Nat. Volatiles & Essent. Oils, 2021; 8(6): 284-293

NVEO
Natural Volatiles &
Essential Oils

The Effect Of Virtual Reality On The Pain Level Of A Child Who Will Be Introduced In The Infection Room Of Rsupn Dr Cipto Mangunkusumo

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ABSTRACT

Pain is the most common thing in children who are hospitalized. Most children who are hospitalized require invasive procedures. One of the procedures that cause pain in children is peripheral infusion. Children who are infused partially feel pain, anxiety, stress, and fear during the procedure. Children judge that the needle procedure is one of the scary and painful things. Proper pain management is needed in overcoming pain. Distraction is a non-pharmacological method that nurses can use in dealing with pain. There are many methods of distraction that can be used, such as music and cards. However, developments prove that technology has an important role in the development of globalization. A method that is following global developments is needed and one of the new methods that can be used is the use of Virtual Reality because apart from being cheap, it is easy to use, especially children like it. Objective: Implementing Virtual Reality on children who will be given an IV in the pediatric infection room at RSCM. Design: quasi-experimental with intervention with control group design. Technique Sampling with accidental sampling. Respondents were 34 children who would be given intravenous drip at the age of 7-18 years and each group (Virtual Reality Group and Group with hospital standard procedures) amounted to 17 children. The sample was selected by accidental sampling. The analysis used an independent t-test. There is an effect of providing Virtual Reality and Group interventions with standard hospital procedures on children who will be infused. Further research should consider the type of VR to be used which is comfortable and flexible/not difficult to operate

Keywords: Pain; Virtual Reality; child; infusion installation.

Introduction

Pain is a common matter experienced by hospitalized children. Most hospitalized children required invasive action, such as intravenous catheterization, venipuncture, and immunization. Child patients that undergo invasive procedures mostly experience pain, anxiety, stress, and fear during the diagnosis and medication Ali et al., 2016). The causes of pain in children hospitalized in the United State of America were due to the needle procedure especially the pen function and intravenous installment (Schlechter et al, 2021). Data from RSCM hospital, building A, showed that the numbers of patients with invasive action in March consisted of 263 patients and in April with 349 patients,

May with 205 patients, and June 130 patients. From the numbers, most children with pain received the invasive action.

Pain affects psychologically, mentally, and emotionally. Therefore, it needs the appropriate pain management during the applied procedure(Ballard et al., 2019). Pain management in children is related to acute and long psychological and physical consequences, such as hypersensitivity of pain, trypanophobia, and care avoidance. Most children perceive needles as the most painful medicate treatment for them after their pathological disease.

A percentage of 50-60% of children reported significant pain and anxiety during their experience of uncontrolled pain (Chan et al., 2019).

The roles of nurses are important for the pain management of children. The observation results of RSCM showed that pain management had not been optimally realized. The nurses focused the management on the pharmacological action that was collaborative in nature. Thus, they also needed autonomous action as the intervention giver. The autonomous action by the nurses involves non-pharmacological pain management.

Canbulat (2015) Found that the non-pharmacological method was effective to prevent acute procedural pain in children. It was because of the method practicability, easiness, and cost-efficiency. One of the applicable non-pharmacological methods is the distractive technique. The method is effective to lose the pain and anxiety of children who receive needle-based procedure treatment (Gerçeker et al., 2020). The distractive strategy is an active coping strategy to distract the attention from nociceptive stimulus to reduce the consciousness toward the pain (Semerci et al., 2021).

Many applicable distractive methods of pain management for children only slightly lose the pain during the invasive actions. The referred methods are such as listening to music and using card plays. Therefore, there is a need for an applicable technique to increase the success rate of the procedure. One of the distractive techniques is Virtual Reality implementation or VR. It is a safe and efficient method during the procedure and can increase the success rate. It is strongly recommended to combine the VR method with other methods, for example, the use of topical anesthesia combination. The evidence proved it could lose the needle pain (Semerci et al., 2021).

VR is a 3D electronic device installed on a handphone. It could produce augmented-real environment displays that influence the human perceptions and emotional responses toward stimulus (Ang et al., 2021). It facilitates the patients to adapt to the pain because of the ability to alter the senses from the pain (Dumoulin et al., 2019).

