

Throw and catch the ball games for children with dyskinesia-type cerebral palsy to improve eye-hand coordination movements

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Published online: August 31, 2021

(Accepted for publication August 15, 2021)

DOI:10.7752/jpes.2021.s4325

Abstract:

Disabled children have primary or secondary disorders in the muscular, bone, and joint systems that result in impaired coordination, communication, adaptation, mobility, and disruption of personal needs. This study aims to identify the effect of throwing and catching the ball games on the improvement of coordination movement in children with dyskinesia-type cerebral palsy. The population and sample were children with dyskinesia-type cerebral palsy. It was conducted in a foundation that was specially established to educate children with special needs, called YPAC (Foundation for Development of Disabled Children). It used an experimental method of a single subject research (SSR) design to determine the effect of the treatment on one subject. In total, it consisted of 15 meetings consisting of 5 meetings at baseline and 10 meetings at intervention. The baseline showed the ability to coordinate eye-hand movement in children with dyskinesia-type cerebral palsy which reaches 0%. In the intervention using throwing and catching the ball games, the children's ability to coordinate the eye-hand movement increased at the 9th and 10th meetings characterized by the increase in the percentage of 57.1% or (0.5% of 100%). Based on the results of the research, there is an effect of the throwing and catching the ball games for children with dyskinesia type cerebral palsy. The intervention affects the target behavior of 57.1% and an overlap percentage of 0%.

Key Words Throwing and Catching the Ball, Disabled, Hand-Eye Coordination.

Introduction

Physical disabled is the abnormality or dysfunctional that occurs in the body, such as bone, or muscle, and joint dysfunctional that caused less capacity for an individual to move in daily activities. The individual who has the physical disabled is facing issues with various sides from emotional, social, to work issues (Graham, 2005; Patel et al., 2020). The child with this issue is always experiencing difficulty in doing movements, it occurs because of muscle, bone, and joint dysfunctional or less flexibility. Flexibility is an important factor for successful performance. Previous studies have identified that adequate flexibility is important in both the prevention and rehabilitation of musculoskeletal disorder (Syahrudin et al., 2019).

Child with physical disabilities is experiencing dysfunction in muscle, bone, and joint system with a primary and secondary character which occurs coordination, communication, adaptation, mobility disorder, and personal needs development disorder (Abd Elmagid & Magdy, 2021; Graham, 2005; Patel et al., 2020; Rachmat, 2017) Furthermore, stated that Physical disabled occurs because of polio disease, accident, inherited, has dysfunctional since born, muscle dysfunctional because of brain inflammation and motoric abnormality which caused by the center of nerve or cerebrum damage (Clutterbuck & Auld, 2020)

Various kinds of opinion from the results of the cause of cerebral palsy researches which has propounded by the researchers to know how far the child's development and management can work alongside with the abnormality. Cerebral Palsy is a physical disability that generally happens to children. Cerebral palsy is described as a group with motion and postural disorder that is also accompanied by the secondary musculoskeletal disorder. 50-65% of children are experiencing cerebral palsy abnormality (AlSaif & Alsenany, 2015; Graham, 2005)

The initial signs of cerebral palsy which can be observed are the occurrence of *quadripareisis*, *hemipareisis*, and *dipareisis* which influenced the motions of upper and lower limbs with different degree of disruption which depends on the damage level, start from *hypoksia cerebral* or *iskemia*. 1-2,5:1000 is the ratio of cerebral palsy case rate in world total labor.

A child with cerebral palsy is having a non-progressive motoric abnormality caused by imperfect development and damage in one or several parts that be in charge of brain control and motoric activity, especially motion (Koldoff & Holtzclaw, 2015; Priego Quesada et al., 2014). So, because of the nerve control

disorder, a child with this abnormality will tend to does not have control of his motion consciously and effectively. Cerebral palsy (CP) is a kind of disorder or abnormality that is included in the child Physical disabled group (Cordero, 2014; Lauruschkus et al., 2017).

