

Virtual Reality Gaming in Hospitals for Paediatric Units

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Abstract

Scientists had begun investigating the possibility of using virtual reality in the field of medicine as a form of therapy for pain since the late 19th century but the size of the equipment and cost could not make it popular among the people. In studies that have been conducted, it has been proven by using virtual reality; a significant decrease of dependency for patients towards opioids (once their medical procedures are completed) also helped them overcome their preconceived phobias and fears during the procedure.

Anxiety separation is the root cause for the fear that stems in a majority of children either in a hospital or a clinic setup, along with the fear of the unknown which increases in such a situation. The patients in the paediatric unit can be completely removed from the stress inducing atmosphere of hospitals; and instead they will be transported to another place all together through the virtual reality experience. This keeps them preoccupied while waiting as well as receiving their procedures in the hospital. This research was conducted on children below the age of eighteen and the data collected was analysed through triangulation method with grounded theory approach. In today's scenario, virtual reality gaming is currently used in many hospitals internationally and is slowly making its way into India through healthcare. This research paper intends to explore how through virtual reality gaming, it helps distract children before, during and after medical procedures, which elevates the entire hospital experience for them. Also, it helps utilize the amount of doctor – patient interaction more efficiently, without wasting any time.

Keywords- Virtual reality, paediatric, interactive gaming, pain reduction, healthcare

Introduction

The virtual reality sector has become multi-billion-dollar industry, though it has been around for half a century. Virtual reality gaming experience is a three – dimensional environment that is created using software and presented to the user in a manner in which their perception between the real and reel world are proximate to each other [1]. High end virtual gaming could be with headset with a display screen and virtual rooms specially meant for the user to explore with the utmost freedom. Some of the experiences are designed to be enjoyed while being seated or in a motionless position[2]. Due to its popularity in Gaming industry, it has burrowed in several fields of such as aviation, education and later in medicine as well. It has helped steer a different direction in which several treatments are administered in hospitals, especially, in areas of mental health including help in phobias and anxiety [3].

In spite of so many technological advancements the hospital visits for many is a daunting experience, the focus is on making the hospital experience comfortable and a stress-free environment for children visiting the hospital, as well as, the hospitalized patients in the paediatric unit through virtual reality gaming. This would help improve the overall the family

dynamics as well as the patient's psychology in which the hospital is perceived. Since the 19th century, Virtual Reality has been used as a technological advancement tool for doctors in the United States, the University of North Carolina and the US Department of Defence started making the VR headsets to help with surgery and other medical specialities [4]. But this was available to only one section of the society. The criticism of playing video games has is not unknown. It has been proved that playing video games for several hours would cause health problems in 2014, the ever-growing virtual reality large fan base for video games worldwide has opened doors and helped make important leaps improvement of the patient lives [5].

In India, in spite of the V.R field developing at a fast pace it has not yet diversified into the field of health care. Virtual Reality has been introduced in surgical fields, to train the surgeons. This also provides an insight on the current use of VR in the medical education in the field of surgery [6]. Virtual Reality Gaming in Hospitals for the paediatric units in India will further change and broaden the outlook of hospitals in country not only for children but for adults as well. It was observed that despite some children having been in and out of hospitals since they were young, the hospital's atmosphere still induced stress because of the procedure that would be done on them. The stigma around hospitals being a serious place, it could become a lot more child friendly environment, especially in the paediatric department, this would lead to better treatments and experiences for both patients and clinicians. Hence introduction of such technology will increase the betterment of a New and Progressive India. It would also further help to increase the number of children who visit hospitals without any compulsion and also help them get over their personal phobias.

Review of Literature

Today with the new age of technology, the cost prices of virtual reality gaming have become much lower along with the size being more user-friendly, it has renewed the interest of it being used as a therapeutic equipment.

Evolution of Virtual Reality Gaming

Since the 19th century, Virtual Reality has been used as a technological advancement tool for doctors in the United States. The evolution of virtual reality has been started from computer generated world with hardware and software's to Virtual reality programmes developed for paediatrics in rehabilitation. The computer generated VR environment came in 1968 [7]. Ivan Sutherland was the person to update the image according to user's position. Power glove was another innovation used to popularize the gaming industry but failed due to high cost. As the technology improved many other controls such as head mounted displays, a cave environment, Fibre-optic weird glove, wii remote controller were launched improving the scope of virtual reality in gaming [8].