Some studies found VR was effective to lose pain. They were Semerci et al (2021), Ang (2021), and Schlechter (2021). Erdogan & Ozdemir (2021)Semerci et al (2021) found the effectiveness of VR to lose the pain and anxiety of children during the port-vein installment for oncology patients. They also found VR could lose the pain of children with burns. Ang (2021)and Schlechter (2021) found that VR was effective to lose pain during infusion procedures in the Emergency Unit.

Research Method

This research used the PICO approach with patients aged 7-18 years old as the population formulation. The patients would undergo infusion procedures. The intervention dealt with VR implementation. The Comparison stage dealt with the hospital standard action. Then, the Outcome dealt with the pain levels. The problem-solving solution of the innovative project was by literature search. The researcher searched the related topics from relevant articles. The instrument to measure the pain was the Numerical Rating Scale or NRS.

The researcher used accidental sampling to select the respondents with some inclusion criteria. They were children aged 7-18 years old that would undergo infusion procedures with Alert consciousness status. The exclusive criteria were children aged younger than 7 years old and unconscious. The researcher used two groups to conduct the research. The first group was the intervention group. This group received VR implementation (17 respondents). Then, the control group, 17 respondents, received the standard procedure of the hospital. The comparison analysis was an independent t-test and the analysis of the correlation was with chi-Square.

The researcher involved the hospital's nurses to promote the intervention. The research took three months from April until June. In the first stage, the resident created the SOP and explained the job description, the instrument to use, and the criteria of the children as the sample. Then, the resident asked for the consent of the family or the children as the sample. The implementation with VR used underwater scenery as the content. The scenery took 360^0 range with 5-minute duration. During the implementation, the paired device was a smartphone with android/IOS that was compatible with the VR. The applied VR device was Sinecom.

The Research Results

The table shows the demographic data results of VR implementation. It also provides the respondents' characteristics grouped in some categories as explained below.

a.The Distribution of the Respondents' Characteristics

Table 3.1 The Frequency Distribution of the Respondents' Socio-Demography in Building A - Infection of RSCM
April - June

Characteristics	Groups				Total	
	Intervention		Control			
	n	%	n	%	n	%
Age						
▪ Children (7-12 Years Old)	7	41,2	9	52,9	16	47,1
▪ Adolescent (12-18 Years Old)	10	58,8	8	47,1	18	52,9
Sex Types						
▪ Male	10	58,8	7	41,1	17	50
▪ Female	7	41,1	10	58,8	17	50

The table shows the dominating age-based group of VR and SOP groups is the group of 12-18 years old with 34 respondents. Most respondents are male, for the VR group, consisting of 10 respondents or 58.8%. The dominant sex type for the SOP group is female, consisting of 10 respondents or 58.8%, from 17 respondents for each group.

b. The Descriptions of the Child Pain Responses during the Infusion Procedure

Table 3.2

The Pain Response Scale and the Duration of Infusion Process (n=34)

Respon	Min	Max	Mean	SD
Kelompok VR				
Skala	0	4	1.94	1.34
Durasi	1	3	1.29	0.58
Kelompok SOP				
Skala	1	10	4.47	2.67
Durasi	1	8	2.94	2.22

Table 3.2 shows the highest pain response and the longest duration of the infusion procedure occurs in children with SOP intervention. The mean score of the pain scale is 4.47, milder pain, with the duration of applying the infusion 8 minutes, mean = 2.94.

c. The Pain Scale Difference Analysis of VR and SOP Groups

Table 3.3 The description of the pain scale average difference (n=34)

Response	Mean	SD	P-Value
VR Group	1.94	1.34	0.001
SOP Group	4.47	2.67	

Table 3.3 shows the significant difference of both groups with = 0.001. It means the VR group has a lower pain scale than the SOP group.

d. The Analysis of Age, Sex Type, Duration, and Pain Scale Correlation

The analysis assesses whether there are correlations among the variables. The method to assess the correlation was Chi-Square. If the value of α is lesser than 0.05, there is a correlation among the variables and vice versa. The variable categorizations are children aged 7-12 (0) and adolescents aged 12-18 (1). Sex type categorizations are male (0) and female (1)

Table 3.4 The Correlation of Age, Sex Type, Duration, and Pain Scale

Response		No Pain	Mild Pain	Moderate Pain	Pain Acute Pain	Pvalue
Ages	7-12 Years Old	1	6	6	3	0.118
	12-18 Years Old	1	13	4	0	
Sex Types	Female	1	9	5	2	0.943
	Male	1	10	5	1	
Duration	1 Minutes	2	15	3	0	0.000
	2 Minutes	0	2	2	0	
	3 Minutes	0	2	2	1	
	4 Minutes	0	0	1	0	
	5 Minutes	0	0	2	0	
	7 Minutes	0	0	0	1	
	8 Minutes	0	0	0	1	

Table 3.4 shows no correlation between age and pain level of children with p = 0.113. The same matter goes for sex type and pain level with p = 0.943. However, the duration of the infusion procedure is strongly and significantly correlated with the pain scale, p = 0.000.

