The Usage of a Hand-Made Chair at Home for Children with Moderate to Severe Cerebral Palsy: Preliminary Study

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Background: *Specially designed chairs are expensive. A hand-made chair easily constructed from recycled material can be an alternative option. However, data on the feasibility of hand-made chair use at home is limited. The present study aimed to explore the usage of a hand-made chair at home in children with moderate to severe motor disabilities.*
Material and Method: *Seventeen children with cerebral palsy were recruited. Main caregivers were interviewed regarding the possibility of using the chair at home. Home visits and observations were also performed to explain how the chair had been used at home.*
Results: *Nine children (52.9%) used the chair everyday. Seven of these nine children were seated at least 30 minutes each time and two to three times per day. The total time that children spent on the hand-made chair each day ranged from 10 to 90 minutes.*
Conclusion: *The severity of disability and main caregivers' workload may explain an inadequate usage of the hand-made chair. A few modifications may help to improve the applicability of the hand-made chair.*

Keywords: *Hand-made chair, Children with cerebral palsy, Recycle materials*

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Sitting ability is an important developmental milestone for children with cerebral palsy (CP) whose main activities of daily living are performed in the sitting position. However, children with CP perform significantly worse in controlling their posture while sitting compared to typically developing children[1], particularly children with severe motor disability (Gross Motor Function Classification System: GMFCS level V)[2]. These children display a total lack of direction-specific postural adjustment and reduced capacity to modulate the degree of postural muscle contraction to the task specific condition[3]. These affect the ability of these children to sit independently. Therefore, they could spend a long part of the day in a lying position, mainly supine lying, which leads to the delayed motor development of these children[4].

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Positioning children with CP seated on a chair not only increases the possibility for being upright and an opportunity to practice head and trunk control but also reduces further secondary deformities[5]. The main purpose of the seating system for these children is to provide postural support for head, trunk and pelvis stability during sitting[6]. Nevertheless, common commercial chairs cannot fulfill these requirements. Most commercial chairs have no backrest or armrest and are often oversized for children with disability. Sitting on these chairs thus results in less trunk support and pelvic instability which reduces the children's ability to perform activities during sitting. Increasing the stability of the hips while seated assists with trunk and head control, leading to a more beneficial position during functional activities[7]. While specially designed chairs are often expensive and thus may not be purchased for every child, mostly in families with socioeconomic problems. Using a special, adapted chair may help children with CP to control their posture while sitting[5]. An easily adaptive chair has been developed from recycled materials such as paper boxes and plastic bottles[8].

However, the feasibility of using the hand-made chair at home in children with CP has not been evaluated. The purpose of the present study was to explore the usage of a hand-made chair at home for children with moderate to severe CP. The usage was assessed in terms of the number of times, duration/time, frequency/day and frequency/week that the child with CP was positioned in the hand-made chair.

Material and Method

Subjects

Seventeen children with moderate to severe CP who received hand-made chairs from the Special Education Center Region 9, Khon Kaen province, were recruited. The present study applied the gross motor function classification system (GMFCS) to classify the level of motor disability of the children with CP who participated. The GMFCS describes the functional ability of children with CP in five levels, from I to V, in the following age groups: up to 2 years, 2 to 4 years, 4 to 6 years and 6 to 12 years[9]. Children in level I have the least severity and can perform all the activities independently of their age-matched peers, but with some difficulties in speed, balance and coordination, while children in level V have the most severe condition such as having difficulty controlling their head and trunk posture in most positions and achieving any voluntary movement. Parents or caregivers of these children gave written informed consent to participate in the present study and also gave permission for the participation of their children. The present study was approved by Khon Kaen University Ethics Committee for Human Research.

Types of the hand-made chair

A hand-made chair has common characteristics of a supporting chair which includes backrest, armrest and leg abductor (Fig. 1). The principle and method how to make the hand-made chair from recycle materials have been explained elsewhere[10]. The aims of using a hand-made chair in physical therapy at the Special Education Center, Khon Kaen, are to increase the possibilities for children with CP in the upright sitting posture, increase the opportunity to practice hand functions and lastly to decrease the main caregivers' workload in carrying the child during meal times. The hand-made chair has been made from the recycle boxes which were 10 x 15 x 4 inches in size and 5-8 boxes were needed to build one chair depending on the length of the child's body. The chair was developed in three types;

Type A: The hip and ankle angle is at 90 degrees while sitting (Fig. 2A). According to the Trefler Classification[11], the characteristics of this type are suitable for children with CP with good head control and fair to good trunk control.

Type B: The hip angle is at 90 degree while sitting but the whole chair is slightly posterior tilted by putting the masking tape rolls underneath the front part of the chair (Fig. 2B). This type of chair was developed for children with poor head and trunk control. A stool or box is needed for foot support while sitting on this type of chair.

