



## RESEARCH ARTICLE

### EFFECTIVENESS OF PLAY THERAPY ON GROSS MANUAL DEXTERITY IN CHILDREN WITH HEMIPARETIC CEREBRAL PALSY

<sup>1</sup>Samia A. Abdel Rahman, <sup>\*2</sup>Shaimaa Elsaied Mohamed Elshamy and <sup>3</sup>Sahar Mohamed Nour El-Dien

<sup>1</sup>Professor of Physical Therapy for Pediatrics, Faculty of Physical Therapy, Cairo University, Egypt

<sup>2</sup>Physical Therapist, Balteem General Hospital, Kafrelsheikh, Egypt

<sup>3</sup>Professor of Pediatrics and Genetics, Medical Genetic Center, Faculty of Medicine, Ain Shams University, Egypt

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##### \*Corresponding author:

Shaimaa Elsaied Mohamed Elshamy

#### ABSTRACT

**Background:** Play therapy is now considered an important part of physical therapy programs in children with cerebral palsy. **Objective:** The purpose of this study was to investigate the effectiveness of play therapy along with conventional physical therapy on gross manual dexterity in children with spastic hemiparetic cerebral palsy. **Participants and Methods:** 30 children with spastic hemiparetic cerebral palsy were divided into two equal groups; a control group received conventional physical therapy and a study group received play therapy in addition to the conventional physical therapy. The treatment was given 3 days per week for 6 successive weeks for both groups. Box and Block Test was used to measure gross manual dexterity of the affected upper extremity before as well as after intervention. **Results:** There is a non-significant difference between the control and study groups before as well as after intervention. However, there is a significant difference in each group when comparing between pre and post measures. The percentage of improvement in the gross manual dexterity is about 16.7% in the control group and about 46.4% in the study group. **Conclusion:** Play therapy combined with the conventional physical therapy may have a significant effect in improving gross manual dexterity in children with spastic hemiparetic cerebral palsy.

#### INTRODUCTION

Cerebral palsy (CP) is a neurodevelopmental condition that can be recognized from early childhood and is the result of antenatal, perinatal or neonatal brain injury (Rosenbaum *et al.*, 2007). It may be stated as a static encephalopathy in which, even though the primary lesion is static, the clinical pattern of presentation may change with time due to growth and developmental plasticity of the central nervous system (Sankar and Mundkur, 2005). Hemiplegic CP is a unilateral paresis with upper limbs affected more than the lower limbs. Voluntary movements are impaired with hand functions being most affected. Pincer grasp of the thumb, extension of the wrist and supination of the forearm are affected (Arnold *et al.*, 2007). Dexterity is a manual skill requiring rapid coordination of fine and gross movements based on a certain number of capacities developed through learning, training and experience. Speed and precision are the criteria used to measure this skill and the tests require high level hand-eye coordination as well as fine motor control of the hand (Barbier *et al.*, 2003). Manipulative movement includes both gross and fine motor manipulation. The gross one involves imparting force to, or receiving force from objects such as during throwing while the fine motor manipulation involves intricate use of the muscles of the hand and wrist such as during typing. The most basic aspects of manipulation are reaching, grasping and releasing (Gallahue and Ozmun, 1995). There are two hand uses; 1) extrinsic hand movements in which the object is held firmly by the fingers in the palm (gross manual dexterity) and 2) intrinsic hand movements in which the object is held in the hand itself (fine manual dexterity) (Elliott and Connolly, 1984).

The Box and Block Test (BBT) is often used in clinical rehabilitation settings to provide an indication of gross manual dexterity. It has increasingly been used to assess gross manual dexterity of the affected versus the non-affected hand in children and young adolescents with unilateral CP (Craje *et al.*, 2010; Mutsaerts *et al.*, 2006) to compare atypically developing children with age-related peers, and to assess the efficacy of intervention (Craje *et al.*, 2010; Sung *et al.*, 2005). BBT is a simple test that can be administered quickly to assess gross manual dexterity; these facets make the test a valuable and suitable test for very young children. (Jongbloed-Pereboom *et al.*, 2013) stated that BBT is valid and reliable for measuring gross manual dexterity in a fast and easy way in young children. Their study provided normative data for young children ages 3–10 years. They added that these scores can be used for comparison with atypically developing children, such as children with unilateral CP. Various techniques such as neurodevelopmental therapy, conductive education and conventional physical therapy methods like icing and stretching are usually applied for management of the children with CP. Apart from the techniques mentioned above, play therapy is among one of the modalities in physical therapy. Play therapy is helpful in developing hand-eye coordination, fine motor skills and gross motor skills (Buddhadev and Arya, 2012). In the present study attempts have been made to analyze the effects of conventional methods with play therapy to improve gross manual dexterity in children with spastic hemiparetic cerebral palsy and thus provide better outcome functionally.