Discussion

The innovative project assessed the VR effectiveness to lose the pain levels during an infusion procedure. The applied VR was Sinecon mini (VR 2). The researcher began the procedure by putting a smartphone inside the external cartridge of the VR. It had the purpose to easily manage the installed VR content. Then, the researcher put on the VR on the respondents' eyes.

Before the current implementation, the researcher used Sinecom (VR1) device with a headset and put a smartphone inside of the VR. Then, the researcher used a laptop computer to manage the VR content. However, the implementation encountered problems and took a long time to promote. Therefore, the researcher did not use it for further implementation because the task and jobs of nurses were rigid.

Thus, the researchers used the VR2 model. It was cheaper and easier to use. The researcher did not take a longer time to install and use it. The type of VR is seen in the following figure. VR 1 (during the test run), VR 2 (applied during the treatment)

VR 1

VR 2

The researcher also considered the different uses during the test run to check the capability to influence the pain level. The results showed no effects found in the pain scale because the VR only brought a 3D environmental view.

Patients that ever used VR mentioned the differences in VR that could influence the image quality. However, patients that never used VR found both VRs were not different. It made the researchers use the practical VR that did not take a longer time. This VR was also practice and cheaper.

The obtained analysis showed significant differences between the VR group and the SOP group with $p = 0.001$. The observation results showed that the SOP group experienced acute pain with a level of 10. The influential factors of this case were the age and the repeated experience of the infusion procedure.

The researcher found children aged 7 were screaming even before the infusion was done. They even were crying and admitted they felt the pain at level 10. The researcher found different results on children aged older than 15 years old. They admitted to feeling the pain at level 1. However, they needed a longer preparation time before the infusion procedure. There were exchanges of exclamations, such as “ouch” during the procedure. They were griming at that moment but they admitted the pain level was at level 1.

It proved that pain perception was subjective. Then, the emotional factor had an important role in pain perception. Aribawa, (2019) Explains that pain is a subconscious experience. It is a combination of sensory activities in the somatosensory cortex and the emotion of the limbic system. Thus, the pain is perceived as an "unpleasant sensory and emotional experience”.

After the infusion procedure, all children would be quiet and calm. Aribawa, (2019) Found that acute pain was a pain due to tissue damage entailed with inflammation. The nature of this pain is self-limited. It soon loses as the patient recovers.

The VR group children, aged from 7-11 years old, did not feel acute pain. They perceived the pain at the maximum level of 4, moderate pain. It was very different from those without VR.

The observation found the immediate infusion procedure after applying the VR could make the children perceived their pain at level 4. Thus, the effects of VR to manage the pain were not fully achieved. The VR implementation procedure required the children to experience the virtual world before the infusion procedure. Thus, the interaction of the patients with the displayed 3D environment could distract the attention and influenced the emotion and pain perception.

Amallia & Rahman, (2020) Found that the 3D environment had illusions that made patients interacted with the virtual world objects. Thus, they would alter their attention so they could handle the unpleasant stimulus to lose the pain. Thus, VR implementation should consider the time management of VR installation and the infusion procedure. It was important because it influenced the outcomes.

The VR contents should also be considered. The researcher used 360^{o} view of underwater scenery, taken from YouTube. The observation results showed some children with longer VR implementation before the infusion procedure did not realize the infusion procedure.

When the nurses asked permission to commence the infusion procedure, as the standard of operational procedure, the patients did not respond to it. They seemed not listening to the utterance. Some patients even fell asleep after the infusion procedure.

It proved that VR had excellent effects because it could influence the children's responses during the invasive procedure. It also provided comfort and improved sleeping patterns. Ioannou (2020) found that VR influenced anxiety, depression, fatigue, and pain.