Virtual Reality on Patients

Virtual Reality has been in Medical fields since decades due to its multiple benefits. The study conducted was to analyse benefits of using virtual reality on patients who were

hospitalized with metastatic cancer. The testing was done on nineteen patients on older age group, here patient was encouraged to undergo virtual environment four times in a week for 30-minute sessions, to instigate joy or relaxation. After assessing the mood pre and post trial this study proved various benefits of the sessions. The Patients mentioned that the Virtual Reality Environment acted as a means of distraction, entertainment, it also enhanced the relaxation and upliftment of their mood [9]. However an experiment done on a younger age proved that virtual reality doesn't only changes the mood and enhances the relaxation but it also reduced the anxiety and fear. This study explained that the patient who feared an Intravenous medication was given a virtual-reality headset at the bedside to use when he felt pain. Once the patient had the VR headset on, he was transported from the hospital room to the natural, calming beauty of Yellowstone National Park. The nurse was able to administer the medication after this, in no time. Since then, he has gone on, to use the virtual reality headset for IV insertions, blood draws, breakthrough pain between scheduled doses of medication [10]. This is very similar to the findings of the randomized controlled trial done by a group of 143 children, the group that wore a virtual reality headset during blood draws reported experiencing less pain and anxiety than the half who did not show any changes [11].

On the contrary at the University of Washington, a study was done on two teenage boys who had undergone skin grafting surgery and had staples post-surgery to hold the grafts in place. During the removal of the staples from the skin grafts, both the participants received opioid medication before treatment. These participants were also exposed to a virtual reality program and were asked to spent the same amount of time playing a video game called Nintendo. Both the participants reported excruciating pain while they were playing the games [12]. Another study was conducted at Harborview burn centre, to judge the effect of environment on the burn patients. They tried immersing patient in the virtual world which shows icy polar area. The environment is meant to be a cooling, which helped the burn patients to reduce their pains and gave a cooling sensation [13].

Virtual Reality on Healthy Volunteers

An interesting experiment was conducted on twenty two healthy volunteers; the objective of this experiment was to measure the effect of virtual reality worlds on pain. The blood pressure cuff was tightly tied to the arm of participants. The participants were asked to rate the pain every 2 minutes as the discomfort kept increasing. During the last 2 trials participants were exposed to the virtual reality programs i.e. spider world and chocolate world,

But during the last two minutes, all of the subjects participated in two brief virtual reality programs, Spider World and Chocolate World. Due to the interactive virtual world the participants reported less amount of pain in these virtual sessions [12]. This Virtual session reduced the amount of pain due to 'gate control theory of pain'. Participants further explained that they were engrossed into the game which shifted their attention from pain sight to the virtual world [14].

Methods and Material

In this study it is important to know the anxiety and phobias amongst the children. The study also reveals the nature of the phobia or anxiety. A heterogeneous group of participants were selected through snowball method. The research was conducted through surveys and semi-structured interviews. The interviews were planned of 40 minutes but due to time constrain the interview time as reduced in pilot study. The total number of 122 participants included children (26), parents (52) and health professionals (44). All the interviews were conducted face to face. Out of 200 indentified participants, 122 were able to complete the interview successfully. All the Participants were identified keeping the inclusive criteria in mind. Participants out of Pune (parents and health professionals) were approached. The consent was taken by email and interview was recorded on Mobile phone. A brief was given to all the participants regarding the research and only thereafter, with their knowledge as well as consent was the interview conducted and recorded. Theme of this was to understand the kind fears and phobias a child develops when he/she enters the hospital or clinic, while waiting, during and after for the procedure; and how they interact with the doctors and other health professionals during this entire process as well as how the professionals and parents handle such situations. The interviews were analysed as per grounded theory approach with triangulation method.

