Correlations between Gross Motor Functions and Health-Related Quality of Life in Thai Children with Spastic Diplegia

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Background: *The motor disorders of cerebral palsy (CP) may not only affect children's functional capacities, but also their health-related quality of life (HRQOL).*
Objective: *The purpose of this study is to examine the correlation between gross motor functions and HRQOL of Thai children with spastic diplegia.*
Material and Method: *Fifty children with spastic diplegia were recruited from an outpatient department of Thammasat University Hospital and Rajanukul Hospital. All participants were measured for gross motor functions by the gross motor function measure (GMFM-66) and their HRQOL by reports of the Pediatric Quality of Life Inventory 4.0 (PedsQL). Spearman's rank correlation coefficients were used to determine the correlations between dimensional scores of GMFM-66 and PedsQL.*
Results: *Forty-five of 50 children with spastic diplegia were completely undertaken for both GMFM-66 and PedsQL measures. The total HRQOL scale score had a fairly significant degree of relationship with the total GMFM score ($r = 0.48$, $p<0.001$). The physical health summary score had a notably moderate to good degree of relationship with the total GMFM score ($r = 0.52$, $p<0.001$). The psychosocial health summary score had a fair degree relationship with the total GMFM score ($r = 0.27$, $p = 0.076$).*
Conclusion: *The gross motor function tended to correlate with HRQOL in children with spastic diplegia, especially with regard to the physical aspects of the HRQOL.*

Keywords: *Spastic diplegia, Cerebral palsy, Gross motor function measure-66, Health-related quality of life, PedsQL, Correlation*

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Cerebral palsy is characterized by abnormal muscle tone, reflexes, or motor development and coordination[1]. The motor disorders of cerebral palsy are often accompanied by disturbance of sensation, perception, cognition, communication, and behavior, by epilepsy and secondary musculoskeletal problems. These outcomes affect not only on children's functional capacities, but also their health-related quality of life (HRQOL) and their families[2-4]. It has been reported that gross motor function was associated not only with the physical aspect, but also the psychological aspect of HRQOL[4,5]. HRQOL, a multidimensional construct of an overall assessment of wellbeing across various domains, is included as an outcome variable to evaluate the effectiveness of interventions for children with cerebral palsy[6,7]. It includes measuring physical health, mental health and social functioning[6].

The gross motor function measure (GMFM-88) is a standard criterion tool for evaluating change of gross motor function over time in children with cerebral palsy[8]. The GMFM-66 has been used as a clinical outcome measure by Thai pediatric physical therapists to follow their children with cerebral palsy. High inter-rater and intra-rater reliability of the GMFM-66 measure among Thai children with cerebral palsy has been reported, compared to the original GMFM measure consisting of 88-items, GMFM-88[9,10]. Regarding the Pediatric Quality of Life Inventory (PedsQL), a cerebral palsy module was developed and validated as a specific instrument to measure HRQOL in cerebral palsy

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patients[7,11]. Unfortunately, the Thai version of the cerebral palsy module of PedsQL had not been developed when the present study started. However, the Thai version of PedsQL generic core scales had adequate reliability and validity, and can be used in hospital and community setting[11]. The purpose of this study is to examine the correlation between gross motor functions and HRQOL of children with spastic diplegia.

Material and Method

Fifty children, aged 2-12 years, were recruited from an outpatient department of Thammasat University Hospital and Rajanukul Hospital. The inclusion criteria were as follows: (1) children were diagnosed of spastic diplegia and were 2-12 years; (2) they had the motor function severity level of 1-3, classified by gross motor function classification system (GMFCS); (3) they could understand and comply with verbal instructions. The exclusion criteria were subjects who received orthopedic intervention or botulinum toxin injection within 6 months, and subjects who have seizure, cardiopulmonary compromise conditions, and severe visual and hearing deficits. Informed consent was obtained from the subjects' parents before participation in the study. All participants were measured for motor function using the GMFM-66 by a well-trained pediatric physical therapist. Their HRQOL were measured by reports of the PedsQL. The present study was approved by the ethics committee of Thammasat University.

The Winstep statistical software was used to analyzing the GMFM-66 scores by transforming the categorical scale into a continuous score of dimension and total scores. The GMFM-66 consists of 5 dimensions as follows: 1) lying and rolling (4 movements), 2) sitting (15 movements), 3) crawling (10 movements), 4) standing (13 movements), and 5) walking, running, and jumping (24 movements)[10]. The 23-item reported PedsQL encompasses the following subscales: physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items)[12]. The instructions ask how much of a problem each item has been during the past one month. A 5-point response scale is used for parental: (a) "never" score 0, (b) "almost never" 1, (c) "sometimes" 2, (d) "often" 3, and (e) "almost always" 4. Items are reverse-scored and linearly transformed to a 0-100 scale (0 = 100, 1 = 75, 2 = 50, 4 = 0), so that higher scores indicated better HRQOL. Scale scores are computed as the sum of the items divided by the number of items answered. If more than a half of the items on the scale are missing, the scale score is not computed. The HRQOL scores are reported as a total score scale and two summary scores. The physical health summary score covers physical functioning subscales while the psychosocial health summary score covers emotional, social, and school functioning subscales.

