Original Article

Impact of Xbox Gaming on Object control skills and Balance for children with autism spectrum disorder-A Pilot study

Soniyasri S[1], Jagatheesan Alagesan[2], Senthil kumar N[3]

[1]Post Graduate, [2]Professor & Principal, [3]Assistant Professor, Saveetha College of Physiotherapy, Saveetha Institute Of Medical and Technical Sciences, Chennai, Tamil Nadu, India.

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Abstract

Background: Children with ASD could face difficulties in a variety of areas including object handling skills and balance. These issues can impair their ability to accomplish everyday tasks, participate in physical activity and successfully communicate with their surroundings.

Purpose: To determine the impact of xbox gaming on object control skills and balance for children with ASD.

Methods: A pilot study was conducted with a total of 20 ASD children who were allocated into two groups. The experimental group (n=10) received xbox gaming and the conventional group received conventional therapy (n=10) The therapy was provided for 40 minutes five days a week for eight weeks to both groups. The test of gross motor development scale-2 and a pediatric balance scale were used to determine the before and post-test values of Object control skills (OCSs) & Balance.

Results: The results findings shows that the experimental group pre and post-test values using the test of gross motor development scale-2(14.2±4.04,33±8.02) and conventional group (12.2±4.56,23.2±2.85) have a p value of <0.01.Experimental group pre- and post-test values using pediatric balance scale was(30.4±4.59,46.9±5.04) and conventional group was (28±4.94,36.9±5.38)with a p value<0.01.The outcome revealed highly significant differences within and between the two groups.

Conclusion: This study concludes that xbox gaming for children with ASD proves a promising way for improving object control skills and balance. Participants revealed significant gains in advanced technology.

Keywords: Pediatric balance scale,Test of gross motor development scale-2,Xbox gaming,Object control skills.

Introduction

Motor development is the process of acquiring key motor abilities that allow people to execute different stances, move around, and handle items[1]. According to research, when children gain motor competencies, their cognitive abilities and athletic abilities increase, which can benefit cognitive growth. Children with Autism Spectrum Disorder (ASD) frequently have limited chances to engage in sporting activities, resulting in a lack of activity that increases vulnerability to illnesses connected with inactivity. According to studies, a significant number of children with autism, which can vary from 50% to 70%, have significant deficits in core motor abilities. These

Corresponding Author: Soniyasri S, Post Graduate, Saveetha College of Physiotherapy, Saveetha Institute Of Medical and Technical Sciences, Chennai, Tamil Nadu, India.

E-mail: soniyashri14@gmail.com

kinds of movement disturbances are characterized by difficulties managing fundamental motions which include walking and position, coordination, and balance [2-4]. In short, children with ASD encounter challenges when it comes to partaking in sporting activities, which can have an influence on their development of motor skills and general health.

Basic Movement Skills are a collection of important talents that serve as the foundation for their physical growth. Basic Movement Skills are a collection of important talents that serve as the foundation for their physical growth. Object Controlled skills entails adjusting and directing items and things with parts of the body that include the hands, legs, or another part of the body. Object controlled skills talents comprise the ability to catch and throw an opponent's ball, hitting a football, and efficiently utilizing tool[5]. These talents are critical for developing advanced motor skills required for involvement in activities or sporting activities subsequently in life[5,6].

Balance control is an enthralling issue in cognitive research because it involves a complex interaction of numerous cognitive systems. These consist of handling data, planning of movements, and muscle action timing and sequencing [7].

Kinect Xbox games are a new type of technology that provides participants with an interactive setting that interacts to their movements and body motions, which leads to varied simulators on the video gaming panel [8,9]. This technique serves as an extra mirror for kids with autism, allowing them to see themselves as digital dolls or creatures within the game. These virtual representations replicate and adapt to the motions of the kids, effectively acting in sync with their actual life actions[10]. As a consequence, autistic kids can take part in a one-of-a-kind and realistic experiences, seeing themselves actively interacting and influencing the activities of the characters that appear on the screen.Children can be inspired and engaged by motion-based gaming applications such as Xbox the Kinect (xbk). Playing such games can raise their conviction in their own capacities to accomplish particular abilities (skill-specific self-efficacy) and so increase their chances of acquiring those competencies. In basic terms, motion-based computer games such as Xbox Kinect may be used as a motivational tool for enhancing children's skill acquisition and self-assurance.[11]Children's learning and play engagement can be influenced positively by motion-based computer games that require active physical participation. Children that participate in these activities receive a successful outcome, which leads to favourable criticism that increases their emotional satisfaction along with their emotions of accomplishment. The encouragement of beneficial encounters could enhance children's drive for exploring fresh experiences and things[12].

