



Intervention Effects of Music Therapy on Social Communication and Attention in Children with Autism

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Abstract. This study aims to examine the practical effects of music therapy on improving social communication skills and attention in the population of children with autism spectrum disorder (ASD). The study employed a case study design. Baseline data were established through naturalistic observations in the preliminary phase, and changes in sustained attention, duration of focus, and eye contact were continuously recorded during the intervention period. A 7-week music therapy intervention was conducted with two children with moderate autism, and the effectiveness was evaluated using the Autism Treatment Effectiveness Checklist (ATEC), parent interviews, and behavioral observation records. The results indicate that music therapy effectively improves the subjects' verbal communication frequency, social initiative, and the joint attention (JA) levels.

Keywords: Children with autism, music therapy, attention, social communication, case study, multimodal perception.

1 Introduction

1.1 Introduction to Autism Spectrum Disorder and Music Therapy

Autism spectrum disorder (ASD) is a neurodevelopmental disorder primarily characterized by impairments in social interaction and communication, as well as repetitive or stereotyped behaviors. In children, deficits in social communication manifest not only in limited verbal expression but also in reduced eye contact, impaired joint attention, and difficulties in initiating and sustaining interactions with others^{[1][8]}. These core difficulties further affect children's language development, classroom participation, and peer interactions, thereby limiting their ability to adapt to and learn in naturalistic educational environments^[2].

Music therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship conducted by a credentialed professional who has completed an approved music therapy program^[3]. Music not only stimulates children's auditory systems through rhythm and melody, which may produce calming effects, but may also support frontal lobe development through music-language neural coupling, thereby contributing to improvements in cognitive and social functioning. Compared with traditional intervention approaches, music therapy uses

musical interaction as its core medium, which may reduce children's resistance and enhance their motivation to participate^[4].

1.2 Research Progress in Music Therapy for Children with Autism

In recent years, as research in this area has expanded, studies on music therapy for children with autism have gradually shifted from a focus on single-domain behavioral improvement to a more multidimensional perspective^[5]. In addition to the traditional emphasis on social interaction and communication skills, an increasing number of studies have explored the potential mechanisms underlying music-based interventions in areas such as emotional regulation, sensory processing, and cognitive functioning^[6]. Multimodal support has gradually emerged as a key research direction in this field. Relevant studies have sought to combine musical stimuli with multiple modalities, such as visual cues, motor feedback, and emotion-related signals, in order to enhance the richness and comprehensibility of intervention contexts. Research indicates that the integration of multimodal information helps improve the ability of children with autism to process social cues, thereby promoting their engagement and sustained attention in interactive settings.

Meanwhile, intelligent assessment technologies have been increasingly incorporated into music therapy research^[7]. For example, technologies such as facial expression recognition, speech emotion analysis, and eye-tracking can provide more objective and continuous monitoring of children's emotional states, attention allocation, and interactive responses during interventions. Existing studies indicate that behavioral assessment methods incorporating AI techniques can enhance the objectivity of data collection and support the development of individualized developmental models, thereby enabling more precise interventions.

2 Research Objectives

2.1 Study Participants

The study participants were two children with autism diagnosed at Quanzhou Third Hospital. Both met the diagnostic criteria for childhood autism in the *Chinese Classification and Diagnostic Criteria for Mental Disorders (Third Edition)* and were rated as having moderate autism on the PEP-3. Both children were between the ages of 3 and 8—a critical developmental period—and had received more than one year of conventional rehabilitation training prior to the intervention; The participants demonstrated sufficient behavioral compliance to adhere to the intervention protocol. Inclusion criteria primarily included: a clear diagnosis, relatively stable condition, parents' explicit expectations for improvements in social communication or attention, and the ability to cooperate in completing pre- and post-tests as well as interviews.

Case 1 involved an 8-year-old boy named Le Le (pseudonym), who primarily exhibited unstable eye contact and avoidant social behaviors, but demonstrated a high level of cooperation with the therapist's instructions. Case 2 involved a 5-year-old girl, Xiaohong (pseudonym), who primarily exhibited limited verbal expression, poor

response to her name, and difficulties with eye contact, but demonstrated some willingness to participate in activities when motivated by interest. These two cases represent two common clinical presentations—the relatively stable and cooperative type and the interest-driven type—and are thus representative of typical cases.