Statistical analysis

Descriptive statistics were used to describe GMFM-66 scores and HRQOL scores. Spearman's rank correlation coefficients were used to determine correlation between dimensional scores, GMFM-66 and HRQOL. According to Portney and Watkins[13], correlations ranging from 0.00 to 0.25 indicate little or no relationship; from 0.25 to 0.50, a fair degree of relationship; from 0.50 to 0.75, a moderate to good relationship; and above 0.75, a good to excellent relationship.

Results

Forty-five of 50 children with spastic diplegia were completely undertaken for both GMFM and proxy-report HRQOL measures. The participant mean age was 6.8±2.3 years with 25 boys and 20 girls. Almost 96% of the participants were at level 3 by GMFCS. Most of them (78%) were in the normal weight range for age and gender (Table 1). The mean GMFM-66 score was 48.8±14.0 (range: 16.9-85.6). The mean proxy-report PedsQL score was 55.9±12.1 (range: 25.0-82.6) with the mean physical health summary score and psychosocial health summary score of 40.1±19.8 (range: 0-87.5) and 55.9±12.1 (range: 25.0-82.6) respectively (Table 2).

Correlation coefficients between dimensional scores of GMFM-66 and PedsQL scores among participants were presented in Table 3. The overall correlation coefficients were ranged between 0.03 and 0.58. The total HRQOL scale score had a fair degree relationship with the total GMFM score (r = 0.48, $p<0.001$) and was significantly correlated with four domains of GMFM-66 score (r = 0.32-0.53), except for lying and rolling domain. The physical health summary score had a moderate to good degree of relationship with the total GMFM score (r = 0.52, $p<0.001$) and was significantly correlated with three domains of GMFM-66 score (r = 0.49-0.58). The psychosocial health summary score had fair degree of relationship with the total GMFM score (r = 0.27, $p = 0.076$) and was significantly associated with two domains of GMFM-66 score (r = 0.33-0.36).

Discussion

The results from the present study showed

Table 1. Characteristics of participants with spastic diplegia

Characteristics	Number of children with spastic diplegia (n = 45)
	Frequency (%)
Gender	
Boy	25 (56)
Girl	20 (44)
GMFCS	
2	2 (4)
3	43 (96)
Nutritional status	
Normal	35 (78)
Underweight	7 (15)
Overweight	3 (7)
On anti-spasticity medications	
Yes	29 (64)
No	16 (36)
Caregiver	
Mother	32 (71)
Father	6 (13)
Other	7 (16)
Caregiver education	
Elementary school	12 (27)
Secondary school	18 (40)
Diploma or bachelor's degree	14 (31)
Higher than a bachelor's degree	1 (2)
Household income (bath)	
<5,000	1 (2)
5,001-20,000	30 (67)
20,001-50,000	11 (24)
>50,000	3 (7)
Mean age of children in years (SD)	6.8 (2.3) Range: 2.2-9.5

GMFCS = Gross motor function classification system

that the reported HRQOL of children with spastic diplegia were worse than that of other children with chronic diseases in the hospital in previous reports[13]. Their physical summary scores and the psychosocial summary scores were lower than those observed in other chronic diseases including respiratory allergic diseases, chronic renal diseases, hematologic malignancy diseases, and congenital heart defects[14]. The children with spastic diplegia in the present study showed the better scores on the psychosocial aspect of HRQOL than on the physical aspect. This is consistent with the previous reports of HRQOL among children with cerebral palsy[15-17]. The result showed that the physical health summary scores were correlated with more domains of gross motor functions than psychosocial health summary scores. Gross motor functions, especially in higher functions as walking running and jumping are good at predicting the physical aspects of HRQOL of children with spastic diplegia, but they are poor predictors of the psychosocial aspects of their HRQOL. A report from more than 20 reviews demonstrated that "functional status measures are reliable indicators of variations in physical function, but do not correlate consistently with psychosocial well-being[18]". Several factors including comorbidities and caregiver characteristics were reported to associate with psychosocial well-being of children with cerebral palsy[19,20]. Higher education and socioeconomic status of caregivers may provide better care for their children resulting in better psychosocial well-being. More than two-thirds of the caregivers in the present study had education at the secondary level or lower and low household incomes.

The present study had some limitations. Only a reported method was used to quantify HRQOL of the children in the present study because some of them

Table 2. Gross motor function and health-related quality of life of children with spastic diplegia

	Children with spastic diplegia (n = 45)		
	Mean	SD	Range
GMFM-66 score	48.8	14.0	16.9-85.6
Proxy-report PedsQL			
Total scale score	55.9	12.1	25.0-82.6
Physical health Summary score	40.1	19.8	0-87.5
Psychosocial health summary score	55.9	12.1	25.0-82.6

GMFM-66 = gross motor function measure-66; PedsQ = pediatric quality of life inventory generic core scales

