Effectiveness of dance/movement therapy intervention for children with intellectual disability at an early childhood special education preschool

Abstract

Children with intellectual disability (ID) often have deficits in gross motor skills and static and dynamic balance abilities, poor lower muscle strength, and an increased risk of serious falls. They also face difficulty in continuing physical activity programs due to cognitive impairment and easy loss of motivation. However, dance/movement therapy (DMT) has been found to help children with ID perform static and dynamic movements.

This study aimed to assess the effectiveness of DMT group sessions for children with ID as part of an early childhood special education preschool program. The outcome measures involved employing a hand-held dynamometer to assess knee extensor muscles, the one-leg stand test for static balance, and the timed “up and go” test for dynamic balance, and administering the Child Behavior Checklist and Caregiver-Teacher Report Form for children’s adaptive functions and behavioral problems, as reported by parents or relatives and teachers respectively. Twenty-one children with ID aged 36 to 72 months participated in the study. Ten 60-minute DMT group sessions were conducted as manualized intervention, once a week. The measurements were done before and after the

10 DMT group sessions, and then compared.

The results showed statistically significant changes in both knee extensor muscles, the standing time for both legs in the one-leg stand test, attention problems and affective problems in the Checklist, and total score, internalizing problems (including emotionally reactive and somatic complaints), externalizing problems (including attention problems and aggressive behavior), affective problems, anxiety problems, and attention deficit/hyperactivity problems in the Report Form.

This study found that the DMT group sessions as part of an early childhood special education preschool program for children with ID aged 36 to 72 months helped improve their knee extensor muscles and static balance while reducing maladaptive behaviors, enabling them to enjoy the sessions for the full study period.

Background

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (American Phychiatric Association, 2013) reported that intellectual disability (ID) entails deficits in both intellectual and adaptive functions. It reported three major deficits: 1) "deficits in intellectual function such as reasoning, problem solving, planning, abstract thinking, judgement, academic learning and learning from experience, confirmed by both clinical assessment and individualized, standardized intelligence testing," 2) "deficits in adaptive functioning that result in failure to meet developmental socio-cultural standards for personal independence and social responsibility," and 3) "onset of intellectual and adaptive deficits during the developmental period."

According to the DSM-5 (American Psychiatric Association, 2013), the most common co-occurring comorbidity for individuals with ID is attention-deficit/hyperactivity disorder, and more severe ID may manifest via more maladaptive behaviors such as aggression and disruptive behaviors, including property destruction or harms of others.

Because of the difficulties in physical functions, individuals with ID have deficits in gross motor skills (Dalvand, 2012) and static and dynamic balance abilities (Enkelaar et al, 2012; Blomqvist et al, 2013), and poor lower muscle strength (Borji et al, 2014; Wuang et al, 2013). A previous study reported that knee extensor muscles are a significant determinant of performance of static and dynamic balance (Carter, 2002). Therefore, such impairments lead to a risk of serious falls and injuries (Enkelaar et al, 2012; Kachouri et al, 2016; Rintala & Loovis, 2013; Hsieh et al, 2012; Lee et al, 2014).

Early intervention for individuals with ID is extremely important. Early intervention would be defined as that carried out right after birth till age five for children at biological risk of developmental disorders and developmental disabilities (Blauw-Hospers & Hadders-Algra, 2005). It helps promote their health and well-being and emerging abilities, minimize developmental delays, remediate existing or emerging disabilities, and prevent functional delays (Blauw-Hospers & Hadders-Algra, 2005). The goal of early intervention is achieved by providing individualized developmental, educational, and therapeutic services to children (Shonkoff & Meisels, 2000; Blauw-Hospers & Hadders-Algra, 2005). Moreover, early intervention targeted at improving physical activity helps increase motor function in individuals with ID (Bossink et al, 2019; Bondár et al, 2020; Houwen et al, 2014).

Thus, it can be said that early intervention is extremely important for supporting individuals with ID. However, a previous study on intervention targeting physical activity for individuals with ID reported several barriers in its continuation—for instance, little or no familiarity with physical activity (Carmeli et al, 2008), dislike of an activity, high difficulty level of the activity, physical discomfort, lack of awareness of program options (Bodde & Seo, 2009; Temple et al, 2017), and lack of interest (Temple & Walkley, 2007).

