Research Paper

Educational Facial Emotion Recognition in Children With Autism Spectrum Disorder: A Clinical Trial Study

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ABSTRACT

Objectives: The disability to recognize facial emotions is one of the behavioral problems in autistic children. This study was designed to evaluate the effect of education on the promotion of face recognition.

Methods: This single-blind clinical trial study was conducted on children with autism. The participants were allocated with random sampling to the two groups. Autistic children in the intervention group were educated in 10 sessions with 40 facial emotions images, each session lasted 20 min. Autistic children in the control group underwent routine teaching. The assistant researcher completed the Benton questionnaire for each child before and after the study. The obtained data were analyzed with SPSS software, version 22.

Results: This study showed that education on facial emotions has good effects on the recognition of facial expressions by children with autism. In addition, a significant difference is identified between the two study groups in identifying facial emotions (P<0.001).

Discussion: Education to children with autism improved facial emotion identification. Therefore, according to the increase in children with autism all over the world such as in Iran, it seems that caregivers and health managers should review and use our study results for providing a supportive environment to promote recognition emotional states of the face and ultimately to improve the child's treatment.

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Highlights

• Emotional facial education training could improve and promote the recognition of facial emotional states by autistic children, which ultimately increases the appropriate efficiency in the treatment of these children.

• The health officials and policy makers should use emotional facial education to improve the quality of communication among autistic children.

Plain Language Summary

One of the most important behavioral-communication problems of children with autism, which limits their interactions with family members and the community and received less attention, is the inability of these children to identify emotional states and subsequently to provide appropriate responses. Therefore, in interactive social situations, they are not able to establish a proper relationship between emotional symptoms and to recognize people's emotional states such as enthusiasm, anxiety, fear, and sadness from their face, speech tone, and body language. this study show emotional facial education training could improve and promote the recognition of facial emotional states by autistic children, which ultimately increases the appropriate efficiency in the treatment of these children.

1. Introduction

The behavioral disorder is known as a serious problem in children with autism, which is characterized by persistent deterioration in social interaction, communication delay or deviation, and stereotyped patterns of interaction [1-3]. This disease can be diagnosed among 18-24 months infants; however, a definitive diagnosis may be made until the age of three years old in children [4]. Epidemiological studies on the prevalence of autism showed that the prevalence of this disorder is increasing worldwide [5], in boys 1 per 42 cases and girls 1 per 189. Moreover, it affects boys 4.5 times more than girls [6, 7]. In Iran, based on the study by Samadi et al., the prevalence of autism spectrum disorder has been reported to be 6.26 per 10000 people [8]. This high prevalence will urge care-providing organizations to face many challenges in Iran in a little while [9]. Accordingly, the inability of these children to identify emotional states and subsequently to provide appropriate responses limits their communications with other people specialty with their families [10]. The impaired emotional perception consequently leads autistic children to pay less attention to faces [11]. So, during interactive status, these children cannot recognize people's emotional situations such as enthusiasm, anxiety, fear, and sadness based on the face or speech tone [12-16]. Additionally, the inability to recognize the emotional states of other people leads to the rejection of children with autism by peers and consequently to the occurrence of their violent behaviors towards themselves and others [17-19]. While an important factor in good interaction is identifying one's emotional state, it is obvious that the disability of autistic children drastically reduces their constructive interactions [20, 21]. In the last decade, some studies have examined the interactive problems of autistic children and the effect of education on their communication and stated that structured and accurate education can improve the communication of these children [22, 23]. In this way, Conallen et al. showed that teaching emotional states of the face improved communication in children with autism [24]. Hassanpour et al. also reported that education improved the recognition of the emotional states of the face in children with autism [25]. In addition, some studies showed that education can decrease communication problems in these children, which consequently improves their constructive communication with others [26, 27]. So, due to the intensification of children with autism in Iran (8000 children with autism) [22] and limited studies that were performed about the recognition of emotional states of the face by autistic children. This research was implemented to evaluate the effect of education on recognizing facial emotions in children with autism.

2. Materials and Methods

Research design

This research was a single-blind randomized clinical trial that was conducted from January 2019 to August 2020 in three autistic children centers related to the University in the west of Iran. This study was conducted based on the consolidated standards of reporting trials.

