

The use of virtual reality in peripheral intravenous catheterization in children/adolescents: experience report


O uso de realidade virtual no cateterismo intravenoso periférico em crianças/adolescentes: relato de experiência


El uso de la realidad virtual en el cateterismo intravenoso periférico en niños/adolescentes: reporte de experiencia


Abstract


Objective: to describe the experience of using virtual reality in peripheral intravenous catheterization in children/adolescents. **Method:** The study included 161 children/adolescents, aged between 6 and 15 years, attending an emergency room, who wore virtual reality glasses during a peripheral intravenous catheterization procedure. The Revised Face Scale was used, with values between 0-10 to verify the perception of pain. **Results:** the participants' reports were mostly positive, with only 7(4.7%) requests to remove the glasses. There was a report of pain level 0 in 51(33.1%) of those who wore glasses throughout the procedure. **Conclusion:** Virtual reality is a feature that can be used as a distraction during peripheral intravenous catheterization. For the students, there was reflection on the appropriate nursing treatment in pediatrics, in addition to the development of communication skills and critical thinking.

Keywords: Virtual Reality; Peripheral Venous Catheterization; Nursing; Child; Adolescent.

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Resumo

Objetivo: descrever a experiência do uso da realidade virtual no cateterismo intravenoso periférico em crianças/adolescentes. **Método:** participaram do estudo 161 crianças/adolescentes, com idade entre 6 e 15 anos, em atendimento em um pronto socorro, que utilizaram um óculos de realidade virtual durante procedimento de cateterismo intravenoso periférico. Foi utilizada a Escala de Faces Revisada, com valores entre 0-10 para verificar a percepção da dor. **Resultados:** os relatos dos participantes foram majoritariamente positivos, com apenas 7(4,7%) solicitações de retirada do óculos. Houve relato de nível 0 de dor em 51(33,1%) dos que utilizaram o óculos durante todo o procedimento. **Conclusão:** a realidade virtual é um recurso que pode ser utilizado como distração durante o cateterismo intravenoso periférico. Para os discentes, houve reflexão sobre o tratamento adequado de enfermagem em pediatria, além do desenvolvimento de habilidades de comunicação e senso crítico.

Descritores: Realidade Virtual; Cateterismo Venoso Periférico; Enfermagem; Criança; Adolescente.

Resumen

Objetivo: describir la experiencia de utilizar la realidad virtual en la cateterización intravenosa periférica en niños/adolescentes. **Método:** un total de 161 niños/adolescentes con edades comprendidas entre 6 y 15 años, que recibían atención en un servicio de emergencias, participaron en el estudio. Utilizaron gafas de realidad virtual durante el procedimiento de cateterización intravenosa periférica. Se empleó la Escala de Caras Revisada, con valores que iban del 0 al 10, para evaluar la percepción del dolor. **Resultados:** los informes de los participantes fueron en su mayoría positivos, con solo 7 (4,7%) solicitudes de retirada de las gafas. Hubo informes de nivel de dolor 0 en 51 (33,1%) de aquellos que usaron las gafas durante todo el procedimiento. **Conclusión:** la realidad virtual es un recurso que se puede utilizar como distracción durante la cateterización intravenosa periférica. Para los aprendices, esta experiencia llevó a una reflexión sobre la atención de enfermería pediátrica adecuada, además de fomentar el desarrollo de habilidades de comunicación y pensamiento crítico.

Descritores: Realidad Virtual; Cateterismo Venoso Periférico; Enfermería; Niño; Adolescente.

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INTRODUCTION

Peripheral intravenous catheterization is a very common practice in pediatric hospitalization, as many of the complaints require hydration, restoration of electrolyte balance and medications to relieve symptoms⁽¹⁾. Venous access is performed by inserting a catheter into a well-visible vein, with cephalic, basilic, median veins and also the back of the hand being more common⁽¹⁾. The success of a venipuncture depends on factors such as: vein visibility, palpability, skin color, absence of tortuous veins, professional management and also the patient's behavior, the latter being complicated mainly in children, due to lack of understanding of the procedure or fear of pain⁽²⁾.

Thus, especially for children, this practice consists of an invasive and painful procedure that can cause fear and stress, demonstrated by crying, screaming and agitation, which can make the procedure difficult⁽²⁾. Thus, it is necessary for the professionals responsible for the procedure to take essential care regarding the handling and insertion of the catheter to avoid complications, as well as to know how to deal with children, in order to provide a pleasant environment and emotional support⁽²⁾. In pediatrics, it is necessary that the professionals know how to manage the behaviors of children/adolescents, providing a calm and safer procedure, ensuring greater comfort⁽²⁾. Thus, performing good practices in the procedure, having good communication, a favorable environment, allows for successful puncture and also facilitates the permanence of access for longer, avoiding new venipunctures that generate more stress and pain in the children⁽²⁾.

