

A Study on the Application of Music Therapy of Ocarina in The Rehabilitation Training of Autistic Children

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Abstract: In order to investigate whether the ocarina has an improvement effect on the emotional perception ability and hand fine motor ability of children with autism, this study used the ocarina music training to conduct a two-week case study on three children with autism, and the following conclusions were obtained through the observation method of follow-up measurements: practicing the ocarina can improve the ability of children with autism to manipulate hand fine motor ability and can reduce the unstable emotions of patients, but due to the training time was short, and it was not possible to judge whether there was an improvement in emotional perception ability.

Keywords: Autistic children, Music therapy, Ocarina.

1. Introduction

1.1. Research Background

Autism Spectrum Disorders (ASD) is defined in the latest Diagnostic and Statistical Manual of Mental Disorders - 5th Edition (DSM5) as a group of neurodevelopmental disorders with social impairment, communication difficulties, narrow interests and repetitive stereotyped behaviors as the core symptoms. The DSM5 defines it as a group of neurodevelopmental disorders with core symptoms of social impairment, communication difficulties, narrow range of interests and repetitive stereotyped behaviors. The majority of autism cases begin in infancy (0-3 years old) and are characterized by avoidance of eye contact, weak response to voice, lack of active interaction, poor expressive skills, lack of interest in things, and stereotypic behaviors and strange movements. Symptom expressions vary among individuals and may change at different ages (Dong X. H, et al., 2020)

Traditional ABA training and play therapy are now more commonly used for children with autism.

ABA (Applied Behaviour Analysis) is a scientifically based Applied Behaviour Analysis therapy, a structured approach to education. It breaks down the skills to be taught into performable behavioral units, uses special techniques to train each unit of behavior until it is mastered, and finally ties the mastered units together to form more complex behaviors. (Retrieved Oct 15, 2022, from <https://baike.baidu.com/item/ABA> Behavioral Therapy/6531024?fr=aladdin) ABA applied behavior analysis therapy needs to be applied at an early age of autism and the intervention needs to be intensive. ABA requires significant parental involvement (Foxy, 2008). ABA is time consuming, requires continuous and intensive treatment, and is expensive. For individuals with autism, ABA therapy is overly directive and can limit the child's ability to think actively (Retrieved Oct 15, 2022, from <https://baike.baidu.com/item/ABA> Behavioral Therapy/6531024?fr=aladdin).

Play therapy is a non-verbal treatment method that responds to the patient's deepest experiences and feelings. When performing this therapy, the child can do whatever he wants to do, without anyone competing with him for toys and

without following rules. This is used to give vent to all kinds of depression within the child and to satisfy their various desires. The adult, in another room, observes the children's behavior during play, the use of toys, and sometimes the adult appears in front of the children and guides them to use a certain toy, from which the children's underlying experiences are examined and explained to them. Through this process, the child's subconscious experience becomes conscious, so that he or she can control it or discard it, and achieve the goal of therapy. However, play therapy tends to create child-centeredness and a lack of shared control (Retrieved Oct 15, 2022, from [https://baike.baidu.com/item/Behavioral Therapy/7328595?fr=aladdin](https://baike.baidu.com/item/Behavioral%20Therapy/7328595?fr=aladdin)).

Early music therapy uses music education, singing groups, folk dancing, and rhythmic activities to help improve the symptoms of individuals with autism. Improvised music therapy was introduced by Nordoff and Robbins in Creative Music Therapy (1977, 2007), which suggested that every child has an innate and unique response to and expression of music. From a neuroscientific perspective, the symptoms of low connectivity in the sensorimotor network of the brain of children with ASD can be improved by music therapy. While the sensorimotor component is often impaired in autistic individuals, this finding suggests that music therapy may be able to alter sensorimotor processes to improve autism symptoms (Sharda, et al., 2019).

Research shows that music is a non-threatening medium of communication for children with autism and therefore children with autism are more engaged in music training (Reschke-Hernández, 2011). Music therapy for treating children with autism is gradually being recognized by psychologists as it continues to be tried and experimented with. There is a large body of research showing that people with autism show unique musical abilities. Subsequent studies have shown that even some individuals with autism who have never received musical training are able to display unusually good musicality (Liu, Fengqin, 2010). Enjoyment of positive music can help improve attention in children with autism, and Pasiali et al. found that children with neurodevelopmental disorders, including autism, showed improvements in selective attention and attentional control after a 6-week group music therapy intervention (LaGasse, et al., 2019)

Therefore, on this basis, this paper chooses a music therapy approach to teach the ocarina to children with autism. The music therapy method has a soothing rhythm, is easily accepted by patients, and the rhythmic and structural properties of musical stimuli provide external cues for organization, prediction, and response that are uniquely appealing to individuals with autism (Tan C. H, et al., 2021) By listening to the music of the ocarina, we can feel the relaxing and comfortable environment brought by the melodious and deep tune of the ocarina. It activates the nerve cells of autistic children in a "dormant state" and has a psychological effect of awakening, soothing, cathartic and encouraging (Zhang Y, et al., 2020).

Music intervention not only improves the socially responsive behavior of children with autism in terms of language, but also significantly improves their verbal communication skills (Chang X, et al., 2016) . The music of the ocarina acts directly on the hypothalamus and the limbic nervous system, which are the mental and emotional centers of the human brain, and can effectively regulate the mental and emotional state of each autistic person in both directions (Wu Q. X. 2021). This study wanted to help enhance the emotional perception and hand movement stiffness of children with autism through music appreciation and instruction.

1.2. Purpose of the study

To investigate whether ocarina music training is effective in enhancing emotional perception and improving the ability to complete fine hand movements in children with autism.