In general, Cerebral Palys classified into several kinds which are, Monoplegia, Hemiplegia, Diplegia, Quadriplegia, and Triplegia. Monolepogia and Triplegia are the kinds that rarely to found. The risk factor of cerebral palsy can happens before and during pregnancy, labor, birth, and a short period after birth. The risk factor before the pregnancy period occurs because of the social factor, which is poverty and lack of knowledge about abnormality that happens to baby (cerebral palsy). The risk factor during pregnancy is caused by gen abnormality in family, both come from males and females. The factor during the labor process is identified by the process of labor itself, premature or non-premature. The factor of birth, this risk factor can be observed by the level of growth when the baby is born (Abd Elmagid & Magdy, 2021)

Cerebral Palsy according to the movement disorder types, as follows: 1. Spastik 2. Dyskinesia 3. Ataxia 4. Campuran. while according to the body part that gets affected by disorder is divided into 1. Monoplegia 2. Hemiplegia 3. Paraplegia 4. Diplegia 5. Triplegia 6. Quadriplegia.

Cerebral Palsy, Dyskinesia is generally marked by no control and coordination in movement. Moreover, Cerebral Palsy Dyskinesia is the combination of hypertonia and hypotonia which deals in uncontrollable movement. People with cerebral palsy dyskinesia have a body position issue to sit and walk, they also show some uncontrollable motion. The damage occurs in the extrapyramidal motor system or pyramidal tract to basal ganglia (Monbaliu et al., 2017; Qin et al., 2018) Cerebral Palsy Dyskinesia is the result of basal ganglia damage which experienced since early life. The symptoms appear marked by a hyperkinetic or dystonic movement that harms the function of hand movement (Monbaliu et al., 2017; Qin et al., 2018; Reid et al., 2018; Sun et al., 2018)Hyperkinetic or dyskinetic is a disorder marked by excessive movement in muscle so, it can bother in controlling normal movement. Dyskinesia is included as a different type if it is compared to Chorea-Ballism, dystonia, myoclonus, tich, dan tremor (Sun et al., 2018).

Dyskinesia or palsy athetosis is characterized by hypotonia and slow movements of the extremities, shoulders, facial muscles, and uncontrollable writhing. People with this type often experience changes in the muscles in all their limbs, muscles become stiff during activities and normal during sleep (Haberfehlner et al., 2019). The uncontrollable movements that are experienced are sometimes random and can be rhythmic regularly, the movements look very strange based on the opinion of society. Movement can be started and stopped depending on the patient such as Parkinson's sufferer. Smooth movements can also be produced depending on the joints of the sufferer. A movement that occurs spontaneously and looks stiff is very common, such as gyrations and stiffness movements that occur in all parts of the patient's body. Spontaneous movements and movement rigidity are part of dyskinesia(Okur et al., 2021).

Movement coordination is the ability in combining different movements into one certain movement pattern. The coordination of eye-hand is the ability in doing right certain movements that involve eye and hand as the main determinant to conduct the movement (Koldoff & Holtzclaw, 2015; Lee et al., 2016; Qin et al., 2018) The coordination exercise for cerebral palsy dyskinesia children is using the manipulative movements skills exercise method. Manipulative movements is a motoric skill which involves the control of object outside the body to the body or body part. Manipulative skills are differentiated into three parts based on their kind, which is: 1. Moving objects: throw, hit, kick. 2. Increase controlling: catch, collect, take. 3. Moving together: carrying, dribbling, rolling the ball, throwing, catching, kicking, herding, hitting(AlSaif & Alsenany, 2015; Angelin et al., 2018; Boroumand et al., 2017; Huang et al., 2014; Kataoka et al., 2020; Koldoff & Holtzclaw, 2015; Lauruschkus et al., 2017; Lee et al., 2016)

Method

The experiment method is the method that is used for conducting this research by using Single Subject Research (SSR) design, which is a research that is conducted in order to know how much the influence of certain actions given to the subject. The research with Single Subject Research (SSR) is a single subject with research procedures using experimental design to see the effect of treatment on changes in behavior quantitatively.

The research that needs repetition in taking data toward the observed individual, taking the data or test can be conducted periodically, such as weekly, daily and every hour with conditional rest hour.

A-B research design is used in this research. A-B design is the basic design from single-subject experimental research. This procedure design is arranged on the basis of what is known as baseline logic. Baseline logic shows a certain repetition of behavior measurement or behavior target to the baseline condition (A) and intervention condition (B). The chosen intervention procedure and technique always be directed to change someone's environment in helping the subject can participate in society. Environmental degana is anything that can affect a person's behavior in the form of objects, events or humans.

