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Research Article

Movement Therapy (*Dohsa-hou*) for Cambodian Children with Cerebral Palsy: Effectiveness in Improving Gross Motor Skills in Sitting Position

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Abstract

This study was conducted with children with cerebral palsy living in a national children's residential facility in Cambodia in order to verify the improvement of children's gross motor skills in a sitting position. *Dohsa-hou* (literally translated to "movement therapy") is a technique developed in Japan to improve movement with a psychological approach. In this study, a total of 6 sessions of *Dohsa-hou* were conducted with 12 target children over a 3-day intensive intervention period. Gross Motor Function Measure Manual-88: GMFM-88 (B: sitting position) was used as an effectiveness index, and the index was analyzed before and after the intervention and significant improvement was confirmed after the intervention.

Highlights

- *Dohsa-hou* was applied to 12 Cambodian children with cerebral palsy.
- The effect of *Dohsa-hou* on the improvement of gross motor skills in the sitting position of the children was examined.
- The scores of the effectiveness index before and after the intervention were statistically analyzed, and the significant improvement effect was confirmed.

Keywords: Cerebral palsy, *Dohsa-hou* (movement therapy), Gross Motor Function Measure Manual-88 (GMFM-88), Gross motor, sitting position, Cambodia

Introduction

Cambodia has been focusing on creating policies and structures aimed at the independence and social participation of persons with disabilities, triggered by its ratification of the International Convention on the Rights of Persons with Disabilities in 2012 [1]. In order to achieve independence and social participation of persons with disabilities, an importance was placed on special needs education for persons with disabilities as a means of helping to develop and improve their independent functioning. However, Cambodia has been facing a shortage of human resources with expertise in special needs education within the country. Nishio's (2019) study indicates that there are approximately 45,000 children with disabilities who are attending public elementary schools and another 6,800 children with disabilities who are attending public junior high schools [2]. In light of the shortage of specialists in special-needs education, teachers in elementary and junior high schools often have had to manage children with disabilities on a trial-and-error basis, and some schools have not been able to provide specialized instruction to improve the independent functions that are essential for children with disabilities.

As such, the outcomes for peoples with disabilities has lagged due to the still nascent supports within the country. In 2017, the Cambodian government established the National Institute for Special Education (NISE) to solve the shortage of specialized teachers for special needs education, hoping to address a historical shortage of trained special education professionals. The NISE has training departments for visual, hearing, and intellectual disabilities, and has already begun training teachers according to their respective curricula with a target of increasing capacity over the next several years. However, it is pointed out that the program content and operation have not yet met the educational and vocational demand of children with disabilities. In particular, NISE does not have a training department for children with physical disabilities, which tend to coexist with the above-mentioned disabilities, and does not offer a specialized curriculum for those with physical disabilities within the mainstream education programs. Nishio (2019) also found that there were approximately 2,400 children with disabilities attending public elementary schools and 460 children with disabilities attending public middle schools. These numbers showed that the number of children with physical disabilities were not as large as those children with visual, hearing, and emotional disabilities [2]. However, there are greater number of children with physical disabilities than the statistics indicate, since there are potentially more children with physical disabilities who are unable to attend school due to mobility difficulties caused by their physical disabilities. The structural and social barriers for Cambodians with physical disabilities still remain large. Despite these facts, NISE has not established a specialized teacher training department for the education of children with physical disabilities. While there are a myriad of reasons, our current research suggests that this may be due to a lack of understanding of the significance and necessity of providing educational and vocational opportunities for children with physical disabilities in Cambodia, as well as the possibility that the specialized means of approach to the education of children with physical disabilities itself is not well known or understood in the educational pedagogy. Given these possible backgrounds, it is necessary to disseminate an understanding of the significance of improving independent functions for children with physical disabilities through skill development. Based on this background knowledge, the purpose of this study is to implement and verify the effectiveness of an approach method aimed at developing motor function in children with physical disabilities. A technique called "*Dohsa-hou*" or "Movement therapy," which is used in the field of special-needs education mainly in Japan, was chosen as the intervention method for this study. *Dohsa-hou* was developed by Gosaku Naruse in the 1960s, and has shown to be useful in improving disabilities in limb disabilities, particularly cerebral palsy [3]. In many special-needs education settings in Japan, *Dohsa-hou* has been applied in classrooms and special classes called "independent activities" to improve the motor functions of children with physical disabilities to promote independence in their lives. *Dohsa-hou* has shown practical effects through studies. With a rise in popularity, *Dohsa-hou* has been practiced not only in Japan but also in China, Korea, and throughout Southeast Asian countries, and has been practiced in Cambodia for more than 20 years [4]. According to Harada & Nakano (2021), Japanese instructors have been teaching *Dohsa-hou* in Cambodia with relative nascency, but in the last 10 years, intensive *Dohsa-hou* practice has been conducted every year for children with cerebral palsy residing at the National Borei for Infants and Children (NBIC) in Phnom Penh, the capital of Cambodia, and four Cambodian experts have been trained in the practice *Dohsa-hou* [4]. Two Cambodian *Dohsa-hou* instructors are currently working full-time at NBIC and regularly conduct *Dohsa-hou* practices for children with cerebral palsy living in residential care and the practice has gained popularity throughout the clinics [4]. With increasing research showing support, *Dohsa-hou* has the potential to become one of the primary means of approach for limb disability education in Cambodia, and in light of this, this study was conducted in Cambodia to examine the

