

## Effects of Occupational-based intervention on Chopsticks Skill in Children with Autism Spectrum Disorder

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### Abstract

*The intervention of Autism Spectrum Disorder (ASD) is limited research focus on the effect of occupational-based intervention. This study sought to determine the effect of occupational-based intervention of chopstick skills for children with ASD. This study included a total of 3 children with ASD. Using single-subject study design, a changing criterion design and ABC design were implemented. The participants' behavior was observed and recorded throughout each session. In this study, the results were analyzed through visual graphs. The amount of food that was moved using the chopsticks was gradually increased. The results show that all participants significantly improved in their ability to use chopsticks in each intervention session. In addition, Assessment of Motor and Process Skills (AMPS) improved the generalization. According to the AMPS, both the overall motor and process skills increased from baseline an average of 0.7 logit. The results of this study showed occupational-based intervention on chopsticks skill to be effective in acquisition and generalization of chopstick skill in children with ASD.*

**Keywords:** Autism, chopstick skills, generalization, occupational performance

### 1. Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by impaired social interactions, deficits in verbal and nonverbal communication, and repetitive behaviors or unusual or severely restrictive interests [1]. For these characteristics children with autism spectrum disorder have poor motor planning and control. It makes occupation-based task or occupational performance difficult and causes difficulty in the acquisition of daily performance skills [2]. Activities of daily living are difficult for children with ASD because the children often require performance skills to initiate or complete a task. Children with ASD also have a narrow range of skills of occupational performance that interfere with their full participation and success in school, home, and community activities [3]. Previous studies have found that children with ASD are particularly at risk for limited activity participation. Furthermore, several studies have shown that children with ASD participate in activities less frequently and with less variety than children with other developmental disabilities as well as their typically developing peers.

Preschoolers with ASD have recently been found to participate less frequently in self-care, community mobility, vigorous leisure activities, and sedentary leisure activities than do typically developing children [4]. The interventions of ASD are primarily focused in social technical training and the reduction of problem behaviors. For targeting the problem occupational therapy have used various method through sensory

integration intervention, relationship-based interventions, structured play activities, and intervention emphasizing responsive, supportive relationships.

Especially, in young children with ASD, occupational therapists often focus on enhancing children's behavioral performance, self-care, and participation in play [5]. Hilton and colleagues compared children with and without ASD in 3 age groups and found that older children in the control group participated more frequently and in more activities than the younger participants, whereas younger children in the ASD group participated less frequently and in fewer activities [6]. This highlights the need for an occupational-based approach to increase the participation in activities by children with ASD.

In Korea, young children are required to chopsticks skill to participate independent. Using chopsticks to participate in family and other meals is a challenging task for ASD children. Chopsticks are the primary utensils used for eating and various hand skills of control are familiar to Korean. Chopsticks are important to obtain in most social participation. Occupational therapists should guide ASD to practice chopsticks tasks to increase hand function in any case [7]. The changing criterion design utilizes step-wise benchmarks for manipulating a dimension (i.e., accuracy, frequency, duration, latency, or magnitude) of a single behavior already present in an individual's repertoire [8]. The design has been used with behaviors where an immediate, considerable increase or decrease may be difficult to achieve or undesired; therefore, gradual shifts toward a desired goal are applied.

Therefore, the purpose of this study was to investigate, through occupational analysis, the effectiveness of occupational-based intervention on the performance and acquisition of chopstick skills in young children with ASD. This single-subject study used a changing criterion design and an ABC design, which is a variation of the multiple-baseline design. The changing criterion design is useful for incrementally changing target behavior, and each phase provides baseline information for subsequent phases.

## **2. Research methods**

### **2.1 Participants**

The children recruited to participate in the study met the following inclusion criteria: (1) diagnosis of ASD; (2) Childhood Autism Rating Scale (CARS) score greater than 30 points; (3) delayed level of development as demonstrated by a score below 30 months on the Denver Developmental Screening Test-II (DDST-II); (4) desired goal of occupational performance in using chopsticks by parents; and (5) agreed to participate in the study.