Michalsen et al. (2020) reported that individuals with ID were more likely to actively participate in physical activity when the activity was fun. Baun et al. (1986) reported that enjoyable physical activity helped reduce the rate of absenteeism of individuals with ID in the activity and increase their motivation for it. To maximize the positive effect of physical activity for such individuals, techniques to increase their motivation to participate in it are needed (Lin et al, 2010). Temple et al. (2017) also reported enjoyment in physical activity as its most common facilitator.

Dance/movement therapy (DMT) is defined as “the psychotherapeutic use of movement to promote emotional, social, cognitive, and physical integration of the individual for the purpose of improving health and well-being” (American Dance Therapy Association, 2020). DMT is effective because it can provide physical and behavioral treatments simultaneously (Levy, 2005).

According to De Tord and Bräuninger (2015), a case series of DMT interventions for individuals with ID increased their motor coordination and grounding, which is the vertical movement to the ground, and improved their walking ability after the sessions. Moreover, Barnet-López et al (2015) reported that DMT intervention significantly increased the emotional well-being of participants in the experimental group after the sessions, while those in the control group did not show any change. Barnet-Lopez et al (2016) also reported that DMT intervention significantly increased participants’ body knowledge after the sessions.

Moreover, because it does not require cognitive functions such as language, the activities under DMT involving music and non-verbal communication can be carried out to improve the difficulties of individuals with ID while enabling them to enjoy the intervention (Barnet-López et al, 2015; Barnet-Lopez et al, 2016; Tsimaras et al, 2012).

This study suggests that using DMT intervention as part of play at an early childhood special education (ECSE) preschool will contribute to it becoming an early intervention tool for improving the motor skills and muscle strength of, and maladaptive behaviors and attention deficit in children with ID while enabling them to enjoy the intervention. It aimed to assess the effectiveness of DMT group sessions for children with ID aged 36 to 72 months as part of an ECSE preschool program.

Methodology

This study compared outcome measures before and after the 10 weekly DMT group sessions. Before commencement, the study was approved by the Kyoto University Graduate School and Faculty of Medicine, Ethics Committee (C-1359).

Participants

The preschoolers and their parents or relatives were given detailed information regarding the study and informed about their right to withdraw at any time. Owing to the children's age, informed consent was provided by the parent or guardian.

Participants were recruited from an ECSE preschool in Japan. Only children aged between 36 and 72 months and diagnosed with ID by a doctor were included in the study. The main purpose of conducting an intelligence test is to measure intellectual function. The Wechsler Intelligence Scale is generally used as an IQ test (Japanese WISC-IV Publication Committee, 2010; Japanese WPPSI-III Publication Committee, 2017). However, in Japan, the Kyoto Scale of Psychological Development, 2001 (KSPD), which is a standardized assessment for measuring respondents' developmental level, is more common than standardized intellectual function test (Kinjo et al, 2011; Tamaru et al, 2011; Kono, 2008; Aoki et al, 2018; Aoki et al, 2016; Koyama, 2009; Tatsuta, 2013).

Thus, we too used the KSPD, which assesses three areas: Postural-Motor (P-M; fine and gross motor functions), Cognitive-Adaptive (C-A; non-verbal reasoning or visuospatial perceptions assessed using materials), and Language-Social (L-S; interpersonal relationships, socialization, and verbal abilities).

In each of the three areas, a sum score is converted to a developmental age (DA), and an overall DA is also obtained. The three area DAs and the overall DA are divided by the child's chronological age and multiplied by 100 to yield four developmental quotients (DQ). In this study, total DQ was used.

The exclusion criteria were diagnosis of epilepsy, serious hearing or vision problems, or restrictions in engaging in physical activities, as recommended by a doctor. Twenty-three children with ID were initially enrolled in this study; later, two exhibiting epilepsy symptoms were excluded. Thus, the study had a total of 21 participants—16 boys and five girls, aged between 36 and 72 months (mean age 46.1 ± 10.8 months). Mean DQ was 48.45 ± 14.33. Two participants had a DQ of over 70.