## MATERIALS AND METHODS

### Participants

This randomized controlled single-blinded trial was conducted on 30 children with spastic hemiparetic CP. Participants were selected from Balteem General Hospital and Tabark Centre for Pediatric Rehabilitation, Kafrelshiekh city. The aim and procedures of the study were explained to every participant and their parents or caregiver and an informed consent was obtained before being enrolled in the study. The study was approved by the ethical committee of Department of Physical Therapy for Pediatrics, Faculty of Physical Therapy, Cairo University. Participants were randomly divided into two equal groups (control, study). Control group was treated with conventional physical therapy. Study group was treated with play therapy program in combination with the same conventional physical therapy.

**Inclusion criteria:** Included in this study were children with spastic hemiparetic CP, their age ranged from 3 to 7 years old, degree of spasticity was 1 and 1+ according to Modified Ashworth Scale, able to reach, grasp and release and able to understand and follow instructions.

**Exclusion criteria:** Excluded from this study were children with recent trauma to the upper extremity, with other type of CP, with visual, auditory or perceptual disorders and those with musculoskeletal limitations of both upper extremities.

### Methods

Participants were first assessed by the Modified Ashworth Scale to determine the degree of spasticity. Then the gross manual dexterity of the affected upper extremity was assessed by the use of BBT (Jongbloed-Pereboom *et al.*, 2013) before as well as after 6 successive weeks of intervention. Participants were randomly divided into two equal groups (control, study). Children in the control group received a conventional physical therapy program for the affected upper extremity consisting of icing on the long flexors of the forearm, stretching of the long flexors of the forearm, sponge ball exercises to the hand, hand weight bearing exercises and upper limb approximations. Each exercise was performed for 10 minutes with 2 minutes' rest in between and a total session time of an hour. The study group received the same conventional physical therapy program in addition to play therapy consisting of cutting with scissors, playing with wooden puzzles and playing with clay and blocks. The conventional physical therapy program was applied for 30 minutes and the play therapy program was performed for 30 minutes as well. The treatment for both groups was given three sessions per week for 6 successive weeks.

### Statistical analyses

The collected data were statistically analyzed using statistical package for the social sciences (SPSS) version 18 for Windows (SPSS, Inc., Chicago, IL). Means and standard deviations of the number of transmitted blocks was calculated. Paired sampled t-test was used to test statistical difference between pre and post measures for each group. Unpaired t-test was used to test statistical difference between both groups before as well as after the 6 weeks of intervention. All statistical analyses were significant at 0.05 level of probability.

## RESULTS

The general characteristics of the participated children are presented in table (1). The results revealed no significant differences between groups regarding age. The results revealed that there was no significant difference between groups regarding the number of blocks before as well as after intervention ( $p=0.751$  and  $p= 0.099$  respectively) (Figure 1). When a comparison was performed between pre- and post-measures for the mean number of blocks for the control group as well as for the study group, the results revealed a significant difference ( $p=0.001$ ) with a percentage of improvement of about 16.7% and 46.4% respectively indicating an improvement in the gross manual dexterity of the affected upper limb (Table 2).

## DISCUSSION

Play therapy is a developmentally responsive modality uniquely suited for children to help prevent or resolve psychosocial difficulties and achieve optimal growth and development. The concrete objects (toys, art, etc.) and other play-based experiences provided in play therapy afford children an age-appropriate and emotionally safe means to express their difficult experiences. For these reasons, play therapy is currently practiced by thousands of clinicians to treat their young clients; however, the scientific community has been less enamored, criticizing this modality's lack of an adequate research base to support its practice (Bratton *et al.*, 2005). (Kuhaneck *et al.*, 2010) found that "there is little literature on the play of children with disabilities compared with the enormous body of work on typical play development". In a literature review of toys that promote the use of both hands, (Greaves *et al.*, 2012) found no studies that included children with unilateral CP. This reflects the lack of evidence regarding how play is developed in children with disabilities. Hemiplegic cerebral palsy is the most common syndrome in children born at term, and is the second in frequency after diplegia in preterm infants (Hagberg *et al.*, 1996). There are several reasons why hand function is affected in hemiplegic CP children. It is often difficult for them to perform movements that counter the spasticity pattern. Poor postural control and the effect of reflex activity also affect the children's ability to coordinate their arms and hands to perform functional tasks smoothly (Eliasson and Gordon, 2000). The results of this study reveal non-significant difference between the control and study groups before as well as after intervention. However, there is a significant difference in each group when comparing between pre and post measures regarding the hand function as measured with Box and block test. The results also showed that the percentage of improvement of the hand function is about 16.7% in the control group and about 46.4% in the study group. As the percentage of improvement of the hand function as measured with Box and block test in the study group who received play therapy is more than that in the control group by about 29.7%, play therapy may be effective in improving gross manual dexterity in children with hemiplegic CP. However, the non-significance differences between the control and the study groups revealed from the results of this study after intervention could be attributed to small sample size, relatively short treatment period and/or less frequency of repetitions of the play activities included in the study.

