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Effect of Play-Based Occupational Therapy on Hand Function of Children with Cerebral Palsy: A Quasi-Experimental Study

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ABSTRACT

Objective(s): This study aims to improve hand function in children with cerebral palsy through using of play therapy methods: clay, beads, and sand, and find most effect method.

Methods: A quasi- experimental study employed pre-test and posttest design with control group. It was conducted at the Centre of Medical Rehabilitation and Arthritis in Baghdad city, at the period November 25th, 2024, to February 13th, 2025. A non-probable sample of 64 children with cerebral palsy was selected by non-random sampling method, they were distributed into one control group and three intervention groups. Both groups continue with their routine care in the center, and only the intervention group expose to play therapy intervention. The Box and Block Test was used to assess children`s hand function before and after play intervention. The data was analyzed by using descriptive and inferential statistics by SPSS program.

Results: The result showed no significant differences in the means score of hand function in the both groups before play intervention. However, after the intervention a significant difference was clear in sand and clay intervention groups. The statistics showed clay therapy was most effective at, P value ≤ 0.05.

Conclusion: Nursing interventions incorporating play therapy methods are effective in improving hand function in children with CP. These methods consider child-friendly and engaging valuable methods.

Recommendations: A cohort study is recommended to assess the long-term effects of play interventions. Pediatric nurses need to integrate these play-based therapies and family's participation to enhance motor skills of hand function in children with CP.

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أثر علاج وظيفي قائم على اللعب على وظيفة اليد للاطفال المصابين بالشلل الدماغي: دراسة شبة تجريبية

المستخلص

الأهداف: تهدف هذه الدراسة إلى تحسين وظيفة اليد لدى الأطفال المصابين بالشلل الدماغي من خلال استخدام أساليب العلاج باللعب: الطين، والخرز، والرمل، وتحديد أكثر طريقة فعّالة منها

منهجية البحث: تم استخدام تصميم شبه تجريبي يتضمن اختباراً قبلياً وبعدياً مع مجموعة ضابطة. أُجريت الدراسة في مركز التأهيل الطبي والأمراض الروماتيزمية في مدينة بغداد للفترة من ٢٥ نوفمبر ٢٠٢٤ إلى ١٣ فبراير ٢٠٢٥. تم اختيار عينة غير احتمالية مكونة من ٦٤ طفلاً مصاباً بالشلل الدماغي باستخدام طريقة غير عشوائية، وجرى توزيعهم إلى مجموعة ضابطة وثلاث مجموعات تدخلية. استمرت جميع المجموعات في تلقي الرعاية الروتينية في المركز، بينما تعرضت فقط المجموعات التدخلية للعلاج باللعب. تم استخدام اختبار الصندوق والكتل (Box and Block Test) لتقييم وظيفة اليد قبل وبعد التدخل. وقد تم تحليل البيانات باستخدام الإحصاء الوصفي والاستنتاجي عبر برنامج SPSS

النتائج: أظهرت النتائج عدم وجود فروق ذات دلالة إحصائية في متوسط درجات وظيفة اليد بين المجموعات قبل التدخل. ومع ذلك، بعد التدخل ظهر فرق معنوي واضح في مجموعتي الطين والرمل، وأظهرت الإحصاءات أن العلاج بالطين كان الأكثر فعالية عند قيمة $P \leq 0.05$

الاستنتاج: تُعد التدخلات التمريضية التي تتضمن أساليب العلاج باللعب فعالة في تحسين وظيفة اليد لدى الأطفال المصابين بالشلل الدماغي. وتُعد هذه الأساليب صديقة للطفل وجذابة، وتمثل وسائل قيّمة في الرعاية

التوصيات: ي يوصى بإجراء دراسة جماعية (cohort study) لتقييم التأثيرات طويلة الأمد لتدخلات اللعب. كما يُنصح بأن يدمج الممرضون المتخصصون في طب الأطفال هذه العلاجات القائمة على اللعب بمشاركة الأسرة لتعزيز المهارات الحركية لوظيفة اليد لدى الأطفال المصابين بالشلل الدماغي

الكلمات المفتاحية: الشلل الدماغي، وظيفة اليد، اللعب العلاجي، تأهيل الأطفال، التداخلات التمريضية.

