

EFFECTS OF VIRTUAL REALITY AUDIO VISUAL SYSTEM AS A DISTRACTION AID TO REDUCE ANXIETY AMONG 6–10-YEAR-OLD CHILDREN UNDERGOING RESTORATIVE TREATMENTS

Dental Science

Dr. Sudheeshna M Post Graduate, Dept.Of Pediatric And Preventive Dentistry

Dr. Sameer Punathil Professor

Dr. Jeswin James Associate Professor

Dr. A B Bindhu Assistant Professor

ABSTRACT

Introduction: Distraction is a commonly used nonpharmacologic behaviour management technique by paediatric dentist to manage pain and anxiety. There are some new techniques which use audiovisual stimulation and distract the patient by exposing him or her to three-dimensional videos. These techniques are referred to as virtual reality audiovisual systems. Virtual reality (VR) utilizes advanced technologies to create virtual environments (VE) that allow patients to be immersed in an interactive, simulated world. **Aim:** To evaluate the effectiveness of virtual reality eyeglasses as a distraction aid to reduce anxiety of children undergoing the dental restorative procedures. **Materials and methods:** 26 children of age 6–10 years were randomly selected and divided into two groups of 13 each. Group I (VR group) and group II (control group). In group I (VR group), procedure was done wearing VR eyeglasses whereas in group II (control group), the dental procedure was done without wearing VR eyeglasses. Anxiety was measured by using Venham's picture test, pulse rate and oxygen saturation. Statistical analysis was done using SPSS Version 21. **Results:** There was statistical difference in oxygen saturation and pulse rate between the study and control group. There was no significant difference found in Venham's Anxiety scale between the 2 groups. **Conclusion:** The present study confirmed the efficacy of VR distraction as a means of behaviour management technique. The use of VR as a distraction technique improves the physiologic parameters of children aged 6–10 years but does not reduce the patient's self-reported anxiety according to Venham's picture test.

KEYWORDS

Virtual Reality, Anxiety, Audio Visual Distraction

INTRODUCTION:

Dental anxiety is defined as “an abnormal fear or dread of visiting the dentist for preventive care or therapy and unwarranted anxiety over dental procedures. Dental treatment can trigger emotions such as anxiety and fear in children, thus increasing pain perception. To minimize or avoid the effect of these emotions on treatment, it is important to ensure that their behaviour is managed properly. Anxiety and fear can be a challenge for dentists, as it is one of the main factors that trigger noncooperative behaviours during dental care. Distraction is a useful technique of diverting the patient's attention from what may be perceived as an unpleasant procedure.

This enables decreased perception of unpleasantness and averting negative behaviour. It includes audio and audiovisual techniques. Several technological options are available for both visual and audio distraction, such as background music, television sets, computer games, and virtual reality (VR) glasses. In recent years, there has been an increase in behavioural research in VR and virtual world. Virtual reality utilizes advanced technologies to create virtual environments (VE) that allow patients to be immersed in an interactive, simulated world. By immersing patients in a virtual environment, VR can effectively divert their attention away from unpleasant procedures, reducing their perception of discomfort and anxiety.

These advanced systems interact at many levels with the VE, stimulating sights, sounds, and motion to encourage immersion in the virtual world to enhance distraction from pain. This study aims to evaluate the effectiveness of VR eyeglasses as a distraction aid to reduce anxiety of children undergoing dental restorative procedure.

MATERIALS AND METHODS

Study Design

The research was a case control study. The study was conducted on a total sample of 26 teeth in 13 children aged between 6 years and 10 years.

The study was initiated after obtaining ethical approval from the institutional ethical committee. Parents gave comprehensive medical and dental history along with informed consent. Oral examination was done for every child using a mouth mirror and probe. The study period was 2 months and the sample selection was carried out during the OP period of the department by random sampling method.

Inclusion and Exclusion Criteria

A total of 13 children with bilateral restorable Class I Cavity on primary molars and those who demonstrated Frankl behaviour rating 3&4 towards the dental procedures were included in this study. Exclusion criteria for the study were medically compromised children, children with special health care needs, patients who had a bad experience with dentist, and Children with Frankl behaviour rating 1 and 2.

MATERIALS AND METHODS

A total of 26 bilateral primary maxillary and mandibular molars in 13 patients aged 6–10 years were selected for this study. Bilateral restorable primary molars were assigned for the restorative procedures. The randomization procedure was done using the split mouth study design and study treatments were randomly assigned to left or right dentition sites. In group I (VR group), Class I GIC restoration was done wearing the VR eyeglasses whereas in group II (control group), the Class I GIC restoration procedure was done without wearing the VR eyeglasses.

The treatment comprised three successive sessions and all dental procedures were performed by a single paediatric dentist and dental assistant. This consistent team ensured continuity of care and familiarity for the patient throughout all three visits. In first visit, all children in group I were introduced to VR eyeglasses using the tell-show-do technique.

During the second visit for Group I, all children were given a few minutes to get accustomed to the eyeglasses. These were VR eyeglasses (IRUSU 40 MM HD Lenses Virtual Reality Glasses 3D VR Box headsets for 4.7–6.69-inch mobile phones, India) (Fig.1) used specifically during the restorative procedures.

These eyeglasses completely block the child's visual field and has a built-in headphones for audio delivery. The device was connected to a mobile device (Vivo Y95) capable of playing MP4 audiovisual files. Throughout the study, a single episode of the cartoon series "Tom and Jerry" was played for all subjects. Once the VR device was securely placed, the cartoon was played. Then Class I cavity preparation was done followed by GIC restoration.