Three children met the inclusion criteria for participation in the study. Participant 1 was a boy aged 6 years and 6 months (chronological age) diagnosed with ASD and a participated in independently task in occupational therapy. He had a CARS score of 34.5 points and a developmental age of 24–28 months on the DDST-II. Based on observation, his verbal communication was minimal and was limited to words and short phrases such as “help me”, “yes”, and “no”. Repetitive behaviors demonstrated included repetitive jumping, shaking his head, and non-communicative vocalizations making a meaningless sound.

Participant 2 was a 6 years 10 months boy who being diagnosed with ASD. He needs visual and physical cues attending the occupational therapy. In CARS score were 38 points and developmental age was 24 to 30 months in the DDST-II. According to observation of behaviors, he can't say the terms and sentences, he just yell and grizzle. In stereotypical behavior, he was repeated shaking a stick.

Participant 3 was a boy aged 7 years diagnosed with ASD and on an independent level with tasks in occupational therapy. He had a CARS score of 30.5 points and a developmental age of 26–30 months on the DDST-II. Verbal communication consisted of two- or three-word sentences. Participant 3 was easily distracted, had difficult to concentrate, and demonstrated emotional fluctuations. The study participants' general characteristics are listed in Table 1.

## 2.2 Procedure

In the present study, a changing criterion design and ABC design (a variation of multiple-baseline design as a single-subject research design) were implemented. The single-subject experimental design followed 3 stages: baseline, intervention, and generalization. The participants' behavior was observed and recorded throughout each session.

The participants in the study attended two sessions per week for a total of 20 sessions consisting of a baseline period for five sessions (A), an intervention period for 6 weeks comprising 12 sessions of occupational therapy using chopsticks (B), and a generalization period for three sessions (C).

In baseline period (A), to determine basic data on the CARS during the baseline phase, occupational performance using chopsticks was evaluated using tasks P-9 and P-12 on Assessment of Motor and Process Skills (AMPS). Criteria for performance were accurately determined and data points for each participant's performance recorded. The criteria for performance while holding the chopsticks were gradually increased in five stages: (1) holding the top part of the chopstick, (2) holding the bottom part of the chopstick, (3) opening the chopsticks, (4) gathering the chopsticks together, and (5) maintaining the position of the gathered chopsticks. The total baseline phase consisted of 5 sessions for 30 minutes each.

In occupational performance period (B), the children visited the center twice per week and participated in occupational-based intervention using chopsticks. First, they moved up to 10 blocks using wooden chopsticks. Then they progressed to moving light food (e.g., rice puffs) using wooden chopsticks. After 20 minutes of intervention, the ability to move a number of blocks and light food to a location 30 cm apart was evaluated for 3 minutes, and the corresponding scores were recorded. The overall occupational performance phase consisted of 12 sessions for 30 minutes each.

In the generalization period (C), the participants visited the center twice per week and engaged in occupational-based intervention using typical chopsticks to eat several types of food (e.g., piece of apple, grape, bread, cookie and pecan). After 20 minutes of intervention, the ability to move a number of blocks and light food to a location 30 cm apart was evaluated for 3 minutes, and the corresponding scores were recorded. In the final session, AMPS were conducted to determine occupational performance using chopsticks. The overall generalization phase consisted of 3 sessions.