2.2 Research Design

This study employed a case study approach. Prior to the formal intervention, three observational sessions were conducted within one week across various naturalistic settings to establish a stable baseline for attention and social behaviors. Subsequently, a 7-week music therapy intervention was implemented, consisting of one session per week, each lasting approximately 30 minutes. During the intervention, changes in the participants' social communication and attention were continuously documented using observation checklists. The intervention was divided into the following three phases:

1. Relationship-Building Phase (Weeks 1–2): Gentle music was used to establish a sense of security, identify the participants' musical preferences, and observe their responses to different rhythms.

2. Core Intervention Phase (Weeks 3–6):

Attention Training: Using instruments such as wave drums, participants were asked to visually track the movement of a small ball to strengthen visual attention.

Social Communication Training: Utilize rhythmic activities and musical instrument interactions (such as taking turns drumming) to teach “waiting” and “taking turns” rules, and encourage the individual to communicate functional needs via instrumental or verbal cues or simple verbal communication.

3. Consolidation and Evaluation Phase (Week 7): Repeat the baseline assessment to evaluate skill transfer. To validate classroom observations, parents will complete the Language and Social Subscales of the Autism Treatment Evaluation Checklist (ATEC) before and after the intervention and participate in a semi-structured interview upon completion of the intervention.

2.3 Implementation of the Intervention

Music therapy sessions were conducted in a hospital setting, led by music therapists with professional training and supported by physicians. The overall intervention followed a four-phase structure: introduction, transition, activity, and conclusion. Each session consisted of three basic components: greetings, the main activity, and farewell, with the difficulty and pace of the activities adjusted in real time based on the children's responses.

Intervention activities primarily take the form of song greetings, body movement, rhythm imitation, percussion playing, and task-oriented musical games. For Case 1, the focus of the activities included promoting eye contact, movement imitation, compliance with instructions, and the development of an awareness of rules through sessions such as “Hello Song,” rhythmic clapping, hopscotch, African drumming, and bell ringing. For Case 2, the focus included enhancing the ability to follow instructions, sit still, complete tasks, and express needs through sessions such as “Hello Song,” “Find a

Friend,” “Find the Little Ducklings,” and “Body Scale Song” to enhance awareness of instructions, the ability to sit still, task completion, and the capacity to express needs. Both interventions emphasized gradually improving the children’s environmental adaptability, sustained attention, and levels of active interaction within a stable activity routine.

2.4 Observation Indicators and Assessment Tools

Behavioral Observation Checklist: Classroom observations primarily focus on two types of indicators. The first is attention indicators, including the number of sustained attention episodes, duration of focus, and the proportion of focus time relative to total class time; the second is social communication indicators, including the number of eye contact episodes, instances of spontaneous expression, and instances of spontaneous social behavior.

Autism Treatment Evaluation Checklist (ATEC) ^[9]: This scale assesses language, social, sensory, and health-related behaviors in children with autism through observation, testing, and interviews; higher scores indicate more severe symptoms. Parents complete this scale before and after intervention, with a focus on the “Language/Communication” and “Social” subscales to compare changes over time.

3 Results

3.1 Changes in Attention

The longitudinal observation of the two subjects revealed a consistent upward trend across all primary attention metrics, including the frequency of sustained attention bouts, the absolute duration of focus, and the relative proportion of time spent focused. During the baseline phase, both subjects exhibited a low frequency of engagement, averaging approximately 2 sustained attention bouts per session. Following the implementation of the music therapy intervention, this frequency improved to an average of 3–4 bouts in the later stages, reaching a relative peak during the 6th intervention session. As illustrated in Figure 1(A), while minor session-by-session fluctuations were observed, the transition from the initial phase to the working phase marks a visible increase in the density of attentive behaviors.

The quantitative data regarding the duration of focus further supports the efficacy of the intervention. Research data indicates that the duration of sustained focus increased from baseline measurements of 2.59 minutes and 4.09 minutes to 4.53 minutes and 6.42 minutes by the 7th session, respectively, representing a net increase of approximately 2 minutes of continuous engagement for each subject. Correspondingly, the proportion of the attention span relative to total class time rose from 9.82% and 13.63% at baseline to 16.03% and 19.24% by the final evaluation. These trends, visualized in Figures 1(B) and 1(C), demonstrate that music therapy activities can effectively extend the temporal boundaries of sustained attention during classroom-based tasks for children with autism. The structured and rhythmic nature of the intervention likely provided a predictable framework that facilitated this gradual expansion of cognitive engagement.