Introduction

Cerebral Palsy (CP) is one of the most prevalent motor disabilities in childhood, characterized by impaired movement and posture due to non-progressive damage to the developing brain [1]. CP often exhibit, abnormal postures, and limited mobility, and delays in gross motor developmental [2,3]. the term "*cerebral* "related to the brain;" *palsy*" means the partial or complete loss of motor function [4].

As a result of these motor impairments children with CP commonly experience secondary complication such as joint deformities, muscle contractures, hip dislocation, and scoliosis [5]. These conditions significantly affect the child's ability and limit functional independence [6]. Globally, CP affects approximately 2-3 per 1,000 live births. With higher prevalence (5-10 times more) reporting in developing countries [7,8]. CP is typically classified based on motor types spasticity, dyskinesia, and ataxia or to the distribution of motor impairment quadriplegia, diplegia, and hemiplegia [9,10].

Given these physical limitations, children with CP often struggle with mobility, sensory processing, cognitive development, and social interaction, all of which contribute to reduced independence and quality of life [11]. Despite advances in medical care, the long-term prognosis and functional participation of children with CP remain challenging. To address these issues, researchers have explored various therapeutic approaches, including the integration of play therapy into rehabilitation. Play therapy is considered a promising strategy that not only encourages engagement but may also improve motor skills in children with developmental disorders [12].

Evidence suggests that structured play activities can enhance both fine and gross motor function in individuals with CP [13]. However, despite these promising findings, there is a need for more targeted studies

examining the specific effects of different play therapy strategies on upper limb function particularly hand function in children with CP. Therefore, this study aims to evaluate the effectiveness of selected play therapy interventions by clay, beads, and sand play on improving hand function in children aged 3 to 7 years with cerebral palsy.

Research Question: Dose the use of play therapy methods (clay, beads, and sand) improve hand function in children with cerebral pals? Which method is most effect?

Methods

Study Design and Setting

Quantitative study, quasi experimental design was used to examine the effect of play therapy by applying clay, beads, and sand for improving hand function in children with CP. This method is used to demonstrate the cause-and-effect relationship between the independent variable (play therapy) and dependent variable (hand function) [14]. The study was conducted at the Centre of Medical Rehabilitation and Arthritis in Baghdad city.

Study Sample and Sampling

The population of study are 99 children diagnosed with CP in the medical records of the center. A sample of 79 children determined with the criteria of the study. Of these (15) children were excluded for their participated in pilot study and refused to participated. A purposive sample of 64 children were eligible at the time of data collection and agreed to take part. The sample was then divided into four groups: the clay, beads, sand and the control groups, in each group the required a minimum sample size is 16 that determined. The sample size was calculated using a conventional sample size formula for proportions, assuming a 50% population proportion (to ensure maximum variability), a 5% margin of error, and a 95% confidence level (Z = 1.96). The study's sample was chosen based on the following criteria: children aged 3 to 7 years, medically diagnosed with hemiplegia right side cerebral palsy (CP), both male and female. All children in the study were conscious and had hand dysfunction. Children were excluded if they had undergone recent hand surgery or received other therapeutic interventions targeting hand function within the last six months. Additionally, children under than 3 years or older than 7 years, those diagnosed with Erb's palsy, facial palsy, monoplegia, tetraplegia, quadriplegia, the effected left side of the body and participants in the pilot study were excluded.

Study Instruments

The instrument of the study includes hand function test by Box and Block Test (BBT). This test was used to assess hand function improvement, which originated by Desrosiers et al (1994) and still used by many researchers for the same purpose with accepted validity and reliability [15]. The BBT is a wooden box divided by a partition into two sections, containing 150 blocks, figure (1). In addition to the collection of children`s data (age, sex, the current weight, address and city).

Figure (1) Wooden of Box and Block Test [15].