## 2.3 Outcome measurement

The CARS widely used rating scale for the assessment symptoms and detection of ASD. The CARS consists of 14 domains assessing behaviors associated with ASD, with a 15th domain rating general impressions of ASD. The 15 items include: (1) relating to people, (2) imitation, (3) emotional response, (4) body use, (5) object use, (6) adaptation to change, (7) visual response, (8) listening response, (9) taste, smell, and touch response and use, (10) fear or nervousness, (11) verbal communication, (12) nonverbal communication, (13) activity level, (14) level and consistency of intellectual response, and (15) general impressions. Each item is rated on a Likert scale as follows: 1 (within normal limits for a child that age), 2 (mildly abnormal), 3 (moderately abnormal), and 4 (severely abnormal). Total scores can range from a low of 15 to a high of 60; scores below 30 indicate that the individual is in the non-autistic range, scores between 30 and 36.5 indicate mild to moderate autism, and scores from 37 to 60 indicate severe autism [9]. This study selected research participants from the ASD with score of above 30 points.

The AMPS is the tool to identify the motor and process skills that induce difficulty during occupational performance of ADLs and IADLs. While the participant performs standardized specific tasks, motor skills and process skills are observed and assessed [10]. Quality of occupational performance and ability of occupational performance can be assessed at the same time [11]. The score considers effort, efficiency, safety, and independence from 1 point (Unacceptable perform) to 4 points (Capable perform). The original score of each

skill item goes through statistic processing of a computer program to be changed to logit. When comparing the logit measured before and after treatment, change of over 0.5 is significant, and change of 0.3~0.4 means the significant increase in daily activity when seen clinically [10].

This study measured the effect of generalization about daily activity by measuring initial session and final sessions. In this research, tasks selected 'eating a snack with a utensil (P-12)' and 'eating an Asian meal with chopsticks (P-9)' due to assessment for using chopsticks skill.

## **2.4 Data analysis**

In the present study, performances were recorded by session and the results were analyzed through visual graphs. The results of measurement in the evaluation of AMPS and number of moving block or foods were plotted on graphs to examine the changes and the frequencies and skills of generalization in the occupations obtained through AMPS were presented through comparison between logit measured before and after intervention.

## **3. Research results**

In baseline period, the ability to hold the chopsticks consisted of five stages in the baseline. Each participant was able to achieve all five stages of chopstick grasp during the baseline phase of the study. In occupational performance period, the number of blocks or food moved using chopsticks increased in baseline phase (A), altering occupational performance (B) and generalization (C). Treatment sessions consisted of incrementally increasing the number of blocks or food moved using chopsticks.

In the case of participant 1 (Figure 1), the average number of moving blocks and light food using wooden chopsticks was 0 during the baseline and change criterion period, 7.3 during the intervention period, and 21.3 during the generalization period, with an overall increase of 21.3 from baseline. In the case of participant 2 (Figure 2), the average number of moving blocks and food was 0, 13.6, and 23.3 for the baseline and change criterion, intervention, and generalization periods, respectively, with an overall increase of 23.3 from baseline. In the case of participant 3 (Figure 3), the average number of moving blocks and food was 0, 6.6, and 12.3 for the baseline and change criterion, intervention, and generalization periods, respectively, with an overall increase of 12.3 from baseline.

In the generalization period (C), the generalization of occupational performance using chopsticks as evidenced by the AMPS is presented in Table 2. According to results of AMPS, when compared with baseline, participant 1's motor skills improved from 1.03 to 1.93 logit, and process skills improved from -0.29 to 0.98 logit. Participant 2's motor skills improved from 0.94 to 1.46 logit, and process skills improved from -0.47 to -0.12 logit. Participant 3's motor skills improved from 0.94 to 1.51 logit, and process skills improved from 0.29 to 0.75 logit. According to the AMPS, both the overall motor and process skills increased from baseline an average of 0.7 logit.

## **4. Discussion**

The purpose of this study was to investigate the effect of occupational-based intervention on chopstick skills in young children with ASD. Three young children with ASD participated in this single-subject design study, which used changing criterion and ABC structure. Chopstick use was classified into five levels according to criteria for measurement during the changing criterion period. The ABC structure was divided into basic line and changing criterion period for grasping the chopsticks (A), moving objects with the chopsticks (B), and generalization as measured by eating food with the chopsticks (C). The AMPS scores were compared to identify the effect on occupational performance skills.