Type C: This type of chair is similar to Type A, but there is an anterior paper bar to support the upper trunk while sitting (Fig. 2C). This type of chair is appropriate for children who have poor to fair trunk control.

Data collection on the usage of a hand-made chair

All main caregivers were interviewed using a questionnaire. The questionnaire was subdivided into three parts. Part I contained general data of the child, main caregiver and history of receiving the hand-made chair. Part II explained the possible usage of the hand-made chair at home, which involved duration and frequency of using the chair. Part III included questions or data which might affect the usage of the hand-made chair such as the severity of disability, type of the hand-made chair, main caregivers' attitude about using

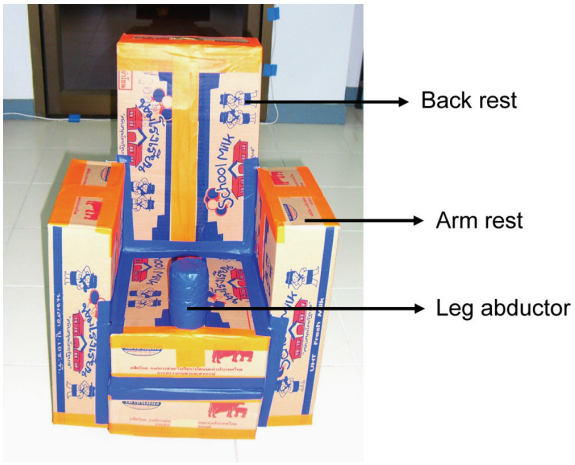

Fig. 1 Characteristics of hand-made chair. The hand-made chair consisted of back rest, arm rest, seat and leg abductor. The chair was made of 5-8 recycle boxes (size 10 x 15 x 4 inches). The seat width is about 10 inches and the height of the chair (number of boxed used) depend on the child's leg length

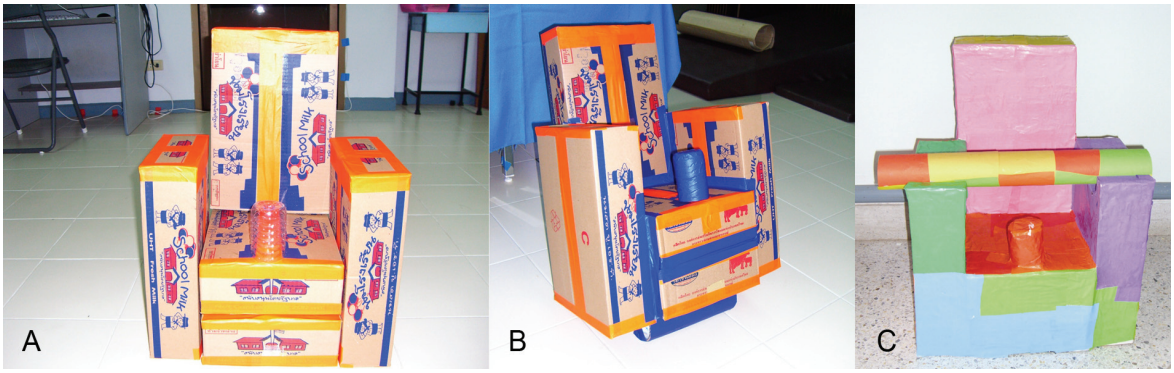

Fig. 2 Types of hand-made chair. Type A: for children with good head and neck control, type B: for children with poor neck control, the chair is slightly posterior tilted by putting the masking tape rolls underneath, type C: for children who need support for their trunk

the chair and main caregivers' knowledge of the proper way to sit on the chair. Proper sitting posture is defined as sitting with the back against the backrest, trunk upright and not leaning to either side with both feet fully supported on the floor[6].

Home visit and observation

Home visits to observe the home environment and how caregiver took the child onto the chair were performed once a week for two weeks. The duration of each observation varied from 60 to 90 minutes. Proper sitting posture was also observed and recorded when each child sat on the chair.

Data analyses

The outcome measures were analyzed using descriptive statistics. Data were described as the categorical variables which were reported in percentages. Home observation results were reported descriptively.

Results

Subjects and main caregivers' characteristics

Seventeen children, nine boys and eight girls, participated in the present study. The average age range of subjects was 5.2 ± 3.9 years (range 1 to 16 years old). Characteristics of all children and main caregivers are shown in Table 1. Most children (13 of 17) were of the spastic type with the GMFCS levels IV and V. Most main caregivers were mothers (Table 1) with mean age of 45.8 ± 11 years.