Table (1). General characteristics of the participated children

| Variables      | Groups              | Control (Number:15) | Study (Number:15) |
|----------------|---------------------|---------------------|-------------------|
| Age            | Mean                | 4.57                | 4.83              |
|                | Standard Deviation  | 1.07                | 1.10              |
|                | Minimum             | 3.00                | 3.00              |
|                | Maximum             | 7.00                | 7.00              |
|                | t-value             | - 0.675             |                   |
| Sex            | p. value            | 0.898               |                   |
|                | Number (Percentage) |                     |                   |
|                | <i>Boys</i>         | 10 (66.70)          | 8 (53.30)         |
| Side of Lesion | <i>Girls</i>        | 5 (33.30)           | 7 (46.70)         |
|                | Number (Percentage) |                     |                   |
|                | <i>Right Side</i>   | 8 (53.30)           | 7 (46.70)         |
|                | <i>Left Side</i>    | 7 (46.70)           | 8 (53.30)         |

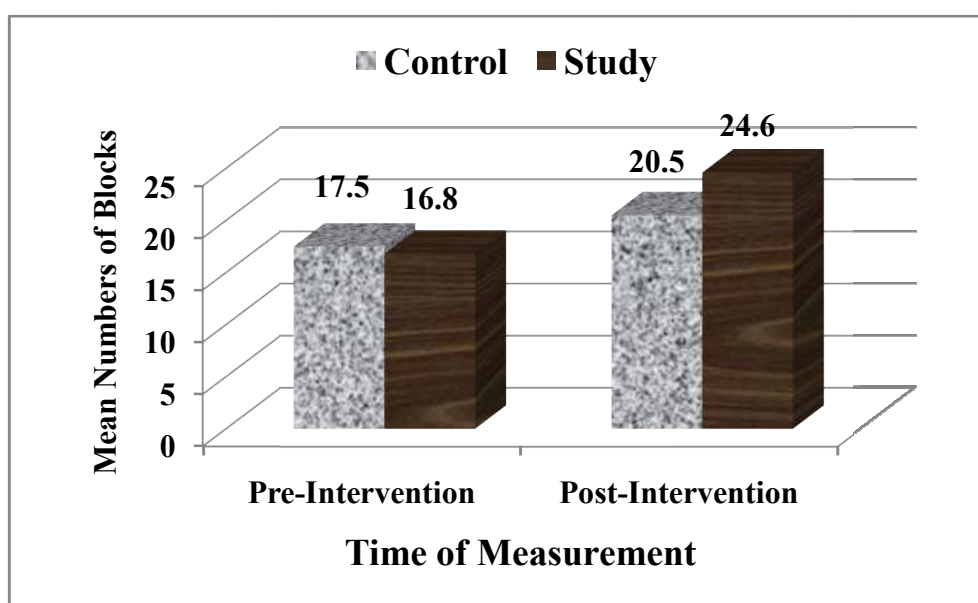


Figure (1). Comparison between groups regarding the numbers of blocks before as well as after intervention

Table (2). Comparison between pre- and post-intervention measures regarding the number of blocks for the control and the study groups

| Groups  | Time of Measurement | Mean  | SD   | Percentage of Improvement | t-value | p. value* |
|---------|---------------------|-------|------|---------------------------|---------|-----------|
| Control | Pre                 | 17.50 | 6.99 | 16.7%                     | -12.9   | 0.001     |
|         | Post                | 20.50 | 6.82 |                           |         |           |
| Study   | Pre                 | 16.80 | 5.43 | 46.4%                     | -16.6   | 0.001     |
|         | Post                | 24.60 | 6.46 |                           |         |           |