effect of *Dohsa-hou* intervention on improving gross motor skills related to independent functioning in daily life for children with several different limb and mobility disabilities.

Experimental/Materials and Methods

Equipment and Program Development

Dohsa-hou is a series of specifically guided movement exercises which aims to improve mobility and flexibility in patients. As an intervention tool, *Dohsa-Hou* is used to direct different exercises and adaptations to child's movements in order to foster the child's self-control of their own body use through working on specific movement tasks. Interventions for children with physical disabilities focus on training self-relaxation techniques to release body tension and to prevent their spontaneous motor movements.

The training of *Dohsa-Hou* movements is very intentional, targeting each joint site and the training of postural movements focusing on turning over, sitting, standing, and walking. Through these activities, children with physical disabilities work not only to develop independent functions in life through the development of their own movement skills, but also work to improve their physical and mental health, self-efficacy, and social skills [3], effectively improving outcomes in several different domains.

As a means of standardization, *Dohsa-hou* is conducted on a mat laid out in a space large enough for a child to lie down in. The trainer or therapist and the child/client work in one-to-one pairs [5] in order to teach, practice, and assist with the movements. From the perspective of group activities and educational significance, *Dohsa-hou* sessions are more often conducted in groups rather than individual sessions, with four to five pairs as a group, and each group is assigned a supervisor who provides instructional support to the client and therapist [5]. The session duration is generally 60 minutes per session, and interventions are often intensive and in high frequency, with 2 to 3 sessions per day for 3 to 6 days [5]. Therefore, in this study, group sessions were conducted with three groups of four pairs of clients and trainers/therapists in each group. The intervention program consisted of two to three 60-minute movement therapy sessions per day for three consecutive days. This schedule is described in detail, as shown in Table1.

Table1: Outcome measure and intervention schedule

Day 1	Day 2	Day 3
Measure GMFM-88(B：Sitting)（Pre）	Dohsa-hou 3（60min）	Dohsa-hou 6（60min）
Break（60 min）	Break（60 min）	Break（60 min）
Dohsa-hou 1（60min）	Dohsa-hou 4（60min）	Measure GMFM-88(B：Sitting)（Post）
Lunch time（60min） Break（60min）	Lunch time（60min） Break（60min）	
Dohsa-hou 2（60min	Dohsa-hou 5（60min）	

Participants

The intervention subjects in this study were children with cerebral palsy admitted to NBIC in Phnom Penh who were selected by the director of NBIC and one full-time staff member. 12 children (11 boys: 1 girl) with cerebral palsy participated in the study. The ages of the participants ranged from 3 to 16 years old as shown in the list of participants in Table 2

Table2: List of Clients

Code	Age	Gender	Diagnosis	Group
1	8	man	cerebral palsy	Group 1
2	16	man	cerebral palsy	Group 1
3	4	man	cerebral palsy	Group 1
4	11	man	cerebral palsy	Group 1
5	10	man	cerebral palsy	Group 2
6	14	man	cerebral palsy	Group 2
7	5	man	cerebral palsy	Group 2

8	3	man	cerebral palsy	Group 2
9	7	female	cerebral palsy	Group 3
10	4	man	cerebral palsy	Group 3
11	5	man	cerebral palsy	Group 3
12	9	man	cerebral palsy	Group 3