1.3. Research significance

A 6-hole plastic ocarina was used in this study. The plastic ocarina has the characteristics of being easy to learn, portable, not easily broken, and inexpensive, which is more suitable for children to learn and can instantly bring encouragement to children with autism. Listening to music can bring a soothing and relaxing state, allowing the autistic children to enter an extremely negative mental state of mind, body and activity (Wu Q. X. 2021). It was effective in relieving the autistic children's impatient and anxious emotions, and the repetitive questions from the autistic children were reduced after several lessons. The autistic children's finger dexterity also improved significantly, and they were able to press the holes of the ocarina faster and more accurately, indicating that ocarina playing is very beneficial to their fine motor training and development (Li S. M. 2019)

2. Research Process

2.1. Research Methodology

This paper uses a case study approach to investigate the improvement of emotional perception and fine motor skills of three autistic individuals, Fang Fang, Yuan Yuan, and Xiao Cheng. We investigated the improvement of their emotional perception and ability to perform fine hand movements while listening to the music and learning the fingering of the ocarina . To investigate whether the musical training of the ocarina is effective.

2.2. Research Subjects

This study was conducted at the Bright Heart Kindergarten in a small, separate classroom with one table and two chairs. Lessons were conducted one-on-one, with a total of 6 lessons

per person, each lesson lasting 30 minutes. The lessons were divided into appreciation of ocarina music and practice of ocarina playing. None of the three patients had ever been exposed to the ocarina before, Fang Fang and Yuan Yuan had no musical foundation, and Xiao Cheng had a piano foundation.

1. Fang Fang: 10 years old, studying in a normal elementary school. Borderline autism. Caused in part by frequent parental quarrels. The main manifestations are social indifference, no active physical contact with others, few words and fast and flat tone of voice. Few strabismus symptoms.

2. Yuan Yuan: 7 years old, undergoing treatment at Mingxin Kindergarten. Autistic, happy to interact with others, emotionally unstable, with a small amount of repetitive language, unable to clearly express his requirements.

3. Xiao Cheng: 7 years old, treated at Mingxin Kindergarten. She has autism and cerebral palsy due to her own central motor disorder, postural abnormalities and other brain functions.

Autism is triggered by brain dysfunctions, such as postural abnormalities, which increase the patient's mental burden (Lai C. M. 2015. Autism is caused by structural brain damage. There are a few symptoms of ignoring others' questions and more repetitive questions. He sometimes does not respond to being called. Due to cerebral palsy, drooling symptoms are severe. He sometimes avoids eye contact when interacting with people and has a small amount of pulling aggressive behavior. When he stops doing something, his eyes look upward with an unhappy expression.

2.3. Study Design

1) Pretest

Six (all) children in Mingxin Kindergarten's older class were pre-tested, using the Autism Behavior Scale ABC.

The scores of the six children were 73, 13 (Yuan Yuan), 22 (Fang Fang), 138, 47, and 84 (Xiao Cheng)

In this paper, a pre- and post-test was conducted using the Autism Behavior Scale (ABC). It was used as a basis for comparing the pre- and post-training status of three autistic patients on the Taupe.

The Autism Behavior Checklist (ABC) was developed by Kug et al. in 1978 for screening, aiding in the diagnosis of autistic patients aged 8 months to 28 years. The previous investigators noted that the scale has 94% rater reliability and 95% retest reliability, with good reliability and validity, and can be used on the three autistic patients in this study.

There are 57 items on the scale, covering a wide range of symptoms in autism, including sensory, behavioral, emotional, language, and self-care, which can be summarized into 5 factors: Sensory S (9 items, 30 points), Interaction R (12 items, 35 points), Somatic Motor B (12 items, 28 points), Language L (13 items, 31 points), and Self-care S (11 items, 25 points). Each item was given a different score, ranging from 1 to 4, depending on its load on the scale; the child was given a score for any item, regardless of the severity of the symptom, as long as the child was present.

The scale is administered by the child's parents or a person with whom the child has lived for at least 2 weeks, and takes about 10-15 minutes to administer.

The pre-test was completed by the kindergarten classroom teacher and was taken when there was no music training on the ocarina .

Fang Fang scored 22 points, Yuan Yuan scored 13 points,

and Xiao Cheng scored 84 points. According to the Autism Behavior Checklist (ABC), Fang Fang and Yuan Yuan had milder symptoms.

The following table shows the pre-test results of the three autistic patients in the case study

See Appendix.

Table 1 Fang Fang Autism Behavior Scale ABC Pretest

Table 2 Yuan Yuan Autism Behavior Scale ABC Pre-test

Table 3 Xiao Cheng Autism Behavior Scale ABC Pre-test

2) Class Objectives: To enhance the ability of children with autism to perceive emotions and to improve fine hand movements.