SD: Standard deviation

\*Significant level is set at alpha level  $\leq 0.05$

These results strong support the studies done by Schaaf (1990) and Smith and colleagues (Smith *et al.*, 2000) who states that play therapy enhances the fine motor outcomes in spastic CP. The post intervention results of the control group agree with Abd Elmaksoud and colleagues (Abd El-Maksoud *et al.*, 2011) who stated that the combination of cold therapy and conventional physical therapy and occupational therapy can reduce spasticity in children with spastic CP and can translate into practical functional gains in the hand function. The post treatment results of the study group could be supported by the opinion of Homeyer and Morrison (2008) who reported that play therapy is an effective means of responding to the mental health needs of young children and is widely accepted as a valuable and developmentally appropriate intervention. In a study of 38 children, half with CP and developmental delay and half typically developing, Okimoto and colleagues (Okimoto *et al.*, 2000) found that the children with CP and developmental delay scored significantly lower on the Test of Playfulness (ToP) than typically developing children. Improvements in scores on the ToP for children with CP and developmental delay were found to be statistically significant from pretest to posttest.

Therefore, playfulness in children with disabilities can change as a result of interventions. Children who lack an opportunity to play on a daily basis can achieve motor and developmental gains after participating in play sessions. In a longitudinal study of 19 children, 6 to 30 months old, at an Indian orphanage, (Taneja *et al.*, 2002) found that 90-minute play sessions increased children's independence. The authors added that play can fit into the routine care of children where environmental support is limited; and the effects of regular play may lead to motor development gains, such as better head and body control. This study reiterates that, with proper support for participation, play is a motivating way for children with disabilities to develop motor skills and enhance overall development. The post intervention results of the study group showed statistically significant improvement in gross manual dexterity for the children receiving the play therapy program in addition to the conventional physical therapy program. This comes in agreement with Buddhadev and Arya (2012) who stated that play therapy along with conventional therapy showed an improvement of hand function in children with spastic diplegia. As an intervention mode, play therapy maintains the child's attention, interest, and energy for the task

(Blanche, 1997). A playful environment reinforces the child's efforts in therapy. It engages the child and motivates him or her to attempt the activity and to sustain the effort (Pierce, 1997). When playing, the child also experiences joy or pleasure, and therefore associates positive affect with the activity at hand. Pleasurable experiences are ones that the child repeats and even initiates on another occasion; therefore, the skills associated with play are generalized and are likely to be practiced with peers and in other environments. Because play includes affective, social emotional, and cognitive components, as well as motor components, it provides opportunities for the child to integrate new skills into his or her daily behaviors (Bundy, 1991).

A physical disability may influence how, when, where, and what a child plays. Bly (1994) stated, "therapeutic intervention must be geared to enhancing the infant's motor skills – for the purpose of exploration, discovery, and learning"; exploration, discovery, and learning are components and results of play. Although play is difficult to generalize for children with disabilities, one commonality is that children with disabilities cannot interact with their environment in the same way as typically developing children (1977). Additionally, the severity of the disability determines the impact on play participation (1988). Through the use of daily activities, such as eating, sleeping, and play, motor development of children with disabilities is promoted (1992). Schaaf and Burke (1997) stated that play is like a food for the nervous system. As play enhances the capabilities of the nervous system, children learn to interact with their environment on a more complex level. Coonc and Nurkse (2014) stated that the most involved CP may be the most at risk of losing motor function over time, and that play based intervention may be one way to counteract this decline.

## Conclusion

The play therapy program combined with a selected physical therapy program has a significant effect in improving gross manual dexterity in children with spastic hemiparetic cerebral palsy. Play therapy can be added safely to the treatment program of hemiparetic CP children as an effective tool in improving gross manual dexterity and as a result, increases the child independency in daily life activities.

## List of abbreviations

- **CP:** cerebral palsy.
- **BBT:** box and block test.
- **TOP:** test of playfulness.

## Declarations

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**Availability of data and materials:** The datasets generated and/or analyzed during the current study are not publicly available due to current Cairo University regulations but are available from the corresponding author on reasonable request and after institutional approval.

## Authors' contributions

- **AS** contributed to the research idea, Data acquisition, analysis and interpretation.
- **ES** contributed to data acquisition, data analysis and interpretation. Both authors contributed to manuscript writing and reviewing.

**Ethics approval and consent to participate:** The aim and procedures of the study were explained to every participant, and an informed written consent was obtained from all participants before being enrolled in the study. The study was approved by the ethical committee of Department of Physical Therapy for pediatrics, Faculty of Physical Therapy, Cairo University.

**Consent for publication:** Not applicable

**Competing interests:** The authors declare that they have no competing interests (financial and non-financial). We declare that the research was conducted in absence of any commercial relationships that could be constructed as a potential conflict of interest.

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