

## ORIGINAL ARTICLE

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## THE EFFECTIVENESS OF CONDUCTIVE EDUCATION ON MOTOR SKILLS IN CHILDREN WITH CEREBRAL PALSY

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## ABSTRACT

**Background:** Cerebral palsy is a nonprogressive neuro-developmental disorders that are caused by damage to the developing brain and affect movement and posture. Children with cerebral palsy suffer difficulty in motor function (coordination and control). The present inquiry investigated the impact of conductive education on motor skills in children having cerebral palsy.

**Methods:** A quasi-experimental research was done using pretest-posttest and control group design. The study subjects consisted of all children with cerebral palsy in Shiraz. A sample of 30 subjects was randomly chosen to employ convenience sampling procedure and classified to two groups of treatment (15 subjects) and control (15 subjects). The pretest was performed for both groups, and the experimental group received conductive education in 20 sessions. While the control subjects did not have this education, finally, the post-test was performed for both groups. The Lincoln-Oseretsky test was used to measure motor skills. The data were analyzed using ANCOVA and MANCOVA.

**Results:** The results showed that conductive education had a significant effect on motor skills ( $P < 0.001$ ) and its subscales such as speed of movement ( $P < 0.001$ ), general static coordination ( $P < 0.001$ ), general dynamic coordination ( $P < 0.001$ ), dynamic manual coordination ( $P < 0.001$ ), synchronous-asymmetrical voluntary movements ( $P < 0.001$ ), and asynchronous-asymmetrical voluntary movements ( $P < 0.001$ ) in children with cerebral palsy.

**Conclusion:** The findings indicated the effectiveness of conductive education on cerebral palsy children's motor skills. Therefore, it is recommended to design and implement a conductive education program to improve motor skills of cerebral palsy children.

**Keywords:** Conductive Education, Motor Skills, Children, Cerebral Palsy.

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## INTRODUCTION

Cerebral Palsy is a movement impairment and organ condition, which is caused by trauma or malfunction of brain regions responsible for motor control [1]. Cerebral palsy children suffer difficulty in motor function (coordination and control) [2, 3]. The problem and weakness in motor skills can reduce the ability to interact with the social world, and the problem in social interaction, in turn, affects the growth of motor functions [4]. In addition to motor problems, cerebral palsy is often associated with additional neurological disorders, such as learning disabilities, epilepsy, visual impairment, communication disorders, and perception problems [5].

The development and growth of children with cerebral palsy require early intervention [6]. Various interventions are applied to cerebral palsy children, including Physiotherapy[7], Occupational Therapy[8], Auxiliary Technology [9,10], and Neurodevelopmental Therapy [11]. One of the considerable therapeutic interventions is conductive education that was invented by Andreas Peto in Hungary during the 1940s [12]. Conductive education is the model of education rather than the model of medicinal intervention and, thereby, integrates educational and rehabilitation goals into one program [13]. Conductive education is based on the belief that continuous training of motor patterns will create more effective pathways and communication between motor cortex neurons, which can overcome the trauma and reduce its effects [8].

In conductive education approach, the child with cerebral palsy is taught to employ his/her capabilities to perform physical activities and generalize these skills to various situations of life. In the conductive education method, the activities are presented in group and the use of rhythmic speech and music during activities, as well as paying attention to whole states of children's growth (social, mental, physical, cognitive.), are the specific features of this approach [14]. In other words, conductive education includes a combined program of learning motor, personal care, psychological, cognitive, and communication skills in daily life and situations which are age-relevant [15]. This approach focuses on the growth of mental, physical, social, and psychological states to help people with neuro-motor disorders for more efficient performance in daily activities [16].

Research findings of the effectiveness of conductive education on cerebral palsy children's motor skills are contradictory. For example, some studies have shown that conductive education improves motor skills in people with motor problems (including those with cerebral palsy) [17, 18, 19, 20, 21, 22, 23, 24, 25]. On the other hand, some studies have shown that conductive education does not affect the motor skills of people with motor problems (including those with cerebral palsy) [26, 27, 28, 29, 30, 31].

