

## Chapter 6

# Longitudinal Study of Motor Coordination Development in Children With Autism Spectrum Disorder

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### ABSTRACT

*Few studies have longitudinally investigated the development of the motor function in children with autism spectrum disorder (ASD). In this chapter, the author investigated trends in how the development of motor coordination ability is closely related to motor functions in children with ASD. The participants were children enrolled in a special education school for persons with developmental disabilities in Kanagawa Prefecture in Japan. Among them, the study targeted 35 children who took the Body Coordination Test (BCT) continuously for more than three years. Although there were individual differences, the average score on the BCT increased with age. In particular, children with ASD showed moderate development, even during adolescence, when typical children experienced the plateau effect. The results suggest that children with ASD have great educational potential in adolescence.*

### INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder appearing in infancy, and it is characterized by qualitative defects in social interaction and communication ability and restricted and repetitive behavior as primary symptoms (American Psychiatric Association [APA], 2013). In addition to these characteristics, children with ASD have various motor impairments (Leary & Hill, 1996) that hinder their daily and school activities, such as changing clothes, tying shoelaces, or playing ball. As they affect daily life, these motor difficulties can lead to secondary psychosocial problems such as isolation and reduced self-esteem (Koreeda, 2014; Miyaji & Tsujii, 2008). In order to prevent the various problems that can arise from motor function impairment in children with ASD, it is essential to provide developmental support with a focus on motor problems during early childhood.

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The behavioral problems of ASD have a great influence on motor performance, resulting in a lack of stability in motor performance (Ando & Tsuchihashi, 1992). In a cross-sectional study on motor development in children with ASD, Kurita, Shimizu, and Ohta (1981) pointed out that such children tend to have irregular development compared to typical children. Kanda (1980) focused on the psychological aspect and showed that children with ASD exhibit high motor performance when subjected to motivation. Other studies have reported that the development of motor function in children with ASD presents great individual and intraindividual differences in comparison with children with intellectual disabilities, in addition to identifying developmental peculiarities and irregularities (Ando & Kobayashi, 1990; Yabe, Mita, & Aoki, 1979). Moreover, the problem of physical clumsiness has been identified as a behavioral feature of Asperger's syndrome, in which language development during infancy is not delayed. In this aspect, a comparative study is underway for high-functioning autism and Asperger's syndrome (Ruth & Renee, 1997; Smith, 2000).

Currently, motor function impairment in children with ASD is not considered a major factor in the characterization of ASD. However, the problems of physical clumsiness and motor cooperativity, which are believed to be caused by central nervous system dysfunction, are deeply involved in the formation of body awareness, which is the basis of self-cognition and cognition of others. Since these problems can lead to a lack of interest in external stimuli or impair social development, a thorough investigation is paramount for the advancement of research on children with developmental disabilities, including ASD.

Considerable research has been conducted on motor function impairments in children with ASD, most of which are cross-sectional studies. However, few studies have examined this problem from a developmental perspective, as motor function problems in children with ASD are not considered to be a major problem in the characterization of ASD. In addition, to date, relatively few studies have longitudinally explored motor function in children with ASD. In order to bridge this gap in knowledge, this study investigates the longitudinal development of motor coordination ability in children with ASD. To this end, the author used a mixed research method that combines qualitative and quantitative research. The Body Coordination Test (BCT) was conducted at a special education school for persons with developmental disabilities in Japan to analyze the longitudinal development of motor coordination ability in children with ASD. Motor developmental changes were assessed throughout a two-year physical education program based on Frostig's (1970) movement education method.

## **BACKGROUND**

Impaired motor function in children with ASD implies many movement problems throughout their lives, including crawling during early childhood (Creak, 1961). In the 1970s, after the cause of ASD was attributed to a functional and organic brain disorder, the number of research reports addressing the movement of the children with ASD began to gradually increase.

Studies in the field of neurophysiology have verified that children with ASD have impaired functions related to voluntary human movements, such as decreased muscle tone, poor coordination, the appearance of physical clumsiness (Coleman, 1976), stereotypic behaviors (e.g., sideways, hand-holding, and toe walking; Tsuchiya & Seki, 1977), sensorimotor coordination disorder (Ornitz & Ritvo, 1976), and obstacles in movement and movement planning (Ayres, 1973). Currently, it is widely known that children with ASD have several motor-function-related problems, in addition to issues with interpersonal relationships and communication.

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