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A review of intervention and treatment approaches for autism spectrum disorder

Sun Wen[1]; Jeong Dae Keun[2]*

[1]*Department of Physical Therapy, Sehan University, Jeollanam-do, Republic of Korea.*

[2]*Department of Physical Therapy, Sehan University, 1113, Noksaek-ro, Samho-eup, Yeongam-gun, Jeollanam-do, Republic of Korea.*

Abstract

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by impairments in social interaction, communication difficulties, and repetitive, stereotyped behaviors. In recent years, its prevalence has shown an increasing trend, making it a major concern in the fields of public health and education. As there is currently no cure for ASD, scientific and systematic interventions and treatments are of great significance in improving patients' functional outcomes. This paper systematically reviews the major intervention and treatment approaches for ASD by analyzing relevant domestic and international literature. It focuses on the theoretical foundations, implementation methods, and effectiveness of various interventions, including applied behavior analysis, structured teaching, speech and communication training, sensory integration therapy, and pharmacological treatment. In addition, emerging approaches such as digital interventions, virtual reality, and other assistive therapies are briefly introduced. Based on this review, the advantages and limitations of different intervention methods are compared, and several existing issues are identified, including the lack of unified evaluation standards, insufficient long-term follow-up studies, and the need to improve individualized intervention strategies. Finally, this paper suggests that future efforts should emphasize multidisciplinary integration, promote precision and individualized interventions, and improve family and social support systems, with the aim of providing references for ASD intervention and rehabilitation practices.

***Corresponding author:** Jeong Dae Keun

Department of Physical Therapy, Sehan University, 1113, Noksaek-ro, Samho-eup, Yeongam-gun, Jeollanam-do, Republic of Korea.

Email: zhangjunahnu@163.com

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Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that originates in early childhood, with its core characteristics mainly manifested as impairments in social interaction and communication, as well as repetitive, stereotyped patterns of behavior and restricted interests [10]. In recent years, with the improvement of diagnostic criteria and the enhancement of public awareness, the reported prevalence of ASD has shown a continuous upward trend, exerting profound impacts on individual development, family burden, and the allocation of social public resources. Although there is currently no effective cure for ASD in medicine, a large body of research has demonstrated that scientific and systematic early intervention, along with continuous support, can significantly improve patients' cognitive abilities, language skills, and social adaptive functioning. Therefore, strengthening the research and application of intervention strategies for ASD is of great significance for improving patients' quality of life and alleviating the burden on families and society [4].

At present, research on interventions and treatments for ASD in foreign countries started relatively early, and a relatively systematic theoretical framework and diversified intervention models have been established, such as applied behavior analysis, structured teaching, and developmentally oriented comprehensive intervention approaches. These studies are mostly based on empirical research, emphasizing the scientific

evaluation of intervention effectiveness and long-term follow-up. In contrast, domestic research in this field started relatively late. Although certain progress has been made in intervention practice and localization, there is still room for improvement in terms of theoretical integration, standardized evaluation, and high-quality empirical studies. Based on this, this paper systematically reviews the relevant research on ASD intervention and treatment methods at home and abroad, and summarizes and analyzes the theoretical foundations, implementation pathways, and effectiveness of major intervention models. The aim is to synthesize existing research findings, compare the advantages and limitations of different approaches, and provide references for future ASD intervention practices and related research.