In Box and Block Test, requesting the child to transfer one block at a time, with a maximum of blocks, from one compartment to another within a 60-second timeframe. During each trial, individuals get instructions advising them to ensure their fingers cross the partition when transferring the blocks, and they are not required to retrieve any blocks that may fall beyond the box [16].

Data Collection and Application of Nursing Care Practice

Prior to starting therapy each child's hand functions were assessed by BBT to identify area of difficulty such as cross motor control and range of motion. Set up the child in free and comfortable environment that allows free movement child's arm and hand, introduces the child to type of play therapy that uses (clay, beads, sand). The study period started from 25th November, 2024 to 13th February, 2025.

Before the implementation of the intervention strategies the study sample were divided into four groups. They are exposed to a pre-test, post -test1 and post -test 2 and content was focused on the objectives. The test was conducted for all children before starting the interventions, the BBT was used to measure hands functions. Children were quasi-randomly assigned to four groups (control, clay, beads, sand).

The researcher was used three types of play therapy clay, sand and beads. these types were used previously in some researcher with adult and children to improve hand functions. All the used materials (clay, beads, sand) were following the safety measure, and were proved by the physician and technical therapist at each center. In additional parents of children were assist as supervisor during children playing to avoid any risk or hazard.

The intervention last for 12 weeks with assessments conducted at baseline (week 4, week 8, week 12 end of intervention) (figure 2). Sessions of intervention lasted for three months, with two sessions per week, each lasting one hour. A WhatsApp group was created with parents to follow up on the program. Measurements were taken in the 4, 8, and 12 weeks.

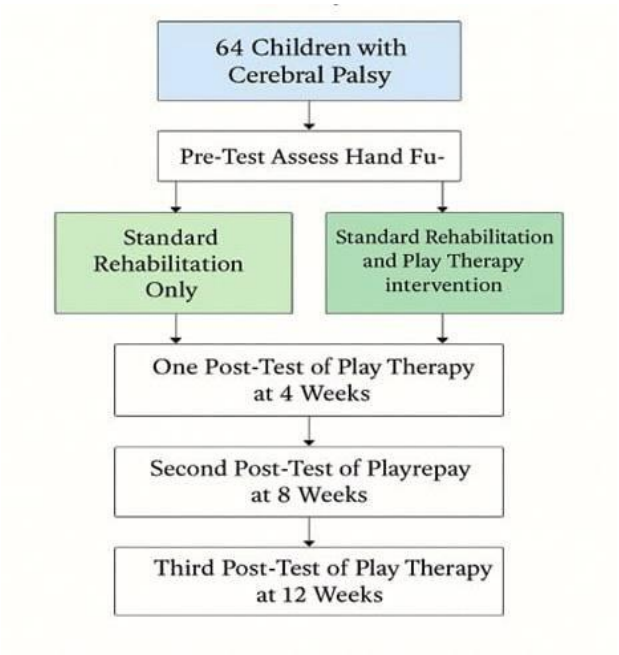

Figure (2) Intervention Process

Ethical Considerations

The Research Ethics Committee at the College of Nursing, University of Baghdad approved the study. The formal administrative request had been obtained from Central Statistical Organization, Ministry of Planning, and Health Department Al-Rusafa Health Directorate, Centre of Medical Rehabilitation and Arthritis in Baghdad city to carry out the study. The ethical considerations were strictly adhered to, including obtaining consent from all parents, who were informed of the study's objectives, purpose, and the benefits of play therapy. All participants were made aware of their autonomy and right to refuse involvement.

Data Analysis

A critical step in nursing research is data analysis to describe them. Descriptive statistics in terms of (frequency, percentage, mean score, and standard deviation) used to describe the socio-demographic data. The inferential statistics (Cronbach Alpha was used to assess the internal consistency of the questioner, ANOVA was employed to compere mean hand function scores among the three-intervention group and one control group, Friedman Test was used for within

group comparisons across different time points, Spearman's correlation was used to examine the relationships between selected study variable's). The data was analyzed and interpreted using the Statistical Package for Social Sciences (SPSS) version 27.0.

