Original Article

Effectiveness of Vojta Therapy on Gross Motor Function in Children with Cerebral Palsy at GMFCS Levels 4 and 5: A Randomized Controlled Trial

Nipaporn Konjen MD[1,2], Lakkana Cheewasittirungruang MD[2], Suwandee Eungrattanachai MSc[1], Atchariyaporn Lertseri BSc[1], Sopatip Rerkmoung MD[1,2]

[1] Thai Red Cross Rehabilitation Center, Samut Prakan, Thailand

[2] Department of Rehabilitation Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

Objective: To study the effectiveness of the Vojta therapy on gross motor function in children with cerebral palsy at the Gross Motor Function Classification System (GMFCS) levels 4 and 5.

Materials and Methods: The present study was a randomized controlled trial, assessor-blinded, in 24 children with cerebral palsy, GMFCS 4 and 5 at Thai Red Cross Rehabilitation Center. Participants were randomly allocated to the Vojta therapy as the intervention group or conventional therapy as the control group and were trained by physical therapists. All participants in both groups received a home program for eight weeks. Outcomes were motor function assessment by the Gross Motor Function Measure (GMFM)-88, range of motion of lower extremities and parent's satisfaction.

Results: Twenty-four participants were randomly assigned with twelve participants each in the intervention and the control group. The mean age of participants in the intervention group was 7.08±3.17 years. The Vojta therapy significantly improved the GMFM-88 Dimension A- lying and rolling (p=0.001) and the improvement was greater than that of the control group (p=0.001). Both groups had significant increase in range of motion, including bilateral hip flexion, bilateral hip extension, bilateral knee flexion, and bilateral ankle dorsiflexion. Parent's satisfaction in both groups were very satisfied and had no adverse effects.

Conclusion: The Vojta therapy significantly improved gross motor function and range motion of the lower extremities in children with cerebral palsy at GMFCS levels 4 and 5. The Vojta therapy was superior to conventional therapy in the GMFM-88 Dimension A- lying and rolling.

Keywords: Cerebral palsy; Vojta therapy; Gross motor function; GMFM-88; GMFCS

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Cerebral palsy is a non-progressive and persistent posture with movement disturbance condition. There are symptomatic treatments, although none of them has been proven to be superior to the others. The ideal treatment goal is maximizing independence and achieve a good quality of life by motivating various activities[1-4].

The Gross Motor Function Classification System (GMFCS) is widely used to classify movement ability of children with cerebral palsy. It is a five-level classification based on the child's current gross motor ability and the level of need for assistive technology. Children at GMFCS levels 4 and 5 have severe limitations on head and trunk control and need more facility assistance[5,6].

Vojta therapy is one of the conservative techniques for treating cerebral palsy. This technique requires treatment several times a day. Family members apply pressure to proprioceptive trigger points of the body or limbs to initiate a reflex movement that leads to rolling and crawling[7]. It assumes that everyone was born with the physical movement pattern in their brain but children with cerebral palsy cannot fully implement this movement pattern.Vojta therapy consists of two standard postures, 1) reflex creeping that stimulates the body to move forward and 2) reflex rolling that includes two phases where in phase 1, it encourages the rotation to the side and in phase 2, it induces rolling[4,8].

A randomized controlled comparative

Correspondence to:

Rerkmoung S.

Thai Red Cross Rehabilitation Center, Samut Prakan 10280, Thailand.

Phone: +66-2-7038915

Email: sopatip.r@gmail.com

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observational study compared the effectiveness of the Vojta and Bobath combined treatment versus the control in 84 high-risk infants with brain damage. Gesell developmental schedules were evaluated after the treatment courses when infants were one year of age. The results showed that the intervention group had significantly higher developmental quotient than the controls[9].

Lim et al (2013) studied the effects of Vojta therapy on gait in three children with spastic diplegia at GMFCS levels 1 and 2. The subjects were trained for eight weeks and followed for eight weeks after training. The spatiotemporal gait parameters were determined and showed that some aspects tended to improve but were not statistically significant[10].

Ha and Sung (2018) conducted a comparison study between the Vojta and the standard physical therapy. Ten children with cerebral palsy at GMFCS levels 1 to 3 were divided into two groups. Both groups were treated for 30 minutes, three times a week, for six weeks. The sitting dimension of Gross Motor Function Measure (GMFM)-88 in the Vojta group was significantly improved but there were no significant differences between the Vojta group and the standard therapy group[11]. Studies reported that the Vojta therapy was effective. However, the patients in those studies were diagnosed and treated at an early age, and most were infants[9]. The GMFCS level was good, and the collected data were mostly on walking[10]. Most studies had small sample sizes. The study designs were descriptive, case study, and cohort study. There was no randomized controlled trial.