3.2 Changes in Social Communication

Regarding social communication indicators, both subjects demonstrated an overall upward trend in eye contact and proactive social behaviors throughout the intervention period. As illustrated in Figure 2(A), Subject 2 initially exhibited significant oppositional behaviors and task avoidance; however, as the activity routine stabilized and therapeutic strategies were adjusted, her seated attention duration improved and the frequency of eye contact rose accordingly. While Case 1 maintained a higher level of general cooperation, early observations identified a persistent wandering gaze. Consequently, improving eye contact was established as a prioritized short-term goal, reinforced through targeted activities such as singing, rhythmic movement, and direct face-to-face interaction. The resulting data, visualized in the fluctuations and eventual gains shown in Figure 2(A), indicate that music therapy plays a constructive role in promoting proactive eye contact.

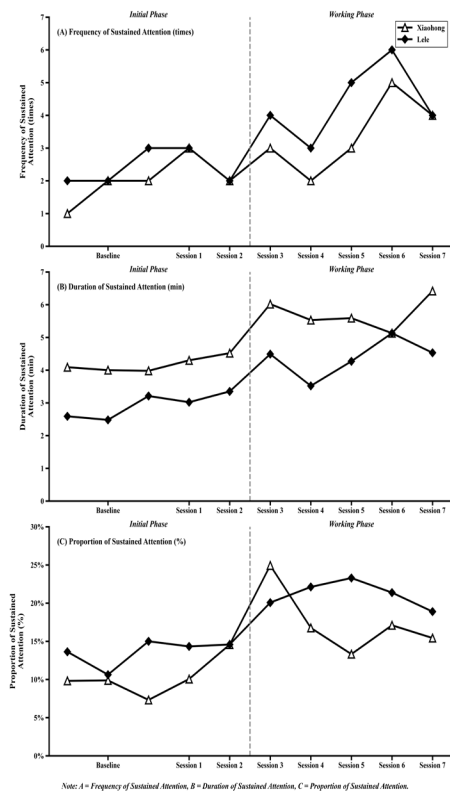


Fig. 1. Changes in Attention Indicators for Children with Autism.

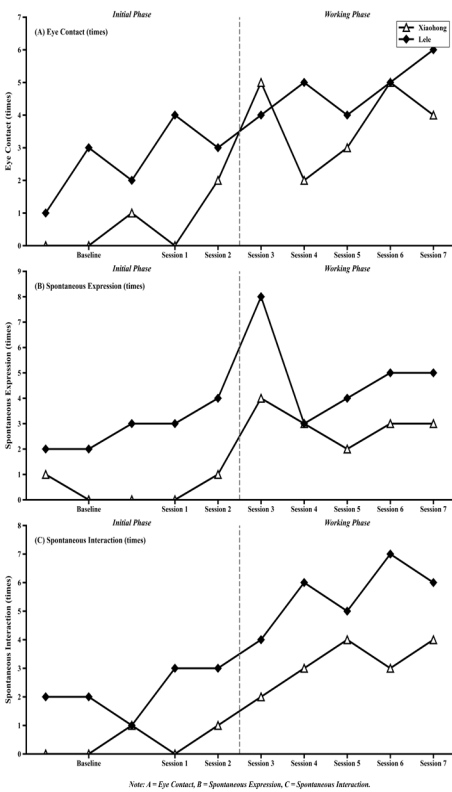


Fig. 2. Changes in Social Communication Indicators for Children with Autism

Furthermore, both subjects showed a significant increase in the frequency of self-initiated expressions and interactions compared to their respective baseline levels. The

study's initial findings revealed that both subjects exhibited minimal levels of spontaneous communication and behavior at the outset. However, by the conclusion of the intervention, self-initiated expression rose to 2 and 4 instances, while self-initiated social behavior increased to 3 and 5 instances for the two subjects, respectively. These advancements are detailed in Figure 2(B) and 2(C), which track the progression of spontaneous interactions across the seven sessions. Collectively, these results suggest that music therapy not only enhances behavioral compliance within classroom activities but also fosters a greater tendency for children with autism to initiate social engagement and express their functional needs.

3.3 ATEC Scale Results and Interview Findings

The ATEC assessment results indicate that both participants showed some improvement in the language and social dimensions. Participant 1's total score decreased from 25 to 22, and Participant 2's score decreased from 24 to 20, reflecting a reduction in language and social behavior issues following the intervention.