Outcome Measure

For the outcome measures, we used the Gross Motor Function Measure Manual-88 (GMFM-88), a scale for measuring gross motor function in cerebral palsy, which is divided into five postures: turning over, sitting, crawling on all fours, standing, and walking, respectively. The GMFM-88 is an observer-rated scale of gross motor abilities in each of the five postures. It has been used in many studies and practices internationally, and its reliability and validity have been assured through multiple research methods and trials [6]. In this specific study, the outcome measure was limited to the GMFM-88 (B: seated), which measures gross motor performance in the seated posture, out of the 88 items in the GMFM-88, in consideration of the participant's physical ability and time constraints. As a background for selecting GMFM-88 (B: sitting position), we referred to the findings of Harada & Nakano (2021) in their experience of practicing the *Dohsa-hou* in NBIC. According to their study, there is a high need for children with cerebral palsy to acquire a sitting position because it directly leads to a reduction in the burden of care by facility staff, mainly for eating [4 4]. As such, addressing this seating position was determined to be the most prudent and useful position to study. In addition, according to Katori (2021), respiratory failure due to aspiration is a common reason for death in children with cerebral palsy in NBIC [7]. The acquisition of a sitting position that supports safe food intake is also considered to be highly significant for NBIC's facility operations, and thus was used as further justification of choosing this specific position. Therefore, it was considered appropriate to set an effectiveness indicator focusing on the acquisition of sitting position for children with cerebral palsy, which is highly needed and determined to be significant in the study facilities in Cambodia.

Statistical Analysis

This study confirmed the normality of the GMFM-88 (B: seated) scores measured before and after the intervention with the *Dohsa-hou* using histograms and Quantile-Quantile Plots. The median of each score was then calculated, and the Wilcox on signed-rank test was performed to confirm significant differences and effect sizes before and after the intervention. For statistical analysis, the free statistical analysis program HAD developed by Shimizu (2016) was used [8].

Procedure

Twelve children were selected among the children with physical disabilities by the director and one full-time staff member of NBIC, taking into consideration the health and physical strength of the children to engage in the intensive 3-day session. Each participant was matched with their trainer and worked on individually set Dohsa-hou movement tasks in pairs. As shown in Table 1, the intervention schedule consisted of the first GMFM-88 (B: seated) measurement and session 1 and 2 on the first day, sessions 3 to 5 on the second day, and session 6 and the second GMFM-88 (B: seated) measurement on the third day. The GMFM-88 (B: sitting position) measurements were taken by the supervisor of each group, and the supervisor overseeing all groups verified the validity of the measurement results. The twelve participant children's case progress records and GMFM-88 (B: sitting position) measurement records were collected as data. The validity of the content of the case histories was confirmed by several supervisors, led by the supervisor in charge of the overall supervision. After the intervention and data collection, a statistical analysis was conducted.

Results

All participants completed the entire program, which included the measurement of the outcome measures and *Dohsa-hou* sessions. The case progress of each participant through *Dohsa-hou* sessions conducted in this study is described as summaries in Table 3. Movement tasks were assigned to each

participant depending on their needs and abilities. Although each of the participants held different ranges of abilities, the summaries indicate that all the participants improved in their range of mobility to a variety of different extents throughout the sessions and some participants displayed their positive emotional change from their achievements by smiling or challenging new movements. After confirming from the histograms and Quantile-Quantile Plots that the pre- and post-intervention data of *Dohsa-hou*, respectively, were not normally distributed, a Wilcox on signed rank test was performed (Figure 1). The median GMFM-88 (B: seated) score before intervention was 22.50, with an interquartile range of 6.50-42.75. The median score after the intervention was 31.50, with an interquartile range of 9.50-47.75. The results of the Wilcox on signed rank test showed a statistic Z=3.02, p=.003, effect size r=.616, confirming a significant increase in scores and high effect size from pre to post intervention.