Outcome Measurement

The outcome measures involved employing a hand-held dynamometer (HHD) to assess knee extensor muscles, the one-leg stand test (OLST) for static balance, and the "timed up and go" test (TUG test) for dynamic balance, and administering the Child Behavior Checklist (CBCL) and Caregiver-Teacher Report Form (C-TRF) for the participants' adaptive functions and behavioral problems, as reported by parents or relatives and teachers respectively.

HHD

Muscle strength was provided for isometric knee extensor muscles measurement using HHD. This device has been widely used as an objective measurement tool in research and clinical fields (Stark et al, 2011; Bandinelli, 1999).

The participants were instructed to sit with their hips and knees at a 90-degree angle, and their thighs were held together by a belt (Matsumura, 2012; Yamasaki & Hasegawa, 2001). Then, they were instructed to hold their arms in front of their chest. The HHD sensor pad was set anteriorly to the malleolus and switched from left to right in each measurement (Shiota et al, 2008; Miura et al, 2015; Beenakker et al 2001). The participants had to apply force for approximately three seconds in each measurement, thrice on each leg, with a break of approximately one minute between measurements (Kelln et al, 2008; Bohannon, 1997). The best result was used as the participant's maximum strength, and the results were recorded in kilogram force (kgf). Those who failed two out of the three trials were excluded from the final data set to maintain the validity and reliability of the records.

OLST

The OLST is used worldwide for static balance measurement (Hardcastle & Nade, 1985; Maribo et al, 2009; Maribo et al, 2011; Kristensen et al, 2014; Lee et al, 2016; Jung et al, 2017). The present study was conducted with reference to a previous study which used the OLST in preschoolers with ID (Jung et al, 2017). The participants were instructed to stand barefoot on one leg (using both alternatively) with eyes open and hands on hips. They were then asked to look at a target at eye level (1.20 meters away).

Three main measurements were taken, and the maximum standing time for each leg was used as the best score. There was concern that the participants would experience difficulties in switching legs between each measurement due to cognitive impairment. Therefore, three right-leg measurements were taken first, followed by three left-leg measurements.

The participants were given the following instructions: a) raise one leg, b) look at the target on the wall, and c) place hands on hips (Okuzumi et al, 2009; Jung et al, 2017; Hardcastle & Nade, 1985; Maribo et al, 2009; Maribo et al, 2011; Kristensen et al, 2014; Lee et al, 2016). Measurement was started at the shout of “Hai,” with a stopwatch used to record the time, and stopped when a participant’s sole, toe, or heel touched the floor, or when the pivot foot was moved. Behaviors such as jumping, running, or not responding after “Hai” were regarded as failed measurements. As participants who failed two out of the three trials could reduce the validity and reliability of the records, they were excluded from the final data set.

TUG Test

The TUG test uses an individual’s functional mobility to evaluate dynamic balance, such as sitting, standing, and walking (Shumway-Cook et al, 2000; Marchese, 2004; Nakatani, 2008). It has been used as a reliable evaluation method for infants and elderly people in both clinical practice and research (Shumway-Cook et al, 2000; Podsiadlo & Richardson, 1991; Nocplini-Panisson & Donadio, 2013a; Williams, 2005; Nicolini-Panisson & Donadio, 2013b; Habib & Westcott, 1998; Katz-Leurer, 2008). The participants sat on chairs with their knees and hips at a 90-degree angle, feet firmly on the floor, backs against the backrest, and both hands on the lap. The following instructions were given to them: a) stand up, b) walk three meters forward, c) turn 180 degrees, d) walk back, and e) sit back in the chair. The participants were asked to walk as fast as possible after standing up (William, 2005; Nicolini-Panisson & Donadio, 2013b; Habib & Westcott, 1998). After they stood up at the signal of "Hai," walking time was recorded using a stopwatch. The measurement ended when the participants sat back in the chair.

Three main measurements were taken after the explanation and demonstration for each participant. The shortest walking time was used as the best result. Those who failed two out of the three trials were considered to reduce the validity and reliability of the study and were excluded from the final data set.

Questionnaires

The Japanese version of the CBCL was used to assess participants' adaptive functions and behavioral problems over the past two months through parents' or relatives' reports (Achenbach, 2015; Itani et al, 2001; Katagiri, 2014; Funabiki, 2017).