Result

The awareness of virtual reality gaming being used in health care to help distract children before, during and after the procedure received mixed response was shown by the patients/parents but it was accepted by doctors, who considered it to be the right step in terms of healthcare and a large number of parents/children lacked the knowledge of virtual reality gaming being used in health care and its benefits 80% of doctors were aware of virtual reality and its benefits in healthcare but only 65% of children and 20% of parents were aware of it. 80% of parents were not open to the idea due to lack of awareness.



Fig 1: - Awareness of Virtual reality between doctors, parents and children

The ambience of the hospital is extremely important and 53% children feel hospitals have a stress inducing atmosphere that fills them with anxiety due to which, some children throw tantrums to visit hospitals. 18% of them sometimes feel uneasy in clinics. 29% of children don't feel any kind of stress in such situations.

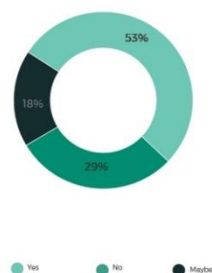


Fig 2: - Importance of Ambience of hospital affecting the stress for children

When parents were questioned if their child was scared to visit hospitals/clinics and if they assessed what caused the fear in their children, it 74% pointed towards injections, nebulizers and blood being drawn. When these children have had any of such procedures administered on them, they ended up crying during and after the procedure and some before as well, because of not wanting to get it done. 15% of parents also claimed their child was not scared of hospitals or injections and 11% said that I. V's and nebulizer had never been administered.

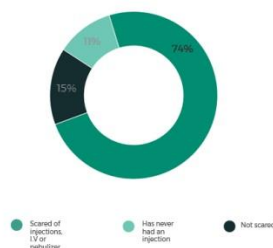


Fig 3: - Factors affecting the fear of children.

In such cases, parents tend to their child during injections or any other procedure through distracting by telling them stories, singing song to them and comforting them by giving reassurances. 4% of children remain calm during injections and didn't cry. 13% of parents allow their children to cry and don't comfort them with the parenting approach of self-soothing in such situations.

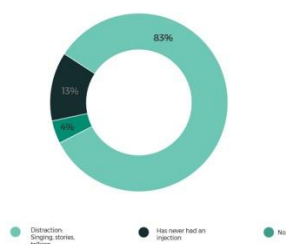


Fig 4: -Strategies used to prevent the children from crying.

65% of children were willing to use virtual reality gaming as a means of distraction in paediatric units before, during or even after the procedure to distract themselves during process but 35% were still unsure due to the lack of awareness on the subject which lead them to fear the unknown

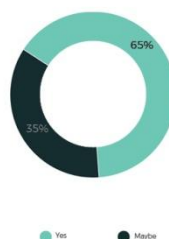


Fig 5: - Readiness of using virtual reality.

Discussion

The enhancement of technology further improves patient safety and helps reduce the time taken between doctor-patient procedures. It has been proven in western countries that virtual reality is an effective solution for overcoming phobias and acts as a method of distraction as well. The awareness of virtual reality being used in the field of medicine and its benefits were unknown by a majority of the parents of children. Since the concept by itself was new to these participants their approval rating for it was also low[13].

Currently in India, parents accompany their children to meet the doctor within his/her cabin for the administration of injections, saline, blood being drawn and nebulizers when children start expressing or show their fear/concerns, they are distracted using topics, bribing the child saying their favourite toy would be bought, singing to the child or just talking.

It was interesting to know that there is a section of parents who allow their child to cry and don't bother distracting during this process who participated in the interviews expressed their concern over needles pricking their bodies and how it got them worked up and induced anxiety.

When asked Children, lack of awareness was seen among them regarding the benefits of virtual reality but knew its existence due to gaming software. They had mixed to positive reviews using it in hospitals.

Medical professionals were open to the idea as they were aware of its use abroad and were well aware of its benefits as well. Doctors also noted that children's fears stem from anxiety separation which causes them to throw tantrums and cry in such situations instead of brushing it off or to empathize with the child by taking their feelings into consideration [15]. Destigmatization of mental health for children has to take place and be taken seriously. Thought the medical professionals are aware of VR benefits, the virtual reality setups are costly and hence emerging such Virtual setup becomes a secondary importance to hospitals or clinics over the cost of other necessities [6].