Table 3: List of Case Study Summaries for Each Participant

Code	Age	Gender	Diagnosis	Case Study Summary
1	8	Male	Cerebal Palsy	Unable to sit in a sitting position. There was a pronounced tendency for dislocation of the right hip joint. Complete dislocation, not subluxation, was likely. In the side-lying position, he performed a motion task in which he twisted his entire back and loosened his entire upper back. Through this task, the participant was able to straighten his round back and, to a lesser extent, to straighten his back and face up on his own. In this case, it was found that improvement of the rounded spine was more likely to occur with the assistance of an aid who supported the pelvis vertically.
2	16	Male	Cerebral Palsy	The participant was able to sit in a sitting posture. Standing and walking were possible with an aid, but the participant did not want to stand or walk out of fear. The participant had a pronounced rounded back, especially in the upper part of the back, which was more significant in the sitting posture. The session focused on relaxation of chronic tension in the back due to the participant's rounded back and expanding movement around the shoulders. The participant also practiced standing up from a sitting position in a chair, and he began to stand up with less fear. The participant engaged in walking movements with the help of an trainer. Eventually, he began to continuously train himself in these standing-up movements.
3	4	Male	Cerebral Palsy	Capable of sitting up. The participant stands up with assistance, but immediately leans back and hugs his trainer. He had difficulty in twisting his upper body due to chronic tension in his rounded back. During the session, He practiced relaxing this chronic tension through back twisting, standing up by stamping the floor with the soles of his feet, and maintaining a standing position with his back straight .After the session, the participant was able to twist his back in order to reach an object (a toy) in a sitting position, continue to hold a standing position with slight assistance, shift his weight to one leg at a time, and walk.
4	11	Male	Cerebral Palsy	The participant was unable to stay in a sitting position. Specifically, he tried to maintain a sitting posture by bending at the waist and chest and putting excessive tension in both arms, but he was off-balance. This was similar in the standing posture with assistance. In the session, the participants practiced standing up from a sitting position from a chair, stepping on the floor with his weight firmly placed on the soles of his feet, and standing up. By stepping up with his weight firmly on the soles of his feet, he was able to stand up more easily, and his initial tendency to arch his back and chest and excessive tension in his arms decreased. In conjunction with the above changes, the participant also showed less back and chest arching, less overstraining of the arms, and was able to keep his face looking straight ahead, even when in a chair-sitting position. In

				addition, the participant showed increased maneuverability of his hands and arms, such as grasping a ball in front of him.
5	10	Male	Cerebral Palsy	During the session, the participant practiced twisting her entire back in a side lying position and moving his pelvis vertically in a cross-legged sitting position. He became able to hold the cross-legged sitting position by himself with his hands on the floor. In addition, he practiced moving his knees, hips, and upper body in a straight line along his body axis by stepping up with his weight firmly on the soles of his feet. Through this standing practice, he improved his ability to make and hold a posture using his waist, and was able to sit in a cross-legged sitting position without using his hands for support.
6	14	Male	Cerebral Palsy	The participant complained of pain in the left hip joint, which was thought to be due to subluxation. He had a pronounced rounded back when sitting upright. During the session, he practiced standing up from a chair-sitting position. When standing up, the trainer encouraged the participant to raise his upper body along the body axis and to extend the back muscles, and the participant was able to extend the back muscles a little in response to the encouragement.
7	5	Male	Cerebral Palsy	The participant had difficulty maintaining posture in the cross-legged sitting position. He had particular difficulty holding his pelvis along his body axis. Therefore, a task was given to hold his pelvis along the body axis and to extend the back muscles in the sitting cross-legged and kneeling positions. At the beginning of the session, the trainer actively assisted the upper body. Gradually, in both sitting and kneeling positions, the trainer only assisted with the shoulder and pelvis positions, and the participant gained the ability to straighten his back along his body axis, raise his head position, and hold while facing forward.
8	3	Male	Cerebral Palsy	The participant was hearing-impaired and needed instructions from visual information. He was able to stand up, but soon sat down. He used a walker and had difficulty walking without assistance. During the session, the participants practiced standing up from a chair-sitting position, standing with their weight firmly on the soles of their feet, and walking while holding the trainer's hand. In the standing position, he was able to stand by himself by switching the hand held by the trainer to one hand and then to the other hand, and then letting go of the trainer's hand. Furthermore, in walking, he was able to walk unassisted by gradually reducing the assistance of his trainers.
9	7	Female	Cerebral Palsy	The participant's hip joint range of motion was less than 90 degrees and contractures were evident. In the cross-legged seating position, she had a pronounced bent back and a rounded back in the upper back due to an anterior pelvic tilt. After relaxing the muscular tension around the shoulders and scapula during the session, she was able to stretch the upper back muscles. She was also able to move her pelvis in the backward and forward tilting directions, and was able to maintain her pelvis position in the body axis direction, leading to an improvement in her cross-legged sitting posture.
10	4	Male	Cerebral Palsy	The participant had difficulty forming a straight upper body posture due to chronic tension in his shoulders, shoulder blades, and entire back. During the session, when the trainer indicated with his hand the direction to lower the shoulders and open the shoulder blades, he was able to relax in the direction indicated by the trainer. Chronic tension in the back was relaxed by the aid's encouragement of back twisting movements. In the cross-legged sitting position, the participant had difficulty holding the posture on his own, but once he was able to apply postural