Theoretical foundations of autism intervention and treatment

The theoretical foundations of autism intervention and treatment are primarily derived from behaviorist theory, developmental psychology, and neurobiological perspectives. These three frameworks provide systematic support and scientific evidence for intervention practices from different levels. First, behaviorist theory is one of the most widely applied and empirically supported foundations in autism intervention. Its core lies in explaining and modifying individual behavior through the relationship between environmental stimuli and behavioral responses. Among these, Applied Behavior Analysis (ABA) is a representative approach, which employs principles of operant conditioning—such as reinforcement, punishment, shaping, and extinction—to systematically train target behaviors in children with autism. ABA emphasizes breaking down complex skills into manageable steps and promoting skill acquisition through repeated practice and positive reinforcement, while simultaneously reducing problem behaviors. It has demonstrated significant effectiveness in improving language development, social interaction, and daily living skills, and is widely recognized internationally as an evidence-based intervention. However, traditional ABA also has certain limitations, such as highly structured training contexts and limited generalization of learned skills. Consequently, more naturalistic and context-based intervention approaches have been developed in recent years [11]. Second, developmental psychology focuses on the holistic and stage-based nature of individual development, emphasizing patterns of growth in cognition, language, emotion, and social interaction. It advocates promoting children's overall development within natural interactive contexts. From this perspective, children with autism are not entirely atypical in development but rather exhibit deviations in developmental trajectories. Therefore, interventions should align with the child's developmental level and emphasize interest-based engagement and emotional interaction. For example, developmentally oriented intervention models encourage active participation through play and parent-child interaction, thereby enhancing social communication and emotional understanding. Compared with purely behavioral training, this approach places greater emphasis on intrinsic motivation and the overall quality of development [3]. Third, neurobiological perspectives explain the underlying mechanisms of autism from the viewpoints of neuroscience and genetics, providing a physiological basis for intervention and treatment. Studies have shown that individuals with autism often exhibit abnormalities in brain structure, neural connectivity, and neurotransmitter function, such as differences in the prefrontal cortex, amygdala, and mirror neuron system, which may affect social cognition and emotional processing [8]. In addition, genetic factors play a crucial role in the development of autism, with complex interactions between multiple genes and environmental factors influencing its onset and progression. Based on neurobiological findings, certain pharmacological treatments and neuromodulation techniques have been applied to alleviate autism-related symptoms, such as aggressive behavior, anxiety, and attention deficits. However, their effects are mainly limited to symptom management rather than addressing the core features of autism.

In summary, behaviorist theory focuses on modifying observable behaviors, developmental psychology emphasizes internal developmental mechanisms and social interaction, and neurobiological perspectives provide physiological and pathological explanations. These three approaches complement one another and together form a multidimensional theoretical framework for autism intervention and treatment, offering essential support for the development of more scientific, systematic, and individualized intervention strategies.

Intervention and treatment approaches for autism spectrum disorder

Behavioral interventions

Behavioral interventions are currently the most widely applied and empirically supported approaches in the field of autism intervention, with their theoretical foundation primarily derived from Applied Behavior Analysis (ABA). Based on the principles of operant conditioning, these methods systematically analyze the relationship between environmental stimuli and individual behaviors, and employ techniques such as reinforcement, shaping, and extinction to train and modify target behaviors in a planned manner. The core objective is to increase the frequency of appropriate behaviors through positive reinforcement while reducing problem behaviors such as stereotyped and self-injurious actions, thereby promoting the development of functional behaviors in children with autism.

In practice, common forms of behavioral interventions include Early Intensive Behavioral Intervention (EIBI) and Pivotal Response Treatment (PRT). EIBI typically emphasizes high-intensity, long-term individualized training during early childhood, using frequent and repetitive exercises to help children establish fundamental cognitive and behavioral skills. In contrast, PRT focuses on pivotal areas such as motivation, spontaneous communication, and responsiveness to environmental cues, and emphasizes intervention in natural settings to enhance the generalization of learned skills. These approaches usually break down complex skills into smaller, manageable steps, enabling children to gradually acquire abilities in language expression, social interaction, and daily living through systematic training [1].

A substantial body of research has demonstrated that behavioral interventions are effective in improving language abilities, social interaction, and daily living skills in children with autism. Early intervention, particularly before the age of three, has been shown to yield more significant outcomes, contributing not only to developmental gains but also to reducing family burden [9]. However, certain limitations remain in practical application. Traditional behavioral training is often highly structured and procedural, which may result in good performance in controlled settings but limited transfer and generalization to real-life situations. Additionally, some training

processes may be overly mechanical, potentially affecting children's initiative and intrinsic motivation. These interventions also require highly trained professionals, involve considerable costs, and demand substantial family involvement. Therefore, in practice, behavioral interventions are often combined with developmental approaches, educational support, and family-based training to achieve more comprehensive and long-term outcomes.