3) Course content and performance of three autistic patients

1. Fang Fang's performance notes

Table 4. Fang Fang's performance notes

Music Appreciation		Course Record (Fang Fang)
The First Class	<i>A Thousand Years of Elegance</i>	She was nervous for the first lesson, but was able to concentrate on the music and say that the piece expressed sadness, and had a good perception of music. He is quiet in class and does not talk much. When practicing the fingering of the clay flute, he can bend his fingers flexibly to find and press the hole of the ocarina.
	<i>The Original Landscape of the Hometown</i>	
The Second Class	<i>You and Me</i>	Does not ask questions when music is appreciated, but answers all questions asked. Frequent touching of the pottery flute, accompanied by mild ADHD symptoms. Emotions are basically unstable. Practices "do ra mi" and the corresponding short and long sounds, and can remember the fingering well. The sound is not accurate at first, but improves after several practice sessions. First, we practice one note at a time, and when we become proficient, we teach four short notes and one long note, and after we can do it well, we play three notes together. "do" in the case of good hole plugging can be better played, "ra mi" can not be completed well for the time being. Can complete the fine hand movements well, press the hole and blowing separately and synchronously without obstacles.
	<i>Let's Swing the Paddle</i>	
The Third Class	<i>The Sky City</i>	Emotionally calm, slowly accepting physical contact such as holding hands. Can tell the general emotion of the song. After listening to the two songs, he can say that "The Sky City" expresses a sad feeling, and "Celadon" is more cheerful compared with the previous one. Can adjust the sound in time. They can master the three sounds they learned in the last lesson: "do ra mi". In this lesson, they have learned "fa", but the fingering of "fa" and "so" is not clear, so they only learned "fa" in the end. The only sound learned in this lesson is "fa".
	<i>The Greenstone Alley</i>	
The Fourth Class	<i>The Farewell</i>	The overall mood is calm and stable. Learn the notes 1-6, and the first phrase of the little star. Four short tones and one long tone, during the practice, they can't change their breath, and they are a bit impatient at the end. After encouragement and guidance, the mood gradually eased. Can accurately press the hole when switching between different tones, and blow with the exhale. Finger dexterity is high and the fingering is well done.
	<i>The Floating Life</i>	
The Fifth Class	<i>The Great Fish</i>	Emotionally calm, gradually interacting more with the researcher. Interested in Japanese and willing to voluntarily share the anime they watch and songs they listen to when asked. Eye contact increases during communication. Reviewed the sounds of 1-6 and the first phrase of the little star; learned the second phrase of the little star. The first sentence is good overall, but the last note is played as "do," and when learning the second sentence, the fingerings of "ra and mi" are confused; after correcting several times, the fingerings are not changed; after correcting and demonstrating several times, the first two sentences of Little Star are played down completely in the last two times.
	<i>Lemon</i>	
The Sixth Class	<i>The Cuckoo</i>	Emotionally calm. Reviewing the notes 1-6 and the first two phrases of the little star. When I play the second phrase, I still get confused with the "ra and mi" fingerings. When I finished the Little Star, I sometimes confused the sounds of "so" and "la", so I reminded them to correct themselves.
	<i>Spirited Away</i>	

2. Yuan Yuan's performance notes

Table 5. Yuan Yuan's performance notes

	Music Appreciation	Course Record (Yuan Yuan)
The First Class	<i>A Thousand Years of Elegance</i>	More emotional, more curious about new things, more repetitive questions, repeatedly asked while watching the video, "What flute is on the wall behind you"
	<i>The Original Landscape of the Hometown</i>	
The Second Class	<i>You and Me</i>	Positive emotions during class. Tends to lose concentration and not pay attention to the tune when enjoying it. Unable to say the general feelings of the pottery flute tune and has a weak ability to perceive the emotions of others. Interested in the pottery flute and tries to play it when it is in hand When taught to spit, due to the development of the mouth, the sound "spit" is not pronounced, and it is difficult to learn to spit, but after several practice sessions, the sound is improved, and there are times when the sound can be made Can grip the flute well and plug the hole, can play "do" with exhalation
	<i>Let's Swing the Paddle</i>	
The Third Class	<i>The Sky City</i>	Enjoys music in a more positive mood and often asks what is in the video. Grows impatient after practicing the pottery flute many times. Shows no desire to continue practicing. Still can't produce the spit sound, but after practicing several times, he/she can produce the spit sound a few times. Sometimes the "spit" sound and sometimes the "whoop" sound. In this lesson, we will learn the "do,ra" sound, and we will be able to blow with our breath.
	<i>The Greenstone Alley</i>	
The Fourth Class	<i>The Farewell</i>	The overall mood was negative, he kept saying he was thirsty during music appreciation, and his concentration was very low. When practicing the pottery flute, I was also more resistant. Due to thirst, I am not very interested in practicing today, I am in a negative mood, I keep saying that my tongue is dry and I don't feel comfortable playing the flute. Learning "do ra", the main problem is that I can't pronounce it, but I have no problem pressing the hole.
	<i>The Floating Life</i>	
The Fifth Class	<i>The Great Fish</i>	I was a little bit negative from the last lesson, and I was a little bit resistant to practice on the flute. Practicing the "do, ra, mi" fingerings, my mood is stable compared to the last lesson.
	<i>Lemon</i>	
The Sixth Class	<i>The Cuckoo</i>	The mood was more positive than in the first two lessons and he was willing to practice the fingering of the flute several times with encouragement. He still plays with a "whoop" sound. After learning "fa, so, la", I couldn't get my fingers to plug the hole completely. After practicing a few times, I was able to play the notes 1-6, but sometimes I forgot how to play "fa".
	<i>Spirited Away</i>	

3. Xiao Cheng's performance notes

Table 6. Xiao Cheng's performance notes

	Music Appreciation	Course Record (Xiao Cheng)
The First Class	<i>A Thousand Years of Elegance</i>	When watching a video of a pottery flute tune, the attention span is very short and keeps tapping the screen to see how much time is left on the tune. Has a high attention span to numbers. Since he has a foundation in piano, he is also interested in the pottery flute, has a good musical foundation, and knows short scores and many instruments.
	<i>The Original Landscape of the Hometown</i>	
The Second Class	<i>You and Me</i>	Emotionally agitated, has difficulty staying quiet and does not control his emotions. When asked questions, he ignores them and does not answer them. In this lesson, he did not learn to spit out the sound, and he used the "whir" sound when playing the fluter; he could not distinguish between the top and bottom of the flute and the front and back of the flute; he had no problem grasping the flute, but his fingers were stiff and he Could not plug the holes well with his index and middle fingers. Due to the large amount of saliva, I need a tissue to wipe the flute several times when practicing.
	<i>Let's Swing the Paddle</i>	