As you can see, the findings on the impact of conductive education on motor skills of cerebral palsy children are inconsistent and contradictory. Therefore, there is no clear answer to the question of whether conductive education

affects motor skills in cerebral palsy children. Hence, the present research examined the effect of conductive education on cerebral palsy children's motor skills to answer this question, while filling the research gaps, so that specialists, planners, teachers, coaches, and parents can safely use this method for enhancement of cerebral palsy children's motor skills.

## METHODS

A quasi-experimental research design with pretest-posttest and control group was conducted.

**Population, sample and sampling method:** The study subjects involved all children aged 5 to 12 years in Shiraz in 2015. The sample consisted of 30 cerebral palsy children aged 5-12 years old in Shiraz. The sampling method was convenience sampling. The inclusion criteria for participants were as follows: the age range of 5 to 12 years, cerebral palsy (diagnosis of cerebral palsy according to the fifth edition standards of the statistical and diagnostic manual of mental impairments and the confirmation of the psychiatrist of the Exceptional Children's Organization in Shiraz), being able to communicate, no other disabilities, and family satisfaction with cooperation in the intervention program. Children with the above conditions have entered the study, and those with associated diseases such as visual and hearing impairments, severe behavioral problems that resulted in lack of cooperation, and severe intellectual and cognitive deficits were excluded. The ethical review board of the regional Welfare Organization and the ethical review board of the regional Special Education Organization confirmed the research.

**Research tools and method:** In this study, the conductive education program was used for improving motor skills and the Lincoln-Oseretsky Scale for measuring motor skills.

**Lincoln-Oseretsky Scale:** The Lincoln-Oseretsky Scale was used to assess motor abilities. Oseretsky presented the early version in 1923 and was subsequently reviewed and revised by many scholars, including Lanser and Sloan. This scale has 36 items under six subscales which include: 1) Asynchronous-Asymmetrical Voluntary Movements (AAVM) 2) General Dynamic Coordination (GDC), 3) Dynamic Manual Coordination (DMC), 4) General Static Coordination (GSC), Movement Speed (MS), 5) Synchronous-Symmetrical Voluntary Movements (SSVM), 6). This scale quantitatively measures the motor ability of children aged 3-14 years. This test is performed individually and takes about 1.5 hours to complete [32, 33].

Anastasi [34] has obtained the reliability of this test through Cronbach's alpha to be 0.92, and its validity was obtained between 0.73 and 0.82 through the correlation of scores of subscales. The reliability of this test in Iran was 0.69 for boys and 0.79 for girls, respectively [35].

**Conductive Education Program:** The Conductive education program has been developed by Andreas Peto [12]. In the conductive education method, all activities and assignments are targeted and pre-designed, with music and

rhythm used to enhance learning capability [36]. The distinction of this method from other rehabilitation methods is the group activities, the use of rhythmic speech and music in exercises, and considering the multidimensional (physical, mental, cognitive, social) development of the child [37]. The conductive education method has five main components as follows:

**Conductor:** During education, the conductor provides children with an environment full of motivation and encouragement for solving their problems and plans the learning conditions based on their individual needs. Law et al. [38] argued that children in such groups can quickly resolve their problems and rarely encounter problems due to the presence of a conductor.

**Treatment Program:** The Intensive program is a feature of the conductive education approach. In this regard, Storvold and Jahnsen [39] showed that intensive treatment programs have better outcomes than non-intensive ones.

**Task-Series:** A set of tasks and exercises designed to achieve physical, social, cognitive and emotional needs, and include a range of functional skills [40].

**Rhythmic Speech:** In conductive education, rhythmic speech is used simultaneously with motion. In fact, speech is used to illustrate, understand, plan, execute and complete the movements, and controls the speed and rhythm of motion [41].

**Group:** One of the most important components of conductive education is the group. Children in the group practice socialization and learn how to solve similar problems [42, 43].

