



Original Article

Effect of physical therapy frequency on gross motor function in children with cerebral palsy

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Abstract. [Purpose] This study attempted to investigate the effect of physical therapy frequency based on neurodevelopmental therapy on gross motor function in children with cerebral palsy. [Subjects and Methods] The study sample included 161 children with cerebral palsy who attended a convalescent or rehabilitation center for disabled individuals or a special school for children with physical disabilities in South Korea. Gross Motor Function Measure data were collected according to physical therapy frequency based on neurodevelopmental therapy for a period of 1 year. [Results] The correlation between physical therapy frequency and Gross Motor Function Measure scores for crawling and kneeling, standing, walking, running and jumping, and rolling, and the Gross Motor Function Measure total score was significant. The differences in gross motor function according to physical therapy frequency were significant for crawling, kneeling, standing, and Gross Motor Function Measure total score. The differences in gross motor function according to frequency of physical therapy were significant for standing in Gross Motor Function Classification System Level V. [Conclusion] Intensive physical therapy was more effective for improving gross motor function in children with cerebral palsy. In particular, crawling and kneeling, and standing ability showed greater increases with intensive physical therapy.

Key words: Children with cerebral palsy, Physical therapy frequency, Gross motor function

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INTRODUCTION

The proper physical therapy frequency is increasingly important in the determination of government financial and insurance benefits. The physical therapist is responsible for demonstrating the value and effect of services, and the therapy schedule should be planned carefully¹⁾. Although appropriate treatment frequency and duration are important in pediatric physical therapy, evidence for determining the optimal program is lacking^{2, 3)}. The frequency of physical therapy is a factor that should be considered with greater importance in children with cerebral palsy (CP) because children with chronic disabilities should receive therapy for as long as the family requests services⁴⁾. In practice, therapy is continued at various frequencies for which effectiveness has not been well documented⁴⁾.

Few studies have provided guidelines for therapy intensity. Treatment Frequency Guidelines (TFG)⁴⁾ and Treatment Frequency and Duration Guidelines (TFDG)¹⁾ have been developed and published. The TFG were developed for use by physical and occupational therapists through adaptations of the existing literature. The 4 developed modes included intensive therapy (3 to 11 times per week), weekly or bimonthly therapy (1 to 2 times a week to every other week), periodic therapy (monthly or less often but at regularly scheduled intervals), and consultative therapy (episodic or as needed). The TFDG modified the TFG, and consisted of 5 intensity levels: intensive, weekly, bimonthly, periodic, and consultative. The intensive mode was 3 to 5 times per week for a 2–6-week duration, while consultative mode provided therapy as needed when a patient was discharged from regularly scheduled therapy and consulted a therapist for only certain needs.

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Opinions about physical therapy intensity remain controversial³). Parent preferences also differ. Although intensity effect has been investigated, the results have been inconsistent. Changes in the Gross Motor Function Measure (GMFM), which is used as a standard outcome measure in children with CP according to intensity dosage, have been variable⁵). Another drawback of previous studies on physical therapy frequency is that the research was performed over a short period of time. Although physical therapy services are usually short-term during recovery from illness or surgery in the outpatient environment, there have been no reports on children with long-term needs⁶).

In addition, current cross-sectional data are limited for revealing the long-term impact of changes on outcomes in children with CP. Because the effect of therapy for chronic disabilities such as CP is difficult to detect in a short period of time, a longitudinal follow-up study should be performed to investigate the proper therapy frequency. This study addressed the following two questions regarding the proper physical therapy frequency based on neurodevelopmental therapy (NDT) for gross motor function in children with CP. First, what is the correlation between physical therapy frequency and gross motor function outcome in children with CP? Second, do gross motor function outcomes differ among intensive (3 to 11 times a week), weekly, or bimonthly frequency modes of TFG?

SUBJECTS AND METHODS

The study sample comprised 161 children with CP (mean age: 9 years, 1 month; SD: 4 years, 6 months) who attended a convalescent or rehabilitation center for disabled individuals or a special school for children with physical disabilities in South Korea. A total of 93 boys and 68 girls were recruited in this study. The age range was 6–15 years. The parents of all children agreed to participate in this study. This study was approved by the Ethics Committee of Jeonju University (Jeonju University IRB-1). Written informed consent to participate in the study was obtained from the parents of all the children. The types of CP in the children were spastic (85.1%), dyskinetic/athetotic (7.1%), and ataxic (7.8%). The participants were classified using the Gross Motor Function Classification System (GMFCS): 26 (16.1%) were classified into Level I, 25 (14.9%) into Level II, 19 (11.8%) into Level III, 19 (11.8%) into Level IV, and 73 (44.8%) into Level V.