Table 3. Correlation between GMFM-66 scores and PedsQL scores

Proxy-report PedsQL	GMFM-66					
	Lying and rolling	Sitting	Crawling	Standing	Walking, running and jumping	Total
Total scale score	0.23 (0.121)	0.32* (0.034)	0.35* (0.022)	0.42* (<0.001)	0.53* (<0.001)	0.48* (<0.001)
Physical health summary score	0.03 (0.822)	0.27 (0.07)	0.54* (<0.001)	0.49* (<0.001)	0.58* (<0.001)	0.52* (<0.001)
Psychosocial health summary score	0.36* (0.014)	0.25 (0.091)	0.05 (0.763)	0.21 (0.172)	0.33* (0.027)	0.27 (0.076)

GMFM-66 = gross motor function measure-66; PedsQL = pediatric quality of life inventory generic core scales
* significance of the correlation coefficient using Spearman's rank correlation with $p<0.05$

were unable to write and speak. This may have affected the results of the study because of an imperfect concordance of HRQOL measurement between self-reported and the parental proxy-reported method, which was noted[11]. Unfortunately, the Thai version of cerebral palsy module of PedsQL was not available during the study period. Specific measurement of the HRQOL may result in stronger correlation with the gross motor function if it exists. More accurate future study should be performed when the Thai version of specific cerebral palsy module of the PedsQL is available. Lastly, the results could not be generalized to cover children with severe involvement with GMFCS levels 4 and 5 who frequently have a greater number of comorbidities.

Conclusion

The present study showed evidence that gross motor function tended to associate with HRQOL in spastic diplegia children with mild to moderate severity. Statistically significant correlation between gross motor function and physical health aspect of HRQOL was documented.

What is already known on this topic?

Gross motor functions measured by standard Gross Motor Function Measure (GMFM-88) in children with spastic diplegia are related to health-related quality of life (HRQOL) measured by the Child Health Questionnaire (CHQ).

What this study adds?

Gross motor functions measured by Thai version of short form of Gross Motor Function Measure (GMFM-66) in Thai children with spastic diplegia are related to health-related quality of life (HRQOL) measured by proxy-report of the pediatric quality of life inventory 4.0 (PedsQL).

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Potential conflicts of interest

None.

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ความสัมพันธ์ระหว่างความสามารถในการเคลื่อนไหวและคุณภาพชีวิตด้านสุขภาพของผู้ป่วยเด็กไทยที่มีสมองพิการชนิด spastic diplegia

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ภูมิหลัง: ความผิดปกติของการควบคุมการเคลื่อนไหวของร่างกายในผู้ป่วยเด็กสมองพิการ นอกจากจะส่งผลกระทบต่อความสามารถในการทำงานแล้ว ยังอาจมีผลกระทบกับคุณภาพชีวิตด้านสุขภาพด้วย

วัตถุประสงค์: เพื่อศึกษาความสัมพันธ์ระหว่างความสามารถในการเคลื่อนไหวและคุณภาพชีวิตด้านสุขภาพของผู้ป่วยเด็กไทย ที่มีสมองพิการชนิด spastic diplegia

วัสดุและวิธีการ: คัดผู้ป่วยเด็กที่มีสมองพิการชนิด spastic diplegia จำนวน 50 รายจากโรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติและสถาบันราชานุกูล เข้าร่วมโครงการ ผู้เข้าร่วมโครงการทุกรายได้รับการตรวจประเมินความสามารถทางการเคลื่อนไหวโดยเครื่องมือ gross motor function measure (GMFM)-66 และประเมินคุณภาพชีวิตด้านสุขภาพเด็กโดยเครื่องมือ pediatric quality of life inventory 4.0 (PedsQL) ซึ่งให้ผู้ปกครองเป็นผู้ประเมิน คำนวณค่าความสัมพันธ์ระหว่างคะแนน GMFM-66 และคะแนน PedsQL ด้วย Spearman's rank correlation coefficients

ผลการศึกษา: มีผู้ป่วยเด็กที่มีสมองพิการในการศึกษานี้จำนวน 45 รายจากทั้งหมด 50 ราย ที่เข้าร่วมโครงการได้รับการประเมินครบถ้วนทั้ง GMFM-66 และ PedsQL โดยคะแนนคุณภาพชีวิตโดยรวม มีความสัมพันธ์ระดับปานกลางอย่างมีนัยสำคัญทางสถิติกับค่าคะแนนรวม GMFM ($r = 0.48$, $p<0.001$) ค่าคะแนนคุณภาพชีวิตด้านสุขภาพกายนั้นมีความสัมพันธ์ในระดับดีอย่างมีนัยสำคัญทางสถิติกับค่าคะแนนรวมของ GMFM ($r = 0.52$, $p<0.001$) ค่าคะแนนคุณภาพชีวิตด้านสุขภาพจิตและสังคมนั้นมีความสัมพันธ์ในระดับปานกลางกับค่าคะแนนรวมของ GMFM ($r = 0.27$, $p = 0.076$)

สรุป: ความสามารถด้านการเคลื่อนไหวของผู้ป่วยเด็กที่มีสมองพิการชนิด spastic diplegia นั้นมีแนวโน้มว่าจะสัมพันธ์กับคุณภาพชีวิตด้านสุขภาพโดยเฉพาะด้านกายภาพ