The total CBCL score assesses internalizing problems, externalizing problems, sleep problems, and a DSM-oriented scale (Achenbach, 2015; Itani et al, 2001). Internalizing problems include anxiety/depression, social withdrawal, and somatic complaints;

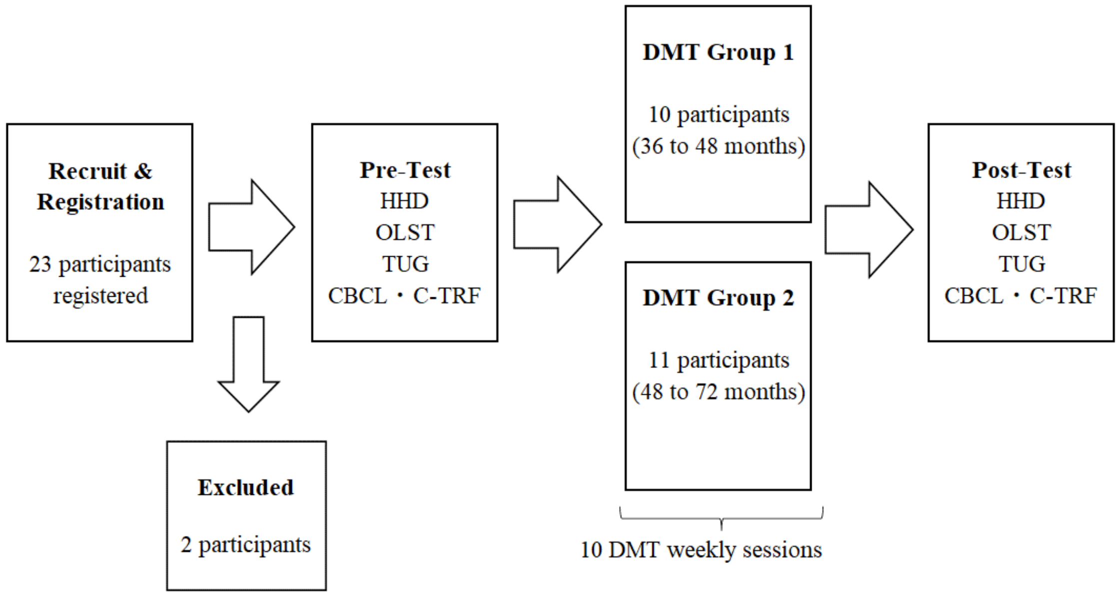
externalizing problems include aggressive behavior and attention problems; and the DSM-oriented scale includes affective problems, anxiety problems, pervasive developmental problems, attention deficit/hyperactivity problems, and oppositional defiance symptoms.

Parents or relatives answered 100 questions using the following rating scale: 0=not true, 1=somewhat or sometimes true, and 2=very true or often true. The results were shown as a T-score. The normal range was defined as 64 points or less, 65–69 points as borderline, and 70 or higher as clinical. Teachers first distributed the CBCL among the participants’ parents or relatives, and then collected and returned the responses to the researchers. Incomplete responses were excluded. Thus, 19 completed questionnaires were used as the final CBCL data.

The Japanese version of the C-TRF was administered to evaluate participants’ adaptive functions and behavioral problems at the preschool over the past two months (Katagiri, 2014; Funabiki, 2017; Kawauchi et al, 2013). The researchers distributed the 100-question C-TRF among expert teachers working with children with ID, and later, collected the completed forms.

The measurements were taken before and after the DMT group sessions, which were then compared (Figure 1).

Figure 1. Flow chart of the study



Intervention

Referencing the discussion of previous studies, this study originally planned 10 DMT group sessions of 60 min each twice a week (Mastrominico, 2018). However, due to the preschool's schedule, it was difficult to hold sessions twice a week. Therefore, these were carried out weekly.

The 21 participants were divided into two groups according to the development stages of the Centers for Disease Control and Prevention, Child Development (Centers for Disease Control and Prevention, Child Development, 2019).