The primary objective of the present study was to compare the effectiveness of Vojta therapy with conventional rehabilitation in children with cerebral palsy at GMFCS level 4 and 5.

Materials and Methods

Setting and participants

The present study was an assessor-blinded randomized controlled trial. The present study was approved by the Committee on Ethics in Human Research, Faculty of Medicine, Chulalongkorn University, No. 414/62. Between September 2019 and April 2020, children with cerebral palsy at GMFCS levels 4 and 5 were recruited from the pediatric rehabilitation service at the Rehabilitation Center. This center is a specialized center that provides pediatric rehabilitation services to children with cerebral palsy. Most patients at this center were at GMFCS levels 4 or 5.

Inclusion criteria were aged between 2 and 12 years, diagnosed with cerebral palsy by a pediatrician and a principal investigator based on the POSTER criteria that included six aspects, posture, oropharyngeal problems, strabismus, tone, evolutional maldevelopment, and reflexes[12], and the patient's mobility was at GMFCS levels 4 or 5. The exclusion criteria were fever, other health problems that included congenital diseases such as cardiovascular system, musculoskeletal disorders such as osteogenesis imperfecta, received physical therapy by a physical therapist within three months, planned to adjust medication to reduce spasm, history of botulinum toxin or neurolytic agent injection less than six months, previous surgery less than a year, history of seizures, and participants who trained less than 80% of the trial period.

Informed consents were obtained from the parents of all participants. The research process was explained to all parents, including home program therapy, according to the group that the participant was assigned. The parents were asked to provide the home program therapy to their child during the study. The consent form was signed by the parent who would be the main provider of the home program.

Randomization and blinding technique

A block randomization technique was used to allocate the participants into two groups, the Vojta therapy as the intervention group and the conventional therapy as the control group. Random assignment numbers were generated. Each number was printed and placed in a sealed envelope. A research assistant who was independent from the treatment procedures in the present study kept the sealed envelopes. A sealed envelope was given to each patient who met the eligibility criteria and gave consent to participate in the present study. The participant was allocated to either group according to the assigned number in each envelope.

Blinding the participants and their parents was not possible because they were told which group they were in while attending the sessions. The assessor, a principal investigator, was blinded to the therapy group in which the participant was assigned.

Interventions

All participants received treatment according to their assigned group. Both groups received the treatment at the rehabilitation center for 60 minutes per session, twice a week, for eight weeks. Each session consisted of two parts, 1) the participants received the treatment provided by a physical

therapist for 40 minutes, and 2) a physiotherapist taught the home program to parents for 20 minutes. The parents were instructed to provide daily training at home. A physical therapist recorded the frequency of home training that the parents provided their child. Participants who trained less than 80% of the trial period were excluded.

Intervention group, treated by Vojta therapy: Participants that attended the sessions at the rehabilitation center as scheduled were trained by an experienced Vojta physiotherapist. Each session included two parts. Part 1 was a 40-minute treatment by a physical therapist that consisted of reflex creeping and reflex rolling. In part 2, a physical therapist spent 20 minutes teaching the Vojta home program training method to the parents. The frequency of home treatment was 20 minutes, four times a day[13].

Vojta therapy

The therapist adjusted the patient's posture to the starting position. Then the therapist applied pressure to specific points in the trigger zones. The pressure was applied in different directions that stimulated the patient's reflex locomotion. The treatment consisted of two basic poses as follows:

1) Reflex creeping was a basic movement. The patient was in the prone position. The arm of one side and the opposite leg were stretched, whereas the other arm and leg were flexed toward the trunk. The head turned to the side of the outstretched arm. The therapist pressed the specified zone, not more than four of nine points and exerted the force to resist the turning head. As a result, there were movements of the arm and the opposite leg from each side that supported the body and resisted the gravity. This moved the body forward.

2) Reflex rolling was a basic position that consisted of two phases, Phase 1 started with a supine position with the arms and legs extended. The therapist pressed on the chest area and exerted the force to resist the turning head. This maneuver encouraged the body to turn to the side. Phase 2 started with the patient lying on one side. The therapist pressed the specified zone. The underlying arm and leg supported the body and pushed it upward and forward against gravity. The muscles of the underlying arm were activated, the area that supported the body was moved from shoulder to elbow and hand. As a result, the body was overturned and the weight was supported by both hands and knees, respectively[8].

