

NEUROFEEDBACK APPLICATION IN THE TREATMENT OF AUTISTIC SPECTRUM DISORDERS (ASD)

Ivana Zivoder¹, Sanja Martic-Biocina², Ana Vodanovic Kosic¹ & Josipa Bosak¹

¹Mens sana, Practice for Neurofeedback, Zagreb, Croatia

²Psychiatric Clinic Vrapce, Bolnicka cesta 32, Zagreb, Croatia

SUMMARY

The aim of this paper is to describe neurofeedback (NFB) treatment in Autistic spectrum disorder (ASD) children. There is no specific cure for autism and therapeutic guidelines are directed to improve the quality of life of people with autism by reducing the symptoms and by increasing their functioning. Neurofeedback is a computerized method based on tracking electrical activity of the brain (EEG) and giving a feedback about it. The method has been developed in neurophysiological labs of scientific institutes in USA and has been used very successfully for over last 20 years. It has proven its efficacy in practise, but also in scientific and clinical research. During 2010 and 2011 neurofeedback treatment was administered to 10 children (N=10, 7 males and 3 females) age range 4 to 7 years which have been diagnosed as autistic spectrum disorder (highly functional) with an unspecific impairment of speech development and trouble communicating. An evaluation of treatment was done according to estimation of changes in functioning (parents, teachers and therapists' ratings and all other experts that were monitoring the child before, during and after the treatment) and tracking of changes in electrophysiology. The results have shown most changes in behaviour (less aggressive, more cooperation, better communication), attention span and sensory motor skills. According to the assessment of parents, teachers, therapists and other experts all children have accomplished a certain degree of improvement in the level of daily functioning. Our experiences in usage of neurofeedback in Autistic spectrum disorder (ASD) children confirmed previous data that this method can be applied to this category of patients.

Key words: neurofeedback - autistic spectrum disorder – children - treatment

* * * * *

INTRODUCTION

Autism was first described by Leo Kanner in 1943. He was doing thorough and systematic observation of children with psychological disorders and he found that eleven of them seemed physically healthy, but were showing specific symptoms like speech impairment, communication and behavioural impairment and by those symptoms they differed from other psychological disorders of young children. He called this disorder infantile autism because of its specific symptoms and the young age at which it occurs (infantile – occurring in the first three years of life; autism – dominance of symptoms related to speech impairment, autisms, Greek – alone).

THERAPEUTIC GUIDELINES IN TREATMENT OF CHILDREN WITH AUTISM

There is no specific cure for autism and therapeutic guidelines are directed to improve the quality of life of people with autism by reducing the symptoms and increasing their functioning. Early intervention is important, it should be individualized, intensive and persistent and done by educational programs and behaviour therapy. This way a child can reach a great level of independence and even social and work related skills. One of these methods is neurofeedback.

APPLICATION OF NEUROFEEDBACK IN TREATING CHILDREN WITH AUTISM

Neurofeedback is a computerized method based on tracking electrical activity of the brain (EEG) and giving feedback about it. It represents a learning process that enables the person to observe; control and change his/her own brain activity. The method has been developed in neurophysiological labs of scientific institutes in the USA and has been used very successfully for over 20 years. It has proven its efficacy in practise, but also in scientific and clinical research.

Great amounts of research investigating the usage of neurofeedback in treating children with autism have shown its great efficiency. A couple of case studies were published in the mid-1990s, but it has not been until the new millennium that more rigorous investigations have taken place. Briefly, case studies or case series have included three single case studies of children with autism. (Cowan 1994, Sichel 1995, Ibric 2003)

Coben and Pudolsky (2007) have conducted a large research on 37 children with autistic spectrum disorder that showed very significant results. They did several measures of symptoms using various neuropsychological and neurophysiological parameters of the autistic spectrum and they have shown marked symptom decrease (89%) (Coben 2007).

Research by Kouijzer (2009) founded that sixty percent of the participants in the treatment group successfully reduced excessive theta power during

neurofeedback treatment. Reduction of theta power was confirmed by pre- and post-QEEG measures. Parents of participants in the neurofeedback treatment group reported significant improvements in reciprocal social interactions and communication skills, relative to the parents of the control group. Set-shifting skills improved following neurofeedback treatment relative to the control group (Kouijzer 2009).