A dance/movement therapist certified by the American Dance Therapy Association and Japanese Dance Therapy Association was the group leader, and three to four teachers from the preschool provided support to the group as co-group leaders. The intervention was conducted with four manualized intervention tasks (warm-up, main activity-I, main activity-II, and cool down) using DMT, such as mirroring the therapist's and others' movements (Koch et al, 2015; Hildebrandt et al, 2016); synchronizing movements with the therapist, co-leaders, and other participants (Bräuninger, 2014); moving their own inner image as an authentic movement (Levy, 2015; Chaiklin & Wengrower, 2009), and applying effort involved in Laban Movement Analysis (LMA) (Levy, 2015; Chaiklin & Wengrower, 2009). The effort of LMA, spacing, weighting, timing, and flowing was used to change the quality of movements.

Data Analysis

Statistical analyses were performed using SPSS Statistics 27. The Wilcoxon one-tailed signed rank test was carried out to analyze the final data set. P values less than 0.05 were considered statistically significant.

Results

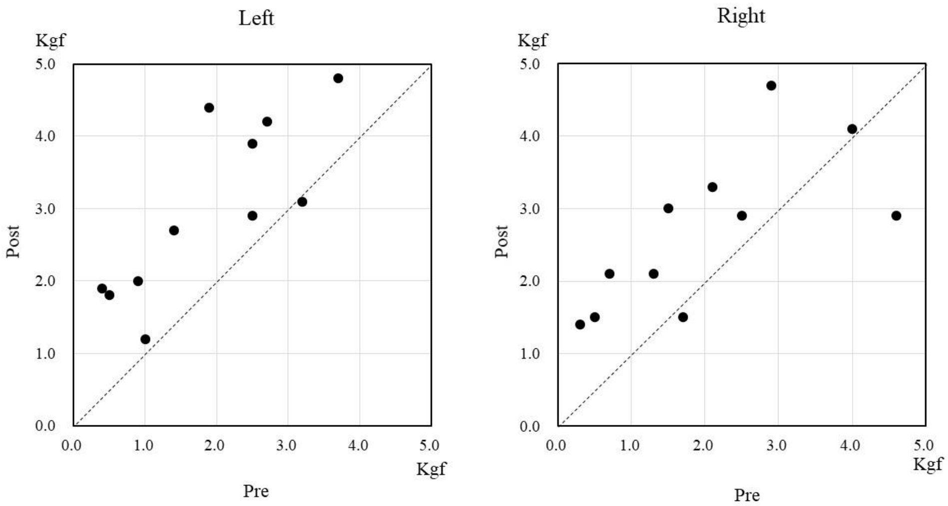
In the measurement of HHD, OLST, and TUG, there were participants who had difficulty in understanding the instructions, and approximately half of the participants were able to undergo the measurement before the intervention. However, since it was possible to collect data from the CBCL for 19 participants and C-TRF for all participants, and some of the participants could undergo the three motor function measurements, all 21 participants were included in this study. The post-test was conducted after all interventions were completed. Similar to the pre-test, approximately half of the participants were able to measure HHD, OLST, and TUG, and the same number of questionnaires in the pre-test were collected in the post-test.

Knee Extensor Muscles

knee extensor muscles measurements for both legs of the 11 participants who passed two out of the three trials were reported—the left ($Z=2.85$, $p=0.002$) as well as the right

(Z=1.87, p=0.031) leg showed a significant increase in knee extensor muscles. Ten of the 11 participants showed increased knee extensor muscles in either or both legs. Nine of the 11 participants displayed increased knee extensor muscles in both legs, while only one exhibited a decrease in both (Figure 2).

