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Effect of Dance Movement Therapy on Gross Motor Function and Cognitive Function in Smartphone-Addicted Children

Dr. Rucha Choudhari[1], Sanika Kulkarni[2], Dr. Abha Khisty[3], Dr. Tushar J. Palekar[4]

[1]Assistant Professor, Department of Physiotherapy, Dr. D.Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India.
[2]Intern, Department of Physiotherapy, Dr. D.Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India
[3]Assistant Professor, Department of Physiotherapy, Dr. D.Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India
[4]Principal, Department of Physiotherapy, Dr. D.Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India

Corresponding Author: Dr. Rucha Choudhari

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ABSTRACT

Background: Excessively used Smartphones, can cause various developmental problems in children, linking to higher risks of developmental delays in communication, fine motor skills, problem-solving, and personal and social skills. Physical activity is necessary for the growth of social, emotional, and cognitive abilities. Dance therapy serves as an effective educational tool that promotes physical and emotional well-being also reduces reliance on mobile phones. By engaging in structured, rhythmic movement, individuals are encouraged to focus on their body and mind, providing alternative to the passive consumption of digital content
Aim: To find out the effect of Dance Movement Therapy on Gross Motor Function and Cognitive Function in smartphone-addicted children.
Materials & methods: A single group pretest-posttest experimental study was conducted on 30 smartphone-addicted children between 5-15 years of age with a Modified Child MMSE score < 35 and Smartphone Addiction Scale – Short Version score > 33. Dance Movement Therapy was administered 45 minutes 5 days/week for 3 weeks. The outcomes measures; Modified child MMSE scale and Test of Gross Motor Development Scale (TGMD) 2 were assessed before and after the intervention
Results: The intragroup comparison of the mean scores on the modified Child MMSE revealed a significant improvement in cognitive function ($p<0.001$), it also improved the sum of standard scores (2.2 ± 0.6), the Gross Motor Quotient (6.8 ± 1.6), and the percentile score (3.8 ± 2.4) on the TGMD scale ($p<0.001$).
Conclusion: Dance Movement therapy is effective in improving gross motor function and cognition in smartphone addicted children

Key words: Modified Child MMSE, Test of Gross Motor Development Scale, smartphone addicted Children, cognitive function

INTRODUCTION

The rate use of technology by children and infants is increasing as they use gadgets like televisions, tablets, smartphones, and laptops in daily lives. In 21st century technology plays a very important role in our life. A study has suggested that children use mobile phones most commonly as compared to tablets and laptops with a mean weakly usage of 28.5hours, In addition to its primary functions of communication, messaging, and internet surfing, individuals increasingly utilize mobile devices for recreational purposes such as playing video games, streaming music, watching personalized videos, and engaging in online purchasing activities. In addition, it is a portable and easily accessible device that makes it possible to use anywhere at any time. (1,2)

India is one of the leading countries having maximum number of smartphone users. (3) Smartphone addiction is a major public health concern that is characterized by compulsive use, tolerance, and withdrawal symptoms. (4) A recent meta-analysis showed that the global prevalence of smartphone addiction is 16% among adolescents whereas in India it ranges from 39%-44% in urban adolescents. (5) Many studies have suggested that the excessive use of smartphones leads to various health hazards such as musculoskeletal disorders, social disturbances, ocular symptoms, psychological disorders, brain tumors. (6,7). it is estimated that around 10-20% of children and adolescents suffer from mental health issues and up to 50% problems start before 15 years. (8) Various neurophysiological studies have indicated that heavy usage of smartphone affects cognitive components including attention, number processing, and right prefrontal cortex excitability impairments. (9)

smartphone and tablet usage duration may relate to early developmental problems in children. A study conducted by Sun-Eun Kim showed that smartphone addiction harms physical health by reducing physical activities like walking which leads to increased fat mass and decreased muscle mass leading to adverse health consequences. (10) Daily regular physical activity is important to improve children's motor skill competence in early life and health promotion across the lifespan. Motor skill competence is defined as fundamental motor skills and goal-oriented movements including large muscle groups or the whole body. (11)

Electromagnetic field radiations generated from mobile phones increases the core body temperature as well as affects hippocampus leading to cognitive disabilities. (12) Several studies have shown that excessive use of smartphones causes impairments in attention, number processing and right prefrontal cortex excitability. (13) In a study conducted by Paulus et al; they found out that the time spent on screens including smartphones is strongly associated with the changes in structural characteristics of brain. They also found out that some activities related to screening media leads to worse cognitive performance. (14)

