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นิพนธ์ต้นฉบับ
ORIGINAL ARTICLE

ความน่าเชื่อถือของระบบจำแนกความสามารถด้านการเคลื่อนไหวในเด็กสมองพิการอายุต่ำกว่า 6 ปี โดยนักศึกษากายภาพบำบัด

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บทคัดย่อ

Gross Motor Function Classification System-E&R (GMFCS-E&R) เป็นระบบจำแนกความสามารถด้านการเคลื่อนไหวที่มีความน่าเชื่อถือสำหรับนักกายภาพบำบัด การศึกษาที่ผ่านมาพบว่าการใช้ GMFCS-E&R ในเด็กสมองพิการที่อายุน้อยกว่า 2 ปี มีความน่าเชื่อในระดับปานกลาง อย่างไรก็ตาม การประเมินความสามารถด้านการเคลื่อนไหวในเด็กเล็กสำหรับผู้มีประสบการณ์ทางคลินิกน้อยนับเป็นเรื่องยาก ในด้านการเรียนการสอนและการฝึกปฏิบัติงานทางกายภาพบำบัด นักศึกษากายภาพบำบัดได้รับการเรียนรู้การใช้ระบบจำแนกนี้ แต่ยังไม่มีรายงานการศึกษาความน่าเชื่อถือของ GMFCS-E&R ฉบับภาษาไทยที่ประเมินโดยนักศึกษากายภาพบำบัด ในเด็กสมองพิการอายุต่ำกว่า 6 ปี การศึกษาครั้งนี้จึงมีวัตถุประสงค์เพื่อศึกษาความน่าเชื่อถือของ GMFCS-E&R ฉบับภาษาไทย ประเมินโดยนักศึกษากายภาพบำบัดจำนวน 6 คน ในการจำแนกการเคลื่อนไหวจากภาพวิดีทัศน์ของอาสาสมัครเด็กสมองพิการอายุต่ำกว่า 6 ปี จำนวน 58 คน เด็กสมองพิการเหล่านี้มาจากศูนย์การศึกษาพิเศษ สถานสงเคราะห์เด็กพิการจังหวัดนนทบุรี และโรงพยาบาลประจำจังหวัด ข้อมูลความน่าเชื่อถือภายในและระหว่างผู้ประเมินได้รับการวิเคราะห์และรายงานโดยค่าสัมประสิทธิ์สหสัมพันธ์ (ICC) และช่วงความเชื่อมั่น (95% CI) ผลการศึกษาพบว่า ความน่าเชื่อถือภายในและระหว่างผู้ประเมินอยู่ระดับปานกลางถึงดีมาก ความน่าเชื่อถือภายในผู้ประเมินอยู่ในช่วง 0.68-0.97 ความน่าเชื่อถือระหว่างผู้ประเมินมากกว่า 0.8 ขึ้นไป สรุปผลการศึกษา นักศึกษากายภาพบำบัดสามารถจำแนกความสามารถของเด็กเล็กที่มีภาวะสมองพิการโดยใช้ GMFCS-E&R ฉบับภาษาไทย ได้อย่างน่าเชื่อถือ

คำสำคัญ: ระบบจำแนกความสามารถด้านการเคลื่อนไหวฉบับเพิ่มเติมและปรับปรุง, พัฒนาการด้านการเคลื่อนไหวของกล้ามเนื้อมัดใหญ่, เด็กสมองพิการ, นักศึกษากายภาพบำบัด

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ORIGINAL ARTICLE

Reliability of the Gross Motor Function Classification System-Expanded and Revised in children with cerebral palsy aged less than 6 years by physical therapy students

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Abstract

Gross Motor Function Classification System Expanded and Revised (GMFCS-E&R) is a reliable classification system for physical therapists. Previous study found moderate reliability of using GMFCS in children with cerebral palsy aged less than 2 years. It is difficult for inexperienced clinicians to assess the gross motor development in young children. In physical therapy academic and clinical practice, physical therapy students have learned to use the GMFCS–E&R to classify children with cerebral palsy. However, there is no report of reliability of the Thai version of GMFCS-E&R in children with cerebral palsy aged less than 6 years by physical therapy students. The objective of this study was to examine the reliability of the Thai GMFCS–E&R for children with cerebral palsy aged less than 6 years by undergraduate physical therapy students. Methods: Six undergraduate physical therapy students used the GMFCS–E&R Thai version to classify 58 children with cerebral palsy aged less than 6 years from video recordings. These children with cerebral palsy were recruited from special education centers, the Home for Disabled Babies in Nonthaburi province, and a hospital. The intraclass correlation coefficient (ICC) and 95% confidence interval (95% CI) were reported for the intra-rater and inter-rater reliability of the Thai GMFCS–E&R. Results: The intra-rater and inter-rater reliability revealed moderate to excellent reliability. Intra-rater reliability revealed ICC values ranging from 0.68 to 0.97. Inter-rater reliability is presented by ICC values of more than 0.80. Conclusion: Undergraduate physical therapy students can reliably classify motor function of young children with cerebral palsy using the GMFCS–E&R Thai version.