Aim

To determine the impact of xbox gaming on object control skills and balance for children with autism spectrum disorder.

Materials and Methods

This pilot study was carried out in the period of August 2022 to February 2023. 20 participants were diagnosed with autism spectrum disorder (ASD). The participants were selected from special education centre Kamal Deep using a concealed envelope method for random allocation were utilized in this research study.

Inclusion criteria

- Children aged between 5 and 10 years old
- Children who had the capability to comprehend and complies with the therapist's instructions
- Children diagnosed with mild and moderate autism as determined by scores ranging from 70 to 106 on the Indian scale for assessment of autism
- Children with ASD diagnosed according to the DSM-V criteria and only those with IQ scores of 70 or above that were independentlyconfirmed bypsychologists were included in this study

Exclusion criteria

- Children with any genetic conditions
- Children who have experienced recent fractures
- Individuals with cardiac issues
- Children diagnosed with epilepsy or those who have vision impairment would also be excluded from the study

Outcome Measures

Test of gross motor development scale-2

The Test Gross Motor Development-2(TGMD-2) is a frequently used assessment instrument for measuring a child's motor competency and identifying any possible motor delays or issues. The TGMD-2 examines both locomotor and object control abilities through a series of subtests.In this object control skills are utilized from this study.The child's performance is used to score each subtest. The grading criteria differ based on the skill being evaluated. The exam includes a variety of tasks, and the child's performance is evaluated and graded depending on certain criteria. A child obtains a score of 1 (properly executed the skill) or 0 (did not correctly do the task)[13.]

Pediatric balance scale

The Pediatric Balance Scale (PBS) is a standardized assessment tool used to evaluate balance and stability in children, including those with autism. It is designed to measure a child's ability to maintain equilibrium during various static and dynamic tasks. The PBS provides valuable information about a child's balance performance, which can be used to identify any balance deficits, track progress over time, and design appropriate interventions or therapies to address specific balance challenges[14]

Procedure

The children were divided into two groups at random: the experimental group (n=10) and the conventional group (n=10). Over an eight-week period, children in the experimental group enjoyed 40-minute Xbox gaming sessions five days a week. Similarly, the conventional group received the same length of intervention. Prior to being a part of the study, informed assent forms were collected from the children's parents or legal guardians, confirming that they were aware of and consented to their child's participation in the research. During these sessions, children took an active role in simulated sports activities such as soccer, volleyball, bowling, and baseball. They controlled the simulated characters and performed the tasks necessary in the games by using their body motions and gestures.

Experimental group (Xbox gaming)

In Kinect sports games players require a Kinect sensor compatible with their gaming console (Xbox 360).19 Inches LED monitor, which serves as equipment.The Kinect sensor allows the games to be controlled solely through body movements, eliminating the need for traditional controllers. When starting the Kinect sports game, follow the onscreen instructions.The therapist chose the sports based on the object control skills and balance in the study.Depending on the game, you need to calibrate the Kinect sensor before their treatment Calibration ensures that the Kinect can track your motions properly.To calibrate the Kinect sensor, follow the on-screen instructions.

Select the Kinect sports that include:

1. **Inbaseball, players** pitching involves standing in the designated position on the pitcher's mound and delivering the ball to the batter with a throwing motion using the upper arm.

- On the other hand, when a player is at bat, they stand in the batter's box and simulate swinging their arm as if they were hitting a bat when the pitch comes their way.
- These two fundamental aspects of baseball, throwing and batting, play a crucial role in determining the outcome of the game, and players work hard to excel in both skills to contribute effectively to their team's success.

2. **In bowling, players** can enjoy the game by standing in front of the Kinect sensor and executing a bowling motion to release the ball.

