Correlation between Dissociated arm Movements and Manual Ability in Unilateral Spastic Cerebral Palsy During Middle Childhood Stage

Amr Hamada[1], Alaa Al-Nemr[2], Walaa ElNaggar[3], Faten Abd El Azeim [4]

1 Physical Therapist (Senior), Abu El Reesh Hospital

2, 4 Department of Physical Therapy for Growth and Development Disorders in Children and its Surgery, Faculty of Physical Therapy, Cairo University, Egypt

[3]Department of Pediatrics, Faculty of Medicine, Cairo University, Egypt

ABSTRACT

Background: Deficient manual ability and dissociated arm movements are common problems in unilateral spastic cerebral palsy. These children have disturbance of manual ability which is the capacity to manage daily upper limb activities and interfering with doing the fundamental functions. Another problem in USCP is the dissociated arm movements which is the performance of intrasegmental and intersegmental isolated movements. It is the ability to isolate the activation of muscles in a selected pattern in response to demands of a voluntary posture or movements. Purpose of the study: to investigate the correlation between dissociated arm movements and manual ability in unilateral spastic cerebral palsy during middle childhood stage. **Methods:** 24 unilateral spastic cerebral palsy children with ages between 6-8 years old, the grade of spasticity are 1 and 1+ according to the Modified Ashworth Scale, and the Manual ability classification system of hand level II-III. ABILHAND-Kids questionnaire was used to assess the manual ability and Quality of Upper Extremity Skills Test was used to assess dissociated arm movements. All patients were assessed for one shot. The Study design was cross sectional observational study. Children were randomly selected. **Results:** a significant Correlation was detected between dissociated arm movements and manual ability in unilateral spastic cerebral palsy during middle childhood stage. **Conclusion:** There is a strong significant relationship between isolated arm movements and manual ability needed for active participation in daily life.

Keywords: Dissociated movements, manual ability, unilateral spastic cerebral palsy.

INTRODUCTION

Cerebral palsy (CP) is an umbrella term that covering a group of non-progressive, sensorimotor impairment. The modern definition of CP extends beyond motor deficits to encompass accompanying sensory and perceptual impairments, cognitive deficits, and learning and behavioral disorders [1]. Unilateral spastic cerebral palsy (USCP) is characterized by unilateral spastic paresis or plegia attributable to a contralateral brain lesion. Children with USCP show a delay in the acquisition of motor milestones and deficits in the organization of body movements of both the upper and lower limbs [2]. These children fail to use the paretic hand for daily tasks such as tying shoelaces, they use the mouth to remove the cap of a pen or unbutton the shirt and so on. In other circumstances, the affected limb lies in a passive dysfunctional position. Some children even sit on it for several minutes at a time. In other cases, children develop negative attitudes towards the affected limb and refer to it as a "thing". Occasionally, children refuse to use the paretic upper limb or remove the equivalent limb from toys [2].

Manual ability is defined as "the capacity to manage daily activities requiring the use of upper limbs whatever the strategies involve". Manual ability is a task-specific and active assembling procedure where two hands are restricted to act cooperatively by virtue of mutual coupling [3]. deficient bimanual activities may comprise disability in several degrees of complexity and different combinations of symmetrical (e.g., moving a big box) or asymmetrical (e.g., opening a jar) movements, it results from failure of a task-specific pattern where both upper extremities act as a single unit with perfect temporal and spatial coupling [4].For USCP children, the process of acquiring bimanual skills develops through environmental exploration and object manipulation during activities of daily living(ADL or ADLs),such as learning to unwrap a piece, of candy or tying shoe laces is not working well [3].

Dissociation is the performance of intrasegmental and intersegmental isolated movements. For example, even though various joints of the upper extremity move in a coordinated manner to produce an upper extremity functional skill, the individual joints, such as the elbow joint, must learn to move independently while the other upper extremity joints do not move [5,6]. Lack of dissociated arm movements is one of four interrelated neuromuscular deficits in spastic cerebral palsy (CP), and typically occurs in combination with muscle weakness, spasticity, and short muscle–tendon length. In the upper limb, bringing a cup to the mouth to drink requires dissociation to attain a combination of elbow flexion while maintaining wrist extension. An obligatory flexor synergy in the upper limb will hinder wrist extension and interfere with this functional activity. To develop more effective treatments, it is essential to delineate the influence

of lack of dissociation from other interrelated deficits seen in spastic CP, such as weakness, short muscle length, and spasticity [7].

The purpose of the current study is to investigate if there is a relationship between dissociated arm movements and manual ability in unilateral spastic cerebral palsy during middle childhood stage.

MATERIALS AND METHODS

Study design: cross sectional observational study

Participants: 24 patients with unilateral spastic cerebral palsy with ages between 6-8 years old, muscle tone ranged from 1 to 1+ on Modified Ashworth Scale and Manual ability classification system of hand level II-III.

All the patients were selected from department of physical therapy at Abou El-Reesh Hospital.

Criteria for children selection:

Inclusion criteria:

All children diagnosed as unilateral spastic cerebral palsy.

Their age ranged from 6 to 8 years old.

Manual ability classification system of hand level II-III.

They are able to follow the instructions.

Spasticity grade ١ and 1+ according to the Modified Ashworth Scale.

Exclusion criteria:

Diff children who may interfere with testing.

Other neurological conditions rather than cerebral palsy such as myopathy, Down syndrome.