Encouraging regular physical activity is essential to counteract these effects and support holistic development. (5) Dance movements incorporate multidimensional physical activity combining motor, cognitive, social, emotional, and sensory domains. Physical activity through dance movements requires motor learning, memory, creativity, attention, auditory cues, and external sounds, rhythmic elements; demanding cognitive function. (15,16) DanceMovement therapy is a creative arts therapy which involves direct expression and experience through body. Various researches have shown that dancing improves range of motion and overall mobility, self- esteem, body image and mood also when done as a group session it helps with impulse control, increased tolerance for frustration, delayed reward, and enhanced interpersonal relationships. (17).

Extended usage of screens has been associated with impaired development of motor abilities, such as problems with

balance, coordination, and fine motor skills, as well as cognitive problems like slowed information processing, memory problems, and attention span reduction. Dance movement therapy is a comprehensive strategy that aims to target these deficits and advance both physical and mental health by fusing creative and emotional expression with physical exercise. Hence the aim of the study was to find out the effect of Dance Movement Therapy on Gross Motor Function and Cognitive Function in children addicted to smartphone.

MATERIALS & METHODS

A single group pre-post experimental study was conducted after obtaining approval from the institutional ethical committee with reference number (DYPCPT/ISEC/50/2024). Around 48 children were screened and 30 smartphone-addicted children between 5-15 years of age having Modified Child Mini Mental State Examination (MMSE) score <35 and Smartphone Addiction Scale - Short Version (SAS- SV) score >33 were included in the study, whereas Children presenting with recent fractures of Upper limb or Lower limb and History of recent surgery (<2-3 months) were excluded from the study; after obtaining an informed consent from the parents.

Cognitive function and gross motor function were assessed using Modified child MMSE and Test of Gross Motor Development scale -2 (TGMD) respectively before the commencement of the treatment program and after 3 weeks. The Dance Movement therapy was given for 45 mins, 5days/week for 3 weeks. The sessions began with warm up for 5 minutes where active movements of all the joints and stretching followed by 2-3 minutes of break then dance therapy on upbeat music for 15 mins was given followed by 5 mins of break again and then dance on slow relaxed music was given for 10 mins as cool down.

Following precautions were taken during the session:

- Dance therapy was conducted in a safe environment – the floor was even and non- slippery.
- A close supervision for each child by the therapist was provided.
- Enough warm up and cool down was set up before starting the main activity.
- Proper instructions were given to the children to ensure that the child has understood the instructions given by the therapist.
- If the child felt uncomfortable then he/she was encouraged to perform the activity.
- The children were given water breaks to keep them hydrated.

The treatment was terminated if the child felt Dizzy or nauseated, if any concerns were raised about the child's safety or well-being during therapy, if the child felt exhausted to a level where he/she could not move further.

RESULT

A single-group pretest-posttest design was used to evaluate the effectiveness of a 3-week Dance Movement Therapy on cognition and gross motor function in 30 smartphone-addicted children. The mean age of the participants was 8.7 years. Out of 30 children, there were 18 girls and 12 boys **(fig.1)**. The mean pretest-modified Child MMSE score was 30.7 ± 2.8, and the mean score was 32.9 ± 2.2, indicating that there was a significant improvement in cognition ($p<0.001$) **(Table 1).** Similarly, considerable improvements were seen in the sum of standard scores (2.2 ± 0.6), the Gross Motor Quotient (6.8 ± 1.6), and the percentile score (3.8 ± 2.4) on the TGMD scale ($p<0.001$) **(Table 2).**

