

Research Article

‘Virtual Autism’: Effects of Excessive Screen Exposure on Communication in Young Children - A Preliminary Study

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Received: May 14, 2024

Accepted: June 19, 2024

Published: June 26, 2024

Introduction

Electronic media has been in the limelight in recent years in lieu of the increasing use and reliance on electronic gadgets and technology. Technological advances have made daily life easier and led to betterment of overall quality of life. Both children and adults depend on numerous technologies and gadgets for ease of life and entertainment. While the benefits of this boom in technology is unarguably a boon, excess use of technology has been observed to negatively affect our lives and functioning. The technological boom in the late 20th century led to the influx of internet and gadgets such as computers, television, video games into the daily life of children. This influx has been

Abstract

Background: Exposure to screen has been on the rise, especially during and post lockdown imposed on account of the covid pandemic. Children are exposed to digital devices at a very young age. It is suggested that the increase in exposure to screen at a young age, during the early developmentally sensitive age, can result in the children exhibiting difficulties with respect to socialization, pragmatics, and effective age-appropriate communication. **Objectives:** The present study aimed to determine whether an association exists between increased exposure to screen and increase in autism-like behavior i.e. Virtual Autism in young children by studying the effects of intervention on children exposed to screen at an earlier age who displayed virtual autism.

Method: A total of 36 children (age range 1.5 – 06 years) exhibiting autism-like behavior combined with an increased screen exposure (> 04 hours/day) were selected for detailed speech language assessment and therapy. The informal assessment and formal assessment were done along with speech-language therapy and post therapy assessment.

Results: Statistical result revealed that there was a significant difference between the pre-therapy and post-therapy scores for ACSLS and ISAA scores. The *p* value obtained was less than 0.05. Post therapy, there was an increase in social interaction duration which co-related with the improvement in language scores and reduction in their ISAA scores obtained post therapy.

Conclusion: Virtual Autism is a relatively new diagnosis, and there is still much to learn about its underlying causes and effective treatment options. However, some experts suggest that interventions aimed at developing strong communication and social-emotional skills, both online and offline, may be helpful for individuals with Virtual Autism.

Keywords: Virtual Autism; Screen time exposure; ASD; Speech-language therapy; Developmental disorders

on a steady rise ever since and in addition, the recent “Covid era” has ushered in an unprecedented increase in exposure to screen use in children for both educational and entertainment purposes. Studies have indicated an increase even in toddlers in screen use during and post lockdown compared to pre-lockdown era and this increase was also found to be co-related to the total duration of lockdown imposed [1]. Studies also have suggested that excessive exposure to screens among children under the age of five, especially in the high and middle-income nations. This increase, with respect to both duration as well as frequency of use, has subsequently led to several negative

effects on the developing child's psychological and physical well-being. These studies have also indicated negative impact of screen use on emotional, sleep patterns and increase in behavioral issues [2]. Studies have indicated detrimental effects of excess screen use on overall health of the children as well as development of cognitive and linguistic skills [3]. Physical and psychological development of children depend on several factors during their early years known as critical period. Language and communication are one such area which depends on both individual as well as external environmental factors. Factors such as environmental language stimulation, family support, individual cognitive skills, motivation all have a direct or indirect effect on language acquisition in developing children.

Autism is a neurodevelopmental disorder characterized predominantly by deficits in areas of social communication. According to the data from the Centers for Disease Control and Prevention in the USA, close to 1 in every 36 children are diagnosed with ASD compared to around 1 in every 100 children being diagnosed with ASD two decades back. A systematic review on prevalence of autism spectrum disorder in Indian children done by Chauhan et.al, indicated the pooled percentage prevalence of 0.11 in the age group of 1 year-18 years in rural areas and in urban areas it was 0.09 in the age group of 0 year-15 years [5].

Recent past also indicated that an increase in the number of children reported to show a delay in language skills associated with autism-like features [4]. In recent years, several children between the ages of 0-3 years exposed to a virtual environment for more than 4-5 hours per day have been seen to show features similar to ones seen in autism spectrum disorder i.e. Virtual Autism [6]. Children have been seen to have, hyperactivity, delayed and deficient language skills, emotional dysregulation and reduced attention span [6-8]. Conversely studies have also shown children with ASD have greater exposure to digital media, and at an earlier age [9]. Early screen exposure has been seen to have an association with lesser frequency of parental interaction thereby leading to an earlier onset of communication deficits [10]. These studies have suggested delayed language skills in children exposed to screens before they acquired language. Toddlers exposed to an increase in screen time during the lockdown period showed lesser increase in vocabulary and expressive language growth [11].