Sampling method and participants

Autistic children together with their mothers participated in the present study. Based on Conallen et al. study, the sample size was estimated at 27 participants for each group (β=0.80, α=0.05). The participants were selected by accessible sampling method, then they were allocated by random sampling method to the study groups (intervention and control). The inclusion criteria were as follows: children aged 6-12 years old, having moderate to the high performance of autism in accordance with the diagnostic and statistical manual of mental disorders, 5th edition (DSM-IV) and the doctor's opinion, having the ability to comprehend education, lacking other physical, psychic, and mental diseases, having no optic disorder, having no shift in the sort and dose of drugs during a month ago, and having consent to participate in the present research. Also, the exclusion criteria were as follows: absence in three or more education sessions and changes in the amount of the drug in children. A total of 60 autistic children participated in this study, but 6 autistic children were excluded due to a shift in the sort and dose of drugs. Finally, 54 autistic children remained in the study and were randomly allocated to the study groups. Also, two mothers of autistic children were excluded from the intervention group due to being infected with COVID-19 and unwillingness to continue participation in the study (Figure 1).

Outcome measures

Demographic information

The information in this questionnaire included age, sex, financial status, number of children in each family, number of autistic children in each family, functional level of autism, parents' age, parents' education of parents, and jobs of the mother's parents.