The need to reduce stress and pain in the children during venous access brings the need to search for methods that can bring comfort and tranquility, with techniques to cause distraction, such as imagination techniques, relaxation, soap bubbles, party blower and use of

Virtual Reality (VR)⁽³⁾. VR is an image and sound technology that provides auditory and visual experiences, creating a sense of being present in another location, enabling a multisensory experience that acts as a distraction⁽⁴⁾. Through the use of VR glasses, it is possible to insert a smartphone into a compartment in the glasses and place a video that acts as a distraction during painful and uncomfortable procedures, minimizing traumatic experiences⁽⁴⁾. VR can be used to decrease painful perception, taking the attention of the children away from the procedure and focusing on the visual media⁽⁴⁾.

VR can be explored by health institutions, as it can offer better nursing care, reducing suffering in pediatrics and obtaining better collaboration from the children⁽⁵⁾. Thus, through a university outreach activity, the objective of this study was to describe the experience of using virtual reality in peripheral intravenous catheterization in hospitalized children/adolescents.

This study had as a guiding question: What is the teaching experience during the use of virtual reality in peripheral intravenous catheterization in children/adolescents?

METHODOLOGY

This is a descriptive study of the experience report type, on the activities developed in the outreach project entitled "Virtual Reality and Peripheral Venous Puncture in Hospitalized Children", carried out from direct observation. The outreach activity was carried out between September 2021 and October 2022 in the emergency department of a pediatric hospital in southern Brazil by undergraduate nursing students. This outreach project started from the research project on the effectiveness of virtual reality as a distraction from pain and a contribution to the success of peripheral intravenous catheterization in children: a clinical, randomized and controlled study, which is in the phase of quantitative data analysis. This article deals

with the experience of students in the outreach action only in the group that used virtual reality as an intervention. The students carried out this activity as a university outreach during their undergraduate nursing studies, under the supervision of the professor and main researcher.

The study sample included patients aged ≥ 6 years and < 15 years who required an elective peripheral intravenous catheter, and were clinically stable and conscious. Exclusion criteria were cognitive impairment, diseases affecting pain sensitivity such as neural tube defects, need for contact precautions, history of seizure disorder, severe dehydration, and collection of laboratory specimens prior to first fixation. Participants were 154 children using VR throughout the procedure and 7 who asked to be removed during the procedure, totaling 161 participants.

Only participants who used VR until the end were asked about their pain level using the Revised Faces Pain Scale FPS-R.

The project was approved by the Human Research Ethics Committee under CAAE 44853621.20000.5363, of the Hans Dieter Schmidt Regional Public Hospital. Literate children were invited to sign the Informed Consent Form, and those responsible, the Informed Consent Form, respecting the precepts of resolution number 510 of 2016.

Participants and their guardians were approached in the waiting room before receiving intravenous medication. During this initial contact, the research was explained and the autonomy of the child or guardian was reinforced if they wished to remove the virtual reality glasses. It was explained that the participant could leave the research at any time, and if they felt psychologically injured, psychological support would be offered, funded by the researcher.

After acceptance, the participating children/adolescents were prepared for peripheral intravenous catheterization, and the children under 9 years old through the instructional

therapeutic toy, being shown the necessary materials for the child and asked to perform the procedure on the doll. For children/adolescents over 9 years old, an instructional booklet was provided called: "It's time to get my vein: what do I do?"⁽⁶⁾. The instructional therapeutic toy and the educational booklet were used only to prepare the child for peripheral intravenous puncture, and data on this activity were not collected.

The use of virtual reality glasses in this activity followed the following stages: hand washing, preparation and start of the 3D video Ocean World Underwater, placing a surgical cap on the child and ear protector on the headset, as shown in Figure 1, positioning the participant lying on the stretcher, observing the peripheral intravenous catheterization procedure, recording the participant's behaviors and recording in the field diary, removing the virtual reality glasses and headset.

As a characterization of children/adolescents and venous access, the following information was collected: sex of the child, age, diagnosis, catheterized vein, catheter size and number of attempts to establish the intravenous route. As an evaluation stage, the child was questioned using the FPS-R scale, validated for use with Brazilian children/adolescents on its pain level, which varies between 0 and 10⁽⁷⁾. These data were collected in this study for characterization purposes only, and no statistical tests were performed at this stage of the study.

All material that came into contact with the participant was sanitized with 70% alcohol after the procedure. Hand washing was performed before and after contact with the participant.

The observation data were recorded in a field diary, and later meetings were held between the students and the responsible teacher to share and summarize the experiences.