		<p>He is interested in listening to the teacher play "Little Star" and is willing to sing along with him after being guided tosing do ra mi</p> <p>He is not very interested in learning the fingering of the instrument; he often ignores the teacher's demonstrations, but is very interested in the fingering charts, and is somewhat resistant when the charts are taken away</p>
The Third Class	<i>The Sky City</i>	<p>Enjoying the music with the researcher's prompt: let him not click on the screen and watch the video carefully. Emotions were smoother compared to before. Repetitive questions were reduced.</p> <p>In this lesson, the exercise "1do, 5 so" was a little difficult to play because of the heavy saliva. He can't pronounce the spit, his fingers are stiff and he can't plug the holes properly, so he is having difficulty playing the do.</p> <p>So let him practice the high "do" sound (fingering is simple, the front is not pressed), can blow some accurate, but the pronunciation is all "hoo" sound, can not pronounce the vowel</p> <p>After several practice sessions, he became impatient and began to repeat "all pressed is the middle do" and stopped practicing actively.</p>
	<i>The Greenstone Alley</i>	
The Fourth Class	<i>The Farewell</i>	<p>Concentrated more than before and less agitated when enjoying music.</p> <p>Learning the "do ra mi" finger can block most of the holes (an improvement over the previous two lessons); no further correction of the exhaled sounds</p> <p>Learning "ra mi" after learning the 'do' fingerings. learning new fingerings made the patient more stable and positive, willing to practice, and the repetitive utterances decreased</p> <p>The patient was able to master the "do ra mi" fingering better with continuous encouragement, and did not reject repeated practice - playing a single tone, four short tones and one long tone</p> <p>As Fang was interested in the simple score, he was finally taught to sing the score and could sing the ltle star completely</p>
	<i>The Floating Life</i>	
The Fifth Class	<i>The Great Fish</i>	<p>Can enjoy music more quietly, compared to the previous two lessons; emotionally stable, no more clicking on the screen.</p> <p>Pottery flute practice: learning "do ra mi" Fingers can block most of the holes (an improvement over the previous two lessons); no further correction of spitting</p> <p>Larning "ra mi" after learning the "do" fingering; learning new fingering made the party more stable, positive and willing to practice, and the repetitive phrases were reduced</p> <p>He was able to master the "do ra mi" fingering better with constant encouragement and did not refuse to practice several times: playing a single note and four short notes and one long note.</p> <p>As Fang was interested in the simple score, he was finally taught to sing the score and could sing the ltle star completely.</p>
	<i>Lemon</i>	
The Sixth Class	<i>The Cuckoo</i>	<p>Today, I am a little bit excited, I get distracted easily, and the number of times I click on the screen increases; I can keep quiet when watching animations, but when I watch videos of people</p> <p>playing the pottery flute, I ask more questions, often saying "the pottery flute is an ancient instrument, there are 6 holes, 12 holes and 36 holes", and when I see a lot of pottery flutes in the background of videos, I will When I see a video with a lot of claves in the background, I keep asking "how many holes is this one?"</p> <p>The basic tones of the pottery flute: today I learned 1-5, I can only let him learn the fingering as much as possible; because of the stiff fingers, I can't press the holes of the pottery flute very well, and the tone I blow out is not accurate; I am not very interested in practicing the fingering, and I keep wanting to read the score; I keep wanting to get the score of the pottery flute, and I ask what I want to do after practicing this fingering; after seeing the score, I keep saying that I want to learn the millennium fengya</p> <p>After practicing the basic notes, let Fang sing the little star, the cooperation is not very high.</p>
	<i>Spirited Away</i>	

Comprehensive evaluation:

1. Fang Fang: Learned the basic tones of the ocarina 1-6, learned to recognize the simple score and correspond with the fingering of the ocarina. Learned how to play the ocarina for "Little Star". The main symptom before the ocarina music training is social indifference and no need for socialization. After two weeks and six sessions of music training, the students were willing to engage in social interaction behaviors such as holding hands and touching with the researcher, and to share their favorite music anime. The mood changed from indifferent to positive, which does not exclude the factor that the patient and the researcher gradually became familiar with each other over time. The ocarina music training provided a topic of communication between the patient and the researcher, and, the soft and long ocarina music provided a soothing environment in which the patient and the researcher could communicate better. In terms of fine hand movements: As Fang herself has more flexible finger movements, there was not much improvement before and after. The patient's symptoms of social indifference would be alleviated by longer musical training on the ocarina.

2. Yuan Yuan: Learned the basic tones of the ocarina 1-6, but had a big problem with intonation when playing. According to the lesson records of the second and third sessions, the patient was in a more positive mood in the first three sessions, but due to the interruptions in the middle, the latter sessions were more resistant to the ocarina and in a more negative mood. According to the researcher's observation, the patients had fewer repetitive problems. In terms of fine movements, the patients had a higher degree of completion of the small finger movements themselves.

3. Xiao Cheng: He learned the basic tones of the ocarina 1-5 (there is no requirement for pitch, just be able to complete the fingering action) and learned to sing "Little Star". When enjoying the music, the first few lessons were very inattentive, always paying attention to the time of the video and reading the subtitles that appeared in the video. He kept asking repetitive questions, such as "What type of song is this? It's called "A Thousand Years of Wind and Elegance". After a few lessons, the mood was more stable than before, and they were able to enjoy the music more quietly, and the repetitive questions were reduced. When practicing on the ocarina, he was slow to learn and impatient because of his slobbering and stiff fingers. With continuous encouragement and guidance, the fingers were able to plug the holes correctly and correspond to the score. A side-by-side comparison between the first lesson and the sixth lesson showed that Xiao Cheng's emotional control increased, his excitement decreased, and his repetitive problems decreased; his fine hand movements improved greatly.

2) Posttest

The post-test was scored by the researcher after two weeks and six sessions of music training on the ocarina.

The following table shows the post-test results of the three autistic patients in the case study

See Appendix:

Table 7 Fang Fang's Autism Behavior Scale ABC Post-test

Table 8 Yuan Yuan's Autism Behavior Scale ABC Post-test

Table 9 Xiao Cheng's Autism Behavior Scale ABC Post-test

Fang Fang had a total score of 19, Yuan Yuan had a total score of 11, and Xiao Cheng had a score of 67.

