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The Effectiveness of Cognitive Rehabilitation Based on Face Emotional Recognition on Behavior Inhibition and Theory of Mind in Children with Oppositional Defiant Disorder

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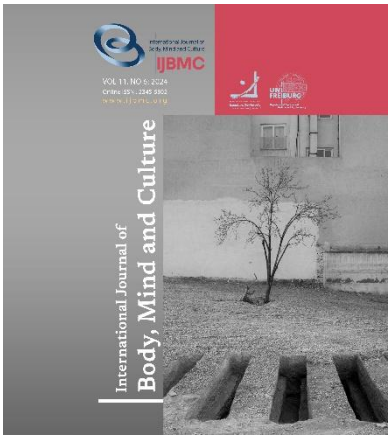

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ABSTRACT

Objective: Oppositional defiant disorder is an outward disorder and one of the most common disruptive behavior disorders that is considered the third most common psychiatric disorder whose primary symptoms are behavioral, cognitive, and emotional problems. The purpose of this study was to investigate the effectiveness of cognitive rehabilitation based on facial emotional recognition on behavioral inhibition and theory of mind in children with oppositional defiant disorder.

Methods and Materials: The present study was quasi-experimental research with a pretest-posttest design. The study population consisted of all male students in the second and third grades of elementary schools in the 7th and 6th districts of Tehran in the academic year (2020-21) who have symptoms of oppositional defiant disorder. The available sampling method was purposeful, so 20 students who met the inclusion criteria were selected and randomly assigned to experimental and control groups of 10 people. The research instruments included the Go/No-Go response inhibition test, the Eyberg Child Behavior Questionnaire, and Stirenman's 38-item theory of mind. A cognitive rehabilitation program based on facial emotional state recognition was performed for the experimental group for 22 sessions. A multivariate analysis of covariance (MANCOVA) was performed with SPSS-26 to analyze the data.

Findings: Findings showed that cognitive rehabilitation based on facial emotional recognition improved theory of mind ($p<0.01$) and behavioral inhibition ($p<0.01$) in children with oppositional defiant disorder.

Conclusion: It can be concluded that cognitive rehabilitation based on face-emotional recognition was effective in behavior inhibition and theory of mind in children with oppositional defiant disorder.

Keywords: Child, Cognitive Training, Oppositional Defiant Disorder, Theory of Mind.

Introduction

One of the most common disorders in children is Oppositional Defiant Disorder (ODD). In this disorder, the child's frenzy, refusal to observe the rules, and disruptive behaviors are beyond expectation compared to children of the same age. This disorder involves a persistent pattern of negativist, arbitrary, stubborn, harsh, hostile, and rude behaviors without serious flaws in social norms or the rights of others (Saddock et al., 2017). The prevalence of this disorder varies from 1% to 11% according to foreign research, with the mean prevalence estimated to be about 3.3%, and in the non-

clinical population is between 4% and 11% (Vatankhah Amjad & Ameri, 2020). The prevalence of this disorder is 12 to 16 percent, depending on the nature of the population and research methods (American Psychiatric Association, 2022).

Primack and Woodruff first proposed the theory of mind in studying chimpanzee behavior (Call & Tomasello, 2018). Recent research has conceptualized the theory of mind as a capacity consisting of two essential components: the social cognitive component and the social cognition component. The element of social perception is the ability to decode the mental state of others based on observable and available information, and the social cognition component is the ability to receive and infer the mental state of others to predict their behavior. Social cognition encompasses all the skills the child needs to understand other children's and adults' desires, emotions, and feelings (Ataei et al., 2022; Bagheri Sheikh et al., 2021; Bulgarelli & Molina, 2016).

Inhibition deficiency is another prominent feature of disruptive disorders and behavior. Inhibition is one of the components of executive function. Executive functions refer to a broad cognitive process used to investigate direct behavior, especially in situations where some responses need to be inhibited or other responses to be initiated. Despite the lack of a consensus on the components of executive functions, most researchers agree on the inhibition component and memory as the main components of administrative functions (Ernst et al., 2018; Nasri et al., 2018). Failure in response inhibition leads to the child's inability to refrain from thinking or behavior created at the wrong time and place, suddenly answering questions or interrupting conversations with others. Such behaviors show children in haste and increase their punishment, blame, and rejection (Fox et al., 2021). In addition, children with this impairment need inhibition and participation in social functions such as waiting for turns, responding to nonverbal cues, understanding the feelings of others, and participating in social situations. Also, they exhibit aggressive behavior concerning others, making it very difficult to establish and maintain friendships (Fox et al., 2021).

