CASE REPORT

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The Impact of Puzzle Games on Attention and Fine Motor Abilities Upon Cases of Autism Spectrum Disorder: A Case Report

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ABSTRACT

Background: Autism Spectrum Disorder (ASD) is brought on by the neurobiology process. This disorder ultimately results in the inability to communicate with others, a lack of interest, and repetitive behavior. One of the things that are most often encountered in children with ASD is reduced eye contact. Which, of course, will impact the severity of social deficits in the future. Patients with this behavior condition also experience motor impairments, particularly in fine motor abilities and eye contact difficulties. Naturally, there is a relationship between eye contact and fine motor abilities, where the intensity of the person's attention will undoubtedly predict fine motor abilities. Both abilities can be improved by solving puzzles. Playing this game might enhance focus, attentiveness, and fine motor abilities. This study aims to understand how puzzle games affect the attention and fine motor abilities of children with ASD.

Case Description: The patient was five years and six months old with a genetic background and was diagnosed with ASD. This study was conducted at the Intan Child Physiotherapy Clinic (IFA), Boyolali. The length of time the child can maintain eye contact with objects during an attention evaluation will be used by the therapist to gauge the fine motor skills and assess how well the youngster grasps and pinches objects. Observational data-gathering approaches are employed throughout therapy.

Results: The patient's capacity for eye contact attention was worth 1 second, whereas the capacity for attention to objects was 30 seconds. The number for grabbing was three (plenty), whereas the value for pinching was one and a half (very little).

Conclusion: There was no significant improvement in both attentional and fine motor skills.

Keywords: Autism, Fine Motor, Attention, Puzzle Games.

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INTRODUCTION

Kemenkes (2022) reports that during the 2020–2021 period, there were 5,530 cases of child development abnormalities, including Autism Spectrum Disorder (ASD), in primary health care (Puskesmas) services.[1] In 2022, 1 in 100 children worldwide is expected to have ASD, according to the World Health Organization (WHO). Of course, the prevalence of those with autism, which keeps rising yearly, is a concern for the family and the national government, whose urgency has increased dramatically.[2] Although there aren't any clear tendencies in this situation regarding racial, ethnic, or socioeconomic categories, there are four times as many men who are affected by ASD as women.[3]

According to one interpretation, ASD is a syndrome marked by repetitive behavior, limited interests, and a disruption in neurodevelopment that results in difficulties in social communication.[3] ASD is a complex developmental syndrome that entails persistent difficulties with social communication, a lack of interest, and repetitive conduct, according to the American Psychiatric Association (APA).[4] Typically, ASD symptoms appear in children and persist throughout life. Although the specific cause of ASD is still unknown at this time. A wide range of genetic and neurobiological abnormalities was known to characterize ASD. Still, new research has shown that these disparate risk factors will come together in endophenotypes that manifest before the diagnosis is made, one of which is decreased eye contact. Reduced eye contact in the first six months is directly linked to severe social deficiencies in later life.[5]

ASD development may also be linked to motor impairments in addition to eye contact.[5] ASD is characterized by deficits in social interaction, communication, and repetitive behavior, according to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5); however, a growing body of research indicates that this condition is also associated with deficits in motor

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development. A review of prior studies reveals that repeated impairments in fine-gross motor abilities, postural control, and other motor behaviors are present in both children and adults with ASD.[6]

One of the most prevalent deficiencies and delays in ASD cases is fine motor skill development.[6] This skill is referred to as the capacity to employ small muscles for tasks like writing, squeezing, gripping, stacking blocks, and inserting marbles.[7] When compared to general gross motor skills like walking, fine hand movements appear to be more susceptible to delays in ASD.[6]

The development of motor skills and eye contact are both related.[9] An underlying motor skill failure can manifest as impaired attentional eye contact. According to earlier studies, children's fine motor skills improve when they can focus more intently to complete tasks.[8] A person's level of attentional focus will undoubtedly predict his fine motor skills. Indeed, paying attention to the object and paying attention while responding is necessary for the motor reaction. Naturally, improper handling of the object will impact the subsequent motor planning.[9]

According to research by Mokobane (2019), children with attention deficit hyperactivity disorder (ADHD) struggle with fine motor abilities, which affects their handwriting and academic performance. This piqued the curiosity of researchers who wanted to discover if puzzle games affected the attention and fine motor skills of ASD children.[9] Playing entertaining games is one approach to help people with ASD develop their attention and fine motor abilities. Puzzle games are educational because they help students focus, pay attention, develop fine motor skills, and practice patience and problem-solving skills.[10]

This case report intends to find an exercise program that can improve attention and fine motor skills in children with ASD. Specifically, this study investigates if playing puzzle games improves ASD patients' attention and fine motor skills. It is expected that by using puzzle games to practice attention and fine motor skills, this research design may be helpful to therapists, parents, and teachers.