Children having cognitive deficit who may not understand the orders.

Orthopedic surgery of upper extremity or hand before 6 months.

Measurement Procedures:

ABILHAND-Kids questionnaire was used to assess the manual ability and Quality of Upper Extremity Skills Test was used to assess dissociated arm movements. All patients were assessed for one time only.

-Manual ability:

ABILHAND kids questionnaire:

Parent was asked to fill in the questionnaire by estimating their child's ease or difficulty in performing each activity, when the activity was done:

Without the technical or human help (even if the child use help in daily life);

Irrespective of the limp(s) actually used to do the activity;

Whatever the strategy used (any compensations is allowed).

Parents will be asked to provide their perceived child's difficulty on a three-level scale:"impossible","difficult", or

"easy". Activities not attempted in the last 3 months are not scored and are entered as missing response (tike the question mark) [8].

- Dissociated arm movements:

Quality of Upper Extremity Skills Test:

Quality of movement is assessed in four domains; Dissociated movements (19 items), Grasp (6 items), Weight bearing (5 items), and Protective extension (3 items), including 33 items [9]. The total testing time including administration and scoring is approximately 45 minutes [6].

Each item comprises, however, several subitems and both left and right upper extremity is assessed on a dichotomous scale; 'able to complete' or 'not able to complete'. If the movement is not administered, this is reported as 'not tested'. Per cent scores for the domains and a total score (scale 0–100%) are calculated [9].

General instructions will be followed:

- The child should be dressed in a short sleeved shirt so that elbows can be easily seen.
- A table used during evaluation should be at a height just above the waist level.
- The child should be seated in a chair with hips and knees bend at right angles with feet rested on the floor or foot rests.
- Child should not wear any devices during the session.
- The therapist can facilitate movement through toys, verbal encouragement, demonstration, and handling the child if necessary.
- The child must hold the position at least for 2 seconds.
- Order of administration can be changed to suit the child and the therapist [6,9].

Data Analysis: Descriptive statistics (mean and SD) were generated for each dependent variable. The Correlation between dissociated arm movements and manual ability was analyzed with a spearman test. All statistical tests used a significance level of $p < 0.05$.

Results

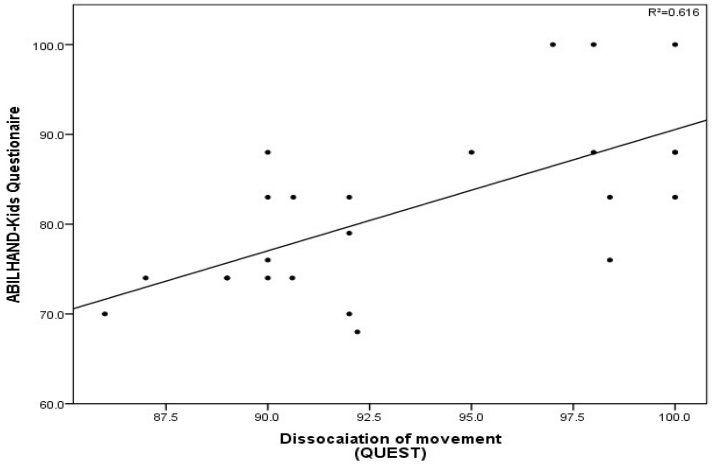
The mean age was 7, Muscle tone was equally distributed between 1 and 1+ while 58 % of children were level II in MACS. The study group showed a significant correlation between dissociated arm movements and manual ability in unilateral spastic cerebral palsy during middle childhood stage Table 1, 2 (Figure 1).

Table (1): Demographic data

N	24	
Age	$\bar{x}$	7
	σ	1.03
MAS	1	12
	1+	12
MACS	II	14
	III	10

Table (2): Correlation

R^2	ABILHAND-Kids questionnaire	Column1
Dissocaiation…check spelling of movement	0.616	
		P-value<0.05



(Figure 1)

DISCUSSION

The present study was conducted to investigate correlation between dissociated arm movements and manual ability in unilateral spastic cerebral palsy during middle childhood stage. We measured the dissociated arm movements and also the manual ability and a significant Correlation between both of them in unilateral spastic cerebral palsy was found in middle childhood stage.

Also studies found that the lack of dissociation affects skilled hand function as the wide range of freedom to move smoothly is important for achieving the activity of daily living [10, 11]. As reduced Selective motor control (SMC) impairs functional movements such as gait and reaching, it interfere with isolated joint movement and by consequence it affect their participation in activity of daily living[7].

Several of specific functions need the delicate control of the arm movement during the object manipulation. Lacking of this control that result in unwanted arm movements during the object manipulation has a negative effect on the function and that is common in children with unilateral spastic cerebral palsy [10,12]. So, strong correlation was found between the level of manual ability and the level of dissociation which should be taken in account during rehabilitation to achieve maximum improvement in manual activity as possible [10,13].

SMC impairment involves movement patterns of upper limb dominated by flexor or extensor synergies that interfere with functional movements as drinking and eating and bathroom activities in children with cerebral palsy (CP) [7,14]. According to what is mentioned, emerging evidence of correlation of isolated movements and manual ability which has important implications for the treatment for children with CP [7,15].

Conclusion:

It was concluded that dissociated arm movements and manual ability are correlated in children with unilateral spastic cerebral palsy during middle childhood. This study supports the value of isolated arm movements and manual ability needed for active participation in daily life.

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