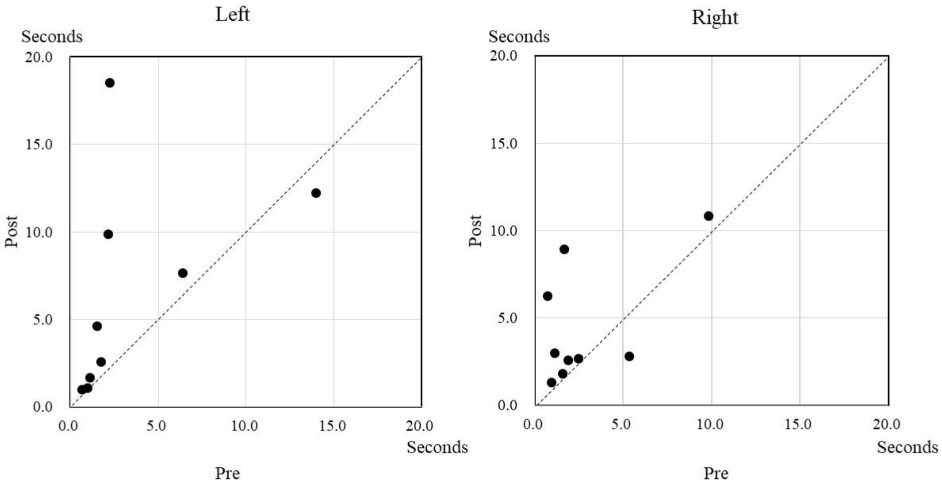
Figure 2. The results of 11 participants at the knee extensors on left and right



OLST

Nine participants passed two out of the three trials for both legs. There was a statistically significant difference for both left (Z=1.96, p=0.026) and the right (Z=1.84, p=0.033) leg. Seven of the nine participants increased their standing time for both legs; however, five of the nine increased their standing time by less than one second for either or both legs (Figure 3).

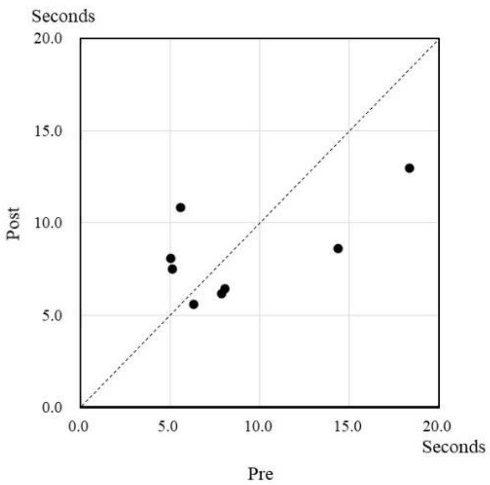
Figure 3. The results of nine praticipants at OLST



TUG Test

Data were recorded for the eight participants who passed two of the three TUG test trials. Time increased for three participants and decreased for five in the post-test. The TUG test results were not statistically significant (Z=-0.42, p=0.34) (Figure 4).

Figure 4. The results of eight participants at TUG



CBCL

The CBCL data were collected for 19 participants. The following two categories were statistically significant: attention problems—a part of externalizing problems—and affective problems—a part of the DSM-oriented scale (Table 1).

Table 1. The result of CBCL.

			T-score Mean (SD)	T-score Range	Z-score	p-value	The number of participants in Normal Range	The number of participants in Boarder Range	The number of participants in Clinical Range
Total Score		Pre	56.26 (9.76)	37-73	-1.06	0.145	15	2	2
		Post	54.26 (10.41)	39-73			16	1	2
Internalizing Problems		Pre	56.11 (10.43)	33-70	0.00	0.500	14	4	1
		Post	53.58 (10.42)	37-73			16	1	2
	Emotionally Reactive	Pre	55.26 (7.00)	50-70	0.20	0.419	15	3	1
		Post	55.68 (6.64)	50-73			16	2	1
	Anxious/Depressed	Pre	56.68 (8.18)	50-79	-0.21	0.417	15	3	1
		Post	54.63 (5.50)	50-69			18	1	0
	Somatic Complaints	Pre	53.32 (6.02)	50-70	0.00	0.500	17	1	1
		Post	52.84 (5.66)	50-70			17	1	1
	Withdrawn	Pre	65.58 (9.79)	51-85	0.13	0.450	10	1	8
		Post	65.74 (10.38)	51-85			12	0	7
Externalizing Problems		Pre	53.11 (11.07)	28-73	-1.23	0.114	8	1	10
		Post	51.79 (9.68)	32-67			17	2	0
	Attention Problems	Pre	59.84 (7.96)	50-80	-1.96	0.025 *	14	3	2
		Post	55.74 (9.68)	50-73			17	0	2
	Aggressive Behavior	Pre	55.37 (6.39)	50-72	-1.40	0.080	17	1	1
		Post	54.37 (5.83)	50-68			18	1	0
Sleep Problems		Pre	54.00 (5.79)	50-67	-1.27	0.103	17	2	0
		Post	53.21 (4.67)	50-64			19	0	0
DSM-Oriented Score	Affective Problems	Pre	57.95 (6.77)	50-70	-1.72	0.043 *	16	1	2
		Post	55.74 (7.17)	50-79			18	0	1
	Anxiety Problems	Pre	58.37 (9.91)	50-81	-0.77	0.221	13	3	3
		Post	56.32 (8.10)	50-78			15	3	1
	Pervasive Developmental Problems	Pre	66.63 (9.15)	50-79	-0.07	0.472	7	4	8
		Post	65.58 (11.09)	50-79			7	3	9
	Attention Deficit/ Hyperactive Problems	Pre	55.05 (6.24)	50-71	-1.38	0.085	18	0	1
		Post	53.47 (4.23)	50-67			18	1	0
	Oppositional Defiant Problems	Pre	54.79 (7.99)	50-77	-1.35	0.089	16	1	2
		Post	54.26 (7.59)	50-73			16	0	3