One such aspect of this deteriorative effect that we intend to explore in this study is the impact of excess screen use on very young children. The present study aimed to determine whether an association exists between increased exposure to screen and increase in autism-like behavior i.e. Virtual Autism in young children by studying the effects of intervention on children exposed to screen at an earlier age who displayed autism-like features i.e. virtual autism

Objectives of the Study

1. To determine the association between excessive screen time and autism-like features (virtual autism) in young children.
2. To determine the effect of therapy on virtual autism in children with excessive screen time exposure duration.

Methodology

Participants

A total of 36 children exhibiting autism-like features combined with an increased screen exposure were referred from the pediatrics department for detailed speech language assessment and therapy. All the children belonged to the age group of 1.5-6 years. All the children evidenced screen exposure greater than 4 hours on a daily basis as reported by parents/care givers.

(a). Exclusion criteria: Children were screened for other comorbidities which could impede the study. Children exhibiting hearing related disorders, visual deficits, intellectual disability, physical/motor deficits, learning disability or multiple disabilities were excluded from the study. Children with previously diagnosed ASD, ADHD, behavioral issues and who have attended therapy for the same were also excluded from the study.

(b) Inclusion criteria: Based on diagnostic ISAA test, children who had mild degree of autism were included in the study.

Procedure

Before applying the standard test for diagnosis of autism or autism-like behaviors an informal assessment was done for the participants. Parents were asked about the behaviors of children, exposure to digital screen devices (Smart phones, tablets, videos games or smart television), total time spent in a day using these digital devices. Once the informal assessment was done all participants were referred for detailed assessment.

(a) The Indian Scale for Assessment of Autism (ISAA) test: The Indian Scale for Assessment of Autism (ISAA) was administered on all children to confirm the diagnosis of autism [12]. ISAA is an objective assessment tool for autism. It evaluates across the six domains of social relationship and reciprocity, emotional responsiveness, speech, language and communication, behavior patterns, sensory aspects and cognitive components. Based on the scores obtained, children are diagnosed as having mild, moderate, severe autism or as normal. Children

Table 1: Descriptive scores for pre-therapy ACSLS and ISAA scores.

Pre-therapy tests	Scores		
	N	Mean	SD
ACSLs receptive language	13	34.86	13.66
ACSLs Expressive Language	13	30.05	1.34
ISAA scores	13	92.23	94

N: Number of participants; SD: Standard deviation

Table 2: Descriptive scores for post-therapy ACSLS and ISAA scores.

Post-therapy tests	Scores		
	N	Mean	SD
ACSLs receptive language	13	68.08	28.3
ACSLs Expressive Language	13	52.64	37.24
ISAA scores	13	68.31	12.19

N: Number of participants; SD: Standard deviation

Table 3: Comparison between pre-therapy and post-therapy scores for ACSLS and ISAA.

	Sample size	P value	Interpretation
Receptive language scores	13	<0.05	Statistically significant difference present
Expressive language scores	13	<0.05	Statistically significant difference present
ISAA scores	13	<0.05	Statistically significant difference present

who exhibited severity of autism more than mild were kept out of study and referred for speech and language therapy. Out of the 36 children, 30 children were diagnosed with autism in accordance with their ISAA scores and diagnostic and manual of mental disorders (DSM-V) criteria. Six children were diagnosed to not have autism or autism-like features and reported as normal and excluded from the study. Further, all children were screened to document their individual total daily screen exposure duration and duration with caregiver and social interaction. Detailed parental interviews were conducted to determine the age of screen exposure and total duration of screen exposure for each child as well as approximate duration of social communication. Informal parental interview was done related to general demographic details, child's language, cognitive, attention skills and other behavioral issues if any. They were also interviewed regarding the presence of characteristic features of autism and the onset of symptoms.