The results of the parent interviews were largely consistent with classroom observations. Case 1 showed more noticeable improvements in following instructions, acceptance of physical contact, and interaction with familiar adults; parents reported that the child responded more promptly to verbal instructions and engaged in increased daily physical interaction. Case 2 demonstrated more prominent improvements in awareness of rules, sense of order, and expressing needs; although there were still limitations in emotional regulation and complex communication, the child's willingness to express themselves increased, and their organizational skills during activities improved compared to before. The parents of both children noted that their children had made progress in language comprehension, eye contact, responding to their names, and classroom attention compared to before the intervention.

4 Discussion

4.1 The Promotive Role of Music Therapy in Social Communication

The results of this study indicate that, following a 7-week intervention, both participants showed signs of improvement in eye contact, spontaneous expression, and proactive social behavior, suggesting that music therapy plays a certain role in promoting social communication skills in children with autism. Music activities, characterized by rhythm, repetition, and context, provide a predictable interactive framework with minimal verbal demands, enabling children to gradually establish connections with others through turn-taking, imitation, responsiveness, and joint engagement^[10].

Compared to training methods that rely solely on verbal instructions, music therapy places greater emphasis on the combined effects of auditory cues, movement imitation, and emotional connection, giving it certain advantages in establishing therapeutic relationships and enhancing classroom participation. Drawing on research in visually supported language instruction, it can be argued that music therapy also provides a form of "nonverbal scaffolding": rhythm and melody offer structured cues that help children

understand activity sequences, predict interaction patterns, and develop response strategies, thereby reducing the difficulty of social interaction.

4.2 The Role of Music Therapy in Enhancing Attention

Attention deficits are a common comorbid issue among children with autism and directly impact their social and language development. Research findings indicate that both participants showed improvements in the number of sustained attention episodes, duration of focus, and the proportion of time spent focused, suggesting that music therapy plays a positive role in sustaining attention. Musical rhythms and rhythmic activities can consistently engage children's auditory and motor systems. Percussion, body movements, and task-based games further enhanced their engagement in classroom settings, enabling them to sustain attention—which is typically easily distracted—during structured activities.

It should be noted that the behavioral gains exhibited non-linear fluctuations throughout the intervention phases.; fluctuations were still evident during certain phases. This suggests that children with autism exhibit significant individual differences in their response to interventions. Factors such as activity difficulty, alignment with interests, daily emotional state, and prior rehabilitation experience may all influence classroom performance. Therefore, the implementation of music therapy should emphasize dynamic adjustments, flexibly modifying rhythm, materials, and reinforcement methods based on the child's immediate reactions to enhance the adaptability of the intervention.

4.3 Future Directions for Multimodal Support and Intelligent Assessment

Current research primarily relies on classroom behavioral observations, parent-administered questionnaires, and interviews to evaluate effectiveness. While this approach is practically feasible, it remains limited in terms of objectivity and real-time data collection. Future music therapy research could further incorporate a “multimodal support” framework, combining auditory stimuli with visual cues, motor perception, and emotion recognition to create a more comprehensive intervention environment. For children with autism, information from a single channel is often insufficient to sustain stable participation; however, the coordinated presentation of auditory, visual, and motor cues may better facilitate their understanding of rules, contexts, and the intent of interactions.

Furthermore, multimodal perception technologies and intelligent algorithms can provide more objective assessment support for music therapy. For example, facial expression recognition and speech emotion recognition can be used to monitor children's emotional responses during activities, while eye-tracking or gaze capture can record their attention allocation toward the therapist, musical instruments, and task materials. This data can then be combined with behavioral data to establish individualized response profiles. Building on this, algorithms can analyze different children's musical preferences, task completion, and emotional fluctuations, thereby providing a basis for subsequent intervention recommendations, difficulty adjustments, and real-time feedback^[11]. Such technologies are not intended to replace therapists but rather serve as

auxiliary tools to enhance the precision of individualized design and effectiveness evaluation. While these approaches hold application potential, more rigorous research is currently needed regarding ethical guidelines, data quality, and clinical adaptability.

5 Conclusion

A longitudinal study of two children with moderate autism spectrum disorder demonstrated that music therapy can improve their social communication and attention to some extent. Specifically, the participants showed positive changes in sustained attention, duration of focus, eye contact, spontaneous expression, and spontaneous social behavior; these findings were further supported by parental questionnaires and interview results. Thus, music therapy can serve as an effective adjunct in the rehabilitation training of children with autism, offering practical value in enhancing their social participation, awareness of rules, and ability to maintain attention in the classroom. In the future, it will be necessary to integrate multimodal perception and intelligent support technologies to further enhance the level of individualization in interventions and the objectivity of outcome assessments.

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