Cognitive rehabilitation is a systematic therapy that aims to improve the patient's cognitive deficits and functions, such as memory, executive functions, social comprehension, concentration, and attention. Aims to treat behavioral problems. Cognitive rehabilitation therapy focuses mainly and exclusively on cognitive abilities, a special and unique type of therapy (Acland et al., 2021; Leung et al., 2013; Mehl et al., 2020; Vatankhah Amjad & Ameri, 2020). Cognitive rehabilitation restores the lost mental capacities by training and providing targeted stimuli, improving performance in individual activities. In completing the definition of cognitive rehabilitation, it can be said that the purpose of this intervention is to reinforce or restabilize the person's previous behavioral patterns and stabilize new behavioral patterns to perform activities or provide cognitive mechanisms to compensate for damaged nervous system functions. The purpose of this study was to investigate the effectiveness of cognitive rehabilitation based on facial emotional recognition on behavioral inhibition and theory of mind in children with oppositional defiant disorder.

Methods and Materials

Study Design and Participants

The present study was a quasi-experimental research with a pretest-posttest design. The statistical population of this study consisted of all male students of second and third-grade elementary schools in Tehran 6th and 7th districts who were studying in the academic year 2020-21 and had oppositional defiant disorder symptoms and had inclusion criteria.

Since the proposed sample size in intervention studies is at least (12-10) people (Delavar, 2002), in this study, considering the possibility of sample loss, the sample size in each group is regarded as 12 people for more accuracy. This study selected purposeful sampling from volunteers who wanted to participate. The study's final sample was 20 children with second and third-grade primary oppositional defiant disorder syndrome who met the criteria for entering the study and remained in the study until the end of the study. Inclusion criteria include the consent of parents to cooperate with the researcher with the presence of oppositional defiant disorder syndrome (based on the Ayberg scale), the child is not under medication and psychotherapy due to psychological problems (based on the information contained in the demographic questionnaire and initial interview), the child lives with both his parents, and the second and third-grade children of elementary school

without a history of repeating the academic grade. Exclusion criteria included the absence of more than three consecutive sessions of subjects, which caused irreparable failure from intervention sessions and concurrent participation in similar educational interventions.

Ethical considerations in the present study included obtaining oral consent from the participants to participate, all research patients being free to withdraw from the study at any stage, and all their information being kept confidential. Patients were also ensured that not participating in the research or not continuing to cooperate would not affect the care provided to them and would not interfere with their treatment. Data entry and preparation of the final report, the information of subjects or their names were not disclosed in any of the data collection steps, and their data was not provided to any actual or legal person. Also, participation in the research did not impose any financial burden on the subjects.

Data Collection Tools

Demographic questionnaire: This questionnaire was used to collect descriptive information and demographic characteristics of parents of the subjects, including the child's name and surname, child's age, grade of education, birth order, occupation and mother's education, occupation and education of the father, entry and exit criteria including history of receiving medication and psychotherapy of the child.

Theory of Mind Questionnaire (Stirrenman, 1999): The original form of this test was designed by (Stirnman, 1999) to measure the theory of mind in normal children with pervasive developmental disorders aged 5-12 and provide information about the extent of the child's social perception, sensitivity, and insight, as well as the degree to which they can accept the feelings and thoughts of others. The correlation coefficients of the subtest with the test's total score were significant in all cases and ranged from 0.82 to 0.96. The reliability of the test by three retest methods ranged from 0.70 to 0.94, and all coefficients were significant at the level of one hundredth. The test's Internal consistency was calculated using Cronbach's alpha for the whole test, and each subtest was 0.86, 0.72, 0.80, and 0.81, respectively. Also, the reliability coefficient of the scorers was 0.98, which was significant at the level of 100 (Jameei & Gharibzadeh, 2023; Kouklari, 2023).