Fig 1: Gender distribution

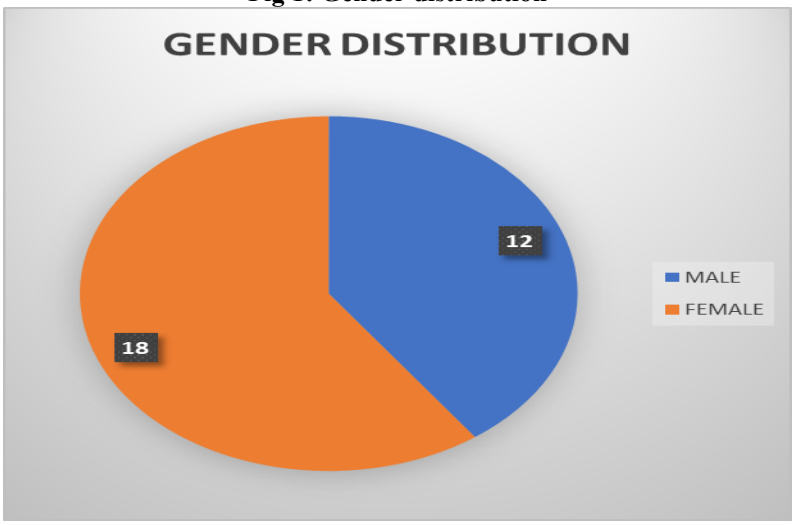

Table 1: Comparison of pre-post mean scores of Modified Child MMSE score

Modified Child MMSE	Mean ± SD	P value
Pre	30.7 ± 2.8	<0.001
Post	32.9 ± 2.2	

Table no. 2: Comparison of pre-post mean scores of TGMD scale scores

TGMD -2	Pre Mean ± SD	Post Mean ± SD	Mean ±SD	P value
Sum of STD Scores	9.7±2.9	11.9±2.3	2.2±0.6	<0.001
GMQ	69±8.6	75.8±7	6.8±1.6	
Percentile	3.3±5.4	7.1±7.8	3.8±2.4	

***TGDM – Test of Gross Motor Development-2, STD – standard, GMQ- Gross Motor Quotient**

DISCUSSION

The study was focused on Effect of Dance Movement Therapy on Gross Motor Function and Cognitive Function in smartphone addicted children. The smartphone addiction was assessed using Smartphone Addiction Scale – Short Version; a 10-item self – reported measure for assessing the severity of addiction. It is a vital tool for determining and measuring children's smartphone addiction, which is necessary to comprehend how it may affect their cognitive and gross motor skills. (18) Modified Child MMSE (Mini-Mental State Examination) Scale is essential tool to assess attention, memory and problem solving. Children's gross motor skills, including movement patterns like running, jumping, and throwing, are evaluated with the Test of Gross Motor Development-2 (TGMD-2). (19)

The study showed significant improvement in cognitive function one of the possible reasons can be due to induction of neuroplasticity across sensory, motor, cognitive, social, emotional, rhythmic, and creative neurobehavioral domains. Also Dance Movement Therapy (DMT) may have strong and long-lasting effects as it requires integration of multiple sensory channels and fine motor control. Music genres influence various brain processes including activation of the anterior ventricular prefrontal cortex and hippocampus. As DMT is a music based activity, similar effects can be seen because of it.(20) Moreover dance practice involves various somatosensory and cognitive brain areas in order to learn and remember dance movements or sequences.(21) Many researches have suggested that Dance therapy improves global cognitive function including memory, attention, executive function by improving hippocampal plasticity, stronger neural activity in the

middle frontal gyrus and inferior frontal gyrus, changes in prefrontal cortex(20)

A noticeable improvement was seen in gross motor function as it leads to improvement in social skills, self-esteem and body awareness. Here DMT helped children to develop a better sense of their body, movements and surrounding leading to improved balance, motor planning and coordination. (22) In an observational cohort study Tadashi Ito et al concluded that the dance program let to a significant improvement in motor skills. They observed improvements in lower limb muscle strength and balance. (23) The results of this study are in line with the study done by Yukti Gupta et al which indicated that dance movement therapy y could serve as a form of gross motor stimulation in children with visual impairment having additional disabilities. (17). Et al conducted a study to find out effects of dance education on motor performance of children in which they found out that dance education was effective in development of rough motor skills like climbing stairs, running, jumping, hopping etc. as well as development of physical compatibility, these results are consistent with the results of our study.(24)

There were few limitations for our study like the duration for the study was short and follow up was not taken. In future studies can be conducted to compare the effects of different dance styles with integrating different technologies

CONCLUSION

This study concluded that Dance Movement therapy is effective in improving gross motor function and cognition in the children who are addicted to smartphones.

Declaration by Authors

Ethical Approval: Approved with ethical no. DYPCPT/ISEC/50/2024

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Conflict of Interest: The authors declare no conflict of interest.

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