				holding force around his pelvis, he was able to relax his shoulders and shoulder blade area and also lower his arms to his body side.
11	5	Male	Cerebral Palsy	Since this participant had significant chronic tension in the shoulders and shoulder blades area, resulting in a rounded back and chronic tension in the hip joints and the entire back, relaxation exercises were performed in each of these areas. The participant gradually began to move his shoulders, shoulder blades, and back in response to the aid's prompting, and the chronic tension in each area improved. In the cross-legged sitting position, the pelvis was tilted backward, and chronic tension in the hip joint area was relaxed through forward bending movements of the upper body. With the improvement of the tension around the hip joints, the participant was able to move and hold the pelvis in the direction of the body axis and begin to create an upper body posture with a straight back. He also worked on standing up from a chair seating position, and with the assistance of an trainer, he occassionally performed standing up movements, focusing on stepping on both feet and leg strength in the practice of moving and holding the pelvis in the direction of the body axis.
12	9	Male	Cerebral Palsy	This participant had right convex scoliosis with left hip dislocation. The neck and back were turned back, and the W position of the upper limbs was evident. Due to the dislocation of the left hip joint, the participant was unable to assume the sitting posture on the floor and assumed the sitting posture on a 10-cm high platform. At the beginning of the session, he had strong warping of the whole body. When the aid encouraged the participant to move in the direction of flexion to the chest and neck while in this posture, the participant relaxed the tension in his warp and both arms relaxed and was able to lower to the body side. To improve his right convex scoliosis, the trainer encouraged him to straighten his back by stepping on the floor with his left hip while his center of gravity was tilted to his left hip. He was able to straighten his back on his own and hold his posture with little assistance from the trainer. At that time, he moved to look around, smiled, and seemed psychologically relaxed.

