

# **POSITIVE OUTCOME WITH NEUROFEEDBACK TREATMENT IN A CASE OF CHILD WITH MILD AUTISM SPECTRUM DISORDER**

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## **1.1 INTRODUCTION**

Autism is a neurological disorder characterized by a lack of appropriate eye contact, facial expression, social interaction, communication, and restricted repetitive behavior. Autism Spectrum Disorder represents a group of disorders, including Autism, PDD-NOS, Rett's Disorder, Child Disintegrative Disorder and Asperger's Disorder (American Psychiatric Association, 1994).

According to DSM-IV-TR (APA, 2000), qualitative impairments in social interaction is one of the defining characteristics for the diagnosis of Autistic Disorder. Social impairments can include: lack of use of nonverbal behaviors such as eye gaze, gestures, body postures and facial expressions; lack of social-emotional reciprocity; impairment in expression of pleasure in the happiness of others; and a lack of interaction with peers, including an absence of symbolic or imaginative play activities (APA, 2000). This core impairment has led some to identify social deficits as the "heart" of Autism Spectrum Disorders (Gutstein, 2005).

The subject of this case study is a 9-year-old boy whom has been

previously diagnosed as Autism Spectrum Disorder (ASD). According to his parent, Richard has reached most of the developmental milestones at his appropriate age level, however he was reported to have speech delay and learning difficulties but no medical conditions or issues with sight and hearing were reported.

## **1.2 PATIENT ASSESSMENT**

Richard has been diagnosed as Autism by a psychiatrist and a speech therapist respectively. He has been noted with typical autistic characteristic. The following assessments have been furthered administered to determine symptom of severity through quantifiable ratings based on direct observation and to identify the presence and the extent of autistic social impairment to distinguish autism spectrum disorders from other childhood psychiatric conditions.

### **1.2.1 Childhood Rating Scale 2 – Standard Test (CARS2-ST)**

Childhood rating scale is a quantitative rating scale used to diagnose autism. In addition, it distinguishes mild-to-moderate from severe autism (Schopler et al., 2010). Richard has been placed in this evaluation prior to the commencement of Neurofeedback Therapy. Richard's CARS2-ST scores displayed a total raw score of 36, which is well above the standard clinical cutoff value of 30, and this suggested that he is likely to have an ASD. The corresponding T-score is valued at 47 and this is consistent with the presence of an average level of autistic behaviours, relative to children diagnosed with an ASD. Below is Richard's pattern of item rating on CARS2-ST:

#### ***1.2.1.1 RATINGS OF 3.0 OR GREATER***

- Relating to people

- Imitation
- Object use
- Listening response
- Fear or Nervousness
- Verbal communication
- Nonverbal communication
- Activity Level
- General Impression

#### ***1.2.1.2 RATINGS OF 2.0 OR 2.5***

- Emotional response
- Adaptation to change
- Taste, smell and touch response and use

#### ***1.2.1.3 RATINGS UNDER 2.0***

- Body use
- Visual response
- Level and consistency of intellectual response

Richard's observed pattern of atypical behavior was consistent with his parents' report of his early development and current behavior at home. The pattern is also consistent with his current social-communicative behavior at school. In accordance with current diagnostic criteria for autism (DSM-IV), Richard's CARS2-ST rating indicate that he has significant impaired social and communication skill, demonstrates many associated features of autism. Coupled with his parents' report of early developmental problems, including both verbal and nonverbal language delays, limited interest in other people, focused and unusual interest and a failure to develop pretend play skills, thus a clinical diagnosis of autism was deemed appropriate for Richard.

### **1.3 PRETREATMENT BEHAVIOUR**

Richard has been noted with poor awareness towards others in the surrounding. He was impulsive and he did not seek comfort when distressed. He did not engage in social play and he did not showed imitation. His mother reported that he did not vocalize until the age of three, until now he still need prompts to express himself. He can only speak about 2 words in a sentence. Verbalizations appeared quite minimal at the beginning of treatment. He did not make eye contact, did not look at the person or smile in social approach. He had a fixed stare in social situations. In summary, pretreatment behavior included symptoms which meet the diagnostic criteria for Autistic Disorder listed in the DSM-IV, sections A, B, C and D

## **1.4 INTERVENTION PROGRAMME**

Neurofeedback is another form of therapy that has gained popularity during the past few years. Research on Autistic Spectrum Disorder (ASD) shows that Neurofeedback (EEG biofeedback) can remediate anomalies in brain activation, leading to symptoms reduction and functional improvement (Coben & Padolsky, 2007).

Neurofeedback is designed to train individuals to enhance poorly regulated brainwave patterns by using sophisticated computer technology (Coben et al., 2009). It is the training of EEG activity through an operant conditioning process by which individual is trained to increase or reduce the brain production of electrical activity. For the past 10 years, numbers of researches have been conducted to identify the effectiveness of Neurofeedback to children with ASD.

### **1.4.1 Sessions and Objectives**

In this case study, a 16 sessions of Neurofeedback treatment has been designed with the objective of improving the executive

function of Richard. He will undergo 3 sessions of Neurofeedback per weekend every session lasts about 30 minutes.