Results

Table 1. Distributions of Study Sample Sociodemographic Data

Socio -Demographic Data		Study Groups									
		Intervention						Control		Total	
		Clay		Beads		Sand					
		F	%	F	%	F	%	F	%	F	%
Sex	Male	9	56.3%	8	50.0%	9	56.3%	9	56.3%	35	54.69%
	female	7	43.8%	7	43.8%	8	50.0%	7	43.8%	29	45.31%
Wight	Mean± SD	17.28±3.27		16.56±6.29		14.31±3.44		15.22±3.78		15.84±3.23	
Age	Mean± SD	4.00±1.36		4.94±1.73		4.13±1.45		4.25±1.48		4.33±1.52	
Total		16 (100%)		16 (100%)		16 (100%)		16 (100%)		64 (100%)	

F= Frequency, **%**= Percentage, **M**= Mean, **SD**= Standard deviation

Table (1) shows that the mean of children`s age was (4.33±1.52) in all groups, (54.69%) were male, while (45.31%) were female. The mean weight was (15.84±3.23).

Table 2. Comparison of Mean Score of Children`s Hand Function at Different Time Periods

Period of study		**Study Groups Hand function**				**Statistical Tests**		
		Clay	**Beads**	**Sand**	**Control**	**F test**	**P value**	**Sig**
Pre test		19.56±10.04	14.75±7.05	16.94±7.47	14.81±6.73	1.31	0.279	NS
Post test1		23.38±9.86	14.81±7.02	18.38±7.43	14.94±6.89	4.14	0.010	S
Post test2		25.69±9.09	14.94±7.31	23.06±8.09	14.88±6.55	8.11	0.001	HS
Statistical Tests	Friedman test	30.72	0.75	29.41	0.36			
	Asymptotic sig	0.001	0.687	0.001	0.832			

F= Fisher Test, **P value** ≤ 0.05, **NS** = Non- Significance, **S**= Significance, **HS**= Highly-Significance

Table (2) shows no significant differences in the mean scores among study groups (clay, beads, sand, and control) in the pre-test. In Post -test 1 and 2, a significant difference was observed among them at (P =value 0.010), (P value=0.001) respectively. In addition, only clay and sand groups showed a difference in their hand function means score before and after the intervention at (P value

=0.001). No correction (e.g., Bonferroni) was applied for multiple comparisons, given the exploratory aim of the study and the limited number of comparisons.

Table 3. Inter-Group Comparisons for The Effective Play Therapy Groups

Study Groups	Post -Test 1		Post -Test 2	
I vs. J	**Mean Difference (I-J)**	**P values**	**Mean Difference (I-J)**	**P values**
Clay Vs. Control	8.438[a]	.036	10.813[b]	.003
Clay Vs. Beads	8.563[a]	.032	10.750[b]	.004
Clay Vs. Sand	5.000	.369	2.625	.825
Beads Vs. Control	-.125	1.000	.063	1.000
Beads Vs. Sand	-3.562	.655	-8.125[c]	.043
Sand VS. Control	3.438	.680	8.188[c]	.041

I= Intervention, **J**= Control, (*) Statistically Significance at P value ≤ 0.05.

Table (3) reveals that clay therapy group was more significant in Post-test 1 and Post-test 2 at (P value ≤ 0.05). In contrast, sand therapy group was significant only in Post-test 2 at (P value ≤ 0.05

Discussion

The majority of children in all study groups were 3 years old (43.75%), with a mean age of 4.33±1.52 years. This suggests that most participants were within the early childhood stage, a critical period for developmental interventions. This finding aligns with previous studies from Denmark and Australia that emphasized the effectiveness of early interventions between ages 3-6 for improving motor skills in children with CP [17, 18]. Males constituted 54.69% of the sample, consistent with studies in the U.S. reporting a higher prevalence of CP in males (male-to-female ratio 1.4:1) [19,20].

Biological factors, such as brain structure and hormonal differences, may contribute to this sex disparity [21]. Children from rural areas dominated the sample. This reflects findings from a 2016 United States study, which suggested that families in rural settings may face more barriers in accessing CP-related healthcare and rehabilitation services [22]. The current findings are consistent with a previous study conducted in California, which highlighted nutritional and growth challenges in children with cerebral palsy due to feeding problems and increased metabolic needs [23,24] .Similarly, El-Shafie et al. (2019) in Egypt reported significantly lower weight-for-age and height-for-age percentiles in children with CP [25].

