Discussion & Conclusions

- Results show significant improvement in attention levels, alertness and social and physical interactions of the ASD-diagnosed patients.

- A significant decrease in delta waveform activity was shown after daily use of therapy methodology proposed. This is co-occurs with an increase in alpha and beta activity respectively.

- The system is therefore shown to be an effective tool for training the brain to attain desirable frequency levels.

- Brain stimulation through real-time sonified neurofeedback proved to help in the management and relaxation of children diagnosed with ASD.

References

Background

- Autism Spectrum Disorder (ASD) is characterised by behavioural and social impairments. These have been looked at from a physiological standpoint and have been associated with abnormal EEG activity.
- An abnormally high level of slow-wave EEG patterns (delta) is noticeable in ASD patients, especially in the frontal-temporal regions, coupled with lower levels of faster waveforms (alpha, beta). 1, 4
- Studies examining neurofeedback have shown promising results in ASD patients, specifically in the frontal-temporal regions, coupled with lower levels of delta EEG activity. 3, 4

Objectives

- Evaluating the qualitative and quantitative effects of a portable, home-based neurofeedback device on children exhibiting ASD.
- Ascertainment of the effect of real-time brain stimulation through neurofeedback therapy in managing ASD-related symptoms.

Methods

Eligibility Criteria

- 1. Clear, medical diagnosis of Autism
- 2. No history of hearing impairment
- 3. No peripheral co-morbidities

2 groups forming a statistical sample size of 33 subjects from a controlled base of 60 participated in this clinical trial. A total of 8 participants were not in a position to finalise the trial due to inability issues. The methodology was reviewed and accepted by the ethics committee of the Università degli Studi di Milano.

Pre- and Post-Tests

EEG Activity Level Scores

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<th>EEG Activity Level Scores</th>
<th>Pre-Tests</th>
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<td>Alpha</td>
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A significant decrease in disruptive behaviour score was registered in the post tests when compared to the pre test scores. The disruptive behaviours exhibited in the QABF were divided in 4 main areas: Attention, Escape, Non-Social and Physical.

Pre-therapy vs. Post-therapy Disruptive Behaviour Score Comparison

A paired-samples t-test was conducted to compare waveform activity levels before and after therapy was received. This resulted in:

- A significant difference in the scores for Alpha waveforms before therapy (M=14.16, SD=14.7) and Alpha waveforms after therapy (M=15.89, SD=15.8); t(-2.931)=, p=>.003
- A significant difference in the scores for Beta waveforms before therapy (M=32.36, SD=24.7) and Beta waveforms after therapy (M=37.9, SD=26.6); t(5.5)=, p=>.001
- A significant difference in the scores for Delta waveforms before therapy (M=53.56, SD=27.5) and Delta waveforms after therapy (M=46, SD=28.8); t(7.2)=, p=.001

This clearly indicates that the therapy was effective in suppressing delta activity while helping in the promotion of alpha and beta EEG activity.

Clinical Evaluation

The therapy proposed consists of a home-based neurofeedback device which picks up clinically comparable EEG and creates a real-time inverse binaural beat representation with the aim to reduce excessive delta EEG activity on the scalp (EEG) control and stabilize the binaural representation, and after each therapy session.

Therapy Protocol

The created wave excites hair cells in the cochlea which creates a tsunami-like vibration of the tympanic membrane are amplified by the stapes. Sound waves are converted into electrical signals in the cochlea which is connected to the inner ear via the 8th cranial nerves up to the auditory cortex. The created wave excites hair cells in the cochlea which create binaural beat representation with the aim to reduce excessive delta EEG activity on the scalp (EEG) control and stabilize the binaural representation.