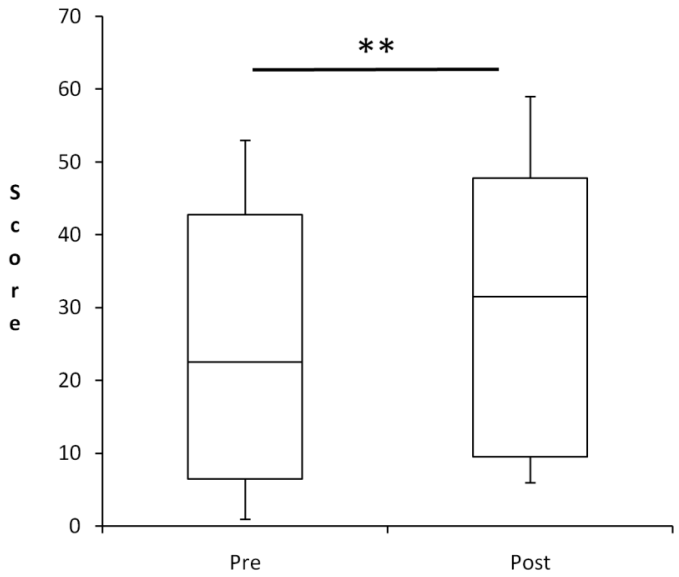

Figure 1: Changes in GMFM-88 (B: sitting position) scores through Dohsa-hou

** : Statistically significant differences pre- and post intervention ($P<.001$)

Discussion

For motor function in children with cerebral palsy, various techniques based on pharmacotherapy, physical therapy, occupational therapy are developed and practiced over the last several decades. Among the interventions showing evidence include medicinal approach (such as anticonvulsants, BoNT or Botulinum Toxin, bisphosphonates, diazepam), surgical approach (such as ankle casting, hip surveillance, and selective dorsal rhizotomy), and physical approach (such as bimanual training, constraint-induced movement therapy, context-focused therapy, goal-directed/functional training, home programs, and occupational therapy) [9]. In physical therapy, which aims to promote the development of independent activities of daily living in people with cerebral palsy, various techniques have been developed with a focus on repetitive practice of daily living activities to be acquired, strength training necessary for daily living activities, and training of upper limb movements to use equipment to support daily living activities [9] [10]. While previous physiotherapeutic interventions have narrowed their scope on techniques that focus on walking and findings on factors that facilitate walking in people with cerebral palsy, more recent findings have begun to identify effective techniques that instead focus on sitting and factors that facilitate such techniques. Intervention techniques for the acquisition of sitting position and its gross motor development include intervention studies applying horseback riding therapy [11], and there have been reports of studies in which simulated horseback riding through virtual reality, as well as actual horseback riding experiences, functioned to improve the gross motor skills of children with cerebral palsy [12]. A study by Cankurtaran et al (2021) to identify facilitators of sitting position acquisition showed that working on the trunk to maintain upper body balance was a facilitator of stable sitting position acquisition in cerebral palsy, and that improved trunk control also functioned effectively in subsequent acquisition of walking movements [13]. For techniques that work around the development of trunk control, the effectiveness of interventions using robotic rehabilitation equipment has been shown [14].

In addition to the content of the intervention, a review article was also reported that demonstrated the importance of intervention frequency, and found that intensive intervention three or more times per week worked more effectively in improving posture and movement in children with cerebral palsy than regular intervention frequencies of two or less times per week [15]. Review studies have also been conducted on session length and duration of intervention, which can also influence the effectiveness of postural and motor improvement in children with cerebral palsy [16]. Other intervention studies applying horseback riding therapy are also numerous [12], and there are research reports that suggest that horseback riding therapy experiences through virtual reality function to improve gross motor skills in children with cerebral palsy [13].

A review article examining differences in effectiveness by frequency of intervention has also been reported, with intensive intervention three or more times per week being more effective in improving the motor skills of children with cerebral palsy than regular intervention of two or less times per week [14]. Others have reported that it is important that interventions for motor function in children with cerebral palsy be ongoing for sustained improvement [15]. In *Dohsa-hou*, movement is not just physical motion, but is viewed as an integrated mind-body activity, and the psychological movement intention behind the physical motion and the process of effort to realize it are considered important [17].

Therefore, the goal is not to practice specific daily living activities, but to develop self-control to move each body part one by one while working on tasks that are set by subdividing a series of daily living activities into more detailed tasks, such as relaxation of specific body parts, joint movements, and posture acquisition [18]. By developing self-control of movement, a person with cerebral palsy can achieve postural retention in a responsive gravity-like manner while sensing the gravity applied by the environment, and learn how to apply

appropriate force while sensing their own physical condition and sense of movement. As a result, they are able to manipulate their bodies according to the surrounding environment and their own condition, eventually expanding their independent life activities [18]. The intervention in this study was an intensive intervention of six sessions over a total of three days, which is considered an effective frequency.

The causal relationship between the participants' demonstrated improvement in gross motor activity in the seated posture after the intervention is discussed according to the content of the case study tasks. The interventions in all six sessions over the three days of this study included relaxation of the back and shoulder area, pelvic movement in the sitting position, hip joint relaxation, standing up from a chair-sitting position, maintaining the pelvic position along the body axis, weight shifting, and walking through postural retention. Because children with cerebral palsy tend to have a rounded back posture, a postural approach is often used in *Dohsa-hou* when assisting them to achieve a seated sitting position. The main focus is on the relaxation of chronic tension around the hip joint which is associated with the formation of the round-back posture and the improvement of movement control. It also addresses the relaxation of chronic tension around the back and shoulders formed by long-term round-back posture. Specific movement tasks are set according to the areas of tension, and training is performed to self-relax muscle tension that inhibits movement, to learn how to apply force to the appropriate body part, and how much and how little to apply that force [3].

In this study, a pelvic motion manipulation task was employed for all participants in addition to tasks that addressed chronic tension around the hip joint and back and shoulders. The ability to stand and hold the pelvis perpendicularly from the floor facilitates sitting stability and back extension [3]. The acquisition of back-stretching movements and the stable maintenance of this posture also promotes hand manipulation and gross motor control [16]. Therefore, these movement practices are considered to be reflected in the improved results of the GMFM (B: sitting position) used in this study. In addition to the sitting posture, there were also cases in which the subject engaged in standing postures including rising from a chair, and in movement tasks for walking. In a previous study, it was reported that *Dohsa-hou* case study in which the engagement in kneeling and standing movement tasks worked effectively to help participants with cerebral palsy acquire manipulation of the pelvis and lower back and postural retention, and subsequently improved stability in sitting posture [17]. According to this report, manipulation and retention of pelvic orientation can be trained in positions other than the sitting posture, and furthermore, it is easier to feel gravity in the kneeling or standing posture than in the sitting posture, making it easier to feel the manipulation of the posture in a stable direction [17]. In terms of walking movements, the process involves shifting weight to one leg, holding a standing position, moving one leg forward, and then repeatedly shifting weight again to the leg that has been moved forward. In this sequence, pelvic-driven weight transfer to the left and right legs is important, and as in the standing position, engagement in walking movements likely improved the participant's ability to manipulate pelvic movements.