3. Analysis and Conclusion

According to the pre- and post-ABC measure scores of the Autism Behavior Scale, Fang's score decreased from 22 to 19, Yuan Yuan's score decreased from 13 to 11, and Xiao Cheng's score decreased from 84 to 67. Among them, Xiao Cheng had the most significant symptom relief, the number of repetitive questions or repetitive phrases decreased, and his attention was less easily affected by the surrounding stimuli. After Taoist music therapy, his mood was much more stable than before, and he would not suddenly stand up to look at something else. The number of repetitive questions was reduced substantially. Through practicing fingering, Cheng's fingers were significantly more flexible and gradually were able to grasp the ocarina better and press on the holes. Fang Fang and Yuan Yuan's symptoms were also relieved to different degrees, Fang Fang's social indifference improved and Yuan Yuan's repetitive problems decreased. The music training of the ocarina stimulates the activity of the cerebral cortex, and a short-term training of 6 months can significantly improve behavior and change the growth of neurosynapses (Han, M.K., Lv, J., 2013).

According to the post-test analysis, the music training of the ocarina alleviated the symptoms of more repetitive problems in children with autism and relieved the patients' hand movement stiffness. According to the two-week training in this study, the patients' ability to perform fine hand movements was improved, but the improvement of emotional perception needs to be proven by longer training.

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Appendix

Table 1. Fang Fang Autism Behavior Inventory ABC Pre-test

Projects	Feelings	Interaction	Movement	Language	Self-care
	S	R	B	L	S
1. like to rotate oneself for a long time					
2. learn to do a simple thing, but soon "forget" it					
3. often without exposure to the environment or the requirement to interact		4			
4. often unable to accept simple instructions (e.g. sit, come here, etc.)					
5. will not play with toys, etc. (such as endlessly turning or throwing, rubbing, etc.)					
6. poor visual discrimination (e.g., poor discrimination of the characteristics of an object - size, color, or location, etc.)					
7. Non-interactive smile (no social smile, i.e., no nodding, greeting, or smiling with others)		4			
8. Inversion or confusion in the use of pronouns (e.g., "I" instead of "you")					
9. Always holding something for a long time					
10. seems not to be listening to the person, so that he/she is suspected of having a hearing	1				
11. Speaking without intonation and rhythm	3				
12. prolonged swaying of the body					
13. to get something that is not physically within reach (i.e., underestimation of one's distance from the object)					
14. Strong reactions to changes in environment and daily routine					
15. Does not respond to being called by name when he is with others					
16. often make forward movement, toe walk, finger pinch and flick					
17. Not responsive to other people's facial expressions or feelings		4			
18. Seldom use the words "yes" or "I" when speaking					
19. having a special ability in a particular area that does not seem to be compatible with mental retardation					
20. cannot execute simple commands containing this (e.g., put the ball on the box or put the ball in the box)					
21. sometimes does not react with surprise to loud sounds (may remind people that children are deaf)					
22. Clap hands frequently					
23. throwing a big tantrum or throwing a little tantrum often					
24. Actively avoid eye contact with others					
25. Refusing to be hugged or touched		2			
26. sometimes do not respond to very painful stimuli (e.g., falls, cuts, or injections)					
27. body is very stiff and hard to hold (e.g., jerking)					
28. feeling his muscles relax when holding him (even if he is not close to the person holding)					
29. Expressing what is desired by posture, gesture (and not inclined to express it in words)					
30. Walk on your toes frequently					
31. Hurting others by biting, hitting, kicking, etc.					
32. Constant repetition of phrases					
33. not imitate other children during play					
34. Often do not blink when the bright light shines directly into the eyes					
35. Self-injury by head-butting, hand-biting, etc.					
36. You can't wait for something you want (as soon as you want something, you want it immediately)					
37. Cannot name more than 5 objects					
38. can't develop any friendship (won't communicate with children to make friends)		4			
39. often cover the ears when there are many sounds					
40. frequently rotating collision objects					
41. Difficulty in potty training (can't control urination)					
42. You can only make up to 5 requests a day					
43. often frightened or very anxious or restless					
44. Squinting, closing eyes and frowning in normal light					
45. Does not dress himself or herself without regular help					
46. Repeating some sound or word over and over again					
47. Staring at people as if to "see through" them					
48. Repeating someone's question and answer					
49. are often unaware of their environment and may be unaware of dangerous situations					
50. particularly fond of and fascinated by monotonous things or games, activities, etc. (e.g., walking or running back and forth, endlessly jumping, hopping, tapping)					
51. likes to touch, smell and/or taste things around					
52. Often no visual response to living people (does not look at incoming people)					
53. Entangled in some complex only type of behavior, like absolutely in the magic garden (such as walking must take a certain route, before meals or sleep or what to do before must put what things in what kind of place or do what action, otherwise will not sleep, do not eat, etc.)					
54. often destroys things (e.g. toys, all utensils in the house break quickly)					
55. The child was found to be developmentally delayed before the age of two and a half years					
56. only use 15 but no more than 30 phrases to interact in daily life so far					
57. Staring at a place for a long time (looking at a place in a dull manner)					
Total Score: S+R+B+L+S			22		