Educational and structured interventions

Educational and structured interventions emphasize optimizing learning environments and teaching strategies to promote the cognitive development and social adaptability of children with autism, making them an essential component of comprehensive intervention systems. These approaches are grounded in educational contexts and are designed in accordance with children's cognitive characteristics and behavioral features. Through systematic and predictable instructional arrangements, they help children better understand external information and actively engage in learning activities.

Among these, the TEACCH (Treatment and Education of Autistic and Communication Handicapped Children) structured teaching model is one of the most representative approaches. Its core lies in the concept of "structured teaching," which involves the use of visual supports, clear time schedules, and task organization to provide a well-ordered and predictable learning environment for children with autism. This highly structured format effectively reduces uncertainty and anxiety, thereby improving attention and task completion abilities [12].

In addition, inclusive education has become an increasingly important focus in both research and practice. This approach advocates placing children with autism in general education settings, where they can develop social interaction skills through engagement with typically developing peers. Through the implementation of Individualized Education Programs (IEPs), teachers can provide targeted instructional support and behavioral guidance based on each child's developmental level and specific needs, thereby achieving the goal of individualized education. Inclusive education not only enhances academic performance but also fosters social adaptability and emotional regulation in real-life contexts, contributing positively to long-term development [5].

Overall, educational and structured interventions emphasize individual differences and promote holistic development within natural learning environments. They focus not only on cognitive and academic achievements but also on the cultivation of social behavior and emotional growth. However, several challenges remain in their implementation. These include the high level of professional expertise required of teachers, the uneven distribution of educational resources, and the difficulty of achieving high-quality inclusive education in certain regions. Moreover, given the significant heterogeneity among children with autism, standardized teaching models must be continuously adapted and refined in practice. Therefore, strengthening teacher training, increasing resource investment, and integrating family and societal support are essential for the effective implementation of educational and structured interventions, ultimately promoting the comprehensive development of children with autism.

Speech and social communication training

Speech and social communication impairments are among the core characteristics of Autism Spectrum Disorder (ASD), mainly manifested as limitations in language expression and comprehension, deficits in nonverbal communication, and insufficient social interaction abilities. Therefore, interventions targeting communication skills occupy a fundamental and critical position within the overall ASD intervention system. Speech and social communication training aims to enhance individuals' language functions and social interaction abilities through systematic approaches, enabling them to achieve effective communication in daily life [6].

This type of intervention primarily includes speech therapy, the Picture Exchange Communication System (PECS), and social skills training. Speech therapy is one of the most basic forms of intervention and is typically delivered by professional speech-language therapists through individualized training programs. It focuses on improving children's language comprehension, expressive abilities, and pragmatic skills, gradually enhancing pronunciation accuracy, vocabulary use, and sentence construction. For children with delayed language development or limited verbal abilities, PECS provides an effective alternative means of communication. This method uses picture cards as a medium for information exchange, guiding children to actively express their needs and intentions, thereby establishing basic communication functions and laying the foundation for subsequent language development. In addition, social skills training places greater emphasis on practical interpersonal abilities, often employing methods such as scenario simulation, group interaction, and role-playing to help children acquire essential social skills, including eye contact, turn-taking in conversation, and emotion recognition, thereby improving their adaptability in real-life social contexts.