Control group, treated by conventional rehabilitation: Participants attended the sessions at the rehabilitation center and were trained to stimulate the participant's development by a physical therapist who completed the Motor Analysis Education Strategies course. Each session included two parts. Part 1 was a 40-minute treatment by a physiotherapist corresponding to the patient's functional movement and development. It consisted of stimulating functional movement to control head, trunk, and limbs[14]. In part 2, a physiotherapist spent 20 minutes teaching the home program to the parents. The frequency of home program was 20 minutes, twice daily.

Data collections and Outcome measurements

Baseline data consisted of age, gender, GMFCS level, motor function assessed by the GMFM-88 Total score, the GMFM-88 three dimensions, which were Dimension A as lying and rolling, Dimension B as sitting, and Dimension C as crawling, and range of motion (ROM) of the hip, knee, and ankle joints. A principal investigator assessed the GMFCS level, the GMFM-88, and ROM at baseline and assessed the outcomes after eight weeks.

Primary outcomes were the GMFM-88 Dimension A, B, and C. Secondary outcomes were the GMFM-88 Total score, ROM of the joints, and parent's satisfaction.

The GMFM-88[15-18] is a tool that is used by rehabilitation specialists to measure gross motor ability in children with cerebral palsy. It is a 4-point scoring system. Scores range from 0 to 3 where higher scores indicate greater ability. There are 88 items in five main dimensions as follows with Dimension A, lying and rolling with 17 items and a full score of 51, Dimension B, sitting, with 20 items and a full score of 60, Dimension C, crawling and kneeling, with 14 items and a full score of 42, Dimension D, standing, with 20 items and a full score of 60, and Dimension E, walking, running, and jumping with 24 items and a full score of 72. Scores could be summed to calculated raw and percentage scores for each main dimension. Total score was calculated by the sum of percentage score of each dimension as %A + %B + %C + %D + %E divided by the total number of dimensions. Parent's satisfaction was assessed by a research assistant using a five-point Likert scale at the end of the study, where 1 was unsatisfied and 5 was very satisfied.

Statistical analysis

Sample size: There were no previous studies comparing efficacy of the Vojta therapy using the GMFM-88 in children with cerebral palsy at GMFCS

levels 4 and 5. Sample size was calculated based on a study by Ko that evaluated the sensitivity to functional improvements of the GMFM-88 Total score in young children with cerebral palsy[12]. For the 0.5 of standard deviation (SD) of GMFCS levels 4 and 5, the minimally clinical important difference of the GMFM Total score was 7.1. The sample size was calculated using program power and sample program[19] with values as α=0.05, Power=0.9, δ (MCID)=7.1, σ=4.95, m=1, therefore, eleven participants were needed for each group.

Data analysis: The present research was analyzed by an intention-to-treat analysis. IBM SPSS Statistics, version 22.0 (IBM Corp., Armonk, NY, USA) was used for data analysis. Quantitative data were shown as mean and SD. Qualitative data were shown as percentage. Mean difference and 95% confidence interval (CI) were used to compare the outcomes within group and between the groups. Within group comparisons were analyzed by a paired t-test. Comparisons between groups were analyzed by ANCOVA. The results of parent's satisfaction were reported as percentage. Statistical significance was defined when a p-value was less than 0.05.

Table 1. Baseline participant demographic data

	Intervention group	Control group
Age (years); mean±SD	7.08±3.17	7.00±1.83
Boy; n (%)	8 (66.67)	7 (58.33)
Girl; n (%)	4. (33.33)	5 (41.67)
GMFCS 4; n (%)	10 (83.33)	10 (83.33)
GMFCS 5; n (%)	2 (16.66)	2 (16.66)

SD=standard deviation; GMFCS=Gross Motor Function Classification System

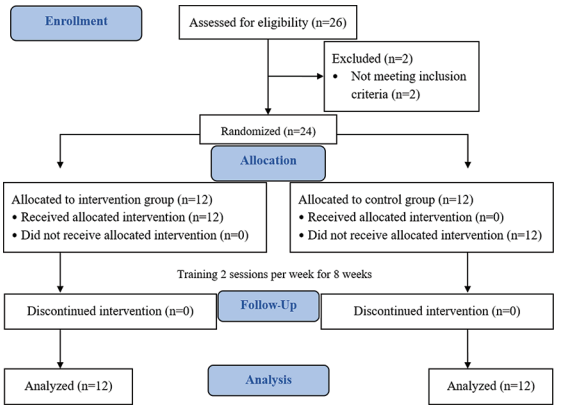

Figure 1. CONSORT 2010 flow diagram.

Results

Twenty-four subjects participated in the present study with 12 subjects in each group (Figure 1). There were no dropouts. The baseline data, including age, gender, and GMFCS levels is shown in Table 1.

