

Research Progress on Intervention of Motor Dysfunction in Children with Autism Spectrum Disorder

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Abstract

Motor dysfunction is common in autism spectrum disorder (ASD), and it has become one of the important performance characteristics of children with ASD. It is extremely important to implement exercise interventions to improve the exercise levels of children with ASD. This article sorts out the intervention research results in the field of ASD motor dysfunction, which can provide a theoretical basis for the early intervention of ASD dyskinesia and the development and formulation of exercise prescriptions.

Keywords: Children with autism; Dyskinesia; Exercise intervention; Motor skills

Abbreviations: ASD: Autism Spectrum Disorder; FMS: Fundamental Motor Skill

Introduction

Autism spectrum disorders (ASDs) belong to the category of generalised developmental disorders, which are characterized by delays or obstacles in skill acquisition in various developmental fields. In 2014, data from the Centers for Disease Control and Prevention showed that there was one ASD patient per 68 children in the United States. According to a report on the development of China's autism education and rehabilitation industry in 2015, there are about 2 million children with ASD in China, increasing at a rate of nearly 200 thousand every year. Exercise is an important rehabilitation treatment for the three core symptoms of ASD. Studies have shown that children with ASD manifest different degrees of dyskinesia, which is gradually obvious with age [1,2]. Exercise intervention has a good effect on improving motor dysfunction in children with ASD, and the intervention methods are diversified.

Fundamental motor-skill intervention

Fundamental motor skill (FMS) is a basic intervention method for motor dysfunction in children with ASD. Under the guidance of professional teachers and researchers, a unit undertakes teaching plans and skill objectives, including posture, movement, physical operation, grasping, and other general motor skills. This intervention model is important for the development of complex skills required in sports activities and helps ASD children establish a more skilled FMS model.

In recent years, researchers have conducted controlled intervention experiments on children with ASD of 3-7 years of age using basic motor skills courses. Bremer et al. [3] showed that FMS intervention can effectively improve motor skills and may lead to the improvement of individual behaviour. Ketcheson et al. [4] found that the overall and delicate movements of the experimental group improved to varying degrees.

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Adaptive sports intervention

Studies have shown that children with ASD have poor control and coordination ability of large muscles of the upper and lower limbs, and their body balance and sensitivity are also weaker than those of normal children [5]. Pan et al. [6] conducted a 12-week table tennis project (including table tennis technical skills and group cooperative games) on 22 children with ASD. After the intervention, the coordination, sensitivity, strength, and hand-eye coordination ability of the experimental group significantly improved, while another study showed that one week of therapeutic riding activity can effectively improve the physical flexibility and response ability of children with ASD of 5-10 years of age [7]. MacDonald et al. [8] instructed 71 children with ASD to ride two-wheeled bicycles. Five days later, 85.4% of children with ASD successfully mastered cycling skills, and their physical sensitivity and coordination significantly improved. It should be noted that the above interventions need to choose simple and interesting sports activities according to the degree of motor dysfunction and individual differences of ASD children. When participating in group sports, it is necessary to adjust the difficulty, equipment, and rules of activities according to children's functional level.

Somatosensory game intervention

Owing to the development of electronic technology, electronic games have also been applied in the rehabilitation of ASD motor disorders. Lei et al. [9] conducted a three-month intervention study on children with ASD using somatosensory games. The experimental results showed that the child's upper and lower limb motor ability and sensory motor coordination ability significantly improved; Roglic et al. [10] have reported similar research results. However, the research in this field mainly focuses on case studies and the lack of large-scale cross-sectional research and its intervention effects need to be further explored.

Sensory integration training intervention

Children with ASD have abnormal perception, communication, sensory processing, and neural function regulation, and 42%-88% of children with ASD have sensory integration dysfunction [11]. Combined with the specific performance of ASD children's emotional behaviour, perception, and movement, sensory integration training has become an effective method to improve motor disorders in children with ASD.

Sensory integration training mainly stimulates children's vestibular perception, touch, proprioception, and muscle motion perception with the help of swing, jumping bed, balance beam, skateboard, slide, jumping ball, one-sided chair, and other equipments, to promote the development of motor coordination and sensory perception function. Zawadzka et al. [12] carried out sensory integration training for 12 children of 6-12 years of age for 4 months. The training mainly included using swing, rotation, and obstacle equipment to design different games such as throwing and catching and drilling a bucket. Studies have shown that the motor-related sensory regulation ability of children with ASD

has significantly improved after intervention. It should be noted that before the implementation of sensory integration training, the sensory integration ability of children with ASD should be comprehensively evaluated, and the corresponding training plan should be formulated according to the evaluation results.

Water sports intervention

In the 1940s, James McMillan proposed the Halliwick method and introduced it into the field of sports rehabilitation for the disabled. According to the principles of fluid mechanics and human body mechanics, Kumar et al. [13] proposed that the Halliwick method can be divided into four stages: adaptation to water, rotation, control of water movement, and water movement, which can be accurately divided into 10 steps. The recommended amount of 60-90 minutes/time, 2-3 times/week, and lasting for 10-16 weeks in the Halliwick method are mostly used in the water intervention of ASD. Practical research shows that children with ASD prefer water sports compared to ordinary children [14]. Water intervention can improve the clumsiness and slowness of children with ASD, improve their balance, sensitivity, and coordination, and promote the development of cardiopulmonary function. After a 14-week water intervention, Pan et al. [15] found that the muscle strength and endurance of children with ASD improved. The study by Yanardag et al. [16] also supported these research results. After 12 weeks of water intervention, the exercise ability of children with ASD improved.

Intervention research on ASD motor dysfunction has gradually increased in recent years. However, the current research mainly focuses on case intervention studies, and large-scale cross-sectional and follow-up studies are rare. Therefore, it is urgent to develop more professional, personalized, and scientific motor dysfunction interventions for patients with ASD.

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