- To perform a realistic bowling motion by swinging your arm as if you were actually throwing a bowling ball.The kinect sensor will track your body movement and replicate it in the game.
- As you swing your arm,the game will allow you to control the direction and speed of throw.Aim by adjusting your arms trajectory and release the virtual ball by letting go at the desired point.
- The interactive and immersive experiences in these sports video games offer a fun way for players to engage with the virtual world of sports.

3. **In volleyball, players** can enjoy the game by walking around in front of the Kinect sensor, you can control the personality and positioning of your in-game player.

- When the ball approaches, you can use hand motions to strike the ball with virtual precision, imitating a real volleyball hit.
- To block incoming shots, simply raise your hand or both hands above your head When the ball is out of reach, you can execute a dive by physically leaning or lunging forward.
- The Kinect sensor accurately captures your movements, translating them into dynamic actions within the game.
- This intuitive gameplay mechanic allows you to fully immerse yourself in the excitement and intensity of a volleyball match, making for an engaging and interactive gaming experience.

4. **In soccer video games**, players can enjoy an immersive experience that involves various aspects of the sport.

- To kick the ball, participants perform an arching motion with their foot, replicating the action of a real soccer kick.
- Moving about the virtual field allows players to control their in-game characters, manage team formations, and strategize gameplay.
- When it comes to passing, shooting, and tackling, players use their hands and to execute these actions with precision and skill.
- The game captures these hand motions, translating them into accurate and dynamic movements in the virtual soccer world.
- This interactive gameplay offers an engaging and realistic soccer experience, allowing players to score goals, control players, and compete in thrilling soccer matches.

Conventional Group

Conventional physiotherapy exercises, including single leg stance, balance board exercises, Frenkel exercises, step up exercises, and step down exercises, form a cornerstone of rehabilitation programs aimed at improving motor skills, coordination, and balance. These techniques are carefully designed to address different aspects of physical functionality and are frequently employed by physiotherapists to aid patient's recovery. For example, the single leg stance exercise focuses on the ability to sustain equilibrium on one leg, enhancing weight distribution and bolstering proprioception the body's innate sense of its spatial orientation. Balancing on a single leg not only challenges the body's stability mechanisms but also encourages the refinement of neuromuscular connections that are vital for coordinated movements.

Balance board exercises and step-up & step down exercises introduce controlled instability, prompting the body to engage a broader range of muscles for stabilization and coordination.

The deliberate challenge of maintaining balance on a dynamic surface or executing precise step movements stimulates both the musculoskeletal and sensory systems, leading to improved motor control and heightened proprioceptive awareness. Frenkel exercises, on the other hand, involve purposeful and repetitive movements that enhance body awareness and proprioception. By consistently engaging in these movements, patients develop a more refined understanding of their own physicality and can better adapt to changes in their surroundings.

Data analysis & Results

In this study, all variables were analysed based on their mean and standard deviation. To assess significant differences between pre and post-test measurements, the Wilcoxon rank test was employed.

Additionally, to compare the two groups, the Mann-Whitney U test was utilized. Statistical significance was considered achieved when the P-value was less than 0.01.The analysis of the results demonstrated that within each group, there were statistically significant differences in pre and post scores using the TGMD-2 and PBS scores,with a p-value of <0.01(Table1).However, when considering only the pretest scores of TGMD-2 and PBS, there were no statistically significant differences between the group with a p-value of <0.01 (Table 2). Conversely, the post-test scores for TGMD-2 and PBS showed statistically significant variations between the groups, with a p-value of <0.01 (Table3).