The solution of using virtual reality is the key to reduce the anxiety and the phobia, the child can be easily distracted and it will be a quicker process for the medical professionals who administer the procedures on the child. For implementation of this to be a success first, people's knowledge needs to be increased on the subject through workshops, lectures, app-based modules for easy learning. This can also help with the funding for getting the equipment quickly.

Conclusion

The use of Virtual Reality in the clinic and hospital set up is yet to have a technological advancement in the right direction. In the current scenario the virtual reality games are popular among the children whereas the hospitals are also engaging in the use of virtual reality. The amalgamation of virtual world with the hospital setups for paediatric departments will help decrease the phobia and anxiety within children. VR applications in healthcare are expected to continue growing and evolving over the coming years and help redesign traditional healthcare systems.

Conflict of interest: No conflict of Interest

Ethical clearance: Ethical Clearance taken from Institutional Research Committee.

References:-

1. Satava RM. *Virtual reality surgical simulator*. Surgical endoscopy. 1993 May 1;7(3):203-5.
2. Whatis.techtarget.com [Internet]. Massachusetts (USA): WhatIs.com; c2016. *Virtual reality gaming* (VR gaming); [updated 2016 August; cited 2020 January 20]; [about 2 screen]. Available from: <https://whatis.techtarget.com/definition/virtual-reality-gaming-VR-gaming>
3. Nbcnews.com [internet]. New jersey (USA): nbcnews.com; c2020. 3 Ways Virtual Reality Is Transforming Medical Care Doctors are using VR to address some of the most challenging medical problems; [updated 2017 August 22; cited 2020 January 22]; [about 1 screen]. Available from: <https://www.nbcnews.com/mach/science/3-ways-virtual-reality-transforming-medical-care-ncna794871>
4. McCloy R, Stone R. Virtual reality in surgery. *Bmj*. 2001 Oct 20;323(7318):912-5.
5. Keogh B. Across worlds and bodies: Criticism in the age of video games. *Journal of Games Criticism*. 2014;1(1):1-26.
6. Puntambekar TS. *Awareness of Virtual reality in Surgical Training in India*. Indian Journal of Public Health Research & Development. 2019;10(5):702-6.
7. Cai Y, Lu B, Zheng J, Li L. *Immersive protein gaming for bio edutainment*. Simulation & gaming. 2006 Dec;37(4):466-75.
8. Boas YA. *Overview of virtual reality technologies*. In Interactive Multimedia Conference 2013 Aug (Vol. 2013).
9. Baños RM, Espinoza M, García-Palacios A, Cervera JM, Esquerdo G, Barrajón E, Botella C. *A positive psychological intervention using virtual reality for patients with advanced cancer in a hospital setting: a pilot study to assess feasibility*. Supportive Care in Cancer. 2013 Jan 1;21(1):263-70.

10. Gromala D, Tong X, Choo A, Karamnejad M, Shaw CD. *The virtual meditative walk: virtual reality therapy for chronic pain management*. In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems 2015 Apr 18 (pp. 521-524).
11. Gold JJ, Mahrer NE. *Is virtual reality ready for prime time in the medical space? A randomized control trial of pediatric virtual reality for acute procedural pain management*. Journal of pediatric psychology. 2018 Apr 1;43(3):266-75.
12. Hoffman HG. *Virtual-reality therapy*. Scientific American. 2004 Aug 1;291(2):58-65.
13. van Twillert B, Bremer M, Faber AW. *Computer-generated virtual reality to control pain and anxiety in pediatric and adult burn patients during wound dressing changes*. Journal of Burn Care & Research. 2007 Sep 1;28(5):694-702.
14. MORRIS DB, WILSON PR. *The challenges of pain and suffering*. Clinical Pain Management: Chronic Pain. 2008 Sep 26;1:1086.
15. Griest DL, Forehand R, Wells KC, McMahon RJ. *An examination of differences between nonclinic and behavior-problem clinic-referred children and their mothers*. Journal of Abnormal Psychology. 1980 Jun;89(3):497.