The usage of a hand-made chair

Subjects used the hand-made chairs at home while performing functional activities such as having meals, playing with toys and watching television. Table 2 shows duration of the chair usage each time, frequency per day and frequency per week. Nine of 17 subjects (52.9%) used the hand-made chair everyday. Two of these nine subjects spending at least 30 minutes on the chair each time, two times per day and five of the nine subjects spending 30 minutes on the chair, three times per day. The frequency of usage per day ranged from one to three times. The total time that subjects spent on the hand-made chair each day ranged from 10 to 90 minutes.

Table 1. Characteristics of subjects and main caregivers

Characteristics of subjects and main caregivers	Subjects (total n = 17)
Gender	
Boys	9
Girls	8
GMFCS	
Level III	3
Level IV	5
Level V	9
Main caregivers	
Relation	
Mother	9
Grandmother	5
Grandfather	1
Baby sitter	2
Level of caregivers' education	
Primary school	10
High school	4
Bachelor Degree	3
Level of caregivers' income	
Less than 5,000 baht/month	13
More than 5,000 baht/month	4

Home visits and observations

Eight subjects received the hand-made chair type A, four subjects had type B and five subjects had type C (Table 3). The duration that subjects occupied the chair ranged from 1 month to 2 years. Regarding the proper sitting posture on the chair, 16 main caregivers took the child onto the chair correctly, whereas 1 main caregiver got the child on incorrectly, that is the feet of the child did not have full support while sitting.

Regarding the attitude of the main caregiver toward the usage of the chair, all main caregivers responded positively and realized the benefit of using the chair. They performed gentle routine care with the children. Nevertheless, 7 of 17 caregivers (subjects 2, 3, 7, 14, 17, 19 and 20) mentioned that they occupied exaggerated workload so that they did not have sufficient time to get the child onto the chair. Eight children with severe cerebral palsy did not show whether they liked to sit on the chair or not. Three of these 8 subjects were blind and 1 in 8 subjects had mental retardation.

Table 2. The practicability of chair usage

Subject number	Duration (minutes/time)	Frequency a day (times/day)	Frequency a week (days/week)
7	10	1	3
17	10	1	3
2	10	2	2
3	10	2	3
19	10	2	7
20	10	3	7
14	20	1	4
11	30	2	5
9	30	2	7
12	30	2	7
10	30	3	5
18	30	3	5
1	30	3	7
6	30	3	7
8	30	3	7
15	30	3	7
16	30	3	7

Discussion

The objective of the present study was to explore the feasibility of using the hand-made chair at home in children with CP. The results from the interviews and home observations showed that 52.9% of main caregivers used the hand-made chair everyday. This could be explained by noting that most children (14 of 17) had severe motor disability with GMFCS levels IV-V. Although all main caregivers realized that seating was important and valuable for the child, getting the child onto the chair added a great burden of care for the main caregivers, because the child could not get on the chair by him/herself. The results are in line with the suggestion of the study of Ostensjo and

Table 3. Data of each subject and type of hand-made chair

Subject number	Level of GMFCS	Clinical conditions	Types of hand-made chair	Period of chair use (months)
7	IV	CP spastic diplegia	A	3
17	IV	CP spastic diplegia	A	1
2	V	CP spastic athetiod	B	12
3	V	CP + blind	B	24
14	IV	CP spastic diplegia	A	12
19	IV	CP + MR	C	1
20	IV	CP spastic diplegia	A	1
11	V	CP spastic athetiod	C	7
9	V	CP spastic tetraplegia	C	1
12	V	CP spastic tetraplegia	B	24
10	V	CP spastic tetraplegia	C	2
18	III	CP spastic diplegia	A	10
1	V	CP + blind	B	6
6	V	CP spastic diplegia	A	2
8	V	CP + blind + MR	C	12
15	IV	CP spastic diplegia	A	12
16	III	CP spastic hemiplegia	A	2

colleagues (2003) that the amount of assistance from caregivers increased with the GMFCS level of children with CP[12].

The duration and frequency of using the hand-made chair were considered as an inadequate usage according to the condition of the children and their chairs, because less than half of children (n = 7) were positioned and spent time about 60-90 minutes per day on the hand-made chair. According to Hulme et al (1983) who reported that a piece of equipment should be used as little as 1 or 2 hours per day in order to affect change[13]. Pope et al (1994) also evaluated the use over 3 years of a Seating and Mobility (SAM) system in children with CP[14]. They found that the average time on SAM in the first year was 0 to 8 hours per day and 0 to 12 hours per day in the second and third years. Results of the present study were collected from most children with severe disability. It can be suggested that the duration of sitting on the hand-made chair of most subjects could be longer depending on individual objectives and the time required for the functional activity performing during sitting. The frequency of sitting could vary from three to four times each day.