The GMFM was used to assess gross motor function according to physical therapy frequency for 1 year. The GMFM is a standard criterion-referenced test that was designed to assess changes in gross motor function in children with CP. The 88-item test assesses activities in the 5 dimensions of lying and rolling, sitting, crawling and kneeling, standing, and walking, running, and jumping. The rating scale for each item is a 4-point Likert scale.

The one-sample Kolmogorov-Smirnov (K-S) test was employed to determine the method of statistical analysis. Because the results of the K-S test were statistically significant, a non-parametric test was performed to verify the physical therapy frequency. The Spearman correlation coefficient and Kruskal-Wallis test were performed. The Turkey test using ranks was employed as a post hoc test.

RESULTS

The correlation coefficients between physical therapy frequency and gross motor function are shown in [Table 1](#). The correlation between physical therapy frequency and GMFM scores, including crawling and kneeling, standing, walking, running and jumping, rolling, and the GMFM total score, was significant. In GMFCS Level V, only standing score showed a significant correlation with physical therapy frequency.

The results of the Kruskal-Wallis test are presented in [Tables 2 and 3](#). The different superscript letters refer to significant differences ($p < 0.05$). The differences in gross motor function according to frequency of physical therapy were significant for crawling and kneeling, standing, and GMFM total score. Intensity mode showed a significant effect for improvement in crawling and kneeling, standing, and GMFM total score compared to the consultative mode. Bimonthly mode showed a significant improvement effect for standing and GMFM total. Intensity mode showed a significant improvement effect for standing compared to the consultative mode in children with CP, which was classified into GMFCS Level V.

DISCUSSION

Gross motor function has been related to functional outcomes such as activities of daily living⁷). Activities and participation domains based on the International Classification of Functioning Disability and Health (ICF) are considered major concepts in rehabilitation; thus, improved gross motor function in mastering tasks and activities of daily living is a major goal of therapy for children with CP⁸). The evidence of the correlation between physical therapy frequency and gross motor function should be clarified to determine the proper physical therapy frequency for improving gross motor function in children with CP. In this study, the correlation between physical therapy frequency and GMFM data was investigated during a 1 year follow-up period.

The GMFM domains that showed significant correlations with physical therapy frequency were crawling and kneeling, standing, walking, running, and jumping, and GMFM total. In children with CP classified into GMFCS Level V, only standing showed a significant correlation with physical therapy frequency. There were significant differences in crawling and kneeling, standing, and GMFM total. The significant difference in standing was seen in children with GMFCS Level V CP. These

Table 1. Correlation between physical therapy frequency and gross motor function changes

		Lying and rolling	Sitting	Crawling and kneeling	Standing	Walking, running, and jumping	GMFM total
Physical therapy frequency	All	-0.027	0.000	0.191*	0.240**	0.133	0.162*
	GMFCS Level V	0.152	0.042	0.176	0.286**	-0.093	0.058

*p<0.05, **p<0.01

GMFM: Gross Motor Function Measure

Table 2. Differences in gross motor function changes by physical therapy frequency

Category		Mean	SD
GMFM domain	PT frequency		
Lying and rolling	Consultative	-0.69	14.23
	Bimonthly	2.08	17.96
	Intensive	-0.74	13.47
Sitting	Consultative	4.51	11.04
	Bimonthly	6.86	14.79
	Intensive	3.53	11.59
Crawling and kneeling*	Consultative ^a	-4.2	15.61
	Bimonthly	0.9	11.32
	Intensive ^b	1.56	10.36
Standing*	Consultative ^a	-4.22	14.35
	Bimonthly ^b	5.05	17.78
	Intensive ^b	4.33	12.41
Walking, running & jumping	Consultative	15.92	15.42
	Bimonthly	26.3	22.69
	Intensive	25.18	20.31
GMFM total*	Consultative ^a	2.26	8.73
	Bimonthly ^b	8.24	11.48
	Intensive ^b	6.77	9.13

GMFM: Gross Motor Function Measure

*p<0.05

The different superscript letter indicates a significant difference (p<0.05).