The results of this study described above suggest that *Dohsa-hou* functions to improve the gross motor skills of children with cerebral palsy in the sitting position. However, the study design did not include a control group, and the intervention effects remain unverified.

Another limitation of this study is that outcome measures were not measured during the follow-up period, and the sustainability of the intervention effect was not examined. It is necessary to set up a research design that takes the above limitations into consideration and conduct research that further enhances the demonstrability of the effects of *Dohsa-hou*. Studies that focus on longer longitudinal results with a bigger population sample will also be useful for sourcing and analyzing data. In addition, the outcome measure in this study was limited to only one type of

GMFM (B: sitting), which measures gross motor movements in the sitting position, and no outcome measure was established to measure other aspects of ability related to gross motor movements in the sitting position. Further research can explore the possibility of focusing on other positions. In future studies, it will be possible to examine the effects of promoting the development of people with cerebral palsy from multiple perspectives by adding tools that measure ability such as hand manipulation, mobility, and social skills, which are considered to be associated with the development of gross motor skills in the sitting position.

Further work should be conducted on gaining input from the participants themselves. While the positive effects of *Dohsa-hou* from a mobility perspective is clear, further questions should be explored on the effects of this therapies on the patients themselves. While the range of disabilities of each of the participants creates an obstacle for determining satisfaction with the therapies, with adequate planning and foresight, this valuable information can be ascertained from the participants.

Conclusions

Through this study, it was shown that *Dohsa-hou*, a psychotherapy through movement improvement, can contribute to the improvement of gross motor skills of children with cerebral palsy in the sitting position. As Cambodia works to improve the outcomes for all of its citizens, including the physically disabled, effective treatments and intervention techniques are vital to improving outcomes for all patients. The significance of this study lies in the novelty that it used Gross Motor Function Measure Manual-88 (GMFM-88), an index which is internationally and universally used, to examine effectiveness of *Dohsa-hou* intervention to people with cerebral palsy. Previous studies have indicated that the motor skills of people with physically disabilities can be improved by targeting specific movements and stretches to improve mobility [4] [7], and this study contributed to verify these previous studies utilizing a statistical method. Dohsa-hou practices are becoming more established, and the results of this study may function to further promote their establishment, training, and usage in other locations and facilities as a primary evidence-based intervention for people with disabilities. The development of skills and functioning in people with physical disabilities will surely contribute to eliminating the stigmas around them and to increasing their educational, vocational, and social opportunities for the better quality of living. This research provides a novel, promising approach to improving the lives of those living with physical disabilities and provide opportunities to engage with society at-large.

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References

[1] Jonsson, K. [2019] CRPD in Cambodia - Effectiveness of Inclusion through Affirmative Action in Employment. LUND UNIVERSITY LIBRARIES (https://lup. lub. lu.se /student-papers/search/ publication/ 8989722).

[2] Nishio, A. [2019] History and Current Situation of Education for Children with Disabilities in Cambodia: A Gray Literature Review. Creative Education, 10, pp1753-1763.

[3] Harada, S. [2015] When Immovable Bodies Start to Move – Dohsa-hou for Children with Cerebral Palsy. Osamu Imura, & Velizara Chervenkova. (Ed). Introduction to Dohsa-hou – An Integrated Japanese Body-Mind Therapy. GURADUATE SCHOOL OF HUMAN SCIENCE, Osaka, Japan,pp.19-27.

[4] Harada, S. & Nakano, K. [2021] Practice of Meso-Micro Approach in Cambodian Disability Welfare through Clinical Dohsa-hou: Focusing on the Practice in National Borei for Infant and children. Bulletin of the Center for Psychological Counseling, University of IryoSousei, 15・16, pp.9-17.