The Go/No-Go Task: This task consists of 100 actuators (planes) that the person had to press the same cursor button on the computer's keyboard when the child presented the plane after delivering the aircraft. The person should refrain from pressing the cursor key on the plane on the keyboard. In this test, the number of right and wrong responses of the person when presenting the non-stop stimulus (stage go), the mean duration of correct and incorrect responses, and the number of right and wrong reactions of the person when presenting the motion stimulus with stop stimulus (stage No-Go) and the average duration of these responses are measured. This test's validity and test-retest coefficient were reported to be above 0.8 (Nejati, 2021; Yang et al., 2018).

Child Behavior Questionnaire (ECBI): This instrument is a self-report tool (parent response) with 36 items, designed in 1978 by Ayberg and Ross, to measure common problematic behaviors in children and adolescents aged 2-16 years in two severity and problem scales. This list is scored by parents and on a 7-point Likert scale from (never) to (always). Also, the child's behavior is determined by grading each item as yes or (no). From the sum of the frequency of behaviors, the severity scale score, and the sum of yes answers, the behavioral problem scale is determined. The validity and reliability of the questionnaire are as follows: In the study of Connors et al. (2007), the alpha coefficient of the severity scale is 0.95, and the problem scale was 0.91 (Abdolali et al., 2023).

Intervention

Cognitive rehabilitation Recognizing Aref facial expressions: This educational therapy program has been designed by the Institute for Cognitive and Brain Sciences, affiliated with Shahid Beheshti University. The Facial Cognitive Rehabilitation Package (Aref) was designed and constructed by Nejati (2017) at the Institute for Cognitive Neuroscience and Brain Sciences affiliated with Shahid Beheshti University. It is a computer program that performs emotional recognition training using graphical forms. The progress of this intervention task is based on the difficulty of recognizing emotional states, the number of options, and the severity of emotional manifestations. Also, the effectiveness of

this program was investigated in a study on the social cognition of children with high-functioning autism, and the results of this study showed that this program is effective on social cognition skills (mind reading) of autistic children.

Data analysis

To analyze the data, frequency distribution tables, graphs, mean and standard deviation, and the inferential statistics section, multivariate analysis of covariance was used to analyze the hypotheses. Data were analyzed by SPSS version 26.

Findings and Results

Table 1 presents the descriptive statistics of research variables.

Table 1

Statistical description of theory of mind scores in two stages of measurement by experimental and control groups

Group	Variables	Pre-test		Post-test	
		M	SD	M	SD
Control	Recognizing Emotions and Pretending	11.58	2.36	12.42	2.43
	Understanding the wrong belief	7.26	2.17	7.83	2.54
	Misunderstanding Secondary Belief	3.06	1.09	3.43	0.92
	Theory of Mind	21.90	2.77	23.69	3.35
Intervention	Recognizing Emotions and Pretending	12.64	2.51	15.62	2.10
	Understanding the wrong belief	6.92	2.29	9.86	2.72
	Misunderstanding Secondary Belief	2.47	1.12	4.04	0.72
	Theory of Mind	22.04	3.42	22.52	2.35
Control	Presentation Error	4.10	1.28	3.90	1.66
	Delete Error	4.45	1.95	4.13	1.55
	Behavioral Inhibition	8.55	2.87	8.03	2.16
Intervention	Presentation Error	4.60	2.01	2.10	1.10
	Delete Error	4.52	1.19	2.40	1.35
	Behavioral Inhibition	9.12	5.34	4.50	2.50
Working Memory	Control	53.60	4.76	53.90	5.93
	Intervention	54.20	5.18	56.50	4.32

Multivariate analysis of covariance (MANCOVA) test was used to evaluate the effectiveness of cognitive rehabilitation training based on facial emotional recognition on behavioral inhibition and theory of mind of children with oppositional defiant disorder.

Table 2

Within-subject effects test to compare theory of mind and inhibition behavior of experimental and control groups in post-test

Variables	Source	SS	Df	MS	F	P-value	Eta
Theory of Mind	Group	175.23	1	175.23	18.96	0.001	0.54
	Error	147.84	16	9.24			
Behavioral Inhibition	Group	67.89	1	67.89	10.90	0.005	0.40
	Error	99.66	16	6.22			
Recognizing Emotions and Pretending	Group	20.83	1	20.83	4.97	0.042	0.24
	Error	62.89	15	4.19			
Understanding the wrong belief	Group	21.35	1	21.35	6.91	0.019	0.31
	Error	46.35	15	3.09			
Misunderstanding Secondary Belief	Group	2.62	1	2.62	5.72	0.030	0.27
	Error	6.88	15	0.45			
Presentation Error	Group	16.97	1	16.97	8.04	0.012	0.33
	Error	33.78	16	2.11			
Delete Error	Group	16.00	1	16.00	8.73	0.009	0.35
	Error	29.31	16	1.83			
Working memory	Group	22.50	1	22.50	5.15	0.036	0.23
	Error	74.16	17	4.36			