The use of a changing criterion design was used because it allows for gradual, systematic manipulation of the target behavior and does not require a withdrawal or return-to-baseline phase [12]. Changing criterion designs are particularly useful when the target behavior is initially performed at either low rates or is not yet displayed by the participant and is a behavior that would lend itself to improvement in increments [13]. Effects of the intervention are observed when the target behavior increases in a stepwise trend to criteria predetermined by the researcher [13]. This study appropriately demonstrated changing criteria by requiring the holding of chopsticks to perform target behavior of increasing complexity.

The results show that all participants significantly improved in their ability to use chopsticks in each intervention session. In addition, the numbers of objects participants were able to move using the chopsticks also increased for all participants, indicating an improvement in the fine motor skill of hand manipulation. In Korea, growing children should learn chopsticks skill independently. It is difficult for ASD children to learn chopsticks skills and use chopsticks to participate in family and other meals. Because chopsticks are important in most social contexts, occupational therapists must guide ASD to perform chopstick techniques [7].

The results of this study further suggest occupational-based intervention has a positive effect on both hand skill and coordination. The AMPS scores conducted after the intervention period showed improvement from baseline in the generalization of chopstick skills for all three participants. This can be regarded as evidence indicating that as a result of improved chopstick skills through occupational therapy, effective chopstick use also increased during activities of daily living. In addition to the primary characteristics associated with ASD, gross and fine motor problems persist across the lifespan of these individuals [5,14,15]. The positive effects on occupational performance demonstrated by the young children with ASD in this study suggest occupation-based intervention including chopsticks skill may be effective for both children and adults, indicating the clinical significance of the study.

Although it demonstrated a functional relationship, this study was limited by single subject design. In addition, because there were no comparisons between occupational therapy and other interventions, the study did not preclude the effects of the other interventions. Furthermore, the authors may have influenced the students' motivation and desire to please the instructors. It is, therefore, necessary to perform future studies using a variety of participants for the occupational-based intervention.

## 5. Conclusion

This study was to investigate the effectiveness of occupational-based intervention on the performance and acquisition of chopstick skills in young children with ASD. In addition, this study single-subject study used a changing reference design and an ABC design, which is a variation of multiple reference designs. A changing baseline design was useful for incrementally changing the target behavior, and each step provided baseline information for subsequent steps. Finally, this research assessed chopstick skills of young children with ASD, provided intervention through an occupational-based intervention on chopsticks skill, and identified whether chopstick performance and generalization improved. According to this study, occupational-based intervention on chopsticks skill is an effective training method in occupational therapy for young children with ASD, and it promotes generalization of the acquired chopstick skills; thus, it presents useful evidence of the effectiveness of the occupational-based intervention approach for children with ASD.

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**Table 1. General characteristics of participants**

| Characteristics   | Participant 1    | Participant 2     | Participant 3 |
|-------------------|------------------|-------------------|---------------|
| Chronological age | 6 years 6 months | 6 years 10 months | 7 years       |
| Developmental age | 24~28 months     | 24~30 months      | 26~30 months  |
| Gender            | male             | male              | Male          |
| Diagnosis         | ASD              | ASD               | ASD           |
| CARS              | 34.5             | 38                | 30.5          |

ASD : autism spectrum disorder , CARS: childhood autism rating scale

**Table 2. Difference of AMPS between baseline and generalization phase (logit)**

| AMPS          | Phase          | Participant 1 | Participant 2 | Participant 3 |
|---------------|----------------|---------------|---------------|---------------|
| Motor skill   | baseline       | 1.03          | 0.94          | 0.94          |
|               | generalization | 1.93          | 1.46          | 1.51          |
| Process skill | baseline       | -0.29         | -0.47         | 0.29          |
|               | generalization | 0.98          | 0.12          | 0.75          |