Figure 1 – VR being used until the procedure is completed

Source: Personal collection, 2022

RESULTS AND DISCUSSION

As a characterization of the participating public, the predominant diagnosis was acute gastroenteritis (AGE), with 44(28.6%), followed by headache with 21(13.6%), dengue with 21(13.3%) and abdominal pain with 17(11%). Eighty girls (51.9%) and 74 boys (48.1%) participated. The most used catheter size was 24 Gauge, being used in 120 children (77.9%) followed by 22 Gauge, being used in 34 (22.1%). Access was obtained on the first attempt in 127 (82.5%), on the second attempt in 22 (14.3%), on the third in 2 (1.3%) and on the fourth attempt in 3 (1.9%).

Regarding pain reports, children/adolescents reported feeling less pain, compared to previous procedures they performed, with phrases: "it hurt a little, but much less", "wearing glasses it hurt nothing" and "it hurt less than yesterday",

reporting that he had been catheterized the day before. One of the mothers also reported that in previous procedures it took four people to contain her child, and using VR was not necessary.

It is important to point out that containment techniques are controversial and can cause consequences such as pain, and psychological repercussions such as phobias, which should be discussed seriously, since they are still widely used in practice and can represent violence and mistreatment against children. Pharmacological and non-pharmacological methods should be prioritized over child restraint⁽⁸⁾.

The FPS-R scale was presented and the children indicated the value with which they classified their pain, ranging from 0 to 10. Of the 154 participants who used VR until the end of the procedure, 51 (33.1%) reported no pain

(0 on the scale) 53 (34.4%) reported pain level 2, 33(21.4%) reported pain level 4, 10(6.5%) reported 6, 1(0.6%) level 8 and 6(3.9%) level 10. One hundred and four (104) children/adolescents (67.5%) reported no pain or pain level 2, which corresponds to mild pain.

These data corroborate several studies^(4,9,10,11), including a meta-analysis published in 2020⁽¹²⁾. Distractions with digital technology, including VR, showed a modest but clinically important reduction in pain indicators, compared to the traditional clinical method⁽¹²⁾, where only emotional support measures are provided.

This reduction in pain reporting is in line with the 2021 study⁽¹³⁾, where improvements in children's well-being were verified, with a considerable impact on the quality of care. Therefore, VR can be an ally as it has demonstrated proven potential to reduce not only pain but also suffering. In addition, limited attention to VR assists in fear of pain, since the child remains distracted even before the procedure begins⁽¹⁴⁾.

Peripheral intravenous catheterization is a technique performed routinely, being an invasive and usual procedure in health care⁽⁹⁾. In large part, it causes a negative and even traumatizing experience due to stress and pain, especially in children/adolescents, before and during the procedure⁽⁹⁾. Thus, when hospitalized children/adolescents are questioned, they place needle procedures as the worst or second worst pain felt, second only to the disease that caused their hospitalization⁽¹⁵⁾.

In this way, VR was inserted during this procedure in order to provide distraction for the children, who turned their attention to the video. These were images of the seabed, 3D Ocean World Underwater, available on [Youtube.com](https://www.youtube.com), with relaxing audio. Images of the ocean have already been used with positive results for distraction and improvement in the success of blood sample collection⁽¹⁶⁾. Therefore, the video with these characteristics was chosen strategically to provide the children/adolescents involved in the study with more serenity and relaxation.

There was also a good reception by those responsible, in addition to generating curiosity about the use of VR in the success of the procedure. The children/adolescents were enchanted by VR, feeling excited and showing facial expressions of fun and surprise, which can be exemplified by the speech of one of the students. "The children reported fear at the image of people in lab coats talking about the procedure they were about to face. However, the approach and explanation were of paramount importance precisely to break this pre-existing blockage. Thus, in view of the clarification through both the instructional therapeutic toy and the instructional booklet, the participants showed enthusiasm for the possibility of using VR. In addition, during the procedure, one could notice their amusement through expressions, as well as some laughter and amusing speeches regarding the fish and the bottom of the sea. In fact, some wanted to continue using the glasses, even after the puncture was finished, and refused to remove it".

Regarding information during the procedure, most children/adolescents prefer to be informed about each stage of the process, especially when inserting the needle. However, some children/adolescents reported preferring not to be informed about the inserting the needle, as it caused a deconcentration of the fun offered by VR, and it is therefore necessary to question the child's preferences before the procedure.

In short, it is important to emphasize that pain is a subjective, specific and individual experience of each child. Therefore, it is up to the Nursing team to know how to manage the situation, generating an environment more conducive to comfort and stress relief, since the greater the pain, the greater the stress caused to the child⁽¹⁷⁾. Finally, it is emphasized that pain management is a basic human right, in addition to being a child's right and a priority issue in care⁽¹⁰⁾.