CASE DESCRIPTION

This research was a case report study conducted at the Intan Fisioterapi Anak Clinic (IFA) Boyolali. The patient was a child aged five years and six months old with genetic background and was diagnosed with ASD. There were no grievances throughout the pregnancy. A healthy baby was born on February 20, 2017, normally (pervaginam), with a great APGAR score. To the mother's inability to produce milk, the child does not ingest breast milk; formula milk is given to the infant, who has a good sucking reflex. Children walk at 20 months without stepping on the crawling phase. Some words come out "mama", "mbah", and "maem". The child has been hyperactive and avoids eye contact since the beginning of their development. At the ENT, a preliminary hearing test was performed; the results showed normal hearing. The patient underwent therapy 6 times in 2 weeks by providing interventions in the form of puzzle games to increase attention and fine motor skills.

The child recently paid attention to eye contact and maintained eye contact with strangers for five seconds. The child can only complete one count while at the clinic. Along with the lack of eye contact, children have poor social skills; they prefer to play alone and can only communicate in two directions by bubbling. Similarly, their emotions often burst into flames. Moreover, the child still struggles with both gross and fine motor skills. When children kneel, they still have trouble integrating their right and left sides. When the child stands and walks, there is a propensity for both the trunk and the knees to be flexed, and when the child sits, the posture tends to be flexed. Fine motor skills still struggle with hand-eye coordination when gripping, picking up, and holding objects.

A child with ASD who exhibits features of social communication difficulties, limited interests, and repetitive behavior is classified as having level 3, according to the findings of a test using the DSM-5. When a person has a level 3 social communication deficiency, they have a severe lack of verbal and nonverbal social communication abilities, severely impairing their ability to function. They also initiate social interactions very slowly and respond only little to social advances from others. Level 3 repetitive conduct and a restricted interest deficit indicate that the child is overly preoccupied with that behavior and repeats it frequently. When routines or activities are interrupted, people become easily agitated and upset; diverting attention from the topic of interest is quite challenging.

METHODS

Measurements

The information for this research study is qualitative information about the attentional and fine motor skills of kids with ASD. Observational data-gathering approaches are employed throughout therapy. The observation of this intervention will be crosschecked through interviews with therapists and parents to establish its effectiveness.

The measurements consist of monitoring the child's eye contact attention on items and on the

therapist, which is computed depending on how long the child can sustain his focus on the object in front of him. Regarding examining children's fine motor skills, this case study employs an observation sheet to track the development of children's fine motor skills in grasping and pinching. The evaluation was based on the assessment criteria and further analyzed using the modified assessment criteria (Table 1).[11]

Interventions

The blocks should be placed apart from the container for this observation, given a distance of roughly 1 meter away. Then, until they are finished crawling, instruct the child to arrange the block pieces according to color. Additionally, during the therapy session, the children's holding and pinching of the block pieces will be observed. During the activity, observations will be made regarding the child's attention while inserting the block pieces that match the color.

Table 1. Observation Sheet of Fine Motor Skills.

Therapy	Fine Motor Skills					
	Holding			Taking		
	O1	O2	A	O1	O2	A
1						
2						
3						
4						
5						
6						
Total						
Average						

O1: Observer 1; O2: Observer 2; A : Average

Assessment Criteria	Modified Assessment Criteria
5 : Very Good	4.6 – 5.0 : Very Good
4 : Good	3.6 – 4.0 : Good
3 : Enough	2.6 – 3.0 : Enough
2 : Less	1.6 – 2.0 : Less
1 : Very Less	0.0 – 1.5 : Very Less

Table 2. Results of Observation of Fine Motor Skills.

Therapy	Fine Motor Skilss					
	Holding			Taking		
	O1	O2	A	O1	O2	A
0	2	4	3	2	1	1.5
1	2	4	3	2	1	1.5
2	2	4	3	2	1	1.5
3	2	4	3	2	1	1.5
4	2	4	3	2	1	1.5
5	2	4	3	2	1	1.5
6	2	4	3	2	1	1.5
Total	14	28	21	14	7	10.5
Average	2	4	3	2	1	1.5

RESULTS

Attention Evaluation

Regarding the development of children's attention (assessed in seconds), the child does not experience an increase in the attention aspect of eye contact with either objects or therapists. From the 0th week until the 6th week, the child could only give attention to objects for 30 seconds and no more than 1 second on the therapist.

Fine Motor Evaluation

There was no gain in fine motor abilities in both the gripping and pinching aspects from the 0th week until the 6th week when using the observation sheet to observe the development of children's fine motor skills in the grasping and pinching parts. The child only gets an average of 3 in the holding aspect, indicating that the capacity to hold is sufficient and an average of 1.5 in the picking aspect, indicating that the child's ability is still inferior.

Furthermore, there was no improvement in fine motor skills from the first to the sixth day. The average value in fine motor skills of holding merely 3 is sufficient for interpretation. On the other hand, fine motor abilities in the form of pinching have an average score of 1.5, indicating that the child's ability remains in the deficient category. The scoring sheet can be seen in Table 2.