Significant improvements in hand function were observed in the intervention groups, especially the clay and sand groups, by post-test 2 (P= 0.001). This supports the benefit of sensory-based play in motor rehabilitation. Hines et al. (2019) found similar outcomes using play-based upper limb therapy (HABIT). This aligns with findings from Hines et al. (2019) reported that an intensive, play-based intervention (magic-themed Hand-Arm Bimanual Intensive Therapy, or HABIT) [26,27].

Clay activities improved motor skills by engaging children in squeezing, shaping, and cutting, as confirmed in Indian studies [28].

Clay activities improved motor skills by engaging children in squeezing, shaping, and cutting, as confirmed in Indian studies [29]. Sensory-rich interventions like clay play stimulate both fine motor control and sensory processing [30].

Sand plays also showed significant improvement in motor skills (P= 0.041), consistent with literature demonstrating its benefits in enhancing coordination and grip through pouring, digging, and shaping [31]. In contrast, the beads group showed minimal improvement. This aligns with research suggesting that while beads develop precision,

they may not stimulate broader motor abilities as effectively as clay or sand [32,33].

Limitations

The intervention of study encountered some difficulties such engaging children consistently in structured play activities that required additional effort and flexibility. The study involved children with varying degrees of motor impairment, which may have influenced their level of participation and outcomes. The duration of the intervention was relatively short, limiting the ability to assess long-term improvements in hand function. The presence of caregivers during sessions, differences in home environments, and individual motivation levels could also have played a role in the effectiveness of the intervention. Future research should consider longer intervention periods, larger and more diverse samples, and follow-up assessments to evaluate the sustainability of improvements. Moreover, comparing different play therapy modalities using randomized controlled trials may provide stronger evidence for specific therapeutic approaches.

Conclusion

Nursing interventions utilizing play therapy strategies such as activities with clay, beads, and sand proved to be effective in enhancing hand function among children with cerebral palsy. These interventions offer a practical, engaging approach that supports fine motor skill development and promotes greater functional independence. It is recommended to incorporate play as an effective strategy in nursing interventions to improve hand function in children with CP, as it provides a stimulating and engaging approach that enhances therapeutic outcomes. While this study focused on clay, beads, and sand, future research should explore other tactile and sensory play approaches, such as water play, texture-based activities, or alternative materials that could further stimulate motor development and therapeutic engagement in children with CP.

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Conflict of interest

None to declare.

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Data availability

The data supporting the findings of this study are not publicly available due to ethical and privacy considerations but may be made available from the corresponding author upon reasonable request and with appropriate approval.

References

1. Janzing AM, Eklund E, De Koning TJ, Eggink H. Clinical Characteristics Suggestive of a Genetic Cause in Cerebral Palsy: A Systematic Review. *Pediatr Neurol*. 2024;153:144–51. Available from: https://doi.org/10.1016/j.pediatrneurol.2024.01.025

2. Anjum S, Huma Dr, Basista R, Jena M, Parveen H, Naaz N. Current Trends in Cerebral Palsy Rehabilitation. *Futuristic Trends in Medical Sciences*. 2024;3: 227–238.doi:10.58532/v3bbms18p2ch8

3. Faccioli S, Pagliano E, Ferrari A, Maghini C, Siani MF, Sgherri G, et al. Evidence-based management and motor rehabilitation of cerebral palsy children and adolescents : a systematic review. doi: 10.1212/WNL.0000000000200936

4. Aamir Jalal Al-Mosawi. The Pattern of Cerebral Palsy in Iraqi Children. *Med Life Clinics*. 2019;1(1): 1001:1-9. SSIN - 978-620-0-09427-8.

5. Sulemi S, R. VD, S. DA, Mujiatiningsih M. Improving Children's Fine Motor Skills through Meronce Activities in Kindergarten. TEMATIK: *Jurnal Pemikiran dan Penelitian Pendidikan Anak Usia Dini*. 2023;8(2):111. doi:10.26858/tematik. v8i2.27569.

