The Application of Senses Me Smart (SMS) Program for Task of Executive Control in Autistic Spectrum Disorders Child

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Abstract—The purpose of this study was to address the effectiveness of Senses me smart (SMS) program to improve task of executive in a child with autism spectrum disorders (ASD). This development of SMS program was based on Sensory Intervention (SI) theory. This program has been designed for a child in particularly ASD diagnosed with shown sensory integration problem that involve with executive function control. The SMS program helps a child to represent higher performance to integrate multisensory activities. This study shown positive outcome in Goal Attainment Scaling (GAS) scores and the Task of executive control (TEC) test was shown the better performance to assess in working memory and inhibition control among pre-test, mid-test and post-test. The result presented lower T score of TEC possibly improves working memory and inhibition control. Therefore this finding suggests that the SMS program is an alternative intervention program for enhancing task of executive control in ASD children.

Keywords—Executive function, Sensory theory, Autistic spectrum disorder.

I. INTRODUCTION

AUTISTIC spectrum disorder (ASD) is a group of development disorders person who refers to characterized by social deficits and communication difficulties, stereotyped or repetitive behaviours and interests, sensory issues, and in some cases, cognitive delays (1). Many children with ASD often have problem in social skill, communication skill and behaviour skill. Previous studies explain the stereotype behaviours in autism is the dysfunction in process of sensory information (2). Sensory processing (SP) or sensory integration (SI) is an ability of sensation for use in daily life. Problem with Sensory processing had been reported in 88% of children with autism. Children with sensory processing disorder (SPD) have difficulty regulating responses to sensation, specific stimuli and use self-stimulation to compensate for limited sensory input or to avoid overstimulation (3). This behaviour problem can effect in social skill, personal life, education and often limit ability in their normal daily living and leads to problem in domain of Executive function (EF) include; rigid (need for sameness),

repetitive behaviours (planning), impulsive (inhibit), difficulty to change and imitating new non-routine action (shifting). Currents researches found EF in ASD are difficulties in inhibition of propose response and working memory, ASD child who had poor EF on inhibition might be lost of their self-control in difficulty situation, lead to emotional control and behaviours problem. In domain of working memory found the relationship between working memory and language skills. Working memory lead to impair in verbal skill, follow command skill and attention span (4-6). At present, there are many interventions for ASD and The SI approach is commonly used with ASD. SI intervention help to explain, alleviate the problem experienced by children with developmental disability. Several studies of children with ASD have support for the positive effect of SI therapy in area such as reduced self-stimulating, increased functional behaviour's, interaction and play. Recently study found the SI program with interactive metronome training can improve executive function as well as sensory processing (7,8). However, there is less evidence on to impact of sensory integration on executive function. Therefore, this study aim to design Senses Me Smart (SMS) program which base on Sensory Intervention (SI) theory. To focused on the effect of SMS program on executive function in autistic spectrum disorders child.

II. METHOD

A. Participant

R is an eight years old boy who has been diagnosed with ASD when he was two years old. He was randomized to the treatment group for this study. R's mother provided parental permission for him to participate in this study. His initials have been changed to maintain confidentiality.

A detailed history of interviewed from the child's mother revealed that R was born by natural birth after full-term pregnancy. His medical history and his health is described as good. But when he was two years old his mother found something mistake about him such as he had cry for a long time in one day, he didn't has eye contact, he can't talk or communicate. His parent took him to see the physician then they diagnosed he is ASD, Define by DSM-4. R have been managed with 5 mg of Risperdal 2 times per day. He lives with his parents, grandma and older sister in their house in Bangkok. He attend school full day in a mainstream classroom with a 1:2 aid for behavioural support.

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His mother and teacher were describe him as smart but distractibility, talkative and impulsivity. He always rolling his head and nod every time. He lost of his self-control and often doing wired thing.

R will participate in all 12 sessions in one month. In addition, the participant was informed that they could withdraw from the study at any time without penalty.