(b) ISAA, the Diagnostic test for autism: Further, according to the severity of autism as detected by ISAA, 13 children were diagnosed with mild degree of autism, 9 children with a moderate degree and 8 children with severe degree of autism. The 13 children diagnosed with mild autism with screen exposure on average 4-5 hours were finalized for the study. A written informed consent was obtained from all participant's caregivers or parents before commencement of the study.

Study Design

An experimental research design was chosen for the study. The study was conducted in phased manner. Phase I consist of Speech and language assessment (pre-therapy assessment) of autism like behaviors i.e. virtual autism, phase II was speech and language therapy, and phase III included post therapy evaluations.

Phase-I

(i) Speech and language assessment (Pre-therapy evaluations): Pre-therapy evaluations of speech and language skills were conducted for all the children. Detailed language assessment was done using Assessment Checklist for Speech-Language Skill (ACSLS) to determine their current linguistic skills [13]. Informal assessments were conducted to evaluate pre-linguistic skills, cognitive prerequisites, receptive and expressive language, pragmatic skills and oro-motor strength and function.

Phase-II

(i) Speech and language therapy: Speech language therapy sessions were designed by a speech language pathologist for each child for a total period of 6 months. 3 sessions were conducted for each child in a week with each session spanning 60 minutes. Parental counseling was done alongside to educate them on the detrimental impact of screen exposure and the need to reduce screen time for children.

(ii) Qualification of Speech Language Pathologist (SLP) and counselling for parents: The speech language pathologist had a maximum qualification of master's in speech language pathology with an experience of minimum 3 years in rehabilitation of children with Autism Spectrum Disorders (ASD). The therapy sessions focused primarily on improving social communication

and pragmatic aspects of their language use. Age-appropriate activities were designed in accordance with each child's individual baseline levels. Intensive counseling was done to educate the caregivers regarding the impacts of excessive screen use and ways to modify their practices. They were also counseled regarding the need to improve opportunities for the child to communicate and interact with caregivers as well as in other appropriate social environments. Speech language pathologist was kept same for the all the children throughout the session.

Phase-III

(i) Post-therapy evaluations: Post therapy evaluations were conducted at the end of 6 months. ACSLS and ISAA were re-administered for all children. A detailed interview was conducted to determine changes in screen exposure duration and parental interaction with the child.

Results

A total of 13 children were finalized for the study. All 13 children had a diagnosis of mild autism in accordance with their ISAA scores and a total screen exposure duration greater than 3 hours per day combined with limited caregiver interaction. ACSLS and ISAA evaluation scores were documented for all children before and after administration of therapy sessions. To meet the objective of the study, results are tabulated and analyzed using IBM SPSS Statistics version 29 software. Normality of the data was tested using Shapiro-wilk test, which showed data were not normally distributed and hence non-parametric test was done. IBM SPSS Statistics version 29 software was used to conduct both descriptive and analytical statistics for the data obtained. Descriptive statistical analysis scores were obtained for receptive, expressive language and ISAA scores for both pre and post therapy conditions and represented in Table 1 and Table 2 respectively. The pre-therapy ACSLS mean receptive scores was 34.86 with Standard Deviation (SD) of 13.66 whereas post-therapy ACSLS mean receptive scores was 68.08 with SD of 28.30. Similarly, descriptive analysis was done for the pre and post-therapy ACSLS expressive scores. The pre-therapy ACSLS mean expressive scores was 30.05 with SD of 16.32 whereas

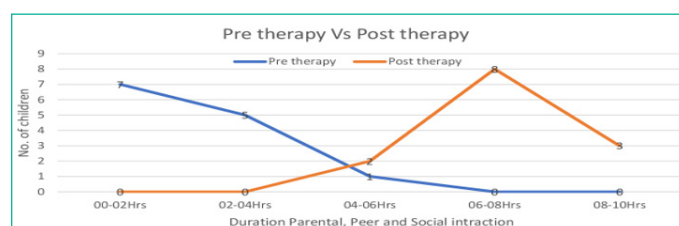


Figure 1: Comparison between pre-therapy and post-therapy conditions of duration of parental peer and social interaction.