Table 2. Yuan Yuan Autism behavior scale ABC pretest

Projects	Feelings	Interaction	Movement	Language	Self-care
	S	R	B	L	S
1. like to rotate oneself for a long time					
2. learn to do a simple thing, but soon "forget" it					
3. often without exposure to the environment or the requirement to interact					
4. often unable to accept simple instructions (e.g. sit, come here, etc.)					
5. will not play with toys, etc. (such as endlessly turning or throwing, rubbing, etc.)					
6. poor visual discrimination (e.g., poor discrimination of the characteristics of an object - size, color, or location, etc.)					
7. Non-interactive smile (no social smile, i.e., no nodding, greeting, or smiling with others)					
8. Inversion or confusion in the use of pronouns (e.g., "I" instead of "you")				4	
9. Always holding something for a long time					
10. seems not to be listening to the person, so that he/she is suspected of having a hearing					
11. Speaking without intonation and rhythm					
12. prolonged swaying of the body					
13. to get something that is not physically within reach (i.e., underestimation of one's distance from the object)					
14. Strong reactions to changes in environment and daily routine					
15. Does not respond to being called by name when he is with others					
16. often make forward movement, toe walk, finger pinch and flick					
17. Not responsive to other people's facial expressions or feelings					
18. Seldom use the words "yes" or "I" when speaking				4	
19. having a special ability in a particular area that does not seem to be compatible with mental retardation					1
20. cannot execute simple commands containing this (e.g., put the ball on the box or put the ball in the box)					
21. sometimes does not react with surprise to loud sounds (may remind people that children are deaf)					
22. Clap hands frequently					
23. throwing a big tantrum or throwing a little tantrum often					
24. Actively avoid eye contact with others					
25. Refusing to be hugged or touched					
26. sometimes do not respond to very painful stimuli (e.g., falls, cuts, or injections)					
27. body is very stiff and hard to hold (e.g., jerking)					
28. feeling his muscles relax when holding him (even if he is not close to the person holding)					
29. Expressing what is desired by posture, gesture (and not inclined to express it in words)					
30. Walk on your toes frequently					
31. Hurting others by biting, hitting, kicking, etc.					
32. Constant repetition of phrases				2	
33. not imitate other children during play					
34. Often do not blink when the bright light shines directly into the eyes					
35. Self-injury by head-butting, hand-biting, etc.					
36. You can't wait for something you want (as soon as you want something, you want it immediately)					
37. Cannot name more than 5 objects					
38. can't develop any friendship (won't communicate with children to make friends)					
39. often cover the ears when there are many sounds					
40. frequently rotating collision objects					
41. Difficulty in potty training (can't control urination)					
42. You can only make up to 5 requests a day					
43. often frightened or very anxious or restless					
44. Squinting, closing eyes and frowning in normal light					
45. Does not dress himself or herself without regular help					
46. Repeating some sound or word over and over again					
47. Staring at people as if to "see through" them					
48. Repeating someone's question and answer				2	
49. are often unaware of their environment and may be unaware of dangerous situations					
50. particularly fond of and fascinated by monotonous things or games, activities, etc. (e.g., walking or running back and forth, endlessly jumping, hopping, tapping)					
51. likes to touch, smell and/or taste things around					
52. Often no visual response to living people (does not look at incoming people)					
53. Entangled in some complex only type of behavior, like absolutely in the magic garden (such as walking must take a certain route, before meals or sleep or what to do before must put what things in what kind of place or do what action, otherwise will not sleep, do not eat, etc.)					
54. often destroys things (e.g. toys, all utensils in the house break quickly)					
55. The child was found to be developmentally delayed before the age of two and a half years					
56. only use 15 but no more than 30 phrases to interact in daily life so far					
57. Staring at a place for a long time (looking at a place in a dull manner)					
Total Score : S+R+B+L+S	13				

Table 3. Xiao Cheng Autism Behavior Scale ABC Pre-test

Projects	Feelings	Interaction	Movement	Language	Self-care
	S	R	B	L	S
1. like to rotate oneself for a long time					
2. learn to do a simple thing, but soon "forget" it					3
3. often without exposure to the environment or the requirement to interact		4			
4. often unable to accept simple instructions (e.g. sit, come here, etc.)				1	
5. will not play with toys, etc. (such as endlessly turning or throwing, rubbing, etc.)			3		
6. poor visual discrimination (e.g., poor discrimination of the characteristics of an object - size, color, or location, etc.)					
7. Non-interactive smile (no social smile, i.e., no nodding, greeting, or smiling with others)		4			
8. Inversion or confusion in the use of pronouns (e.g., "I" instead of "you")					
9. Always holding something for a long time					
10. seems not to be listening to the person, so that he/she is suspected of having a hearing	1				
11. Speaking without intonation and rhythm				2	
12. prolonged swaying of the body					
13. to get something that is not physically within reach (i.e., underestimation of one's distance from the object)		2	2		
14. Strong reactions to changes in environment and daily routine					
15. Does not respond to being called by name when he is with others					
16. often make forward movement, toe walk, finger pinch and flick			1		
17. Not responsive to other people's facial expressions or feelings		4			
18. Seldom use the words "yes" or "I" when speaking					
19. having a special ability in a particular area that does not seem to be compatible with mental retardation					4
20. cannot execute simple commands containing this (e.g., put the ball on the box or put the ball in the box)					
21. sometimes does not react with surprise to loud sounds (may remind people that children are deaf)	1				
22. Clap hands frequently			3		
23. throwing a big tantrum or throwing a little tantrum often					
24. Actively avoid eye contact with others		4			
25. Refusing to be hugged or touched					
26. sometimes do not respond to very painful stimuli (e.g., falls, cuts, or injections)					
27. body is very stiff and hard to hold (e.g., jerking)					
28. feeling his muscles relax when holding him (even if he is not close to the person holding)		4			
29. Expressing what is desired by posture, gesture (and not inclined to express it in words)					
30. Walk on your toes frequently					
31. Hurting others by biting, hitting, kicking, etc.					
32. Constant repetition of phrases				4	
33. not imitate other children during play		4			
34. Often do not blink when the bright light shines directly into the eyes					
35. Self-injury by head-butting, hand-biting, etc.					
36. You can't wait for something you want (as soon as you want something, you want it immediately)					
37. Cannot name more than 5 objects					
38. can't develop any friendship (won't communicate with children to make friends)		4			
39. often cover the ears when there are many sounds					
40. frequently rotating collision objects					
41. Difficulty in potty training (can't control urination)					
42. You can only make up to 5 requests a day					2
43. often frightened or very anxious or restless					
44. Squinting, closing eyes and frowning in normal light					
45. Does not dress himself or herself without regular help					
46. Repeating some sound or word over and over again					
47. Staring at people as if to "see through" them		4			
48. Repeating someone's question and answer				2	
49. are often unaware of their environment and may be unaware of dangerous situations					4
50. particularly fond of and fascinated by monotonous things or games, activities, etc. (e.g., walking or running back and forth, endlessly jumping, hopping, tapping)					
51. likes to touch, smell and/or taste things around	4		4		
52. Often no visual response to living people (does not look at incoming people)					
53. Entangled in some complex only type of behavior, like absolutely in the magic garden (such as walking must take a certain route, before meals or sleep or what to do before must put what things in what kind of place or do what action, otherwise will not sleep, do not eat, etc.)				1	
54. often destroys things (e.g. toys, all utensils in the house break quickly)					
55. The child was found to be developmentally delayed before the age of two and a half years					3
56. only use 15 but no more than 30 phrases to interact in daily life so far					
57. Staring at a place for a long time (looking at a place in a dull manner)	2				
Total Score: S+R+B+L+S			84		