6. Domenighetti AA. Muscle contracture in children with cerebral palsy: Mechanosensitive pathways and cellular dysfunction. *Dev Med Child Neurol*. 2024;9–10. doi:10.1111/dmcn.16034

7. Almasri NA, Saleh M, Abu-Dahab S, Malkawi SH, Nordmark E. Development of a Cerebral Palsy Follow-up Registry in Jordan (CPUP-Jordan). *Child Care Health* Dev. 2018;44(1):131–9. doi:10.1111/cch.12527.

8. Rose J, Papadelis C. Editorial: Neurologic correlates of motor function in cerebral palsy: opportunities for targeted treatment, volume II. *Front Hum Neurosci*. 2024; 18.doi:10.3389/fnhum.2024.1525962.

9. Mushta SM, King C, Goldsmith S, Smithers-sheedy H, Badahdah AM, Rashid H, et al. Epidemiology of Cerebral Palsy among Children and Adolescents in Arabic-Speaking Countries: A Systematic Review and Meta-Analysis. *Brain Sci*. 2022;12(7).doi:10.3390/brainsci12070859.

10. Hasan S, Shaker N, Ismail Z. Impact of spastic cerebral palsy upon the quality of life of children under the age of 12 years in Erbil City: parents' reports. *Iraqi National Journal of Nursing Specialties. 2015;28(1):8–16.*

11. Prest KR, Borek A, Boylan AM. Play-based groups for children with cerebral palsy and their parents: A qualitative interview study about the impact on mothers' well-being. *Child Care Health Dev*. 2022;48(4):578–587. DOI:10.1111/cch. 12962.

12. Gupta N, Chaudhary R, Gupta M, Ikehara LH, Zubiar F, Madabushi JS. Play therapy as effective options for school-age children with emotional and behavioral problems: A case series. *Cureus*. 2023;15(6): 2023;15(6): e40093. doi:10.7759/cureus.40093.

13. Graham NE, Truman J, Holgate H. Parents' understanding of play for children with cerebral palsy. *American Journal of Occupational Therapy*. 2015;69(3): 6903220050. doi:10.5014/ajot.2015. 015263.

14. Maciejewski ML. Quasi-experimental design. Biostat Epidemiol. 2020;4(1):38–47. *Available from*: https://doi.org/10.1080/24709360.2018.1477468

15. Mathiowetz V, Volland G, Kashman N, Weber K. Adult norms for the Box and Block Test of manual dexterity. *The American journal of occupational therapy*.: official publication of the American Occupational Therapy Association. 1985;39(6): 386–391.doi:10.5014/ajot.39.6.386.

15.Harini K, Raj G, Dhasaradharaman K. A Comparative Study of Play Therapy and Child Friendly Constraint Induced Movement Therapy in Cerebral Palsy. *International Journal of Health Sciences and Research*. 2022;12(7): 48–50. doi:10.52403/ijhsr.20220706.

17. Hestbaek L, Vach W, Andersen ST, Lauridsen HH. The effect of a structured intervention to improve motor skills in preschool children: Results of a randomized controlled trial nested in a cohort study of danish preschool children, the mips study. *International Journal of Environmental Research and Public Health*. 2021;18(23). doi:10.3390/ijerph182312272.

18. Cameron KL, Albesher RA, McGinley JL, Allison K, Cheong JLY, Spittle AJ. Movement-based interventions for preschool-age children with, or at risk of, motor impairment: a systematic review.

Developmental Medicine and Child Neurology. 2020;62(3): 290–296.doi:10.1111/dmcn.14394

19. Yeargin-Allsopp M, Van Braun KN, Doernberg NS, Benedict RE, Kirby RS, Durkin MS. Prevalence of cerebral palsy in 8-year-old children in three areas of the United States in 2002: *A multisite collaboration. Pediatrics.* 2008. p. 547–554.doi:10.1542/peds.2007-1270.