Some previous studies also did the same thing and proved the effectiveness of VR in losing pain. Erdogan &Ozdemir (2021) found the effectiveness of VR toward invasive procedures for children. Semerci (2021) found the effectiveness of VR toward child patients with oncology. Ang (2021) found the effectiveness of VR toward burns. Schlechter (2021) found the effectiveness of VR toward the invasive procedure in the Emergency Unit. Chan (2019) found children aged 4-11 years old in the Emergency Unit needed intravenous cannulation/venous puncture. Eijlers (2019) and Gupta (2018) concluded that VR influenced the decreased pain level of children.

The mechanism of how VR could provide comfortability and lose the pain deals with the subconscious experience. It could influence pain perception. Using VR makes the brain focuses on the virtual world. It involves some senses, such as vision and auditory. These senses focus on the world inside of VR and distract the brain concentration toward the pain that is strongly correlated with an emotional factor.

The FMRI, Functional Magnetic Resonance Imaging, results show some areas of the brain are consistently activated on certain acute pains, as the somatosensory, insula, cingulate anterior cortex, prefrontal cortex, and thalamus. The parts have roles in receiving the pain, known as the pain matrix. In this case, the somatosensory cortex has the function to determine the sensors. Then, the limbic system determines the emotional reaction (Aribawa, 2019). The evidence was when the patients were dragged into the virtual world. They were not aware of the surrounding situation. Thus, it needs appropriate time usage consideration to apply VR.

The implementation of VR on some children found that they were not aware of the infusion procedure. The implementation was done due to the emotional effect consideration. The children, at the first time, did not want to use VR and wanted to see the procedure directly. After being reviewed with the parents, they admitted that the children had undergone some invasive procedures, such as blood drawing and repeated infusion procedures. Thus, children were crying before the procedure. The results had impacts on the expected results because of the emotional influence toward the pain.

The researcher also considered the parents' responses. Most parents had children younger than 12 years old. They commented on the VR implementation positively. They argued the pain differences during the VR implementation were no denial, exchange, and the cry of the children in the infection unit room. The adolescents felt shy once they know they would use VR. They argued that they did not need it so the nurses needed to persuasively approach them and keep their privacy. This procedure took a long time.

Kami The researchers also assessed whether age and sex types would influence the pain scale. however, the results did not show any correlation between age and sex types. It was different from Chan (2019) and Schlechter (2021). They found the effect of VR was significant for younger

children, aged from 4-11 years old. They explained that younger children could not manage the pain. However, older children could obtain the benefit of VR distraction.

The duration should be also considered since the infusion initiation toward the experienced pain level. The results showed that the duration of the infusion procedure was strongly correlated with the pain scale of the children, p = 0.000. The observation results also showed the influential factors of the duration were adaptation toward pain. It dealt with the frequency of the children who experienced the repeated invasive procedures, such as blood drawing and infusion procedures. Children with these conditions felt afraid and denied the procedure. The nurses' experience to handle the children's responses with trypanophobia due to repeated infusion procedures.

The expert nurses could notice the low children's adaptation. They would select a safer location of infusion procedure so that it could prevent further disturbances. For example, when the children got angry, the nurses knew what location should be controlled and knew the role of parents during the procedure. Thus, it would not take a long time.

The researchers used the NRS pain scale. It was different from the previous studies with VAS. VAS was possible to apply for the SOP group. However, the researcher did not use it because both groups had to receive the same scaling measurement instruments. Therefore, the researcher used NRS.

The researcher chose NRS based on the VR intervention. The VR had to cover some faces of the respondents. Thus, it hindered the assessing system with VAS. The NRS was easy to use. The scale seems subjective. However, since pain is a subjective experience of an individual, it has the various perception of individuals toward pain (Mustamu, 2019). It means to determine the pain scale requires verbal responses of the patients during the infusion procedure.

Limitation: The innovative project implementation with VR during the infusion procedure showed various implementation realizations by the nurses. It made biases to assess the duration and the pain scale so that further investigations are needed. However, the investigation must involve the same nurses.

Conclusion and Suggestion

The use of the innovative project showed the VR implementation was useful to lose the pain and anxiety of the children aged 7-18 years old during the infusion procedure. VR is also developed based on Science and Technological Advancement. Many children also love this device. VR is cheap and practical to apply so all nurses could use it to lower the children's pain. It also belongs to the part of the autonomous caring intervention. This research recommends nurses consider the appropriate pain measuring scale and ensure the VR is done within 1 minute before the infusion procedure. Thus, children could get inside the VR world and achieve better results.

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