Table 6. Fang Fang Autism Behavior Inventory ABC Post-test

Projects	Feelings	Interaction	Movement	Language	Self-care
	S	R	B	L	S
1. like to rotate oneself for a long time					
2. learn to do a simple thing, but soon "forget" it					
3. often without exposure to the environment or the requirement to interact		4			
4. often unable to accept simple instructions (e.g. sit, come here, etc.)					
5. will not play with toys, etc. (such as endlessly turning or throwing, rubbing, etc.)					
6. poor visual discrimination (e.g., poor discrimination of the characteristics of an object - size, color, or location, etc.)					
7. Non-interactive smile (no social smile, i.e., no nodding, greeting, or smiling with others)		4			
8. Inversion or confusion in the use of pronouns (e.g., "I" instead of "you")					
9. Always holding something for a long time					
10. seems not to be listening to the person, so that he/she is suspected of having a hearing					
11. Speaking without intonation and rhythm	3				
12. prolonged swaying of the body					
13. to get something that is not physically within reach (i.e., underestimation of one's distance from the object)					
14. Strong reactions to changes in environment and daily routine					
15. Does not respond to being called by name when he is with others					
16. often make forward movement, toe walk, finger pinch and flick					
17. Not responsive to other people's facial expressions or feelings		2			
18. Seldom use the words "yes" or "I" when speaking					
19. having a special ability in a particular area that does not seem to be compatible with mental retardation					
20. cannot execute simple commands containing this (e.g., put the ball on the box or put the ball in the box)					
21. sometimes does not react with surprise to loud sounds (may remind people that children are deaf)					
22. Clap hands frequently					
23. throwing a big tantrum or throwing a little tantrum often					
24. Actively avoid eye contact with others					
25. Refusing to be hugged or touched					
26. sometimes do not respond to very painful stimuli (e.g., falls, cuts, or injections)					
27. body is very stiff and hard to hold (e.g., jerking)					
28. feeling his muscles relax when holding him (even if he is not close to the person holding)					
29. Expressing what is desired by posture, gesture (and not inclined to express it in words)					
30. Walk on your toes frequently					
31. Hurting others by biting, hitting, kicking, etc.					
32. Constant repetition of phrases					
33. not imitate other children during play					
34. Often do not blink when the bright light shines directly into the eyes					
35. Self-injury by head-butting, hand-biting, etc.					
36. You can't wait for something you want (as soon as you want something, you want it immediately)					
37. Cannot name more than 5 objects					
38. can't develop any friendship (won't communicate with children to make friends)		4			
39. often cover the ears when there are many sounds					
40. frequently rotating collision objects					
41. Difficulty in potty training (can't control urination)					
42. You can only make up to 5 requests a day					
43. often frightened or very anxious or restless					
44. Squinting, closing eyes and frowning in normal light					
45. Does not dress himself or herself without regular help					
46. Repeating some sound or word over and over again					
47. Staring at people as if to "see through" them					
48. Repeating someone's question and answer					
49. are often unaware of their environment and may be unaware of dangerous situations					
50. particularly fond of and fascinated by monotonous things or games, activities, etc. (e.g., walking or running back and forth, endlessly jumping, hopping, tapping)					
51. likes to touch, smell and/or taste things around					
52. Often no visual response to living people (does not look at incoming people)					
53. Entangled in some complex only type of behavior, like absolutely in the magic garden (such as walking must take a certain route, before meals or sleep or what to do before must put what things in what kind of place or do what action, otherwise will not sleep, do not eat, etc.)					
54. often destroys things (e.g. toys, all utensils in the house break quickly)					
55. The child was found to be developmentally delayed before the age of two and a half years					
56. only use 15 but no more than 30 phrases to interact in daily life so far					
57. Staring at a place for a long time (looking at a place in a dull manner)					
Total Score: S+R+B+L+S			19		