[5] Teruta, E. & Harada, S. [2015] Dohsa-hou and Monthly Meetings in Japan. Osamu Imura, &VelizaraChervenkova. (Ed). Introduction to Dohsa-hou – An Integrated Japanese Body-Mind Therapy. GURADUATE SCHOOL OF HUMAN SCIENCE, Osaka, Japan, pp.78-85.

[6] Russell, D., Rosenbaum, P., Gowland, C., Hardy, S., Lane, M., Plews, N., McGavin, H., Cadman, D., & Jarvis, S. [1993] GROSS MOTOR FUNCTION MEASURE MANUAL Second Edition. Gross Motor Measure Group, Neurodevelopmental Clinical Research Unit, McMaster University, Hamilton, ON, Canada.

[7] Katori, S. [2021] A survey on death in children with severe cerebral palsy in an orphanage in Cambodia. Journal of International Health, 36(1), pp3-10.

[8] Shimizu, H. [2016] An introduction to the statistical free software HAD: Suggestions to improve teaching, learning and practice data analysis. Journal of Media, Information and Communication, 1, pp59-73.

[9] Novak, I., Mcintyre, S., Morgan, C., Campbell, L., Dark, L., Morton, N., Stumbles, E., Wilson S., & Goldsmith, S. [2013] A systematic review of interventions for children with cerebral palsy: state of the evidence. Developmental Medicine & Child Neurology, 55(10), DOI: 10.1111/dmcn. 12246.

[10] Zai, W., Xu, N., Wu, W., Wang, Y., & Wang, R. [2022] Effect of task-oriented training on gross mother function, balance and activities of daily living in children with cerebral palsy.: A systematic review and meta-analysis. Medicine, DOI:10.1097/MD. 0000000000031565.

[11] Guindos-Sanchez, D.L., Lucena-Anton, D., Moral-Munoz, A.J., Salazar, A., & Carmona-Barrientos, I. [2020] The Effectiveness of Hippotherapy to Recover Gross Mother Function in Children with Cerebral Palsy: A Systematic Review and Meta-Analysis.7(9), DOI:10.3390/children7090106.

[12] Jung, G.Y., Chang, J.H., Jo, S.E., & Kim, H.D. [2022] The Effect of Horde-Riding Simulator with Virtual Reality on Gross Mother Function and Body Composition of Children with Cerebral Palsy: Preliminary Study.Sensors,22(8), DOI:10.3390/s22082 903.

[13] Cankurtaran, D., Abidin, N., Akyuz, U.E., & Tezel, E. [2021] An investigation into the factors which affect the sitting balance of non-ambulatory children with cerebral palsy. Neurology Asia, 26(3), pp575-583.

[14] Abidin, E., Akyüz,Ü. E., Cankurtaran, D., Karaahmet, Z.Ö., & Tezel, N. [2022] The effect of robotic rehabilitation on posture and trunk control in non-ambulatory cerebral palsy. Assistive Technology, DOI:10.1080/10400435.2022.2059592.

[15] Rahlin, M., Duncan, B., Howe, L.C., & Pottinger, L.H. [2020] How does the intensity of physical therapy affect the Gross Motor Function Measure (GMFM-66) total score in children with cerebral palsy? : A systematic review protocol. BMJ Open, DOI:10.1136/bmjopen-2019-036630.

[16] Hsu, C.W., Kang Y.N., & Tseng S.H. [2019] Effects of Therapeutic Exercise Intensity on Cerebral Palsy Outcomes: A Systematic Review with Meta-Regression of Randomized Clinical Trials. Frontiers in Neurology, 10, DOI: 10.3389/ fneur.2019. 00657.

[17] Naruse, G. [1973] Psychological Rehabilitation. seishinshobou, Tokyo, Japan. (in Japanese)

[18] Imura, O. [2016] The Birth and Development of Dohsa-hou. Osamu Imura, &VelizaraChervenkova. (Ed). Introduction to Dohsa-hou – An Integrated Japanese Body-Mind Therapy. GURADUATE SCHOOL OF HUMAN SCIENCE, Osaka, Japan, pp.6-18.

[19] Piek, P.J. [2006] Infant motor development. Human Kinetics, IL, USA.

[20] Harada, S., Nagayama, T., Nakano, K., &Morizane, M. [2020] The practice of dohsa-hou for sleep improvement and verification by actigraphy in trainee with cerebral palsy. The journal of rehabilitation psychology, 46(1), pp13-24.

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