Coben and Myers (2010) compared results of two published controlled studies examining the efficacy of neurofeedback in the treatment of autism. Specifically, they examined whether a symptom based approach or an assessment/connectivity guided based approach was more effective. Although, both methods demonstrated significant improvement in symptoms of autism, connectivity guided neurofeedback demonstrated greater reduction on various subscales of the Autism Treatment Evaluation Checklist (ATEC) (Coben 2010).

Study from Kouijzer, M. E. G., B. J. L. Gerrits and J. K. Buitelaar (2011) evaluated the effects of EEG-biofeedback in ASD in a randomized pre-test and post-test control group design with blinded active comparator and six months follow-up. Fifty-four percent of the participants significantly reduced delta and/or theta power during EEG-biofeedback sessions and were identified as EEG-regulators. In these EEG-regulators, no statistically significant reductions of symptoms of ASD were observed, but they showed significant improvement in cognitive flexibility as compared to participants who managed to regulate SC (Kouijzer 2011).

Results of the pilot study with 42 children with ASD by Sokhadze, E. M., El-Baz, A. S., Tasman, A; (2014) has proven positive effects of combined transcranial magnetic stimulation and neurofeedback in the active treatment group (20 children with ASD), as compared to control WTL group (22 children with ASD). The active treatment group (TMS-NFB) showed significant improvements in behavioural and functional outcomes as compared to the control WTL group (Sokhadze 2014).

APPLICATION OF NEUROFEEDBACK IN TREATMENT OF CHILDREN WITH AUTISM – OUR CASE STUDIES

During 2010 and 2011 year, neurofeedback was administered in treatment of 10 children (N=10, 7 males and 3 females) age range 4 to 7 years which have been diagnosed as autistic spectrum disorder (highly functional) with an unspecific impairment of speech development and trouble communicating.

TREATMENT GOALS

Improvement of the quality of life and increase in everyday functioning by reducing the symptoms related to the primary diagnosis.

INITIAL ASSESSMENT

- Analyses of medical documentation (conducted diagnostic and therapeutic procedures);
- Structured interview (with one or both parents);
- Measuring of baseline EEG (one channel, Cz).

CHILD ADJUSTMENT ON CONDUCTING NEUROFEEDBACK TREATMENT

Considering the specific problems of these children and their sensitivity, 90% of them had to go through an adjustment period – sensor placement, deciding what kind of feedback is acceptable (auditory or visual), adjustment to the therapist, etc. The adjustment period lasted from 5 to 10 arrivals (except for the one child who did not need any adjustment period). During these arrivals they were gradually adjusted to the conditions of the treatment, playing with the sensors. All children have successfully finished the adjustment period.

IMPLEMENTATION OF NEUROFEEDBACK

Protocols were determined for each child individually according to the initial assessment:

- Electrode position (according to the international 10-20 system);
- Frequency bands that will be inhibited or rewarded. Mean duration of each session was 15-20 minutes.

EVALUATION AND RESULTS

An evaluation of treatment was done according to:

- Estimation of changes in functioning (parents, teachers and therapists ratings, and all other experts that were monitoring the child before, during and after the treatment);
- Tracking of changes in electrophysiology.

The results have shown most changes in:

- Behaviour (less aggressive, more cooperation, better communication);
- Attention;
- Sensory-motor skills.

According to the assessment of parents, teacher, therapist and other experts all children have accomplished a certain degree of improvement in the level of daily functioning. Tracking of trend changes in electro psychological measures have yielded a positive shift according to the protocols that have been administered, but due to a small sample and short duration of records without artefacts there was no statistically significant difference.

CASE STUDY 1

A.G. Male; 5 year old (2006)

Initial assessment

Distinctive difficulties in attention span, motoric skills, social relations, communication, play and imagination and speech impairment.

Neurofeedback treatment

65 sessions.

Administered protocols

- CZ - inhibition of delta and theta waves (2-7 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 30 sessions;
- C4 - inhibition of delta and theta waves (2-7 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 15 sessions;
- F3 - inhibition of delta and theta waves (2-7 Hz), strengthening of SMR and beta waves (14-18 Hz), inhibition of high beta (22-30 Hz) – 20 sessions.

Description of treatment implementation, evaluation and results

A. G. has attended neurofeedback treatment around a year. After first 10 arrivals significant changes were detected in motoric skills and attention span– he started rollerblading, he was more awake and present during the day (before therapy he was drowsy and sleepy as soon as he had to do an assignment that was not to his interest) and more interested in his surroundings.