Data collection tools in this study were recording events. Data were collected using a data collection format, namely the data collection format at baseline conditions and in intervention conditions. The tools used in data collection through action tests and the target size of this study used percentages. The calculation of the percentage of children's abilities formulated as follows:

Formula : $\frac{\text{the child's score}}{\text{total score}} \times 100\%$

This analysis is using endo-condition analysis and inter-condition analysis.

Result and discussion

The observation toward the baseline condition is when the child is asked to throw the ball up and catch the ball again. There is no direction to the catching so, the sample will only focus to throw up and catch the ball. Scoring in the baseline condition will be given if the sample can do the throwing and catching correctly.

Based on the obtained data through eyes-hands movement coordination skill to baseline condition (A) treatment test, it can be observed that the sample is not able to do catching correctly by showing this table below:

Baseline Condition (A)

Table 1. The Subject's Eye and Hand Movement Coordination Ability

Meetings	Date	Score	Percentage
1	Saturday/25 February 2017	0	0%
2	Tuesday/28 February 2017	0	0%
3	Saturday/ 4 March 2017	0	0%
4	Tuesday/ 7 March 2017	0	0%
5	Saturday/ 11 March 2017	0	0%

Eyes-hands movement coordination ability data can be seen in this graphic below for clearer explanation:

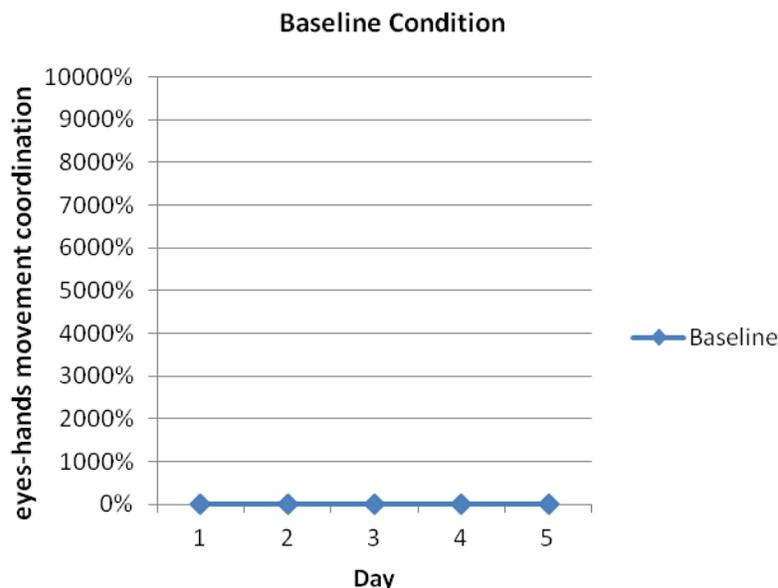


Figure 1. The Graphic of The Ability to Coordinate Eye and Hand Movements in Baseline Conditions

Intervention conditions is a treatment given to the child. The treatment is throwing and catching a ball game, by throwing the ball up and catching the ball using hands. The sample will get a 100 score if the sample can catch the ball correctly. This treatment is conducted in 10 meetings with 15 minutes of duration. The aims from this intervention are to train sample's eyes and hands movement coordination skill that has issues in movement coordination skills. These are the obtained data in the intervention condition:

Table 2. The Ability to Coordinate Eye and Hand Movements in The Conditions of Intervention

Meetings	Date	Score	Percentage
1	Monday/ 13 March 2017	1	14,3%
2	Tuesday/ 14 March 2017	1	14,3%
3	Thursday/ 16 March 2017	1	14,3%
4	Saturday/ 17 March 2017	2	28,5%
5	Monday/ 20 March 2017	2	28,5%
6	Tuesday/ 21 March 2017	2	28,5%
7	Thursday/ 23 March 2017	3	42,9%
8	Saturday/ 25 March 2017	3	42,9%
9	Monday/ 27 March 2017	4	57,1%
10	Tuesday/ 28 March 2017	4	57,1%

Based on the data, the sample is experiencing well transformations. It means that there are eyes and hands movement coordination developments. In the ninth and tenth meetings, the child has got better in movement coordination skills. The data is shown in a graphic below for a clearer explanation:

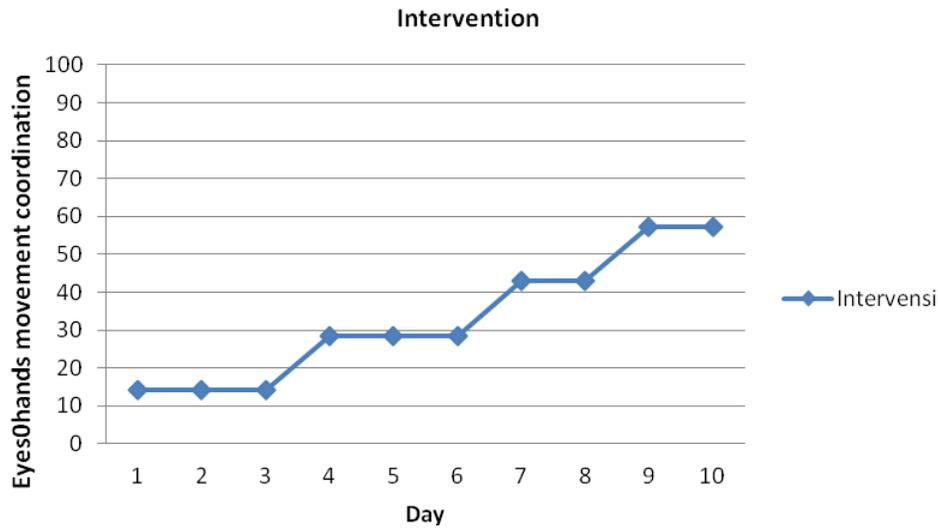


Figure 2. The Graphic of The Ability to Coordinate Eyes and Hand Movements in The Intervention Condition

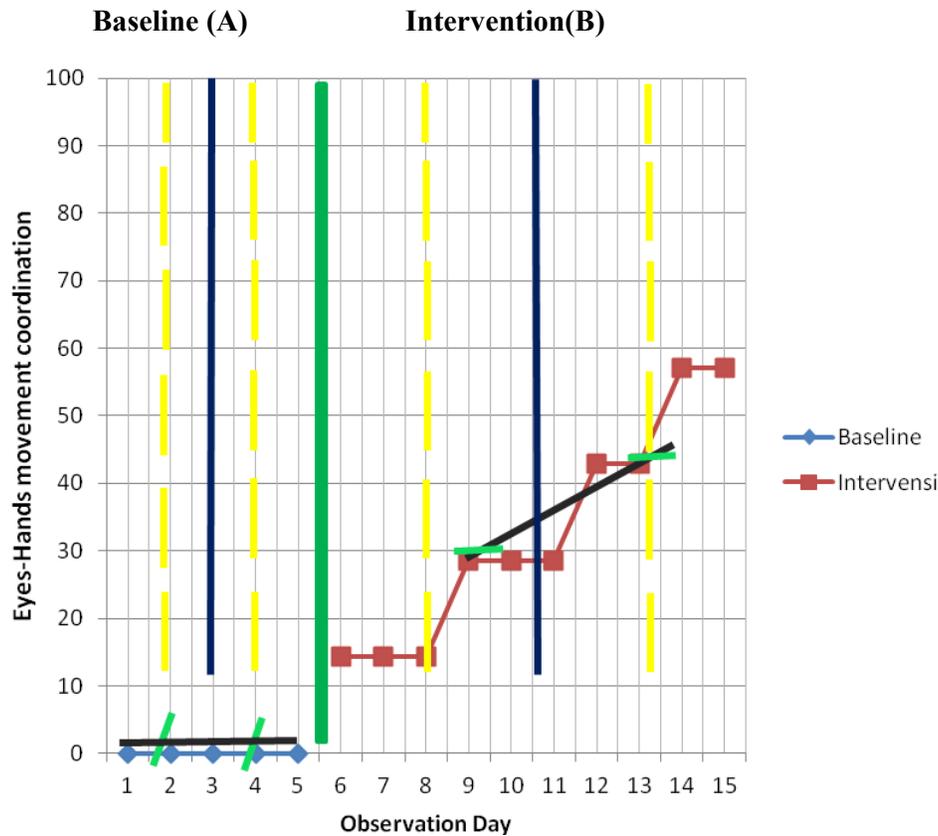


Figure 3. The Graphic of Recapitulation Analysis of Hand-Eye Coordination Ability

Based on the data analysis, it shows that throwing and catching the ball games can improve eyes and hand movement coordination skill to cerebral palsy dyskinesia type child. In baseline condition (A) shows that eyes-hands coordination skills in a cerebral palsy child with dyskinesia type in amount of 0% which is observed during five meetings.