Existing studies have shown that systematic speech and social communication training can effectively improve communication abilities, reduce social withdrawal behaviors, and enhance participation in social activities among children with ASD [2]. However, such interventions typically require long-term and consistent implementation, and their effectiveness is influenced by multiple factors, including training intensity, individual differences, and environmental support. Moreover, some children experience difficulties in generalizing skills acquired in training settings to everyday life situations. Therefore, in practical application, it is important to integrate multiple communication training approaches and strengthen collaboration between families and schools. Repeated practice and reinforcement in natural contexts are essential to promote the stable application of acquired skills. In addition, attention should be given to children's interests and motivation to enhance their active participation in training, thereby comprehensively improving their language abilities and social adaptability.

Existing problems and limitations

Although intervention and treatment approaches for Autism Spectrum Disorder (ASD) have continued to develop and have achieved certain practical outcomes, a number of problems and limitations remain, requiring further improvement. First, there are considerable differences in effectiveness among various intervention methods, and even the same intervention may yield significantly different outcomes across individuals. This variability is partly due to the high heterogeneity of ASD, as individuals differ markedly in cognitive levels, language abilities, behavioral characteristics, and comorbid conditions. It is also influenced by factors such as the timing, intensity, and quality of intervention, as well as the level of family involvement.

As a result, it remains difficult to reach consistent and stable conclusions regarding intervention effectiveness. Second, there is a general lack of unified and scientifically standardized evaluation criteria in the field of ASD intervention. Different studies employ diverse assessment tools, outcome measures, and evaluation methods, leading to limited comparability across research findings and affecting the objectivity of conclusions regarding intervention efficacy. Some studies rely excessively on subjective evaluations or single measurement scales, lacking multidimensional and comprehensive assessment systems, which makes it difficult to fully reflect intervention outcomes. Third, the lack of long-term follow-up studies represents another significant limitation. Most existing research focuses on short-term intervention effects, while insufficient attention is paid to the sustainability and stability of outcomes, as well as their impact on long-term development, such as social adaptation and vocational abilities. This limitation restricts a deeper understanding of the true value of different intervention approaches.

In addition, the level of individualized intervention remains insufficient. Although the principle of "individualized instruction" is widely emphasized, in practice, many interventions still rely on standardized programs and lack fine-grained adaptation to individual differences, making it difficult to meet the diverse needs of individuals with ASD. This issue is particularly pronounced in resource-limited settings, where comprehensive individualized assessment and intervention planning are often difficult to implement. In summary, future research on ASD interventions should place greater emphasis on addressing variability in intervention outcomes, establishing unified and standardized evaluation systems, strengthening long-term follow-up studies, and enhancing the level of individualized intervention, thereby promoting the field toward more scientific, systematic, and precise development.

Conclusion

In conclusion, intervention and treatment approaches for Autism Spectrum Disorder (ASD) have shown a trend toward diversification, including behavioral interventions, educational and structured interventions, speech and social communication training, and pharmacological treatment. Among these, behavioral interventions, particularly those based on Applied Behavior Analysis, have strong empirical support in improving core behavioral problems; educational and structured interventions enhance cognitive abilities and social adaptability by optimizing learning environments and teaching strategies; speech and communication training plays a crucial role in addressing core deficits in communication; and pharmacological treatment serves mainly as an adjunctive approach for alleviating emotional and behavioral problems.

It is important to emphasize that a single intervention method is often insufficient to fully meet the complex and diverse developmental needs of individuals with ASD. Therefore, comprehensive intervention models have gradually become the mainstream approach in both research and practice. By integrating multiple intervention strategies and tailoring them to individual characteristics, it is possible to achieve more effective outcomes and provide more holistic support for individuals with ASD.

From a practical perspective, greater attention should be given to early screening and early intervention, the development of individualized intervention plans, the training of professionals, and multidisciplinary collaboration. At the same time, it is essential to promote the effective integration of family, school, and societal resources to establish a sustainable support system. In addition, continuous efforts should be made to improve evaluation mechanisms and standardize intervention processes to ensure scientific and effective implementation. Looking ahead, with the advancement of research and technological innovations, ASD interventions are expected to move toward greater precision and individualization, thereby further improving the quality of life and social participation of individuals with ASD.

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