*p<0.05

C-TRF

The C-TRF data were collected for all 21 participants. The following 10 categories were statistically significant: total score, internalizing problems (including emotionally reactive and somatic complaints), externalizing problems (including attention problems and aggressive behavior), affective problems, anxiety problems, and attention deficit/hyperactivity problems as part of DSM-oriented scale (Table 2).

Table 2. The result of C-TRF.

			T-score Mean (SD)	T-score Range	Z-score	p-value	The number of participants in Normal Range	The number of participants in Boarder Range	The number of participants in Clinical Range
Total Score		Pre	56.95 (9.78)	44-85	-2.76	0.003 **	19	0	2
		Post	51.00 (7.54)	40-69			20	1	0
Internalizing Problems		Pre	54.90 (8.95)	41-76	-2.13	0.017 *	18	2	1
		Post	50.61 (7.97)	40-68			19	2	0
	Emotionally Reactive	Pre	57.00 (7.75)	50-79	-1.92	0.028 *	18	1	2
		Post	53.95 (5.31)	50-66			19	2	0
	Anxious/ Depressed	Pre	55.28 (7.20)	50-74	-1.55	0.061	18	1	2
		Post	53.52 (5.69)	50-70			19	1	1
	Somatic Complaints	Pre	53.38 (6.68)	50-79	-1.72	0.043 *	20	0	1
		Post	51.90 (5.90)	50-76			20	0	1
	Withdrawn	Pre	56.57 (6.20)	50-68	-1.50	0.067	17	4	0
		Post	54.57 (4.16)	51-64			21	0	0
Externalizing Problems		Pre	55.38 (8.70)	36-75	-2.49	0.007 **	19	1	1
		Post	50.14 (7.39)	36-66			19	2	0
	Attention Problems	Pre	57.90 (6.30)	50-70	-2.86	0.002 **	18	2	1
		Post	53.85 (4.45)	50-65			20	1	0
	Aggressive Behavior	Pre	56.33 (6.35)	50-76	-2.45	0.007 **	19	1	1
		Post	52.66 (4.86)	50-65			20	1	0
DSM-Oriented Score	Affective Problems	Pre	54.66 (5.97)	50-70	-2.07	0.020 *	20	0	1
		Post	52.95 (4.71)	50-79			20	1	0
	Anxiety Problems	Pre	56.85 (8.07)	50-81	-1.74	0.044 *	18	0	3
		Post	54.71 (6.73)	50-78			19	0	2
	Pervasive Developmental Problems	Pre	60.04 (8.69)	50-79	-1.57	0.058	15	2	4
		Post	56.52 (5.04)	50-79			20	1	0
	Attention Deficit/ Hyperactive Problems	Pre	56.61 (7.22)	50-71	-2.56	0.005 **	17	2	2
		Post	52.47 (4.57)	50-67			20	1	0
	Oppositional Defiant Problems	Pre	54.95 (5.87)	50-77	-1.61	0.053	19	1	1
		Post	52.76 (4.25)	50-73			21	0	0

**p<0.01 *p<0.05

Discussion

In the present study, 10 DMT group sessions for children with ID as part of an ECSE preschool program encouraged the participants to continue the sessions without losing motivation; as a result, there were no dropouts during the program. This study found that the sessions helped increase knee extensor muscles and static balance while decreasing attention problems and affective problems, as reported in the CBCL and C-TRF, and maladaptive behaviors and problems at the preschool.