B. Measurement Tools

Task of executive control (TEC) is a standardised computer-administered measure of two fundamental aspects of executive control processes: working memory and inhibitory control. This task is the individual test for people who at age range from 5-18 years. The test have two subjects; N-back paradigm that parametrically increases working memory load and A go/no-go task to manipulate inhibitory control demand. The four tasks for 5- to 7-year-old children and six tasks for older children and adolescents ages 8-18 years. With highly accurate timing and a stable platform, the TEC calculates multiple norm-referenced measures of accuracy, response time, and response time variability as working memory load increases in both inhibit and no inhibit conditions (9). In this study TEC assessment for three times (Pre-test, Mid-test and Post-test) and higher score of T- score indicate higher problem in Executive control.

Goal attainment scaling (GAS) is a method of scoring the extent to which patient's individual goals are achieved in the course of intervention. In effect, each patient has their own outcome measure but this is scored in a standardized way as to allow statistical analysis. Traditional standardized measures include a standard set of tasks (items) each rated on a standard level. In GAS, tasks are individually identified to suit the patient, and the levels are individually set around their current and expected levels of performance (10). For this study, the goals were set by researcher and parent. The goals were individualized for the child and divided in to four areas; 1.Repetitive behaviour and restricted interests, 2. Behaviour issues, 3.Attention difficulties, 4. Emotional skill.

An important feature of GAS is the 'a priority' establishment of criteria for a 'successful' outcome in that individual, which is agreed with the patient and family before intervention starts so that everyone has a realistic expectation of what is likely to be achieved, and agrees that this would be worth striving for. Each goal is rated on a 5-point scale, with the degree of attainment captured for each goal area: If the patient achieves the expected level, this is scored at 0. If they achieve a better than expected outcome this is scored at: +1 (somewhat better), +2 (much better). If they achieve a worse than expected outcome this is scored at: -1 (somewhat worse) or-2 (much worse). The negative numbers represent less-than-expected outcomes, and the positive numbers represent greater-than-expected outcomes. The scores from parents and therapists provided input into what score the child attained in each goal at the end of the study to ensure that the goals were relevant and at appropriate for the child.

C. Intervention

Intervention was decided to a child who has ASD by license occupational therapist. Participant received SMS program for tree times per week until twelve sessions were completed in one months. The preliminary examinations were conducted on the first session, after the six session and after the last session. The Senses Me Smart (SMS) program is based on Sensory intervention (Ayres, 1991). The SMS program consisted of multisensory input, physical exertion activities, guide emotional control, ensure that activities are successful, improve attention and all activity are safety.
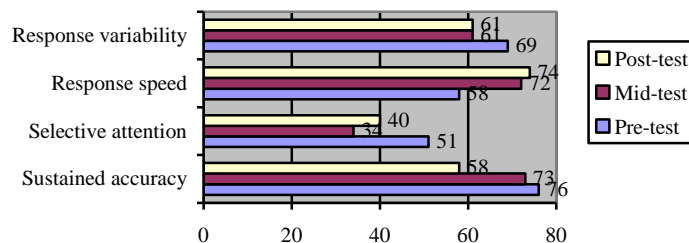
III. RESULT

Fig. 1: The trends of Factor *T*-score on the TEC

As shown in Figure 1 , R showed T-score of Sustained accuracy is 76 scores for the pre-test, 73 scores for the mid-test and 58 scores for the post-test. These T-score shows the child had improvement on the mid-program and the post-program. The T-score of Selective attention is 51 scores for the pre-test, 34 scores for the mid-test and 40 scores for the post-test. This result shows the child had improvement on the mid-program and the post-program. The T-score of Response speed is 58 scores for the pre-test, 72 scores for the mid-test and 74 scores for the post test. These t-score shows the child had not improvement on the mid-program and the-post-program. The T-score of Response variability is 69 scores for the pre-test, 61 scores for the mid-test and 61 scores for the post-test. These result shows the child had improvement on the mid-program and did not improvement more on the post-program.

In addition, the results are show the T-score of TEC report from pre-test, mid-test and post-test as followed variable of working memory and inhibitory control (Table 2).

TABLE II: The Task *T*-score on Working memory and inhibitory control

Time	*T*-scores	
	Working memory	Inhibitory control
Pre-test	65	79
Mid-test	58	71
Post-test	56	52

According the table 2 indicates the level of each time in working memory and inhibitory control. The T-score of working memory is 65 scores for the pre-test, 58 scores for the mid test and 56 scores for the post-test. The T-score of inhibitory control is 79 scores for the pre-test, 71 scores for the mid-test and 52 scores for the post-test.