The conductive education program of the present study was designed based on the Peto's education program in 20 sessions, each containing three parts and the child was resting at the end of each session. It is worth noting that the content of the education session is presented in Table 1, which was repeated in each session.

Table 1: The conductive education program (Adapted from Sorsdahl et al, 2010)

Activity	Task/movement	Reps/Time	Motor Learning and teaching strategies identified during the part (always, often, sometimes, occasionally)
PART 1: GROUP ACTIVITIES ORGANIZED IN A RING			
Welcome songs	Squat-position: Performing arm movements along with the songs	5 min	During part 1: - Visual demonstration (always before and during activities) - Verbal instruction - action (always before and often during activities), e.g. "Now we are going to be elevators. We push 19th floor and stop, then the 38th floor, stop, 101st floor, stop. Ready?" or "Now we are going to stand up. How do we do?" - Verbal instructions - movements (occasionally during activities), e.g. "Can you sit with the feet a bit more together?" - Physical assistance/tactile guidance to children who lack ability to perform the action (often three children, amount of guidance vary between and within children; occasionally three children) - Children active in creating the activities e.g. choosing songs, deciding which floor the elevator stops, singing, counting, deciding which animal they want, suggesting variations (often) - Using songs, rhymes, short stories and counting for motivation (often) - Using toys and equipment for motivation (sometimes) - Motivating feedback e.g. "Well done" (occasionally after activities)
"Elevator"	Rising from squat to stand. Stop and hold the position three times during the movement trajectory	A total of 15 reps, 2-3 in a set with breaks sitting on a stool in between	
Clapping and finger games	Sitting on a stool: Finger games like "Itsy Bitzy Spider." Clapping to rhymes involving bending and rotating the trunk, e.g. clapping on opposite shoulder	10 min	
Clapping games and oral motor activities	Prone lying: Clapping games, waving, pressing a toy that makes bubbles, blowing bubbles	12 min	
Safari	High kneeling and half kneeling. Using arms as binoculars, looking for animals. Reaching for and holding large animal toys, balancing animals on different parts of the body. Dorsal flexion of ankles when crocodile eats on toes	10 min	
Parachute	Sitting, lying and high kneeling: Parachute games like hiding, shaking, para-ball, make balloon fly	15 min	
Hot-dog	Children are wrapped in a mat, "un-wrap" themselves by rolling	10 min	

PART 2: INDIVIDUAL ACTIVITIES ORGANIZED AS STATIONS OR OBSTACLE COURSES			
Individual programs of activities	Ball bouncing, throwing and catching Balance on one foot, different surfaces, and heights Crawling over foams of different sizes and shapes Climbing steps or stairs sometimes while carrying a toy Sitting to standing Floor to standing Picking up toys from floor Walk on balance beam, between or over obstacles Climb wall-bars or a climbing wall Crawling over a balance beam fasten to a wall bar Standing with/without support, different surfaces Walking in parallel bars Prone crawling board Three individual sessions during the training, each lasting 10-15 minutes		During part 2: - Verbal instruction from escort (often before and during activities). Action or movement instructions dependent on the escort - Physical assistance/tactile guidance (occasionally or never depending on the activity) - Using toys and equipment for motivation (always) - Motivating feedback, e.g. "Well done" "Come on!" (often during activities) - Feedback on result "You are standing!" (occasionally after activities) - Visual demonstration (occasionally before activities)
PART 3: CLOSING ACTIVITIES			
Stretching	Muscles in legs and arms	8 min	During part 3: - Verbal instruction - movement (always before stretching) - Visual demonstration (always before stretching) - Verbal instruction - action (always -swing) - Songs, music CD and counting for motivation (always) - Physical assistance (always during stretching, two children when climbing into the swing) - Children active in creating the activities, e.g. choosing songs, singing, counting, deciding when enough stretch (sometimes during activities) - Motivating feedback, e.g. "Well done" (occasionally after activities)
Large boat swing	Climbing into. Sitting or standing in the swing	10 min	
Reflections/comments	Each child comments on the training	5 min	