In intervention condition (B) using throwing and catching the ball games that were conducted in 10 meetings, the result shows that there is a significant increase. However, the increase occurs gradually and has a positively ups and downs graphic. eyes-hand coordination skill in the cerebral palsy child with dyskinesia type can experience development in ninth and tenth meetings, it is marked by the acquisition of percentage in the amount of 57,1% or (0,5% of 100%). Based on the explanation of the results of research, it can be concluded that throwing and catching a ball game can improve the eyes-hands coordination skill in the cerebral palsy child with dyskinesia type, and supported by several experts (AlSaif & Alsenany, 2015; Boroumand et al., 2017; Huang et al., 2014; Kataoka et al., 2020; Lee et al., 2016)

Conclusions

The result of this study shows that throwing and catching balls can improve eyes and hands movement coordination skill to child with cerebral palsy dyskinesia type. Based on the explanation of the results of research, it can be concluded that throwing and catching a ball game can improve the eyes-hands coordination skill in the cerebral palsy child with dyskinesia type.

Acknowledgements

The Authors would like to thank you to university and the experts

References.

- Abd Elmagid, D. S., & Magdy, H. (2021). Evaluation of risk factors for cerebral palsy. *Egyptian Journal of Neurology, Psychiatry and Neurosurgery*, 57(1), 1–9. <https://doi.org/10.1186/s41983-020-00265-1>
- AlSaif, A. A., & Alsenany, S. (2015). Effects of interactive games on motor performance in children with spastic cerebral palsy. *Journal of Physical Therapy Science*, 27(6), 2001–2003. <https://doi.org/10.1589/jpts.27.2001>
- Angelin, A. C., Sposito, A. M. P., & Pfeifer, L. I. (2018). Influence of functional mobility and manual function on play in preschool children with cerebral palsy. *Hong Kong Journal of Occupational Therapy*, 31(1), 46–53. <https://doi.org/10.1177/1569186118783889>
- Boroumand, S., Hassani Mehraban, A., Dadgou, M., & Raji, P. (2017). Virtual Reality Practice, Computer Games, and Improvement of Cerebral Palsy Balance: A Single Subject Study. *Journal of Modern Rehabilitation*, 11(1), 23. <https://doi.org/10.18869/nirp.jmr.11.1.23>
- Clutterbuck, G. L., & Auld, M. L. (2020). High-level motor skills assessment for ambulant children with cerebral palsy : a systematic review and decision tree. 693–700. <https://doi.org/10.1111/dmnc.14524>
- Cordero, L. F. (2014). La movilidad sostenible en campus universitarios: Una comparación de las mejores prácticas en Estados Unidos y Europa. *Aplicabilidad en universidades Venezolanas. Revista de La Facultad de Ingeniería*, 29(2), 23–40. <https://doi.org/10.1097/GRF.0b013e3181870ba7>.Diagnosis
- Graham, H. K. (2005). Classifying cerebral palsy. *Journal of Pediatric Orthopaedics*, 25(1), 127–128. <https://doi.org/10.1097/00004694-200501000-00026>
- Haberfehlner, H., Goudriaan, M., Bonouvrié, L. A., Jansma, E. P., Harlaar, J., Vermeulen, R. J., Krogt, M. M. Van Der, & Buizer, A. I. (2019). Instrumented assessment of motor function in dyskinetic cerebral palsy: A literature review. *Gait & Posture*, 73, 439–440. <https://doi.org/10.1016/j.gaitpost.2019.07.169>
- Huang, P. C., Pan, P. J., Ou, Y. C., Yu, Y. C., & Tsai, Y. S. (2014). Motion analysis of throwing Boccia balls in children with cerebral palsy. *Research in Developmental Disabilities*, 35(2), 393–399. <https://doi.org/10.1016/j.ridd.2013.11.017>
- Kataoka, M., Okuda, K., Iwata, A., Imura, S., Yahagi, K., & Matsuo, Y. (2020). Throwing distance and competitive performance of Boccia players. *Journal of Physical Therapy Science*, 32(9), 574–577. <https://doi.org/10.1589/jpts.32.574>
- Koldoff, E. A., & Holtzclaw, B. J. (2015). Physical Activity Among Adolescents with Cerebral Palsy: An Integrative Review. *Journal of Pediatric Nursing*, 30(5), e105–e117. <https://doi.org/10.1016/j.pedn.2015.05.027>
- Lauruschkus, K., Hallström, I., Westbom, L., Tornberg, Å., & Nordmark, E. (2017). Participation in physical activities for children with cerebral palsy: feasibility and effectiveness of physical activity on prescription. *Archives of Physiotherapy*, 7(1), 1–12. <https://doi.org/10.1186/s40945-017-0041-9>
- Lee, W. C., Reyes-Fernández, M. C., Posada-Gómez, R., Juárez-Martínez, U., Martínez-Sibaja, A., & Alor-Hernández, G. (2016). Using health games for rehabilitation of patients with infantile cerebral palsy. *Journal of Physical Therapy Science*, 28(8), 2293–2298. <https://doi.org/10.1589/jpts.28.2293>
- Monbaliu, E., Himmelmann, K., Lin, J. P., Ortibus, E., Bonouvrié, L., Feys, H., Vermeulen, R. J., & Dan, B. (2017). Clinical presentation and management of dyskinetic cerebral palsy. *The Lancet Neurology*, 16(9), 741–749. [https://doi.org/10.1016/S1474-4422\(17\)30252-1](https://doi.org/10.1016/S1474-4422(17)30252-1)
- Okur, E. O., Inal-Ince, D., Saglam, M., Vardar-Yagli, N., & Arikan, H. (2021). Physical activity patterns in children with cerebral palsy and typically developing peers. *Physiotherapy Theory and Practice*, 37(6), 710–718. <https://doi.org/10.1080/09593985.2019.1641863>

