Investigating the Effectiveness of Noninvasive Brain Stimulation in a Mouse Model for Relieving Tinnitus

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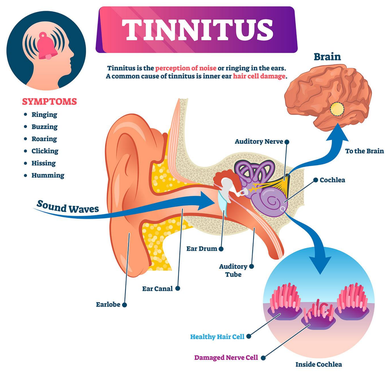
Introduction

- Tinnitus is a noise such as buzzing, ringing, or whistling, heard in the ear that has no apparent external cause.
- Severe chronic tinnitus can lead to disturbances in sleep, impaired concentration, depression, and other psychological issues.
- no definitive treatment for tinnitus.
- research suggests that patients with tinnitus can express undesired plastic changes in the brain, indicating that noninvasive brain stimulation may aid in the countering the maladaptive changes of the auditory cortex.
- The experiment aims to evaluate the effects of brain stimulation on a tinnitus mouse model.



Objectives

- **Induce tinnitus in mice**
- **Create a test to measure the tinnitus**
- **Reduce effects of tinnitus with brain stimulation**

Experimental Procedures

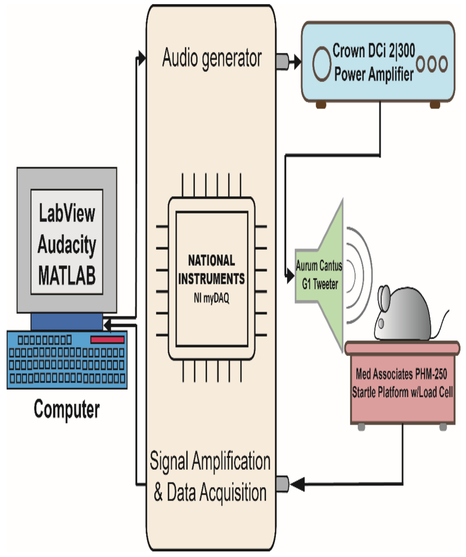
File 1: startle only 6-8 kHz (6-8 kHz: 0.005, White Noise: 0.9)

File 2: Gap Detection 6-8 kHz (6-8 kHz: 0.005, White Noise: 0.9)

File 3: startle only 10-12 kHz (10-12 kHz: 0.005, White Noise: 0.9)

File 4: Gap Detection 10-12 kHz (10-12 kHz: 0.005, White Noise: 0.9)

File 5: sample of tone used to induce tinnitus (12 kHz, experimental would be at 120 dB for 60 minutes



To induce tinnitus, the animal must have prolonged exposure to loud sound. An animal with tinnitus will be unable to detect silence in its environment. We will induce tinnitus in mice through exposure to 120 dB sound for an extended period. (File 5 provides a lower frequency example of the tone used)

Mice will be divided into a brain stimulation group which will receive stimulation and control group which will receive no stimulation. Transcranial direct current stimulation will be applied to the test group via 3D printed helmets with fitted electrodes, which are designed to target the auditory cortex.

The experiment measured the acoustic startle response in the lab mice.

The mice were tested to see if ASR inhibition, the decrease in reflex intensity after a silence gap is played before the startle sound, occurred due to tinnitus. Files 1-4 constitute the ASR test that both the control and experimental groups will be subjected to.

Results

- We found the mice provided with tDCS stimulation to have a stronger acoustic startle reflex than the sham group.
- the tDCS treated mice will have an increased ability to detect silent gaps
- decrease in endogenous noise pervading throughout the ASR test.
- the induced tinnitus in the tDCS treated mice will have improved

Conclusions

- that noninvasive brain stimulation (tDCS) can potentially be an effective means of improving tinnitus in mice.
- indicative of the potential effectiveness of noninvasive electrical brain stimulation in human trials.
- Future experiments can be conducted to test if electrical stimulation amplifies the effects of antidepressant treatments for tinnitus.

References

Natalia Hoshino, Yazan Altarshan, Ahmad Alzein, Amali M. Fernando, Vincent C.-F. Chen, M. William Rochlin, Wei-Ming Yu. Ephrin-A3 is Required for Tonotopic Map Precision and Auditory Functions in the Mouse Auditory Brainstem. March 2021. Doi: 10.21203/rs.3.rs-299438/v1