#### 1.4.2 Training Protocol

After considering the atypical behaviours and major concern of his parent, it has been decided that the protocol of training should be divided into 2 parts. The first 6 sessions of the training will focus on rewarding his Theta (4-8Hz) while inhibiting Beta (16-22Hz) and HiBeta (23-40Hz). The area of focus will be on C3 (central-left position of the scalp). The rationale of this protocol is to reduce the hyperactivity and impulsivity of Richard.

From 7 sessions to 16 sessions, the protocol of training will be diverted to rewarding SMR Beta (sensorimotor Beta) which is at the frequency of around 12-15 Hz and decreasing his Theta at 4-8 Hz and HiBeta at 15-24Hz. This treatment will be using referential (monopolar) montage as the aim is to identify and train a specific component of Richard's EEG at a particular site. Thus only one active recording sensor (electrode) will be placed on the scalp over an area of interest, in Richard's case, the second part of the therapy will focus on T3, the left temporal of the scalp. The reason for this protocol is to focus on attention and executive functioning ability. In addition to it, Richard has been noted with excessive verbal repetition, he will keep repeating the same word which does not serve any purpose. Thus, during the second part, Theta will be inhibited in T3 area to stimulate better self-controlling activity to reduce his non-functional speech.

#### 1.4.3 Modality of feedback

In term of modality of feedback, audio-visual feedback was selected. Richard will be exposed to soothing music during the first 6 sessions of Theta training. From 7<sup>th</sup> until 16<sup>th</sup> sessions, various

videos will be provided during the training. The following table is the summary of the 16 Neurofeedback therapy sessions:

**Table 1(a)** Summary of 16 sessions of Neurofeedback

<b>No</b>	<b>Protocol</b>	<b>Tools</b>	<b>observation</b>
1	C3 Theta	Soothing music	Feeling uneasy with the electrode attached to his scalp and ears Impatient, unable to wait and sit still
2	C3 Theta	Soothing music	Same situation as in 1 <sup>st</sup> session
3	C3 Theta	Soothing music	Possesses better ability to sit still however still very impulsive
4	C3 Theta	Soothing music	Able to use simple word to describe his need. ('take', 'give'). too much of 'alien' talking and noise
5	T3 Theta	Soothing music	More cooperative
6	T3 Theta	Chinese song	Impatient, fidgety Need prompts
7	C3 Beta	Video	Unable to concentrate
8	C3 Beta	Video	Able to look at therapist when therapist count to 20
9	C3 Beta	Video	Calm and able to sustain longer patience during the therapy sessions
10	C3 Beta	Video	Able to sustain 15 minutes attention
11	C3 Beta	Video	Emotionally unstable, however able to request for video and song
12	C3 Beta	Video	Stable and able to sit still

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13	C3 Beta	Video	High beta was stable, beta was higher. At the 4-6 periods, his theta increased.
14	C3 Beta	Video	He was very routine and insist on watching the familiar video
15	C3 Beta	Video	Able to greet others with clearer pronunciation and he responds better to instructions.
16	C3 Beta	Video	Sometimes, distracted and exhibited higher activity level. However, more controllable.

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## 1.5 POST-TREATMENT BEHAVIOUR

The following description of changes since the initiation of Neurofeedback training comes from his mother and uncle, who is currently staying with them in the same house, and also from our own observations.

According to the feedback from his mother; Richard was noted with more functional speech. When his brother hit him, he will express: “brother is naughty” (in Mandarin), previously he will ignored. According to his uncle, the eyes contact of Richard improved and his social interaction skill improved, he was able to express verbally regarding his needs. Visible result was also noted when his speech is getting more appropriate in different scenario.

The self-help skill of Richard improved; he is now able to use toilet instead of potty; in additional to that, he possesses better understanding towards his surroundings. Even though Richard exhibited improvement in different areas, however he is still very distracted and unable to concentrate. To overcome this, SMR beta was rewarded at T3 region. At 14<sup>th</sup> session, his mother feedbacks that the temperament of Richard has improved, he’s much calmer than before the therapy. In additional to it, the high activity level of

Richard has improved and he is in a better position to control his behaviour.

## **1.6 AUTISM TREATMENT EVALUATION CHECKLIST (ATEC)**

ATEC was used to evaluate the effectiveness of Neurofeedback therapy in Richard. According to the ATEC prior to the treatment, Richard scores a total of 104. The score of 104 indicates that Richard is at the 90th percentile, and is considered as severely autistic. After the 16 sessions of Neurofeedback therapy, Richard was retested and an overwhelming result was produced, the test review a score of 56. This places Richard in the 30-39 percentile level and indicates that Richard has a good chance of being semi-dependent and a greater chance to study in mainstream education.

## **1.7 CONCLUSION**

Neurofeedback is biofeedback training of EEG activity through an operant conditioning process by which the individual is trained to increase or inhibit the brain's production of electrical activity in specific frequency ranges (Jacobs, 2005). The behavioral changes in this 9-year-old boy with autism are viewed as a positive outcome of Neurofeedback therapy. These results are suggestive that Neurofeedback therapy can be an effective treatment for some of the symptoms of mild autism. There is no clear guideline and direction on how many session of Neurofeedback therapy should one receives to optimize the performance. However, it is significant that Neurofeedback therapy does not produce any adverse effect; thus it is recommended for Richard to carry on with Neurofeedback therapy for long term EEG changes.



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