The experience with patients and the nursing team was fascinating, and it was possible to observe how technology can be used in a way that brings comfort and safety to the child patient. Regarding the acceptance of the nursing team,

it was favorable, since it was generated a curiosity in the professionals to know if VR would help in the procedure to be performed, which resulted in the effective contribution to the application of the project. The acceptance of the nursing team can be evidenced by the speech of one of the students, "At first, the professionals did not know VR well; they had little knowledge, as we approached and explained, they showed interest and were enthusiastic about using VR in care. Talking to them, it was said that VR optimizes the puncture process, since the child is more comfortable and dispersed, favoring the success of the practice, which makes it easier for them".

Therefore, the use of VR helps the practice of professionals, according to the student's comment, it is possible to do the PIC in a comfortable and least stressful way for the children/adolescent. It is essential for health professionals to engage in new technologies to improve care, promoting patient well-being.

The collaboration of those responsible was fundamental for the use of VR. Parents may be apprehensive due to the fact that the child is already sick and has to undergo an invasive and painful procedure, even though they are aware that it is for the improvement of the patient's condition. Consequently, their receptivity was important in this process, since children/adolescents became more confident in the procedure after parental approval, most of the time. The acceptance of VR by the parents is observed in a positive way by the students, according to one of the students "The parents were, at the first moment when the project is presented, a little confused about how everything would be conducted. But when there was a detailed explanation of the whole process and how VR would contribute to the procedure, they understood and showed a lot of interest in applying VR. It should be noted that most guardians guaranteed the children's autonomy, asking whether or not they wanted to use VR, making it very clear that they would only use it if they really felt comfortable".

Therefore, a good approach with parents and the children is essential, explaining the objective of the research, the importance of VR, which video will be presented, so that parents feel excited and pass this on to the children, as it was observed that good communication with parents and children/adolescents directly influences the success of VR.

As a limitation, VR can cause dizziness and nausea, which generates discomfort for children/adolescents^(9,13). Thus, only three children/adolescents reported nausea when watching the video, requesting the removal of the object. This event is known as Cybersickness, which means disease induced by the use of virtual reality, and is caused due to discrepancies between the received visual stimuli and vestibular stimuli⁽¹⁸⁾. This sensation is similar to car sickness⁽¹⁸⁾. This event was minimized by choosing a video with little head movement, which is an important factor to consider when choosing the video. The use of glasses was also less than 10 minutes in all cases, minimizing these effects⁽¹⁸⁾.

Also, according to the recommendations of the manufacturer of the glasses and previous studies^(10,19), the use of VR for users with a history of seizures and dizziness is contraindicated, since the VRG can increase the susceptibility of these events. Therefore, patients with this history did not participate in the research⁽²⁰⁾.

The use of the VRG was well accepted by most participants. However, during the study, 4 children/adolescents asked to remove the VRG because they were unsure about the time of the inserting of the needle and would like to see the procedure to feel more comfortable. Another 3 participants presented disruptive behavior, being contained by several people and making it impossible to use VR, totaling 7 (4.3%) children/adolescents who gave up using VR during access. Another factor that directly influenced the abandonment of the VRG was the number of attempts to insert the catheter, with 3 or 4 being the maximum number tolerated by children/adolescents using VR, as found in some studies^(14,16).

This reinforces the need for individualized care, where the child's cooperation is indispensable for the distraction to be successful.

For these children, emotional support was provided by the hospital team and researchers, and the fear of crying ceased soon after the procedure was completed.

As a limitation of the study, no statistical analysis of the collected data was performed, and it was not possible to evaluate the effectiveness of the use of virtual reality. This study should be expanded to a randomized clinical trial to obtain data with statistical value.

Thus, the experience of using VR was positive in most cases, enabling children/adolescents to receive individualized and respectful care. For the students, the approach to the hospitalized children enabled ethical and humanized nursing care as recommended for the profession. Non-recommended measures such as child restraint can be avoided through distraction methods.

CONCLUSION

The use of virtual reality made it possible to immerse these patients in a virtual world, being a resource that can be used as a distraction during peripheral intravenous catheterization. The performance of the outreach activity was beneficial for patients, guardians and the nursing team, as outreach practices enable health education and develop the autonomy of students in relation to nursing practice. It should be noted that the use of VR contributed to maintaining the comfort and well-being of the patients even in painful situations, making it possible to work with understanding, making the permanence of children/adolescents in the hospital environment more pleasant.

The students improved interpersonal communication and critical thinking, being a rewarding experience, reflecting on the respectful approach to the pediatric patients during invasive procedures.

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