In summary, data at second week of this program showed that working memory and inhibitory control had the positive changes during the SMS program and the data at fourths week showed that working memory and inhibitory control had the positive changes after the SMS program as measured by Task of Executive control (TEC) (Figure 2).
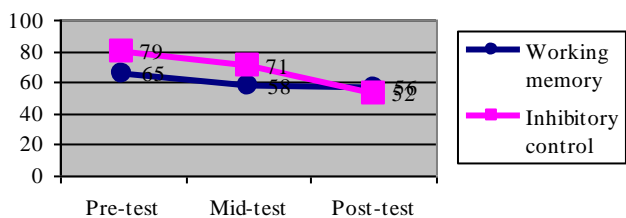
Fig. 2: The trends in Executive function T-score

Therapist and parent shown positive rating of R' GAS as shown in the Figure 3, indicating better-than-expected achievement of goals. For OTs, his outcome in the first and the third goal was better than expected (rating =1), and the outcomes on the other goals was much better than expected (rating =2). And for parent, his outcome in the third goal was better than expected (rating =1), and the outcomes on the other goals was much better than expected (rating =2). The goals follow on his behaviour; 1) R. rocks himself less than 10 times in one hours, 2) R. laugh with no reason less than 5 time in one hours, 3) R. has attention more than 15 minutes in one hours and 4) R. can follow command for 4 sequence. This result indicates that the variable are trend to an efficacy trial.
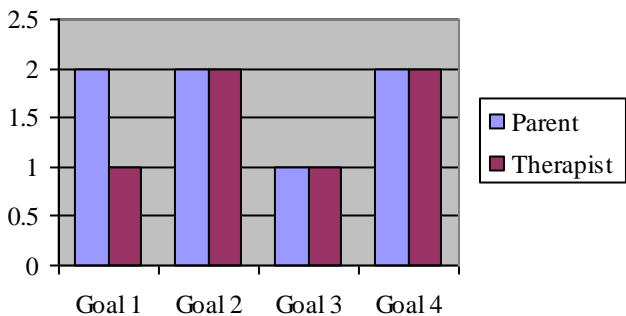

Fig. 3: The trends in GAS scale

IV. Discussion

This study demonstrated the Application of Senses Me Smart (SMS) Program for Task of Executive Control in Autistic Spectrum Disorders Child. The result of TEC and GAS scale support the hypothesis that SMS program can improve Executive function in area of Working memory and Inhibitory control. The result of TEC represent the positive outcome after program. The score of Factor T-score on TEC showed the child had improvement performance in Sustain accuracy, Selective attention and Response variability that showed the improve of working memory skill and Inhibitory control skill, according to the T-score of Task score of T working memory and inhibitory control showed the positive from Elevated score (60-100 scores) to Typical score (40-60 scores) in all areas. However the result of Response speed in Factor score had higher score, that can interpret to not positive change on TEC but it's present the positive change in attention for the child, even he used more time he can select more correct answer, too. That's showed the responds time is related to attention skill and executive function.

The result of the study supported the use of more individual measure, GAS is a useful method for qualifying individual outcome (11). The goals were develop by the parents and therapist before the start of the program and then score again after the program. GAS data were analyzed by standard scores that follow all goals. These finding positive preliminary support to use SMS program to improve the desirable behavior, attention and executive function.

V. Conclusion

This study provides positive effect of The SMS program to improve Executive function in an ASD child. The results showed positive change in TEC test and GAS score after four weeks of SMS program, these finding are interesting and may be strengthened even in future study with a longer period time.

A. Limitations and Future Research

Finding from this study suggest the future studies should be address more effectiveness of Senses me smart (SMS) program to improve task of executive in a child with autism spectrum disorders (ASD). The duration and intensity of this program is for a short-term goal, it is important to guild intervention planning. The measurement will be develop for the future effectiveness studies. Finally the pilot study and RCT should include a larger sample size, the longer period of program, the reliability of the fidelity measure is necessary.

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