Keywords: Gross Motor Function Classification System-Expanded & Revised, Gross motor development, Children with cerebral palsy, Physical therapy student

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Introduction

Clinical classification of severity in children with cerebral palsy (CP) is commonly based on neurological features and motor impairment.[1] This various subtypes of CP give ambiguous explanation about the functional ability of the child with CP. The Gross Motor Function Classification System (GMFCS) was developed[2] and used internationally in research. In 2007, the GMFCS was revised for children ages 6 to before 12 years and expanded for adolescents age 12-18 years according to the International Classification of Functioning, Disability and Health (ICF) from the World Health Organization (WHO), which encourages the user of this system to be aware of the impact of personal and environmental factors on mobility of children and adolescents with CP[3]. An Expanded and Revised (GMFCS–E&R) version also has high reliability which guaranteed the usefulness of this system for physiotherapy research and clinical practice[2]. The GMFCS–E&R presents five different levels of mobility based on age range. Each level is defined with a clear explanation, which has been developed into a systematic and reliable method. The GMFCS can be used without certification and free. It is helpful for families to understand their child's performance of activities in everyday life [4]. The GMFCS-E&R system is easily understandable and has been widely used in clinical practice and education [5-8].

The GMFCS and GMFCS–E&R have been translated into 22 languages[9] and several reliability studies have been conducted. The reliability of the GMFCS - Japanese version was tested twice, and it has been reported that the overall reliability (kappa coefficient: k) changed from 0.64 to 0.66. It has been suggested that the GMFCS should be explained to Japanese clinicians thoroughly with emphasis upon the descriptions of each level– prior to use[5]. The reliability study of the GMFCS–Greek version, by 2 pediatric neurologists, in children with CP aged 5.4 years gave an overall weight k of 0.80 (95% CI 0.67-0.94)[10].

The reliability of the Thai version of the GMFCS[7] has also been examined in three physiotherapy lecturers, rating 300 children with CP aged 0–12 years. The weighted kappa for all children was high (k=0.773), and when considered by 3 age ranges were high for age 2–4 years (k=0.757), 4–6 years (k=0.762), and 6–12 years (k= 0.792). The weighted kappa for children with CP aged less than 2 years, however, was moderate (k=0.665). Reliability of raters for children with CP aged less than 2 years were relatively lower compared to other age bands. This might be because the observation of gross motor development of children with CP in this age group is difficult and results might depend on the clinical experience of raters.

GMFCS has also been introduced for undergraduate students in education or teaching However, the reliability study of student as raters is limited. Only one study reported the use of the Brazilian–Portuguese GMFCS by undergraduate students as raters[6]. This study performed semantic analyses of the translated GMFCS content by 2 groups of participants: 3rd and 4th year undergraduate students and participants who had more clinical experience. The GMFCS was studied to determine its reliability in children with CP aged 8 months to 12 years, with the ICC of inter-rater reliability at 0.945 (95 %CI 0.861-0.979). The results suggest that the GMFCS-Brazilian-Portuguese version could be understandable and helpful in clinical practice, particularly for students[6].

Research suggestions encourage that the GMFCS can be used either by health science students or by students who will provide interventions to children with neurological disorders. Because of the limited clinical experience of students, the GMFCS might be useful and provide these students with a clear view of movement performance of children with CP[6, 11, 12]. Although the GMFCS-E&R is commonly taught in many physical therapy curriculum for undergraduate students in Thailand, there is limiting data of the reliability of GMFCS - E&R Thai version in children with CP by physical therapy students. Furthermore, it can be difficult for undergraduate students who have less clinical experiences to differentiate abnormal gross motor development in children aged less than 6 years[13]. The GMFCS–E&R was therefore hypothesized to be a useful and simple classification for undergraduate physical therapy students particularly in young children with CP.