Data from home visits and observations may signify some reasons why the handmade chair was used inadequately. The severity of motor dysfunction of subjects may be an important reason contributing to an inappropriate usage of the chair, since most children needed their main caregivers to get them on the chairs. Moreover, eight children with severe disability could not pass on their desires that how long they want to sit on the chair or they were unable to show their appreciation of seating on the chair. Main caregivers need to put their great afford to position the child on the chair. Therefore, sometimes it was easier for the caregivers not to use the chair although they realized that sitting will promote the child's postural control. This result can be implied that caregivers use the chair less because they did not feel comfortable with it. Similar to Raja (2006) study which suggested that the severity of disability may account for poor compliance with walking aid use, as the child may find it hard to ambulate with their walking aids[15]. Moreover, the main caregivers' workload may also be a reason influencing the usage of hand-made chairs, while most caregivers were females, all of them also need to be responsible for household chores.

There are some noteworthy limitations to the present study. The present study explored the usage of a hand-made chair in a small number of subjects and in a short period of time. Thus a further study on a larger number of subjects is important to warrant the results of the present study. In addition, the structure of the hand-made chair could affect the use of the chair. The chair was made from rigid materials such as paper boxes and plastic bottles and thus did not conform to the shape of the children's bodies. Pillow inserting or supports were needed in some small children to maintain a good sitting posture. A few modifications should be made in order to improve the efficacy and applicability of the chair. Firstly, there should be a hip strap for stabilizing the hips and preventing the child from sliding forward while sitting. Secondly, a modification could be made to the Type B chair for future study by having an exact angle of posterior tilting. Larnert and Ekberg (1995) suggested that the flexed neck position combined with a 30 degrees reclined sitting position decreased aspiration in children with severe CP who have poor head and trunk control[16]. However, Michael and colleagues (2007) concluded that there is still a lack of quality evidence to support and guide the use of the tilted position in seating for the population with neurological impairments[17]. Moreover, to make a suitable cut-off tray instead of the paper bar to accompany the chair while performing functional activities would help to support the child's upper extremities in a proper sitting position. Furthermore, the information from semi-structured questionnaires may provide more meaningful information for chair modification[18] since caregivers and therapists often have different points of view for consideration of the child's adaptive seating system.

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Potential conflicts of interest

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การใช้เก้าอี้ประดิษฐ์ขึ้นเองที่บ้านสำหรับเด็กสมองพิการที่มีระดับความรุนแรงปานกลางถึงมาก: การศึกษาเริ่มต้น

วัณทนา ศิริธราธิวัตร, รัมภ์รดา อินทโฉม, สมพร หวานเสร็จ

***ภูมิหลัง**: เก้าอี้ที่ออกแบบพิเศษมักมีราคาแพง การประดิษฐ์เก้าอี้อย่างง่ายจากวัสดุเหลือใช้จึงเป็นทางเลือกได้อย่างไรก็ตาม ข้อมูลเกี่ยวกับการใช้ประโยชน์ของเก้าอี้ที่ประดิษฐ์ขึ้นเองที่บ้านยังจำกัด*

***วัตถุประสงค์**: การศึกษานี้ คือสำรวจการนำเก้าอี้ประดิษฐ์ไปใช้ประโยชน์ที่บ้านในเด็กพิการที่มีความรุนแรงปานกลางถึงมาก*

***วัสดุและวิธีการ**: เด็กสมองพิการจำนวน 17 คน เข้าร่วมการศึกษานี้ ผู้ดูแลหลักเป็นผู้ให้สัมภาษณ์ข้อมูลเกี่ยวกับการใช้เก้าอี้ประดิษฐ์ที่บ้าน ผู้วิจัยได้เยี่ยมบ้านและสังเกตความเป็นไปได้ของการใช้เก้าอี้ประดิษฐ์ที่บ้านด้วย*

***ผลการศึกษา**: อาสาสมัครเด็ก 9 คน (ร้อยละ 52.9) ได้รับการจัดให้นั่งบนเก้าอี้ประดิษฐ์ที่บ้านทุกวัน เด็ก 7 ใน 9 คนนี้นั่งบนเก้าอี้อย่างน้อย 30 นาทีต่อครั้งและ 2-3 ครั้งต่อวัน เวลาที่เด็กนั่งบนเก้าอี้ประดิษฐ์แต่ละวันอยู่ในช่วง 10-90 นาที*

***สรุป**: ระดับความรุนแรงของความพิการและภาระงานของผู้ดูแลหลักอาจเป็นเหตุผลที่อธิบายถึงการใช้เก้าอี้ประดิษฐ์ที่ไม่เพียงพอการดัดแปลงเก้าอี้ประดิษฐ์เล็กน้อยอาจช่วยเพิ่มความเป็นไปได้ในการนำเก้าอี้ไปใช้ที่บ้านได้*