The reason for the improvement in physical function was that DMT intervention through music led to continuous weight shifting and movement of the center of gravity in different directions such as up and down, left and right, and back and forth; this led to a high level of knee muscle contraction and put sufficient load on participants' knee extensor muscles (Richardson et al, 1999; Yanagisawa, 2011). In addition, continuous jumping to the music and twisting of the body beyond the midline also added to the load on knee extensor muscles. In the intervention, music at different speeds was played, and the participants had to adjust the speed of their movements to stay in sync with it. Synchronous movement to music may increase the physical load on knee extensor muscles by controlling body movements at different speeds. Improvement in knee extensor muscles may help improve balance (Carter, 2002). According to a previous study, knee extensor muscles contribute significantly to balance.

For future research, DMT equipment such as para-balloons and balance balls may be more effective in increasing the physical load, and subsequently strengthening the leg muscles of children with ID (Demers & Mckinley, 2015). DMT does not use iron equipment such as dumbbells or barbells, so the risk of injury is low; thus, children with ID can enjoy their activity while also experiencing some physical load.

This study also found that DMT improved the participants' daily life in and out of the preschool. In particular, there were significant reductions in attention problems, as reported in the CBCL and C-TRF, and attention deficit/hyperactive problems, as reported in the C-TRF.

Movement synchronization, which is a part of DMT approaches, may help reduce attention problems and attention deficit/hyperactive problems (Scharoun rt al, 2014); in this study, it occurred when the participants danced or moved with their friends and the therapist to the music played as part of the DMT intervention. The participants acquired the ability to learn the rules of play through movement synchronization with music, and adapted to each situation accordingly (Scharoun et al, 2014). This, consequently, was believed to reduce their attention problems and attention deficit/hyperactivity problems.

Even though the CBCL showed the effects on maladaptive functions and behavioral problems, the C-TRF results showed better effects on it. A reason for this might be that teachers may compare students with those classmates having roughly the same level of intellectual function, while parents may compare their child with ID with those without ID, including his/her siblings or neighborhood children (Dekker et al, 2002). Another reason may be that through the DMT group sessions at the preschool, the participants began to perceive pre-school as a better place to learn rules and manners than their homes.

Limitations

One of the limitations of this study is its design. It was originally planned as a single blind randomized controlled trial; however, since it took place in an ECSE preschool, it was difficult to divide and mix the classes of different age groups. Therefore, the before-after comparisons were conducted.

Motor function measurement, such as HHD, may not be an appropriate method to evaluate the participants with severe ID because approximately half of the participants could not pass two of the three trials for motor function measurements. Consequently, only 11 of the 21 participants could be included in the HHD trials: eight in the TUG test and nine in the OLST. For future studies on DMT and children with ID using motor function measurements, it is necessary to investigate a method for evaluating the motor function of individuals who have difficulty understanding instructions.

Conclusion

Children with ID have poor spatial orientation, which decreases static and dynamic balance and increases the risk of falling. This study aimed to assess the effectiveness of a 10-session DMT intervention once a week for 21 children with ID at an ECSE preschool, aged between 36 and 72 months, by employing the HHD for knee extensor muscles, OLST for static balance, and TUG test for dynamic balance, and administering the CBCL and C-TRF for maladaptive functions and behavioral problems. The results showed a statistically significant increase in knee extensor muscles and static balance and decreases in attention problems and affective problems in the CBCL, and total score, internalizing problems (including emotionally reactive and somatic complaints), externalizing problems (including attention problems and aggressive behavior), affective problems, anxiety problems, and attention deficit/hyperactivity problems in the C-TRF. This study found that carrying out DMT intervention as part of an ECSE preschool program helped children with ID between the ages of 36 and 72 months improve their knee extensor muscles and static balance while reducing their maladaptive behaviors and motivating them to participate in and enjoy the sessions.

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