Table 1: Pre and post test scores of TGMD-2 & PBS within a group utilized by experimental & conventional group

Outcome measures	Groups	Test	MEAN ± SD	Z value	p value
TGMD-2	Experimental group	Pre test	14.2 ± 4.04	-2.8031	.00338
		Post test	33 ± 8.02		
	Conventional group	Pre test	12.2±4.56	-2.9341	.00256
		Post test	23.2±2.85		
PBS	Experimental group	Pre test	30.4±4.59	-2.8031	.00256
		Post test	46.9±5.04		
	Conventional group	Pre test	28±4.94	-2.3953	.00084
		Post test	36.9±5.38		

*TGMD 2-Test of gross motor development scale-2 ,*PBS-Pediatric balance scale,

*SD-Standard deviation

Table 2: Pre-test scores of TGMD-2 & PBS between group utilized by experimental and conventional group

Outcome measures	Groups	Tests	MEAN ± SD	Z score	p value
TGMD-2	Experimental group	Pre test	14.2±4.04	-1.70084	.08914
	Conventional group	Pre test	12.2±4.56		
PBS	Experimental group	Pre test	30.4±4.59	-1.66304	.04846
	Conventional Group	Pre test	28±4.94		

*TGMD 2-Test of gross motor development scale-2 ,*PBS-Pediatric balance scale,

*SD-Standard deviation

Table 3:Pre-test scores of TGMD-2& between group utilized by experimental and conventional group

Outcome measures	Groups	Tests	MEAN ± SD	Z score	p value
TGMD-2	Experimental group	post test	33 ± 8.02	-3.74185	.00009
	Conventional group	post test	23.2±2.85		
PBS	Experimental group	post test	46.9±5.04	3.13711	.00084
	Conventional group	post test	36.9±5.38		

*TGMD 2-Test of gross motor development scale-2 ,*PBS-Pediatric balance scale,

*SD-standard deviation

Discussion

The present investigation's major goal was to investigate the impact of Xbox gaming on the balance and object handling abilities of children with autism spectrum disorder (ASD). Based on the findings, it is acceptable to conclude that playing active video games can help children improve coordination and balance. Virtual reality training utilizing technology such as Kinect might be one way to achieve this goal.

Recently, contemporary advances have been gradually included into rehabilitation programs for a wide spectrum of people, including those with ASD.

Using immersive gaming equipment like Xbox and virtual reality technology like Kinect to support skill development in children with autism is a promising method, especially when it comes to enhancing their motor abilities. However, while the study's findings show good benefits, further research with bigger sample numbers as well as control groups would be required to create more convincing evidence. The potential advantages of employing technology-driven therapies in the therapeutic process and skill development of autistic children are still being researched.

According to **Noor et al. (2012)**[15] study findings shows that computers and gaming consoles are the most popular resources among those on the autistic spectrum disorder.

These platforms were found to be frequently used by this population, demonstrating their importance in their everyday lives and activities.

The similarity in findings between the two research emphasizes the continuous dominance of computers and gaming consoles as the principal mode of interaction for people with autism. Such consistent results highlight the value of these electronic tools in adapting to the special needs and preferences of those on the autism spectrum, providing them with essential avenues for interaction, development, and entertainment.

In contrast to the current hypothesis, there was a study **(Berkeley et al., 2001)**[16] that reported some efficiency in object control skills in male children with autism spectrum disorder (ASD).

This difference in findings could be attributed to several factors. Firstly, the study by Berkeley and colleagues used a different methodology and involved tasks that required virtual object manipulation compared to the natural object manipulation tasks were utilized in this study.

As a result, it is plausible to expect different patterns of performance when comparing autistic children with a low level of symptom severity to children across the entire range of ASD (as in the current study, **Jarrold and Brock, 2004)**[17].

The severity of ASD symptoms may influence how object control skills manifest, leading to contrasting outcomes between the two studies **(Edward et al ., 2017)**[18].

In regard to the findings, the short length of the intervention may not have offered enough time for the children to practice and enhance their OCSs skill-related movement patterns.

An AVG program could prove more beneficial if conducted over a longer length of time or integrated into treatment sessions inside a well-planned setting rather than being used as informal recreation in the context of the home.Nonetheless, playing sports-themed AVG games proved to positively alter children's assessments of their ability levels. Even if the objective gains in OCSs abilities were not as noticeable, this increase in self-perception may lead to more positive active actions.

Conclusion

This pilot study will provide initial insights into the effectiveness of using xbox gaming as an intervention to improve object control skills and balance in children with autism spectrum disorder. The positive results observed in this research pave a way for larger scale studies and encourage the integration of technology-basedintervention intherapeutic approaches for children with ASD.

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