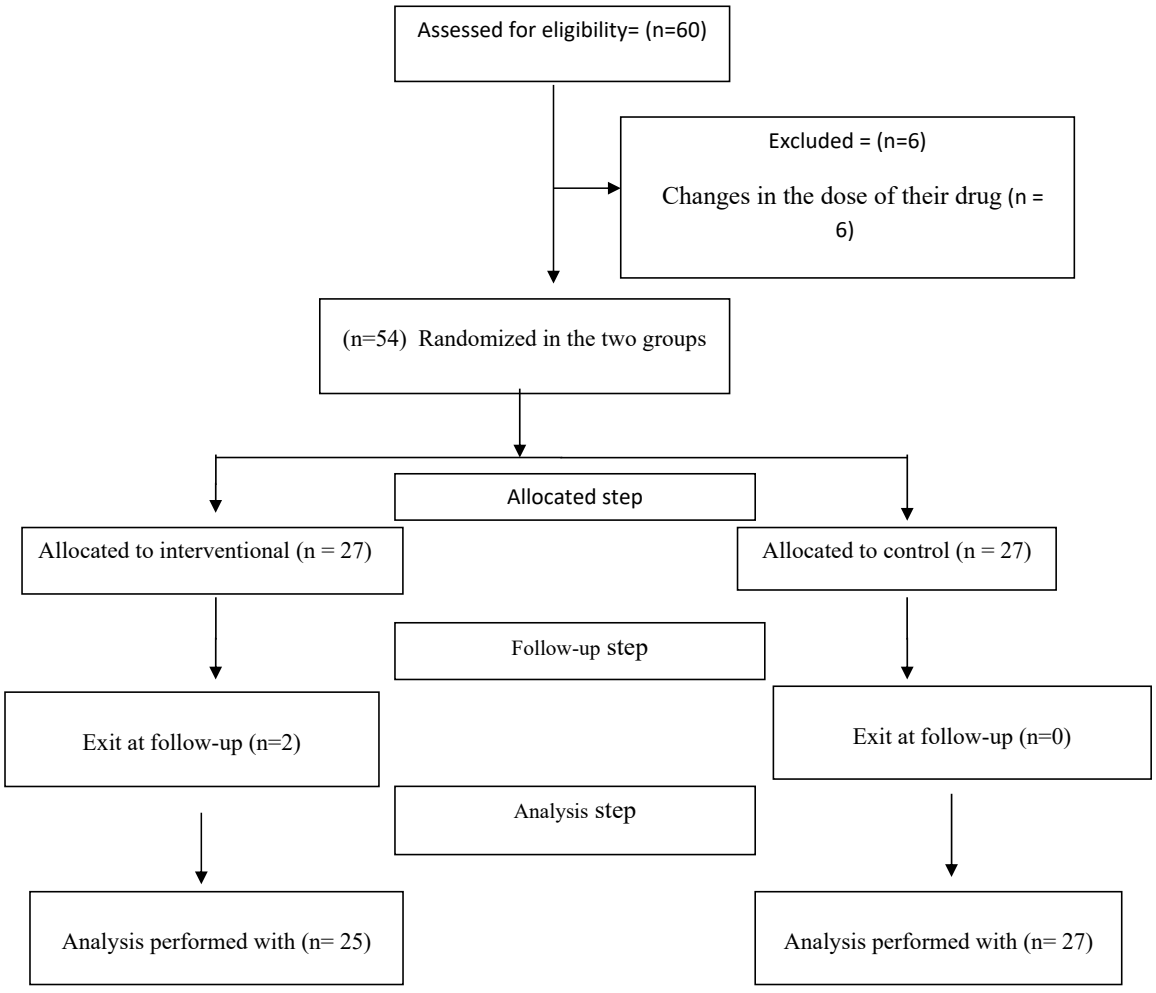

Figure 1. The study design

Benton visual recognition test

The Benton test was used for the evaluation of face recognition. This test evaluates cognitive diminution in children in school aged 6-12 years. This 28-item test included related emotional faces (happiness, sadness, fear, and anger). Each emotional face has 7 pictures that children must select the appropriate picture according to the question. The child needs 1 minute to answer each question. The score of this test is gained by the sum of correct answers [24]. Shiri et al. stated that this test had good validity and reliability of 98% [28].

Study intervention

The researcher trained the autistic children in ten 20-min sessions, once per week for 10 weeks in the presence of their mothers. Correspondingly, the mothers were present beside the researcher. Therefore, mothers learned how to educate their children. Forty images were used for training based on the status of happiness, sadness, anger, and fear and every emotional face condition had 10 pictures. The pictures were designed based on a study by Conallen et al. The face and content validity of these pictures was assessed by 10 faculty members with about 5 years of experience in teaching behavior to children with autism children. They chose the emotional face image that related to the target image. The researcher and the mother assist autistic children in selecting the correct image. An image of a boy in A5 size and color was used for all images. The images were displayed to each child, and without explanation, autistic children must choose the image that matched the target image. When the child correctly identified one picture, the mother or researcher encouraged the child, and in the following, the next image was taught. But if the child was incorrect, a small and indirect guide was given to the child, and was asked to answer with more attention. If the child repeated the wrong answer, the child directly referred to the correct answer, and until the time the participant recognized the answer correctly, the process was repeated. In each session, the child received teachings with four pictures (each picture for an emotional state). The mother was present beside the researcher when mothers learned teaching to the child and had the desire and readiness to teach the child, the researcher would entrust the teaching of one or more images to the child and would supervise the child's education by the mother, so education was done correctly. Meantime, the researcher explained more if mothers had ambiguities and questions about the images taught in each session. Parents of children with autism in the control group received routine training. The assistant researcher collected questionnaires in both groups one day before, one and seven days after the study, and was not informed of the allocation of children into two groups.

Statistical analysis

The obtained data were analyzed with the SPSS software, version 22. In this study, the Kolmogorov-Smirnov test confirmed the normal distribution of data. To compare demographic information between the two groups, we used the independent t test, Fisher exact, and Chi-square test. Also, to compare the two groups at the three time points, we used a repeated measures test. P values less than 0.05 were considered statistically significant.

3. Results

The majority of autistic children (33, 62.96%) were boys, and more children were in the medium functional level of autism. The Mean±SD ages of autistic children were 11.24±2.14 and 11.54±2.91 years in the control and intervention groups, respectively.

Most mothers of children with autism (15, 27.77%) had a secondary school level of education and were self-employed (22, 40.74%). The average ± SD ages of the mothers of children were 381.14±1.32 and 38.42±1.24 years in the control and intervention groups, respectively. Thus, the two groups were homogeneous (P>0.05) (Table 1). The facial recognition scores were low in both groups in the pretest, especially identifying anger status (Table 2). Therefore, no statistically significant difference was found in emotional facial scores at the beginning of the study between the intervention and control groups (P=0.93). However, after performing education, there was a statistically significant difference between both groups in the post-test (one day and seven days later) (P<0.001). In addition, there was a statistically significant difference in each group at three time points (P=0.025) (Table 3).