We expected that the GMFCS–E&R Thai version would be a reliable tool to classify children with CP and can be learned simply by undergraduate students. The current study then aimed to investigate the reliability of the GMFCS–E&R Thai version by undergraduate physical therapy students in children with CP aged 0–6 years, recruited from different sources. If results of this study show acceptable reliabilities of the GMFCS–E&R Thai version by undergraduate physical therapy students, it might increase the use of the GMFCS–E&R Thai version in clinical practice.

METHODS

For this cross-sectional descriptive study, participants with CP were recruited from 3 sources in Thailand: special education centers, the Home for Disabled Babies in Nonthaburi province, and a hospital in Loei province. These children were aged less than 2 years, 2 to less than 4 years, and 4 to less than 6 years. Children who did not have CP and were blind or deaf were excluded. Written informed consents were obtained from their parents of recruited children. This study was approved by the Khon Kaen University Research Ethics Committee (Reference Number: HE552136).

Raters were 6 purposive undergraduate physical therapy students 3rd year (n=3) and 4th year (n=3), at the School of Physical Therapy, Faculty of Associated Medical Sciences, Khon Kaen University. The GMFCS–E&R Thai version of 3 age ranges: less than 2 years, 2 to less than 4 years, and 4 to less than 6 years[8], were used to classify the levels of functional ability of children.

The functional mobility of each child was recorded using a video tape, while doing his/her daily activity. The video recording was continued as long as the real time taken for performing functional movement, at approximately 1 hour for each child.

Procedures

Prior to data collection, all raters attended the GMFCS-E&R one-day workshop. Each rater then watched videotapes and classified the child's functional movement independently using the GMFCS–E&R Thai version. Each rater spent approximately 3 weeks to finish all assessment. A two-week interval between the 1st and 2nd

assessment was given to prevent the recall of raters regarding participants' level of GMFCS–E&R. Descriptive statistics were analyzed to describe characteristics of children with CP and raters. The ICC (model 2,1) was used to analyze intra-rater and inter-rater reliability with SPSS for Windows version 17.0. ICC values less than 0.5 are indicative of poor reliability, values between 0.5 and 0.75 indicate moderate reliability, values between 0.75 and 0.9 indicate good reliability, and values greater than 0.90 indicate excellent reliability[14].

RESULTS

Fifty-eight children with CP were recruited in this study. Most children with CP (74.1 %) in this study were spastic bilateral CP and used a wheelchair for long distance mobility. The characteristics of all participants are presented in **Table 1**. The six raters were undergraduate physical therapy students who had academic performance with Grade point average (GPA) ranging from 2.83-3.07. The Thai level of GPA can be from 0 to 4.0 (A = 4.0, B = 3.0, C = 2.0, D = 1.0, and F = 0), with 4.0 representing either a "perfect" GPA or a student having earned straight A's in every course[15]. Raters had 2–6 cases of children with CP for clinical experience.

Results showed moderate to good intra-rater reliabilities among the 3rd year raters and good to excellent reliabilities among the 4th year raters (**Table 2**). Inter-rater reliabilities for different age groups of all raters revealed good to excellent reliabilities (**Table 3**).

Table 1 Characteristics of all children with CP (n = 58)

Characteristic	Age range		
	< 2 y (n=10)	2–< 4 y (n=24)	4–< 6 y (n=24)
Age (mean±SD)	1.5±0.02 y	2.6±0.05 y	4.5±0.58 y
CP subtypes (n)			
Spastic (unilateral)	0	2	5
Spastic (bilateral)	7	18	18
Dyskinesia	0	1	0
Ataxic	0	1	1
Hypotonia	3	2	0
Ambulation aids (n)			
Walker	0	0	1
Crutches	0	0	0
Wheelchair	7	21	18

Table 2 Intra-rater reliability (ICC, 95%CI) of the 3rd and the 4th year undergraduate physical therapy students

Education level	Rater	ICC (95%CI) for different age groups		
		< 2 y (n = 10)	2–< 4 y (n = 24)	4–< 6 y (n = 24)
3rd year	R1	0.80 (0.38-0.95)	0.90 (0.79-0.96)	0.95 (0.88-0.98)
	R2	0.73 (0.22-0.92)	0.90 (0.79-0.96)	0.95 (0.88-0.98)
	R3	0.68 (0.13-0.91)	0.86 (0.71-0.94)	0.94 (0.87-0.97)
4th year	R4	0.91 (0.69-0.98)	0.90 (0.77-0.95)	0.97 (0.94-0.99)
	R5	0.97 (0.88-0.99)	0.89 (0.75-0.95)	0.96 (0.92-0.98)
	R6	0.81 (0.41-0.95)	0.87 (0.71-0.94)	0.93 (0.84-0.97)