## PROCEDURE

After obtaining the necessary permits, the educational and rehabilitation centers and schools for cerebral palsy children were met. After a briefing session with school officials, the eligible children's parents were asked to take part in the research. By mentioning the necessity of research, the parents delivered their written consent forms. Then, a sample of 30 children with cerebral palsy was selected by convenience sampling procedure. The subjects were classified randomly to control and treatment groups. Then, both groups' motor skills (experimental and control) were indicated by the Lincoln-Oseretsky Scale. The experimental group then participated in the conductive education program in 20 sessions. The control subjects did not have any training during the study. At the end of the education sessions in the post-test stage, the Lincoln-Oseretsky Scale was performed for both groups. It should be noted that the intervention program was also implemented for the control group after the completion of the research to observe ethical principles.

**Analysis Method:** SPSS-21 software did the data analysis. Descriptive statistical parameters such as mean and standard deviation were indicated to analyze the descriptive data. Univariate and multivariate analyses of covariance were applied for inferential data analysis.

## RESULTS

In the following, the mean and standard deviation of the dependent parameters are shown regarding the treatment and control groups in the stages of pre-test and post-test, which can be seen in Table 2. The Kolmogorov-Smirnov evaluation revealed a normal distribution of data in research variables ( $P > 0.05$ ).

**Table 2:** Mean and standard deviation of motor skills and its subscales in both control and experimental groups in the pretest and posttest

Variable	Group	Pretest		Posttest	
		Mean	SD	Mean	SD
total score of motor skills	Experimental	45.26	14.85	59.53	13.37
	Control	42.33	13.27	41.26	12.66
general static coordination	Experimental	12.93	4.39	14.73	4.94
	Control	12.46	4.35	12.40	4.17
general dynamic coordination	Experimental	4.80	3.60	6.60	4.13
	Control	4.75	3.64	4.86	3.31
dynamic manual coordination	Experimental	11.53	4.37	13.33	4.28
	Control	10.73	4.39	10.40	4.51
movement speed	Experimental	3.40	1.63	5.33	1.91
	Control	2.86	1.84	2.73	1.90
Synchronous-symmetrical voluntary movements	Experimental	3.73	2.43	6.13	2.74
	Control	3.13	1.92	2.73	1.75
Asynchronous-asymmetrical voluntary movements	Experimental	8.86	5.65	13.40	4.33
	Control	8.33	4.95	8.13	4.73

The average scores of both experimental and control groups in the subscales of GSC, GDC, DMC, MS, SSVM, ASVM, and a total score of motor skills in the pretest are almost equal. However, after the intervention, the mean score of the experimental group in subscales of motor skills and its total score has been increased. Univariate and multivariate



covariance analyses indicated whether the changes were statistically significant or not. In fact, ANCOVA was used to determine the impact of conductive education on cerebral palsy children's motor skills, the results of which are shown in Table 3. It is worth noting that regression homogeneity [ $P > 0.05$ ,  $F = 0.82$ ] and homogeneity of variance [ $P > 0.05$ ,  $F = 8.99$ ] were investigated prior to the ANCOVA. The results showed that the use of ANCOVA test is possible.

**Table 3:** The results of AMCOVA for the motor skills of children with cerebral palsy in experimental and control groups

Source of changes	Sum of squares	df	Mean squares	F-ratio	Significance level	Eta coefficient
Pretest	4428.48	1	4428.48	371.12	0.001	0.93
Group	1815.22	1	1815.22	152.12	0.001	0.84
Error	322.18	27	11.93			
Total	83458	30				

Table 3 shows that considering the pre-test scores as a covariate variable, the conductive education intervention has caused a significant variation among the groups ( $P < 0.001$ ), and the effect size was 0.84. The corrected mean of motor skills post-test in the experimental group (58.22) was more than that of the control group (42.57). Conductive education, hence, has a significant positive impact on cerebral palsy children's motor skills.