4. Discussion

The prevalence and spread of autism in the world and especially in Iran, have led care systems, families, and especially parents to face many challenges in educating and interacting with children with autism [25]. Therefore, the present study was conducted regarding the shortcomings of the educational program offered to children with autism in Hamedan City, Iran, to investigate the effect of education on facial emotions on improving the identification of facial emotion states in these children. The majority of the children included in this study

Table 1. Characteristics of the study participants

Variable		No. (%)		Sig.
		Intervention	Control	
Age of mother (y)	24-33	6(22.22)	5(18.52)	0.73*
	34-44	12(44.44)	14(51.85)	
	45-55	9(33.34)	8(29/63)	
Level of education of mother	Unlettered	3(11.11)	2(7.41)	0.89*
	Primary school	7(25.93)	6(22.22)	
	Secondary school	8(29.63)	7(25.93)	
	Bachelor's degree	5(18.52)	8(29.63)	
	Higher than a bachelor's degree	4(14.81)	4(14.81)	
Level of education of father	Unlettered	4(14.81)	3(11.11)	0.81*
	Primary school	2(7.41)	1(3.70)	
	Secondary school	9(33.34)	10(37.04)	
	Bachelor's degree	5(18.52)	7(25.93)	
	Higher than a bachelor's degree	7(25.93)	6(22.22)	
Job of mother	Self-employed person	10(37.04)	12(44.44)	0.82*
	Government employee	8(29.63)	7(25.93)	
	Housekeeper	9(33.34)	8(29.63)	
Job of fathers	Self-employed	14(51.86)	16(59.26)	0.80*
	Government employee	6(22.22)	6(22.22)	
	Ranchero and Farmer	9(33.34)	5(18.52)	
Number of children in each family	1	6(22.22)	9(33.34)	0.86*
	2-3	14(51.86)	12(44.44)	
	4 and more	7(25.92)	6(22.22)	
Number of autistic children in each family	1	25(92.59)	26(96.30)	0.76**
	2-3	2(7.41)	1(3.70)	
Guardian of the child	Mother as guardian	3(11.11)	4(14.81)	0.84**
	Father as guardian	6(22.22)	5(18.52)	
	Both parents	18(66.66)	18(66.66)	
Financial situation	High level	11(40.74)	10(37.04)	0.77*
	Average level	14(51.86)	16(59.26)	
	Low level	2(7.41)	1(3.70)	

Variable		No. (%)		Sig.
		Intervention	Control	
Sex of autistic children	Son	18(66.66)	16(59.26)	0.87*
	Daughter	9(33.34)	11(40.74)	
Age of autistic children	6-8 years	5(18.52)	4(14.81)	0.89*
	8-10 years	14(51.86)	16(59.26)	
	10-12 years	8(29.63)	7(25.93)	
The functional level of autism	High functional level	11(40.74)	12(44.44)	0.91*
	Medium functional level	16(59.26)	15(55.56)	

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*The Chi-square test; **The Fisher exact test

were boys in the age range of 8-10 years with moderate functional levels. In other studies, the majority of infants were boys, but these studies have generally evaluated a small group of autistic children, also they only evaluated children with high-functioning which is consistent with the results of the present study [25, 22]. However, in this research, the appropriate effects of emotional facial education were investigated in autistic children with high and moderate functional levels. Hasanpour et al. conducted a study on 5 boys with high-functioning autism, as a single group with a "before and after approach" without considering the follow-up period. They found that although at the beginning of the study, children with autism in terms of facial emotional states performed poorly and scored low, after training in emotional facial recognition, they performed better in recognizing facial emotional states [25]. In addition, the results of this study are in line with the study by Conallen et al. that was conducted in one group with 10 autistic children with high functional levels. They reported that although in the pretest, these children weakly identified facial emotions, education during 10 sessions promoted the ability to recognize emotional states [24]. Silver et al. reported that Asperger's children had difficulty distinguishing tired and thoughtful faces, but the education on the emotional states of the face had a significant positive impact on the ability of these children to identify facial emotions, which is consistent with the present study [26]. Also, Shiri et al. reported teaching facial expressions with a computer program improved the identification of facial emotions of joy, sadness, anger, and fear in autistic children with high functional levels [28]. Najafi et al. and Tanaka et al. also reported that