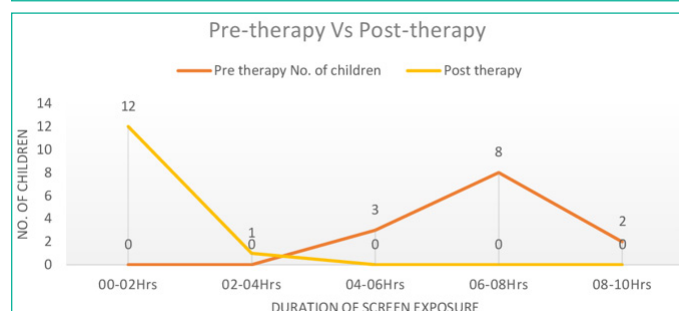


Figure 2: Comparison between duration of screen exposure in the pre-therapy and post-therapy conditions.

post-therapy ACSLS mean expressive scores was 52.64 with SD of 37.24. The above findings indicate significant improvement in both receptive and expressive language skills for the children. Further, descriptive analysis was also done for the pre and post therapy ISAA scores. The mean pre-therapy ISAA score was 92.23 with SD of 9.13 whereas post-therapy mean ISAA score was 68.31 with SD of 12.19. However, the ISAA scores for 6 out of the 13 children showed greater improvement across as compared to the other 7 children. Based on descriptive results, we further moved to compare the pre and post therapy scores of ACSLS and ISAA and applied the statistical test to find out if there was a significant difference between pre and post therapy scores.

The descriptive scores indicate greater scores in the post-therapy condition for all children. The post-therapy scores were higher for receptive, expressive language as well as ISAA. The non-parametric test Wilcoxon signed rank test was employed to determine if there was a statistically significant difference between the scores obtained in the two conditions. Statistical result revealed that there was a significant difference between the pre-therapy and post-therapy scores for ACSLS and ISAA scores. The p value obtained was less than 0.05 ($P < 0.05$).

Parental interviews indicated lack of language stimulation, opportunities to communicate at home and in other social situations and increased dependence on electronic gadgets during daily activities prior to initiation of speech therapy. Intensive counseling was done regarding the importance of speech language stimulation and regular social and peer interaction with the child.

Post therapy, the duration of screen exposure showed a drastic reduction for majority children combined with an increase in social interaction duration which co-relate with the improvement in language scores and reduction in their ISAA scores obtained post therapy represented in Table 3. A significant difference was obtained for receptive language, expressive language and ISAA scores when the post-therapy scores were compared with the pre-therapy scores, with the post-therapy scores being greater.

Further we observed that, out of the 13 children, six children showed considerably greater improvement in their ACSLS and ISAA scores. The ISAA scores of these six children suggested no autism and these children also did not show persistence of any core autistic behaviors whereas the remaining seven children showed some persistent behaviors associated with autism and ISAA scores persistently indicating less degree of improvement. The six children had their milestones returned to age-appropriate levels after the therapy along with reduction in screen exposure and increased social and peer interaction (Figure 1). A probable indication of the condition we have focused on in our study i.e. 'virtual autism.'

Parental interviews were conducted in both pre-therapy and post-therapy conditions to determine the screen exposure. In the pre-therapy condition, the majority of children had a high dependence on electronic gadgets during daily activities i.e. a high screen exposure duration greater than 3 hours per day. Post therapy with intensive counselling there was a drastic re-

duction in the total hours of screen exposure for most children.

Interviews also indicated a lack of language stimulation, opportunities to communicate at home and in other social situations prior to initiation of speech therapy. Along with counselling to reduce screen exposure, counselling was also done regarding the importance of speech language stimulation and regular social and peer interaction with the children Figure 2. Post therapy, there was an increase in social interaction duration which co-related with the improvement in language scores and reduction in their ISAA scores obtained post therapy.

Discussion

Exposure to screen in early childhood deprives children of a valuable amount of sensory stimulation and input necessary for normal development. Child is deprived of several other sensory inputs viz. touch, smell, vestibular senses. This further restricts the child's developing neuronal system [14]. Reduced melatonin levels, deficiency of neurotransmitters such as Neurotransmitter deficiency like dopamine, acetylcholine, Gamma Aminobutyric Acid (GABA), and 5-Hydroxytryptamine (5-HT) have all been reported to be associated with increase in screen exposure [15-17]. Melatonin is a major contributor for normal circadian rhythm or the sleep cycle. Excess exposure to screen causes a temporary peak in the reward system neurotransmitters and eventually leads to an imbalance in both excitatory and inhibitory neurotransmitters [17]. Television exposure has been indicated to cause negative anatomical and structural effects on the developing brain [18]. These factors, combined with a lack of sensory stimulation from the environment can drastically affect normal acquisition of speech, language and cognitive skills in a growing child.