Also, MANCOVA was used to assess the conductive education intervention's impact over the subscales of motor skills in subjects with cerebral palsy. The results are shown in Table 4. First, the Mbox test was used to examine the assumption of homogeneity of variance and covariance matrix. The results showed that the Mbox statistic was not significant (14.38) ( $P > 0/05$ ,  $F = 524$ ). Therefore, it can be concluded that the variance and covariance of the dependent variables are equal in both groups.

**Table 4:** The results of multivariate analysis of covariance for motor skills subscales

Type of test	Value	Degree of freedom of hypothesis	Error degrees of freedom	F- ratio	Significance level
Pillai's trace	0.876	6	17	20.068	0.001
Wilks's lambda	0/124	6	17	20.068	0.001
Hotelling's trace	7.083	6	17	20.068	0.001
Roy's largest root	7.083	6	17	20.068	0.001

The results of the MANCOVA tests in Table 4 show that the experimental and control group are significantly different at least in one of four subscales of motor skills ( $P < 0.01$ ). ANCOVA test was used to find out this difference, and the results are presented in Table 5.

**Table 5:** Covariance analysis for subscales of motor skills

Source of changes	dependent variables	Sum of squares	df	Mean squares	F-ratio	Significance level	Eta coefficient
Group	general static coordination	25.444	1	25.444	27.93	0.001	0.56
	general dynamic coordination	21.545	1	21.545	23.87	0.001	0.52
	dynamic manual coordination	32.859	1	32.859	47.23	0.001	0.68
	movement speed	30.588	1	30.588	44.57	0.001	0.67
	Synchronous-symmetrical voluntary movements	55.248	1	55.248	50.93	0.001	0.70
	Asynchronous-asymmetrical voluntary movements	157.190	1	157.190	22.65	0.001	0.51

The results of Table 5 show that considering the pre-test scores as a covariate variable; the conductive education intervention has a meaningful variation in the general static coordination of both treatment and control groups in the post-test ( $P < 0.001$ ); the effect size was 0.56. The corrected mean of general static coordination posttest in the treatment group (14.51) was more than the control subjects (12.62).

The table shows that considering the pre-test scores as a covariate variable, the conductive education intervention has a meaningful variation in the general dynamic coordination of both treatment and control subjects in the post-test ( $P < 0.001$ ), and the effect size was 0.52. The corrected mean of general dynamic coordination posttest in the treatment subjects (6.60) was more compared with the control subjects (4.86). Also, the results of the above table show that considering the pre-test scores as a covariate variable, the conductive education intervention had a meaningful variation in the dynamic manual coordination of both treatment and control groups in the post-test ( $P < 0.001$ ), and the effect size was 0.68. The corrected mean of dynamic manual coordination posttest in the experimental group (12.94) was more than that of the control group (10.72).

Also the results of Table 5 show that considering the pre-test scores as a covariate variable; the conductive education intervention has a meaningful variation in movement speed of both groups in the post-test ( $P < 0.001$ ), and the effect size was 0.67. The corrected mean of movement speed posttest in the treatment (5.07) was more compared to the control (2.99). The table shows that considering the pre-test scores as a covariate variable, the conductive education intervention has a significant difference in synchronous-asymmetrical voluntary movements of both groups in the post-test ( $P < 0.001$ ), and the effect size was 0.70. The corrected mean of synchronous-asymmetrical voluntary movements' posttest in the experimental group (5.82) was more than that of the control group (3.04). Also, the results of the above table show that considering the pre-test scores as a covariate variable; the conductive educa-

tion intervention has a significant difference in Asynchronous-asymmetrical voluntary movements of both groups in the post-test ( $P < 0.001$ ), and the effect size was 0.51. The corrected mean of Asynchronous-asymmetrical voluntary movements' posttest in the treatment group (13.12) was more than the control (8.41).