Table 8. Yuan Yuan Autism Behavior Scale ABC Posttest

Projects	Feelings	Interaction	Movement	Language	Self-care
	S	R	B	L	S
1. like to rotate oneself for a long time					
2. learn to do a simple thing, but soon "forget" it					
3. often without exposure to the environment or the requirement to interact					
4. often unable to accept simple instructions (e.g. sit, come here, etc.)					
5. will not play with toys, etc. (such as endlessly turning or throwing, rubbing, etc.)					
6. poor visual discrimination (e.g., poor discrimination of the characteristics of an object - size, color, or location, etc.)					
7. Non-interactive smile (no social smile, i.e., no nodding, greeting, or smiling with others)					
8. Inversion or confusion in the use of pronouns (e.g., "I" instead of "you")				4	
9. Always holding something for a long time					
10. seems not to be listening to the person, so that he/she is suspected of having a hearing					
11. Speaking without intonation and rhythm					
12. prolonged swaying of the body					
13. to get something that is not physically within reach (i.e., underestimation of one's distance from the object)					
14. Strong reactions to changes in environment and daily routine					
15. Does not respond to being called by name when he is with others					
16. often make forward movement, toe walk, finger pinch and flick					
17. Not responsive to other people's facial expressions or feelings					
18. Seldom use the words "yes" or "I" when speaking				4	
19. having a special ability in a particular area that does not seem to be compatible with mental retardation					1
20. cannot execute simple commands containing this (e.g., put the ball on the box or put the ball in the box)					
21. sometimes does not react with surprise to loud sounds (may remind people that children are deaf)					
22. Clap hands frequently					
23. throwing a big tantrum or throwing a little tantrum often					
24. Actively avoid eye contact with others					
25. Refusing to be hugged or touched					
26. sometimes do not respond to very painful stimuli (e.g., falls, cuts, or injections)					
27. body is very stiff and hard to hold (e.g., jerking)					
28. feeling his muscles relax when holding him (even if he is not close to the person holding)					
29. Expressing what is desired by posture, gesture (and not inclined to express it in words)					
30. Walk on your toes frequently					
31. Hurting others by biting, hitting, kicking, etc.					
32. Constant repetition of phrases				1	
33. not imitate other children during play					
34. Often do not blink when the bright light shines directly into the eyes					
35. Self-injury by head-butting, hand-biting, etc.					
36. You can't wait for something you want (as soon as you want something, you want it immediately)					
37. Cannot name more than 5 objects					
38. can't develop any friendship (won't communicate with children to make friends)					
39. often cover the ears when there are many sounds					
40. frequently rotating collision objects					
41. Difficulty in potty training (can't control urination)					
42. You can only make up to 5 requests a day					
43. often frightened or very anxious or restless					
44. Squinting, closing eyes and frowning in normal light					
45. Does not dress himself or herself without regular help					
46. Repeating some sound or word over and over again					
47. Staring at people as if to "see through" them					
48. Repeating someone's question and answer				1	
49. are often unaware of their environment and may be unaware of dangerous situations					
50. particularly fond of and fascinated by monotonous things or games, activities, etc. (e.g., walking or running back and forth, endlessly jumping, hopping, tapping)					
51. likes to touch, smell and/or taste things around					
52. Often no visual response to living people (does not look at incoming people)					
53. Entangled in some complex only type of behavior, like absolutely in the magic garden (such as walking must take a certain route, before meals or sleep or what to do before must put what things in what kind of place or do what action, otherwise will not sleep, do not eat, etc.)					
54. often destroys things (e.g. toys, all utensils in the house break quickly)					
55. The child was found to be developmentally delayed before the age of two and a half years					
56. only use 15 but no more than 30 phrases to interact in daily life so far					
57. Staring at a place for a long time (looking at a place in a dull manner)					
Total Score : S+R+B+L+S			11		

Table 9. Xiao Cheng Autism Behavior Scale ABC Post-test

Projects	Feelings	Interaction	Movement	Language	Self-care
	S	R	B	L	S
1. like to rotate oneself for a long time					2
2. learn to do a simple thing, but soon "forget" it					
3. often without exposure to the environment or the requirement to interact		4			
4. often unable to accept simple instructions (e.g. sit, come here, etc.)				1	
5. will not play with toys, etc. (such as endlessly turning or throwing, rubbing, etc.)			3		
6. poor visual discrimination (e.g., poor discrimination of the characteristics of an object - size, color, or location, etc.)					
7. Non-interactive smile (no social smile, i.e., no nodding, greeting, or smiling with others)		4			
8. Inversion or confusion in the use of pronouns (e.g., "I" instead of "you")					
9. Always holding something for a long time					
10. seems not to be listening to the person, so that he/she is suspected of having a hearing	1				
11. Speaking without intonation and rhythm				2	
12. prolonged swaying of the body					
13. to get something that is not physically within reach (i.e., underestimation of one's distance from the object)		2	2		
14. Strong reactions to changes in environment and daily routine					
15. Does not respond to being called by name when he is with others					
16. often make forward movement, toe walk, finger pinch and flick			1		
17. Not responsive to other people's facial expressions or feelings		2			
18. Seldom use the words "yes" or "I" when speaking					
19. having a special ability in a particular area that does not seem to be compatible with mental retardation					4
20. cannot execute simple commands containing this (e.g., put the ball on the box or put the ball in the box)	1				
21. sometimes does not react with surprise to loud sounds (may remind people that children are deaf)					
22. Clap hands frequently			2		
23. throwing a big tantrum or throwing a little tantrum often					
24. Actively avoid eye contact with others		2			
25. Refusing to be hugged or touched					
26. sometimes do not respond to very painful stimuli (e.g., falls, cuts, or injections)					
27. body is very stiff and hard to hold (e.g., jerking)					
28. feeling his muscles relax when holding him (even if he is not close to the person holding)		4			
29. Expressing what is desired by posture, gesture (and not inclined to express it in words)					
30. Walk on your toes frequently					
31. Hurting others by biting, hitting, kicking, etc.					
32. Constant repetition of phrases				2	
33. not imitate other children during play		4			
34. Often do not blink when the bright light shines directly into the eyes					
35. Self-injury by head-butting, hand-biting, etc.					
36. You can't wait for something you want (as soon as you want something, you want it immediately)					
37. Cannot name more than 5 objects					
38. can't develop any friendship (won't communicate with children to make friends)		4			
39. often cover the ears when there are many sounds					
40. frequently rotating collision objects					
41. Difficulty in potty training (can't control urination)					2
42. You can only make up to 5 requests a day					
43. often frightened or very anxious or restless					
44. Squinting, closing eyes and frowning in normal light	2				
45. Does not dress himself or herself without regular help					4
46. Repeating some sound or word over and over again					
47. Staring at people as if to "see through" them		4			
48. Repeating someone's question and answer				1	
49. are often unaware of their environment and may be unaware of dangerous situations					4
50. particularly fond of and fascinated by monotonous things or games, activities, etc. (e.g., walking or running back and forth, endlessly jumping, hopping, tapping)					
51. likes to touch, smell and/or taste things around	2		1		
52. Often no visual response to living people (does not look at incoming people)					
53. Entangled in some complex only type of behavior, like absolutely in the magic garden (such as walking must take a certain route, before meals or sleep or what to do before must put what things in what kind of place or do what action, otherwise will not sleep, do not eat, etc.)				1	
54. often destroys things (e.g. toys, all utensils in the house break quickly)					
55. The child was found to be developmentally delayed before the age of two and a half years					3
56. only use 15 but no more than 30 phrases to interact in daily life so far					
57. Staring at a place for a long time (looking at a place in a dull manner)					
Total Score : S+R+B+L+S			67		