Our study indicated that young children referred with autism-like features i.e. virtual autism responded well to a period of therapy combined with drastic reduction in overall screen exposure. These children were diagnosed with autism on the standard assessment protocols at the time of referral. However, they were receptive to therapy and their autism-like features i.e. virtual autism were reduced to almost nil by the end of therapy-period. Whereas some other children continued to exhibit core features of autism in spite of an overall improvement in communication and cognitive skills at the end of 6 months duration. These findings lead us to believe that excessive screen exposure at a younger age can be a factor leading to communication deficits and autism-like features virtual autism. Children indicating autism at an early age may in fact be a prey of the negative effects of screen use and sensory deprivation.

Marius Teodor Zamfir (2018) was one of the first few researchers who examined the link between excessive consumption of virtual environment in early childhood and presentation of features associated with ASD and introduced the term virtual autism [19]. His study indicated a positive link between presentation of virtual autism and screen-time of greater than 2 hours per day. The incidence data done in the first stage of the study amongst children with ASD in Romania indicated a steady rise in the consumption of screen use throughout the years 2012-2017. The study also compared the therapeutic efficiency between children with and without excessive screen

use and concluded a greater progress was indicated in children with screen exposure. Similar results were reported in another case study done by Yurika Numata-Uematsu et al. in 2018. The subject, who on initial assessment indicated severe autism as evaluated through childhood autism rating scale and observation of other ASD like symptoms such as reduced eye contact, attention span. On increasing caregiver interaction and reduction in overall screen use, child showed a significant reduction of ASD like symptoms and a reduction in his Childhood Autism Rating Scale (CARS) score [20]. Dikkala et al. in 2022, in their study suggested presence of autistic like symptoms in children with a screen exposure greater than 3-4 hours per day [21]. Several studies have also indicated the impact of excessive screen use on speech and language development of children. A study done by Dhanasekhar Kesavelu & Priyadharshini in 2023 suggested the association between increased use of nonverbal methods of communication and incidence of speech delay in children with higher screen use [22]. Another study done by Xiaoyan Wu in 2017 suggested a positive correlation between presence of emotional and conduct problems, hyperactivity, prosocial problems and autistic like symptoms in children with a screen time greater than 2 hours per day. The authors suggest that this might be due to the reduced social interaction and reduction in normal duration of self-play among children [23].

Conclusion

Virtual Autism is believed to be caused by a combination of several environmental factors, and it typically affects individuals who spend a significant amount of time engaged in online or offline with electronic gadgets. Individuals with Virtual Autism may exhibit similar symptoms to those with Classic Autism, such as difficulties in social communication and sensory regulation. Such children might evidence difficulties in forming and maintaining relationships with others. It is not clear whether virtual autism is a distinct condition from Autism Spectrum Disorders (ASD) or whether it is risk factor or trigger ASD in genetically predisposed children. Virtual Autism is not formal diagnosis but a relatively new diagnosis, and there is still much to learn about its underlying causes, symptoms, assessment, and effective treatment options. Expert suggest that virtual autism can be reversed or prevented by limited screen time, developing strong communication with parents and other family members, developing social-emotional skills, and increasing social interaction. These may be helpful for individuals with Virtual Autism. However more research is needed to understand exact cause and consequences of virtual autism as well as the best way to treat the individual virtual autism.

Limitations and Future Direction

The current study was a preliminary study and involved a small sample of children. Future studies should be undertaken with a larger sample set. Studies could also be done with a control group in place to determine the exact affecting variables. The term virtual autism is still a relatively new term with the need for standardization. Future studies should also be done considering other possible variables such as genetic predispositions, socio-cultural differences as well as parenting styles. We recommend that more studies to be undertaken to determine the need for standardizing the term and to ensure that this sub-

set of affected children are not missed out of receiving rehabilitation services.

Author Statements

Acknowledgement

We would like to offer our sincere gratitude to Mr. Bebek Bhattarai (Paediatric Audiologist) and Ms. Roseleema Kujur (Speech Language Pathologist) who provided their immense support and help throughout this research study.

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