Therefore, it can be concluded that the conductive education intervention was effective. That is, the intervention has improved GSC, GDC, DMC, MS, SSVM, and ASVM in cerebral palsy children.

## DISCUSSION

The present study aimed to investigate the impact of conductive education on cerebral palsy children's motor skills. The findings of this study showed that conductive education improves cerebral palsy children's motor skills.

In explaining this finding, it can be said that conductive education has assumed whole child growth aspects. This approach has a therapeutic plan for achieving optimum development in all child growth aspects and improves cerebral palsy children's motor activity through continuous training of patterns of movement and alteration of incorrect ways of doing works [44]. Also, one of the components of conductive education is music that affects motor skills. The effect of music is due to the visual, auditory and motor data that stimulates the temporomandibular area of the brain. Mirror neurons in these brain regions are responsible for the system of "hearing and performing" or "seeing and performing." The use of musical and rhythmic motor activities is a way to strengthen motor skills by increasing the understanding of rhythm in children. With these exercises, the child understands the structural components of the rhythm and shows it in a coordinated manner [41].

One of the main causes of motor skills disorder in cerebral palsy children is muscle weakness [2]. Also, strength is a crucial feature of physical readiness, which is a good foundation for other physical functions if it is correctly strengthened in the body muscles [45]. Therefore, it is possible to enhance cerebral palsy children's motor skills by increasing their muscle strength, following the constant conductive education [46]. In addition to the above, another reason for the effectiveness of conductive education was the use of ball exercises. Exercise with the ball affects the cardio-respiratory system, strengthens trunk muscles, and improves motor skills in children with cerebral palsy [18, 47]. Another important factor in conductive education is the intensive exercises [39, 46, 47]. In the present study, these tasks were carried out intensively by the conductor and the children were given continuous feedback.

Regarding the subscales of motor skills, the findings showed that conductive education improves the GSC of cerebral palsy children. In explaining this finding, it should be said that one of the activities used in the rehabilitation phase of conductive education is the one-leg balance exercise. According to Bressel, Yonker, Kras & Heath [48], one-leg balance exercises gradually increase the involvement of the balance system by changing the reliance area, and

thereby, improves general static coordination. Also, motor exercises accompanied by rhythmic speech and conductive education music lead to flexibility in neuromuscular structures [47, 49] and improve general static coordination by involving the sensory-motor system [50, 51, 52, 53].

Regarding the subscales of motor skills, the findings showed that conductive education improves the GDC of cerebral palsy children. In explaining this finding, it should be said that improved coordination in children aged four years and above is due to the improvement of the sensory system and the neural coordination [54]. Therefore, the stimulation of the sensory, neural and motor systems of the subjects and the repetitive movements of ankle due to displacement training, general dynamic coordination exercises, lateral supremacy and spatial perception in the conductive education program have caused neuromuscular coordination and increased stimulation of deep sensory receptors in the ankle muscles [44, 55]. In addition to the above mentioned, the improvement of general dynamic coordination in the conductive education program can be due to the effect of such exercises on the muscle strength, the motor range of joints, neurotic control of movements and psychological factors of subjects [2, 47, 44, 18].

Also, the study results showed that conductive education improves DMC of cerebral palsy children. In explaining this finding, it can be argued that one of the reasons for the lack of eye-hand coordination in cerebral palsy children is an increased vision, which is due to the compensatory mechanisms for sensory-motor damage in these children [56]. In other words, the visual focus of children with cerebral palsy on the target increases when exercising [57]. Therefore, one of the reasons for improved eye-hand coordination is probably the reduction of visual focus through conductive education [50]. Another possible reason for improved eye-hand coordination in the research can be exciting and motivating games in a colorful, happy, large and simple environment (such as games with table tennis, Walls, targeting at different heights on the wall, targeting at different distances on the ground, etc.). It is because the game experiences of conductive education can increase the child's eye-hand coordination [58]. Sensory-motor cortex activity is also transmitted to the opposite of the injury in people with cerebral palsy. This activity can be re-transmitted towards the injured cortex, both in children [58] and in adults with cerebral palsy [59] by performing exercises on the playing field. Sensory-motor cortex activity is likely corrected by the conductive education and thereby the motor function, and eye-hand coordination is improved [60].