After the eight-week training, the GMFM-88 Total scores of both the intervention and control groups were significantly increased from the baseline (p=0.001 and p=0.004, respectively). In the intervention group, there were significant improvements in Dimension A (p=0.001) and Dimension B (p=0.02). Dimension C tended to improve but the difference was not statistically significant. In the control group, there were no significant differences from the baseline in Dimension A, B, and C as shown in Table 2.

Comparisons between the intervention group and the control group showed that the Dimension A improvement in the intervention group was significantly greater than the control group (p=0.001). Comparisons within group and between the groups are shown in Table 2.

There was significant increase in ROM of bilateral hip flexion, bilateral hip extension, left knee flexion, and bilateral ankle dorsiflexion in both groups.

Although the range motions of bilateral knee extension and bilateral ankle plantar flexion tended to increase, the differences were not statistically significant in both groups (Figure 2). The parent's satisfaction scores in both groups were 5 as very satisfied at 100%. No adverse effects such as seizures, bruises, and fractures were found in either group.

Discussion

The results of the present study demonstrated that the Vojta therapy significantly improved lying and rolling (Dimension A) gross motor function assessed by the GMFM-88. The Dimension A improvement in the Vojta group was significantly different than the control group. This could be because the GMFM-88 is divided into five dimensions according to the developmental sequence, of which Dimension A, lying and rolling, is the earliest development[18].

The Vojta therapy induces repetitive reflex locomotion that encourages movements in the ways that were previously restricted and initiates lying on back and rolling[5]. This could be a reason for the significant improvement in lying and rolling. The Vojta method is more suitable for the patients with cerebral palsy than the conventional therapy because it does not require a lot of skills and the method is not complicated[19].

The Vojta therapy significantly improved the

Table 2. Mean of GMFM-88 before and after treatment

	Intervention group; mean±SD	Control group; mean±SD	p-value between groups	95% CI between groups
GMFM-88 Total score (%)				
Before treatment	24.02±17.17	29.09±16.97	0.447	
After treatment	30.30±17.78	35.51±19.18	0.574	–5.07 to 4.98
Difference before and after 8 weeks treatment	6.28±5.00	6.42±6.23		
95% CI	3.10 to 9.45	2.46 to 10.38		
p-value in group	0.001*	0.004*		
GMFM-88 Dimension A, lying rolling (%)				
Before treatment	64.38±30.97	74.51±26.84	0.271	
After treatment	76.96±29.07	80.72±27.96	0.001*	9.96 to 31.69
Difference before and after 8 weeks treatment	6.42±5.00	8.33±23.68		
95% CI	3.24 to 9.59	–6.71 to 23.38		
p-value in group	0.001*	0.248		
GMFM-88 Dimension B, sitting (%)				
Before treatment	30.42±29.80	41.25±28.26	0.244	
After treatment	40.42±31.34	53.19±33.50	0.777	–5.55 to 7.33
Difference before and after 8 weeks treatment	6.00±7.68	13.67±33.7		
95% CI	1.12 to 10.88	–7.77 to 35.10		
p-value in group	0.020*	0.188		
GMFM-88 Dimension C, crawling (%)				
Before treatment	20.24±26	22. 22±28.58	0.139	
After treatment	25.99±26.23	33.13±31.91	0.443	–3.75 to 8.26
Difference before and after 8 weeks treatment	2.42±6.44	5.42±21.43		
95% CI	–1.68 to 6.51	–8.20 to 19.03		
p-value in group	0.221	0.400		