Table 2 shows the results of the within-subject effects test in the post-test stage to compare the theory of mind and behavioral inhibition in experimental and control groups. According to the results presented in Table 2, the obtained F value is significant for all components at the alpha level of 0.01 ($p<0.01$). The results of the within-subject effects test are shown in the post-test stage to compare the theory of mind in experimental and control groups. According to the results presented in Table 2, the value of F is significant for all components at an alpha level of 0.05 ($p<0.05$). The results of the within-subject effects are shown to compare behavior inhibition in experimental and control groups in the post-test stage. According to the results presented in Table 2, the value of F is significant for both components of the problem at the alpha level of 0.05 ($p<0.05$). The results of covariance analysis to compare working memory scores in experimental and control groups are shown in the post-test stage. The obtained F value is 5.157 and is significant at the alpha level of $P<0.05$.

Discussion and Conclusion

The purpose of this study was to investigate the effectiveness of cognitive rehabilitation based on facial emotional recognition on behavioral inhibition and theory of mind in children with oppositional defiant disorder. The results of the analysis of the findings of the present study showed that cognitive rehabilitation with face emotion training has led to improvement of theory of mind ability in children with oppositional defiant disorder. Therefore, the results of this study were with the results of previous studies (Acland et al., 2021; Hamidzadeh et al., 2020; Hartmann & Schwenck, 2020; Leung et al., 2013; Matiz et al., 2019; Mehl et al., 2020; Vatankhah Amjad & Ameri, 2020) on the effect of cognitive rehabilitation Emotion based on improving theory of mind and social skills.

It can be said that if the components of a capability are strengthened, it eventually leads to the strengthening of that ability. The main elements constituting the theory of mind include attention, visual perception, desire, intention, emotion, pretense, and belief (Dinolfo & Malti, 2013); therefore, excitement and simulation are the main components of the theory of mind reinforcement. In cognitive rehabilitation with facial emotion training, the most crucial issue is learning to recognize facial emotions by the person's appearance and guessing the feeling, so by strengthening this component, the ability of the child's theory of mind is strengthened. Pretending also requires two significant skills, including having an idea of a particular desire or belief and imagining what actions, thoughts, or emotions a person might experience if they have those desires and beliefs (Shuai et al., 2011). In facial emotion-based cognitive rehabilitation, when a child is asked to experience certain emotions (e.g., joy, sadness), the child must use the ability to simulate and simulate. Thus, reinforcing these abilities improves his theory of mind (Mehl et al., 2020).

Social cognition is the set of cognitive processes of an individual about their own and others' thoughts, attitudes, behaviors, and emotional issues, in which the individual argues about himself as a human being and his relationships with others based on the results of the same cognitive processes (White et al., 2018). Considering the critical role of emotion recognition as one of the essential components of social cognition, improving the recognition and correct interpretation of emotional expressions of others for children helps in making decisions to choose appropriate social sentences and behaviors, and in addition to improving children's social cognition, serves as a guide for successful social interactions that is the basis for healthy mental health in children. Also, improving emotional knowledge enables increasing empathy in children (Fonagy & Luyten, 2018); therefore, it can be stated that cognitive rehabilitation based on facial emotions by improving social cognition and theory of mind gives children with oppositional defiant disorder a better understanding of the mentality and thoughts of others and when they want to take action if they recognize it. Social behavior is not appropriate to deter it.

Sample selection from the population with a limited number and location range of two regions, 6 and 7 of Tehran city, made it impossible to carry out follow-up studies due to the coronavirus pandemic and the limitations due to the lack of cooperation of some subjects. Undoubtedly, the extent of social interaction of the subjects of this study was different, and on the other hand, the parents of these children provided various opportunities and emotional stimuli for their children. Since this point has not been considered in the present study, the degree of children's access to emotional stimuli at home can provide a perfect context for

understanding the emotions of children with oppositional defiant disorder. This issue can have possible interference effects in generalizing the research findings.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this study.

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