeles VA Healthcare System University of California, Los Angeles



Introduction

Traumatic Brain Injury (TBI) patients show dysfunctional recruitment patterns of the frontal lobes when performing cognitive tasks. Neuromodulation could regulate this aberrant activation pattern and improve symptoms after mild TBI (mTBI). Trigeminal nerve stimulation (TNS) is a non-invasive form of neuromodulation that has been shown to modulate several regions of the frontal and cingulate regions on PET scan.



A: Whole system shown in use
B: The external pulse generator allows changes the parameters
C: Self-adhesive electrode placed on the skin above the eyebrows

Fig 1. Depiction of the TNS device (Neurosigma Inc)

Aims

1. Study the changes in frontal lobe metabolism after 8 weeks of TNS

2. Study the effects of TNS on mTBI symptoms.

Methods

Participants, Design and Intervention

Two US veterans suffering from mTBI symptoms for at least 5 years have been enrolled in this prospective open-label trial. The TNS device was used at home for 8 hours/day for a duration of 8 weeks. The subjects adjusted the amplitude to feel a pleasant stimulation on the forehead/scalp area. The other parameters were preprogrammed in the device.

Assessments

The subjects completed a resting FDG PET study, the Beck Depression Inventory (BDI), the Beck Anxiety Inventory (BAI), the post-traumatic stress disorder Checklist (PCL) and the Patient Assessment of Own Functioning (PAOF) before and after the treatment.

Results PET Findings

4.33% 1.79%

3.03%

Table 1. Mean change in cerebral metabolism compared to baseline



Fig 2. Baseline and Post-treatment resting ¹⁸FDG PET

Both subjects showed increased metabolism in Broca's area, dorsolateral prefrontal cortex (DLPFC), anterior cingulate cortex (ACC) and medial frontal gyrus (MFG). The mean changes above pre-treatment values in these regions ranged from 1.7% to 4.3% of whole-brain mean metabolism (Table 1). Amygdala metabolism was reduced by about 1.3% (Table 1).

1.91

-1.42%

1.92%

-1.28%

Psychological Findings



Anxiety and post-traumatic headaches improved for both subjects. Depression symptoms improved in subject 2.



Conclusions

TNS may prove beneficial in mTBI by normalizing recruitment patterns of the frontal and cingulate cortices. These neuromodulatory changes may improve neuropsychiatric symptoms seen in patients suffering from chronic mTBI.