SD=standard deviation; CI=confidence interval; GMFM=Gross Motor Function Measure

p<0.05, statistical significance

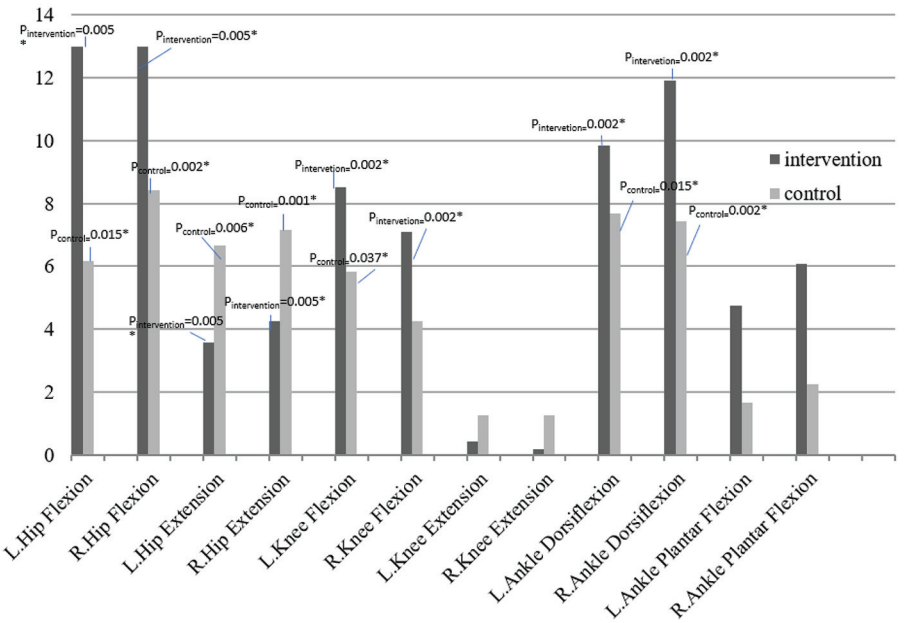

Figure 2. Changing in range of motion (ROM) of hip, knee, and ankle compared with baseline.

GMFM-88 Total score and the Dimension B, sitting, when compared with the baseline. However, there were no significant differences when compared between the groups. These findings were consistent with a study by Ha and Sung that compared the effects of Vojta therapy with standard physical therapy. They assessed motor function of ten children with cerebral palsy at GMFCS level 1 to 3[9]. However, they assessed the subjects at different GMFCS levels. Their subjects were at levels 1 to 3, which were better than the subjects in the present study, which were at levels 4 to 5. In addition, the number of subjects was smaller than the present study. The GMFM-88 Total score improvement after the Vojta training was consistent with a study by Gajewska et al. A 12-year-old female patient was diagnosed with spastic quadriplegia cerebral palsy and received intensive physiotherapy and hippotherapy.

After the Vojta therapy, her GMFM-88 was improved in all five dimensions. After the Vojta therapy was discontinued while the kinesis therapy was still continued, the GMFM-88 scores of all dimensions were reduced. After the Vojta therapy was resumed, the GMFM-88 scores of all dimensions were improved[20]. Based on minimum clinically important difference of the GMFM -88 Total score, the Minimally Important Difference of GMFCS IV/V, at the 0.3 SD of baseline is 4.26[12]. In the present study, the mean difference in GMFM Total score in the Vojta group was approximately 6, which was clinically significant and supported that Vojta therapy significantly improved gross motor function. There were tendencies of improvement in crawling, but the differences were not statistically significant in both within group and between groups. Rosenbaum et al studied the GMFM in children with cerebral palsy[21] and found that the gross motor function capacity was improved when the children grew up. The GMFM was improved over time with age, like an exponential curve then entered the plateau phase at approximately seven years of age. The improvement of GMFM score is also dependent on the GMFCS level, where the more severe GMFCS levels are less likely to improve. The average age of participants in the present study was seven years with the GMFCS at level 4 and 5. These may be the reasons that no significant differences in crawling were demonstrated.

There were significant improvements in range of motion of both hips in both groups. However, the improvements were not statistically significant between the two groups. This is consistent with a study by Lim that assessed the effect of Vojta therapy on gait in three children with spastic diplegia cerebral palsy at GMFCS Level 1 and 2. The Vojta therapy increased the range of motion of these children[8]. The parent's satisfaction scores indicated that the parents were very satisfied in both groups. There were no adverse effects during the study period. The Vojta therapy and the standard physical therapy by physiotherapists who completed specialized treatment courses are safe.

Limitation

The home programs required daily treatment several times a day that depended on continuity and cooperation from the parents. Further study assessing long-term treatment effects is suggested.

Conclusion

The Vojta therapy improved lying and rolling, total score of GMFM-88, and range of motion of the lower extremities in children with cerebral palsy at GMFCS levels 4 and 5. The Vojta therapy was superior to the conventional therapy in the GMFM-88 Dimension A, lying and rolling.

What is already known on this topic?

Cerebral palsy is a non-progressive and persistent posture with movement disturbance condition. There are treatments that aim to maximize independence and obtain good quality of life for children with cerebral palsy.

Vojta therapy is based on initiation of reflex locomotion, which can be provided by applying pressure to proprioceptive trigger points of body and limbs. Vojta therapy is one of the promising conservative treatments for cerebral palsy patients.

What this study adds?

In this study, Vojta therapy demonstrates significantly improved gross motor function measured by GMFM-88 in children with cerebral palsy at GMFCS levels 4 and 5. Dimension A of GMFM-88, which is about lying and rolling, significantly improved in Vojta group. Furthermore, improvement of range of motion of the lower extremities are also found after Vojta therapy.

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identification number TCTR 20190712002.

Conflicts of interest

The authors declare no conflict of interest.

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