DISCUSSION

According to the findings of a study on ASD children, there was no development in attention or fine motor abilities using puzzle games. The findings of static graphic data were acquired on features of attention development both before the intervention (T0), and after the intervention (T6). The child could only maintain eye contact in a puzzle game for 30 seconds. When the kid believed that he could place the pieces of blocks in the container even though the two colors did not match, or when the child found it difficult to place the pieces of blocks according to their shape, the child preferred to leave them. Similarly, when the child began crawling, they were easily distracted by items and the therapist. The youngster then did not care about staring at the therapist during therapy or when the therapist spoke and only stared for one second. There was no progress in staring at the therapist either before the intervention (T0) or throughout the last intervention (T6).

This contradicted the findings of Rohman and Ardianingsih (2018), who discovered that puzzle

games impacted the attentional abilities of ASD children. There were changes in the outcomes before and after therapy by delivering treatment of puzzle games for 230 minutes in 6 meetings to 6 children.[12] Before treatment, the average value of autistic children's ability was 54.16, with an inferior interpretation. The capacity to pay attention to autistic children could touch an average value of 73.60 after therapy, indicating that the child's ability was considered adequate.

This disparity in outcomes may be due to variances in treatment delivery mechanisms. In the previous study, the child was only told to put the puzzle together without crawling from one place to another.[12] In our research, the child was easily distracted by the therapists and needed help to give complete attention to the work. Furthermore, suppose the child's brain was damaged in the amygdala (the focus of attention) and the cerebellum (the coordinator of body movements). In that case, it will be difficult to correct the ability disturbance. In other words, brain injury is irreparable and will endure a lifetime.[13]

Naturally, the puzzle game method's inability to help the child grow his attentional skills will coincide with the child's failure to advance his fine motor talents. There was no change in gripping and picking skills. From the start of the intervention (T0) through the end (T6), gripping abilities received an average score of 3, indicating that he has good grasping abilities. The child could maintain the block pieces so that he did not slip from their grasp while engaging in crawling activities, even though the way he held was not satisfactory. The average score for the child's capacity to pick up things from before the intervention (T0) to the final intervention (T6) was only worth 1.5. The child typically struggled and took a long time to pick up small objects.

The child's poor attention probably caused the child's difficulty in increasing his fine motor skills. Due to their inability to fix their focus on a single thing, people with attentional problems will undoubtedly need help to finish tasks.[14] There will undoubtedly impact how well kids understand material due to the multiple distractions they face while trying to perform activities in this game. Because focus dramatically affects the transmission of information from sensory memory to short-term and, subsequently long-term memory.[15]

The literature review by Karalina and Budiyanto (2022) discovered that the effects of puzzle games could produce a beneficial response to the fine motor coordination skills of autistic children.[10] This could benefit children with autism by stimulating fine motor development through the use of media related to hand and eye coordination movements in puzzle games. This finding is supported by research by Yusuf et al. (2018) with toddler subjects. The average value obtained before therapy was 7.71, with a standard deviation of 0.849. The average value acquired after treatment was 8.65, with a standard deviation of 0.493. However, donating behavior was only undertaken in 6 sessions for two weeks.[16] Of course, more intervention is needed to alter the situation significantly. The duration of treatment and cooperation from the patient, the patient's family, and the therapist are longer for central nervous system disorders.[17]

The age of the child receiving therapy is a component that also needs to be considered. This intervention occurs at five years and six months when the child has passed his *Golden Age Period*. The increase in children's learning ability was due to greater brain plasticity during this critical period to make it easier for the brain to accept new experiences.[18]

Meanwhile, parental support plays a vital role in child development. Our interviews with the patient's family and therapist indicated that the patient's family allowed the patient to play alone and left the child's growth to the therapist. Children's poor attention and fine motor skills could also be attributed to a lack of learning repetition at home by the therapist's instructions. Much research indicated that family characteristics influence response for various therapies.[19] Parental empowerment has a favorable effect on the abilities of children with ASD, including increases in communication skills, everyday life satisfaction, tactile-language, psychological, and command comprehension.[20] Further research using other methods are required to get comprehensive results.

CONCLUSION

Attention and fine motor skills did not improve due to physiotherapy treatment in the form of a puzzle game for a 5-year-old with ASD. Several factors, including brain injury, the age of the children during therapy, and a lack of family support, will contribute to improving attention and fine motor abilities.

CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

ETHICAL CONSIDERATION

The authors had requested the patient's and parent's consent before reporting the condition, and they had been permitted to write and publish the work.

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AUTHOR CONTRIBUTIONS

ZA, AFN, IP, and APW conceived the study design, collected the data, performed data analysis, and interpreted the results; ZA, AFN, and AP prepared the manuscript; IH reviewed the results and approved the final version of the manuscript.

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