Table 3. Differences in gross motor function changes according to physical therapy frequency, GMFCS Level V

Category		Mean	SD
GMFM domain	PT frequency		
Lying and rolling	Consultative	-6.64	16.14
	Bimonthly	0.81	24.13
	Intensive	2.36	21.94
Sitting	Consultative	3.42	16.16
	Bimonthly	3.03	19.04
	Intensive	5.93	22.78
Crawling and kneeling	Consultative	-11.77	21.29
	Bimonthly	2.38	19.17
	Intensive	4.17	19.52
Standing*	Consultative ^a	-2.43	5.23
	Bimonthly	2.77	22.45
	Intensive ^b	5.33	17.22
Walking, running, and jumping	Consultative	20.89	14.27
	Bimonthly	27.4	24.17
	Intensive	21.45	23.25
GMFM total	Consultative	1.57	6.89
	Bimonthly	6.45	11.04
	Intensive	6.74	18.47

GMFM: Gross Motor Function Measure

*p<0.05.

The different superscript letters indicate significant differences (p<0.05).

results indicate that intensive physical therapy might be effective for improving the gross motor function in children with CP. The cause of non-significant correlations for lying and rolling as well as the differences in lying and rolling and standing could be explained by the ceiling effect of the GMFM. Vos-Vromans et al.⁹⁾ reported the ceiling effect of the GMFM in dimensions A, B, and C. They assessed gross motor function at baseline and at 3 follow-up assessments at 6-month intervals to describe the responsiveness of the measures used to evaluate the motor abilities of children with CP. Dimensions A (lying and rolling), B (sitting), and C (crawling and kneeling) of the GMFM were not responsive in the children participating in this study. An explanation for this phenomenon is that dimensions A, B, and C of the GMFM are relatively easy for children with mild CP to achieve. The only significant difference of standing in GMFCS Level V might be attributed to ceiling effect.

The insignificant correlation between physical therapy frequency and walking, jumping, and running might be explained by the bottom effect. Walking, jumping, and running were the most difficult GMFM domains in children with CP. For that reason, domain E showed no effect in intervention studies. Labaf et al.¹⁰⁾ reported that NDT improved gross motor function in children with CP in 4 dimensions (lying and rolling, sitting, crawling and kneeling, and standing) but that walking, running, and jumping did not improve significantly.

Although there was a significant effect between gross motor function and physical therapy frequency, the correlation coefficients were small. One reason for this result might be the content of the physical therapy provided for the children with CP. Activity-based interventions should reduce activity limitations in children with CP⁸⁾. However, physical therapy based on NDT focused on reducing abnormal tone, reflexes, and posture, which comprised an impairment-based intervention.

Another cause of the small correlation coefficients might be due to the use of the GMFM for outcome measures in this study. The activity limitation might differ by GMFCS level¹¹⁾. The effect of physical therapy frequency was different at GMFCS Level V. For that reason, the effect of physical therapy frequency should be examined according to GMFCS level to verify the specific effect of frequency.

Intensive physical therapy was more effective at improving gross motor function in children with CP. In particular, crawling and kneeling and standing ability were more increased in the intensive physical therapy mode. Previous studies reported the effect of intensive physical therapy. Tsorlakis et al.¹²⁾ compared the effect on gross motor function in group A with NDT twice a week and in group B with therapy 5 times a week for 16 weeks. The results showed that gross motor function in the children of both groups improved significantly after intervention and that the children in group B performed better and showed significantly greater improvement than those in group A. The results of this study support the effectiveness of NDT and emphasize the need for intensive treatment.

Although more intensive physical therapy is thought to be more effective, evidence of this assumption has been insufficient. This study provided evidence of the effects of intensive physical therapy in children with CP during a 1 year follow-up period. However, further studies should be performed to accumulate evidence of the various effects according to physical therapy frequency. First, the different effects according to physical therapy content should be investigated. Because the effects of therapy on gross motor function might vary depending on whether therapy focused on gross motor function, the specific content of therapy should be identified. Second, the different effects according to the ages of the children with CP should be examined. According to a previous meta-analysis¹⁰⁾, the effect of intensive treatment tended to be stronger for children 2 years of age. Third, physical therapy duration should be considered together with frequency.

This study examined the effect of physical therapy based on NDT according to frequency during a 1 year follow-up of gross motor function in children with CP. Intensive therapy significantly improved gross motor function for crawling and kneeling as well as standing.

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