Table 3 Inter-rater reliability of all physical therapy students

Children age range (n)	ICC (95%CI)
< 2y (10)	0.87 (0.72-0.96)
2–< 4 y (24)	0.85 (0.76-0.92)
4–< 6 y (24)	0.95 (0.91-0.97)

DISCUSSION

This study aimed to determine the reliability of the Thai GMFCS–E&R in children with CP aged less than 6 years by undergraduate physical therapy students. Results of inter-rater and intra-rater reliability of most raters gave ICCs of more than 0.75, which indicates moderate to excellent reliabilities[14], except 2 of 3rd year raters when rating in children with cerebral palsy aged less than two years. Therefore, the GMFCS–E&R Thai version is a useful system for learning and practicing, by undergraduate physical therapy students, to classify functional movement of young children aged less than 6 years. We suggest that the inexperienced undergraduate students should practice using the GMFCS–E&R especially in young children, after receiving an introduction from an expert. Results of this study agree with the good reliability of GMFCS Brazilian–Portuguese version, when assessing children with CP aged 8 months to 12 years by 3rd and 4th year physical therapy students. Hiratsuka et al recommended that the translated GMFCS–E&R could be helpful in clinical practice for students who have limited clinical experience[6].

When analyzing the intra-rater reliability in different age groups, the overall intra-rater reliability presented at a moderate to excellent level. The ICC revealed a wide range (0.68–0.97) among six raters for the younger children with CP aged less than 2 years, and the range of the ICC decreased slightly in older age groups (**Table 2**). This result suggests that it is more precise to classify functional movement of older children with CP than of younger infants, especially those aged less than 2 years[2, 7, 16, 17]. This variation occurs even in children with typical development in reaching motor milestones[18]. Furthermore, the range of 95% CI in participants aged less than 2 years was wider for the 3rd year physical therapy students, compared with that of the 4th physical

therapy students. This may be due to the different clinical experience between raters. This result agrees with Palisano et al.[2, 16] who reported reliability (K) at 0.55 for children with CP aged less than 2 years, even when studied in experienced therapists. This supports the statement that observing functional mobility in younger children with CP is more variable than doing so in older children. Furthermore, in other studies, the reliability values in children with CP aged less than 2 were generally presented at a lower level than were those in older children, even when assessed by experienced raters.

The inter-rater reliability of all undergraduate physical therapy students revealed a good to excellent level for children with CP aged less than 6 years. However, the range of 95% CI in children with CP aged less than 2 years (0.24) was wider than that of children with CP aged 2 to less than 4 years (0.16) and 4 to less than 6 years (0.06), respectively (**Table 3**). This variation of 95% CI in children with CP aged less than 2 years may be due to the small number of participants in age range 0–2 years (n=10). This is similar to the study of reliability of the GMFCS–Greek version in 2007[10], which showed a wider range of 95% CI in children with CP with same age range.

The limitations of this study need to be addressed that there were only 10 children with CP aged less than 2 years in this study. The reason for low recruitment in this study was the medical diagnosis of CP being done from 18 months to 2 years. Furthermore, there were children with CP aged less than 2 years at the data collection site who were ill during data collection so we did not recruited them for our study. A future study is needed to recruit more participants aged less than 2 years to confirm the result of the reliability of the GMFCS–E&R. Moreover, it was also suggested that raters should re-classify functional movement of children with CP again when they are older than 2 years[17].

This study used video recordings for assessing reliability. The advantage of video is increased practicality of time management with several raters. A previous study has shown that video recording can be successfully used for the assessment of gross motor function and for training pediatric clinicians to use the GMFM[2]. Therefore, videotape is a simple method for the assessment of motor function in young children with CP, because young children with CP might have unstable stages of behavior. Furthermore, videotape provides continuous observation of movement, and the assessment could be completed or reviewed as many times as needed[19]. However, there can be limitations of using videotape, such as that watching movement from video may not reflect the child's ability in several environments. In future study, the observation of functional mobility should be performed while the child is having daily activity if possible, so that children could present their performance of daily living activities in different environments.

CONCLUSION

This study has demonstrated that GMFCS–E&R Thai version has good intra-rater and inter-rater reliability in children with CP aged less than 6 years by undergraduate physical therapy students. This implies that the GMFCS–E&R Thai version can be used either in clinical practice or in teaching but it should be used with caution in children age less than 2 years.

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