AMPS : assessments of motor and process skill

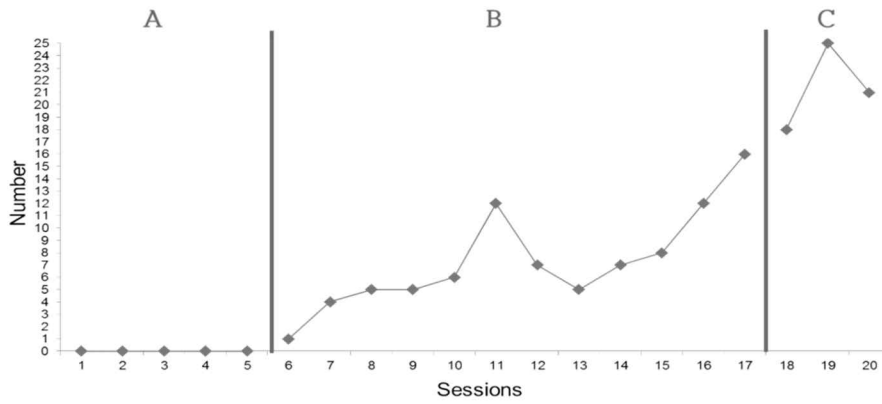


Figure 1. Result of using the chopstick of participant 1

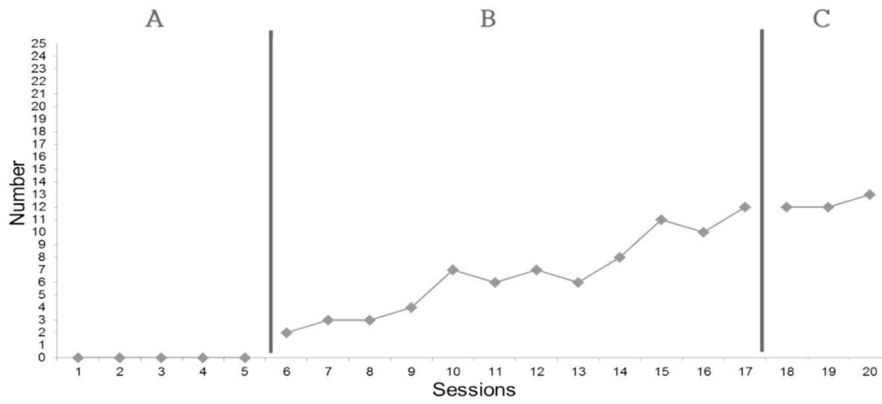


Figure 2. Result of using the chopstick of participant 2

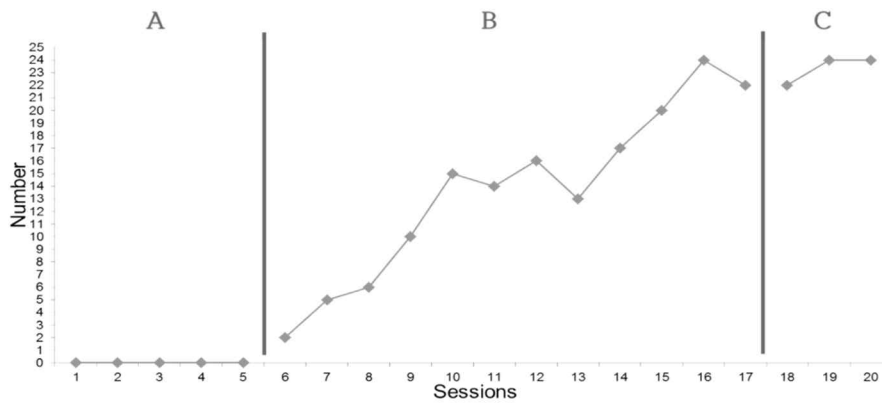


Figure 3. Result of using the chopstick of participant 3