After stabilization of these changes, another protocol was administered directed to improving communication, emotions and emotional expression. After all 65 treatments that were administered parents said that he is significantly more communicative, he is more open to other people, had better understanding and was more willing to do all kinds of tasks. He uses more complicated speech, 3 words in a sequence and spoke very clearly and understandably.

CASE STUDY 2

E.V. Female; 5,5 year old (2005)

Initial assessment

Distinctive difficulties in attention span, speech and social relations, especially while playing.

Neurofeedback treatment

30 sessions.

Administered protocols

- Cz - inhibition of delta and theta waves (2-7 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 20 sessions;
- C4 - inhibition of delta and theta waves (2-7 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 10 sessions;

Description of treatment implementation, evaluation and results

The girl comes primarily because of difficulties in attention span and social relationships, especially while playing. She has a younger sister to whom she never showed any interest regarding playing and friendship. Her attention span was short and scattered. Also there were speech difficulties and distinctive emotional sensitivity. There were 30 sessions administered to the sensorimotor area. We have observed better emotional functioning, social functioning and attention span. She got interested in her surroundings; she started to play with her younger sister and to use the computer for play.

CASE STUDY 3

B.K. Male; 4 year old (2007)

Initial assessment

Difficulties focusing, motoric skills and difficulties in speech and speech understanding.

Neurofeedback treatment

40 sessions.

Administered protocols

- Cz - inhibition of delta and theta waves (2-7 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 20 sessions;
- C4 - inhibition of delta and theta waves (2-7 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 10 sessions;
- F3 - inhibition of delta and theta waves (2-7 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 10 sessions.

Description of treatment implementation, evaluation and results

The boy came with problems in focus and motoric, speech difficulties and understanding abstract thoughts and difficulties in dialogue with other people. There was no adaptation period and 40 sessions were administered. We have noted better functioning in emotional and social aspects and focusing. Motor skills also became better.

CONCLUSION

Our experiences in usage of neurofeedback in Autistic spectrum disorder (ASD) children confirmed previous data that this method can be applied to this category of patients. Number of treatments, according to our results is between 40 and 60. On average, it takes 5 to 10 meetings for children to get accustomed to the method. Neurofeedback can help children with autism to increase their functioning through improving attention, behaviour and sensory motor skills.

Acknowledgements: None.

Conflict of interest: None to declare.

References

1. Coben, Robert, and Ilean Pudolsky: Assessment-guided neurofeedback for autistic spectrum disorder. *Journal of Neurotherapy* 2007; 11:5-23.
2. Coben R and Thomas E. Myers: The relative efficacy of connectivity guided and symptom based EEG biofeedback for autistic disorders. *Applied psychophysiology and biofeedback* 2010; 35:13-23.
3. Cowan J & Markham L: EEG biofeedback for the attention problems of autism: A case study. Presented at the 25th Annual Meeting of the Association for Applied Psychophysiology and Biofeedback, 1994.
4. Ibric VL & Hudspeth W: QEEG and Roshi use in Autism post-toxic encephalopathy – a case study. Presented at the 11th Annual Winter Brain Conference, Palm Springs, CA, 2003.
5. Kouijzer, Mirjam EJ, et al: "Long-term effects of neurofeedback treatment in autism." *Research in Autism Spectrum Disorders* 2009; 32:496-501.
6. Kouijzer MEG, B.J.L Gerrits and J.K. Buitelaar: "Is EEG-biofeedback an effective treatment in autism spectrum disorders?" A randomized controlled trial. *Applied Psychophysiological and Biofeedback* 2011; 10:301-312.
7. Sichel Arthur G, Lester G, Fehmi and David M. Goldstein: "Positive outcome with neurofeedback treatment in a case of mild autism." *Journal of Neurotherapy* 1995; 1:60-64.
8. Sokhadze EM, El-Baz AS, Tasman A, Sears LL, Wang Y, Lamina EV & Casanova MF: Neuromodulation integrating rTMS and neurofeedback for the treatment of autism spectrum disorder: an exploratory study. *Applied psychophysiology and biofeedback* 2014; 39:237-257.

Correspondence:

Sanja Martic-Biocina, MD, PhD
Psychiatric Clinic Vrapce
Bolnicka cesta 32, Zagreb, Croatia
E-mail: smarticbiocina@gmail.com