Also, the findings showed that conductive education improves movement speed in cerebral palsy children. In the explanation of the efficiency of conductive training on MS in cerebral palsy children, it can be said that cerebral palsy children have poor muscular activity. It is because they have a disorder in the cerebral cortex, which is responsible for muscular activity [50]. Since conductive education activities improve the function of the cerebral cortex and muscle function [61], it probably improves movement

speed in cerebral palsy children. In addition, the intensity and frequency of the conductive training program make the muscles of cerebral palsy children stronger and, thus, they gain more skills and speed in the movements [47].

The results also showed that conductive education improves SAVMs in cerebral palsy children. By synchronous-asymmetrical voluntary movements, we mean the two-way successive and simultaneous coordination of the lower and upper limbs. In cerebral palsy children, the function of the upper limbs is lower and slower than that of the lower limbs due to the extent of the neurons in the cerebral cortex and the neural flexibility of the human brain at an earlier age. It leads to the lack of coordination between upper and lower limbs [62]. In explaining the effectiveness of conductive education on synchronous-asymmetrical voluntary movements in cerebral palsy children, it can be said that one of the important causes of simultaneous movement impairment in cerebral palsy children is muscle weakness (especially in the upper limbs) [2]. Also, strength is a prominent feature of physical robustness, which is a good foundation for other physical functions if it is correctly strengthened in the body muscles [45]. Therefore, the motor skills of cerebral palsy children can be improved by increasing their muscle strength, following the sustained exercises of lower and upper limbs in the conductive education sessions [46]. The repetitive and game-like exercises were also probably one of the most influential factors of conductive education on the synchronous-asymmetrical voluntary movements of the upper and lower limbs [63, 64, 46]. In conductive education, the tasks and exercises are presented for children as game-types with repetition and continuity, which results in better learning of children [16, 3].

Also, the results showed that conductive education improves ASVMs in cerebral palsy children. In explaining this finding, it should be stated that when one body side performs superior compared to the other side according to the exact location of the lesion in the brain, the child prefers to use the healthier side for play and exercise because he/she has found that the other side is not very effective in problem-solving [65]. This phenomenon is called "learned non-use" [29]. For this reason, ignoring the affected limb over time leads to further disorders, including increased muscle trunk, poor motor control, a decrease in active movements, general weakness, and delay in the child's bone growth, secondary orthopedic deformities, and cognitive-perceptual deficits [66]. In other words, when the patients found the involved limb ineffective, they learn not to use it. In conductive education, the person is enforced to utilize the involved limb by limiting the use of the dominant (and less involved) limb; it helps to undo the learned non-use and leads to an increase in the abilities and functioning of cerebral palsy children [67]. In fact, the limited usage of the dominant (and less involved) side can correct the non-use of the affected side in the brain and motivate the inactive limb [66, 68].

The sampling method in this study was a convenience. Thus the findings should be generalized carefully. The fu-

tility of implementation and following-up are other limitations of this study. It is suggested to compare the effects of conductive training with other therapies on cerebral palsy children's motor skills. It is also recommended to assess the influence of conductive education on other disabled children's motor skills. It is also suggested to use conductive education in special and rehabilitation schools for cerebral palsy children and individuals. Conductive Education Workshops should be held for parents, educators, teachers, and people involved with children with cerebral palsy.

## CONCLUSION

Cerebral Palsy is a neurodevelopmental disorder caused by a nonprogressive lesion in the growing central nervous system. This disorder affects the motor activity and the quality of motor control. The results of this study showed that conductive education is an effective intervention for improving the motor skills of these children. Therefore, parents, psychologists, educators, teachers and people working with these children can help improve motor skills by using conductive education.

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