Neurofeedback: A Possibility To Treat Chronic Tinnitus?
A pilot study with sLORETA-based Neurofeedback

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Background & Goals

Tinnitus:
- Disorder of the brain!
- Differences in spontaneous EEG activity in auditory cortex (AC) of individuals with chronic tinnitus compared to healthy controls - reduced delta & gamma

Neurofeedback (NFB):
- Enables individuals to voluntarily modulate certain features of brain activity
- Basic principle: operant conditioning (rewarding of desired, inhibiting of unwanted activity changes)
- Strongly improved by combination with sLORETA source estimation technology [6]
  - Makes more specific training of distinct brain areas possible!

Rationale:
- Subjects learn to normalize abnormal EEG patterns associated with tinnitus
- Subjects train primary auditory cortex (AC) specifically due to sLORETA source estimation
- Subjects improve tinnitus related symptoms
- Gain first important experiences with sLORETA-NFB in the treatment of chronic tinnitus

Methods

EEG Data:
Trained Theta/Delta (1 – 6 Hz) in AC:
Trained High-Beta/Gamma (20 – 35 Hz) in AC:

Tinnitus Data:
Tinnitus Handicap Inventory (THI):

Results

Neurofeedback works!
- Significant reduction in trained high-beta/gamma in right auditory cortex (p < 0.5, Cohen's d = 1.38 → strong effect)
  - Very surprising effect (small sample size)
- Strong tendencies in other frequency bands in direction of training, except for alpha
  - Not significant due to high interindividual variance and small sample size
- Promising results in tinnitus related data
  - Not significant due to high interindividual variance and small sample size
- Subjects report that tinnitus experience was considerably altered after trainings

Neurofeedback has specific effects on brain activity and tinnitus related symptoms!

Crucial experiences for future projects:
- Improve source estimation used in feedback procedure (more electrodes)
- Design feedback protocols on more individual basis (heterogeneity of tinnitus)
- Trainings in gamma frequency range debatable
- Controlling of placebo effects ( sham-neurofeedback training)
- Minimizing potentially disturbing effects by changing various aspects of feedback application and setting

Key benefits of this pilot project:

Outlook

Planned: Clinical study with 52 older individuals

Objectives:
1. Testing efficiency of neurofeedback in treatment of tinnitus for older individuals
2. Comparing SLORETA-based neurofeedback to classical single electrode neurofeedback

Method (major improvements):
- Focus on alpha-enhancement only
- 32-electrode system for neurofeedback application
- Improved controlling of setting and feedback

References


Participants:
- 6 individuals with chronic tinnitus (4 male, 2 female)
  - Dropouts: 1 after 3 sessions (excluded from analysis), 1 after 12 trainings (included in analysis)

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