- Patel, D. R., Neelakantan, M., Pandher, K., & Merrick, J. (2020). Cerebral palsy in children: A clinical overview. *Translational Pediatrics*, 9(1), S125–S135. <https://doi.org/10.21037/tp.2020.01.01>
- Priego Quesada, J. I., Lucas-Cuevas, A. G., Llana-Belloch, S., & Pérez-Soriano, P. (2014). Effects of exercise in people with cerebral palsy. A review. *Journal of Physical Education and Sport*, 14(1), 36–41. <https://doi.org/10.7752/jpes.2014.01006>
- Qin, Y., Li, Y., Sun, B., He, H., Peng, R., Zhang, T., Li, J., Luo, C., Sun, C., & Yao, D. (2018). Functional Connectivity Alterations in Children with Spastic and Dyskinetic Cerebral Palsy. *Neural Plasticity*, 2018. <https://doi.org/10.1155/2018/7058953>
- Rachmat, F. (2017). Brain Disorders (Cerebral Palsy) And The Ability Of Academic. *Journal of Educational Science and Technology (EST)*, 3(2), 122. <https://doi.org/10.26858/est.v3i2.3564>
- Reid, S. M., Meehan, E. M., Reddihough, D. S., & Harvey, A. R. (2018). Dyskinetic vs Spastic Cerebral Palsy: A Cross-sectional Study Comparing Functional Profiles, Comorbidities, and Brain Imaging Patterns. *Journal of Child Neurology*, 33(9), 593–600. <https://doi.org/10.1177/0883073818776175>
- Sun, D., Wang, Q., Hou, M., Li, Y., Yu, R., Zhao, J., & Wang, K. (2018). Clinical characteristics and functional status of children with different subtypes of dyskinetic cerebral palsy. *Medicine (United States)*, 97(21). <https://doi.org/10.1097/MD.00000000000010817>
- Syahrudin, S., Imam, I. S., Lungit, L., Ramdan, R. P., & Bagus, B. W. (2019). Infrared Sensor Technology (IST) Test as a Tool for Assessment of Flexibility. 3, 5–9.