Table 2. Mean scores of facial recognition between intervention and control groups

Study Groups		Mean±SD			Sig.*
		Before the Intervention	One Day After the Intervention	One Week After the Intervention	
Intervention	Pictures of happiness	3.99±2.74	25.77±7.69	27.01±5.78	0.017
	Pictures of sadness	2.98±2.26	24.01±7.13	26.41±5.14	0.019
	Pictures of anger	2.01±1.96	23.87±7.78	24.76±4.82	0.014
	Pictures of fear	1.99±1.74	23.77±7.17	24.86±4.61	0.012
Control	Pictures of happiness	3.87±2.68	5.35±4.91	4.01±3.11	0.34
	Pictures of sadness	3.01±1.97	3.27±2.54	3.21±2.37	0.42
	Pictures of anger	2.11±1.04	3.01±2.14	2.88±2.64	0.47
	Pictures of fear	2.04±1.93	2.41±2.75	2.01±2.47	0.51

*The repeated measures test

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Table 3. Comparing mean scores of facial recognition between the intervention and control groups

Study Groups	Mean±SD			Sig.
	Before the Intervention	One Day After the Intervention	One Week After the Intervention	
Intervention	4.81±2.97	9.25±23.13	9.03±5.26	<0.02**
Control	4.88 ±2.96	5.04±4.10	4.04±4.99	<0.10**
Sig.	0.89*	<0.001*	<0.001*	-

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*The dependent t test; **The repeated measures test

teaching emotional facial expressions with a computer program significantly improved the identification of facial emotions in autistic children [23, 29], which is in line with this research. However, face-to-face relationship in these children was confined in these studies, which is inconsistent with the present study. This difference can probably be due to the participation of the coach and the mother in the training, the conversations, and the interactions during the training. Faja et al. also stated that facial education training has caused more attention from adults with autism to people's faces, so basic perceptual skills training can be a promising educational method to promote the identification face emotions states in this group of patients [30]. On the other hand, Krysko and Rutherford showed that young children with autism have a poor performance in recognizing angry faces; this inability to recognize the angry moods of people around them sometimes causes their anger and harassment [31]. In the present study, it was also shown that children with autism have more difficulty in recognizing the emotional state of anger compared to other facial emotional states. However, the education caused the intervention group to perform better in identifying all emotional states of the face during the study.

5. Conclusion

Face emotions education could improve and promote identifying emotional states in children with autism, which ultimately increases the efficiency in the treatment of these children. In this regard, the caregivers and managers in health should use these findings to promote the relationship of children with autism with other people in the community and finally plan and adopt more comprehensive arrangements and plans.

Study limitations

One limitation was the sudden onset of COVID-19, which prolonged sample collection. Examining the small number of children with autism was another limitation. So, researchers suggested for studying the exact effect of teaching facial expressions to children with autism further studies with more samples should be performed. Additionally, considering the effect of emotional face painting on the course and progress of treatment of autistic children, it is suggested that in various treatment interventions offered to children with autism, emotional face education should be developed along with treatment programs and its effect on adults should also be measured. Otherwise, this method should be done in adults as well.

Ethical Considerations

Compliance with ethical guidelines

This study received ethical approval from Hamadan University of Medical Sciences (No.: 1399.330), with the Iranian Registry of Clinical Trials (IRCT) (Code: 20190703044082N1). At the beginning of the study, the study objectives were explained to the participants and written consent was obtained from all mothers who participated in the present study.

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Authors' contributions

Conceptualization and Supervision: Fateme Mohammadi, Fatemeh Cheragi, Fatemeh Mirzaei, Mahdieh Seyedi and Mohammad Rezaei; Investigation, Writing – original draft, and Writing – review & editing: Fateme Mohammadi, Fatemeh Cheragi, Fatemeh Mirzaei; Data collection: Fateme Mohammadi, Fatemeh Cheragi, Fatemeh Mirzaei, Mahdieh Seyedi and Mohammad Rezaei; Data analysis: Salman Khazaei.

Conflict of interest

The authors declared no conflict of interest.

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