20. Kalel MJ, Shawq AH. Effect of music medicine intervention on child's pain level during bone marrow aspiration and lumbar puncture procedures. *J Coll Nurs Univ Baghdad*. 2024 Jun 30; Published online. doi:10.58897/99mxqa51.

21. Romeo DM, Venezia I, Pede E, Brogna C. Cerebral palsy and sex differences in children: A narrative review of the literature. *Journal of Neuroscience Research*. 2023;101(5): 783–795. doi:10.1002/jnr.25020

22. Case-Smith J, Frolek Clark GJ, Schlabach TL. Systematic review of interventions used in occupational therapy to promote motor performance for children ages birth-5 years. *American Journal of Occupational Therapy*. 2013;67(4): 413–424.doi:10.5014/ajot.2013.005959.

23. Brooks J, Day S, Shavelle R, Strauss D, Brooks AJ, Day S. Low Weight, Morbidity, and Mortality in Children with Cerebral Palsy: *New Clinical Growth Charts*. 2011; doi:10.1542/peds.2010-2801.

24. Musihb ZS, Hussein HSA, Ali AMA. Disruption of sleep patterns among secondary school adolescents. *Journal of Integrative Nursing*. 2024;6(3):145–9.

25. Osama M. El-Asheer, M.D. Gaaamd;, Masoud, M. Sc. Mh. Nutritional Assessment and Intervention in Children with Cerebral Palsy (Clinical Audit). *Med J Cairo Univ*. 2018;86(6):1811–6. doi:10.21608/mjcu.2018.56746.

26. Hines A, Bundy AC, Black D, Haertsch M, Wallen M. Upper Limb Function of Children with Unilateral Cerebral Palsy After a Magic-Themed HABIT: A Pre-Post-Study with 3- and 6-Month Follow-Up. *Phys Occup Ther Pediatr*. 2019;39(4):404–19. Available from: https://doi.org/10.1080/01942638.2018.1505802

27. Abdulzahra FA, Shawq AH. Mobile application to develop nurses' knowledge of pediatric cardiopulmonary resuscitation: A quaMobile application to develop nurses' knowledge of pediatric cardiopulmonary resuscitation: A quasi-experimental studysi-experimental study. *Journal of Emergency Medicine, Trauma and Acute Care.* 2024;2024(6).

28. Sundresh NJ. Original Research Paper Management Effectiveness Of Clay Modeling In Improving The Hand Motor Skills Among Mild Mentally Retared Children U . *Divya Basi* : 2017;536–7.doi:10.3390/jcm12134548.

29. Maharani N, Jannah M. the Effect of Constructive Play with Clay Media Towards Fine Motor Skill of Children. *International Journal of Advanced Research.* 2018;6(3): 87–94.doi:10.21474/ijar01/6653.

30. Sarla GS. International Journal of Medical Science and Research. *ResearchgateNet* [Internet]. 2023;162(130). Available from: https://www.researchgate.net/profile/Gurmeet-Sarla-2/publication/338801825_Life_begins_at_fifty_and_so_does_Osteoarthritis/links/5e2b0f8f4585150ee7807e22/Life-begins-at-fifty-and-so-does-Osteoarthritis.pdf

31. Pragistha IF, Mansur H, Triningsih RW. The Effect of the Use of Kinetic Sand as a Stimulation Media for Fine Motor Development in Preschool Children at RA Al-Masithoh Karangploso. *Journal of*

Local Therapy. 2022;1(1): 18.doi:10.31290/jlt. v1i1.2939.

32. Imms C, Wallen M, Elliott C, Hoare B, Randall M, Greaves S, et al. Minimising impairment: Protocol for a multicentre randomised controlled trial of upper limb orthoses for children with cerebral palsy. *BMC Pediatr [Internet]*. 2016;16(1):1–15. Available from: http://dx.doi.org/10.1186/s12887-016-0608-8

33. Maurer MN, Roebers CM. Is the fine motor-executive functions link stronger for new compared to repeated fine motor tasks? *PLoS One* [Internet]. 2020;15(11):1–9. Available from: http://dx.doi.org/10.1371/journal.pone.0241308