Third appointment was scheduled 1–2 weeks after the second visit, GIC restoration was performed on Group II children without using VR eyeglasses. Each therapeutic session lasted approximately 30 minutes.



Figure 1
Anxiety Assessment



Figure 2

Child's anxiety level in each procedural visit was assessed using a combination of three measures. The Venham's Picture Test (VPT)(Fig.3) is a projective and psychometric self-measure test designed to assess the state anxiety of young children. It consists of eight cards, each featuring two pictures: one depicting an anxious figure and the other a non-anxious figure. The child is asked to select the figure they feel the most like at that moment. Each card is numbered and presented in a specific order. If the child selects the anxious figure, a score of 1 is recorded; if the child selects the non-anxious figure, a score of 0 is recorded. The scale ranges from 0 to 8, with higher scores indicating higher levels of anxiety. Pulse rate and oxygen saturation measured before, during and after the procedure by the finger pulse oximeter (Pulse Oximeter, India) (Fig.2) which is a direct measure of physiological arousal since its increase is attributed to stress during dental procedures.

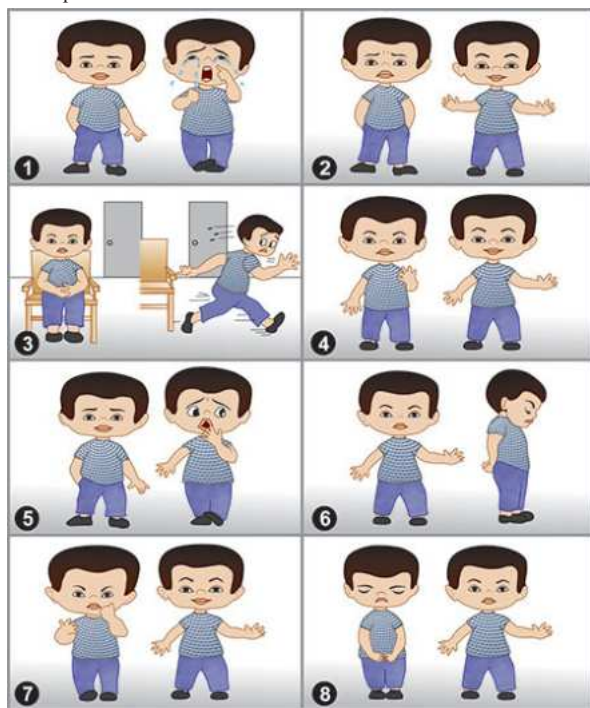


Figure 3



Figure 4

Statistical Analysis

The statistical analysis was performed using the SPSS version 17

software (SPSS Inc., Chicago, IL). Level of significance set at 5% ($p < 0.05$ = Statistically Significant). Intergroup comparisons were done using Independent-t-Test (For Quantitative Data) and Mann-Whitney Test (For Qualitative Data).

RESULTS

A total of 13 patients ($n = 26$ teeth) with bilateral molars indicated for Class I GIC restoration were enrolled in the study. The selected patients' ages ranged from 6 to 10 years. It's noteworthy that all patients reported for all three visits, demonstrating a 100% follow-up rate throughout the study.

Table 1: Intergroup Comparison (Before)

		N	Mean	Standard Deviation	p-value
Oxygen Saturation	VR Group	13	96.85	1.46	0.954
	Control	13	95.54	6.79	
Pulse Rate	VR Group	13	100.54	9.54	0.035*
	Control	13	89.08	13.76	

p-value based on Independent-t-test

* = Statistically Significant ($p < 0.05$)

Table 2: Intergroup Comparison (During)

		N	Mean	Standard Deviation	p-value
Oxygen Saturation	VR Group	13	94.69	0.95	0.951
	Control	13	93.23	9.57	
Pulse Rate	VR Group	13	90.62	16.86	0.043*
	Control	13	96.62	13.35	

p-value based on Independent-t-test

* = Statistically Significant ($p < 0.05$)

Table 3: Intergroup Comparison (After)

		N	Mean	Standard Deviation	p-value
Oxygen Saturation	VR Group	13	95.38	3.10	0.834
	Control	13	93.62	8.15	
Pulse Rate	VR Group	13	91.15	14.78	0.045*
	Control	13	98.38	13.23	

p-value based on Independent-t-test

* = Statistically Significant ($p < 0.05$)

Table 4: Intergroup Comparison

		N	Mean Rank	p-value
Anxiety Scale	VR Group	13	3.23	0.993
	Control	13	3.38	

p-value based on Mann-Whitney Test

* = Statistically Significant ($p < 0.05$)

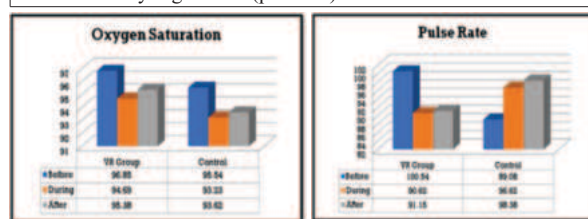


Figure 5

Figure 6

Table 1, 2 and 3 shows the intergroup comparison of Oxygen saturation and Pulse rate before, during and after the procedure. Table 4 shows the intergroup comparison of anxiety scale.

There is statistical difference in oxygen saturation and pulse rate between the study and control group. No significant difference in Venham's Anxiety scale between the 2 groups.

DISCUSSION

Dental anxiety can be defined as a feeling of apprehension about the dental treatment that is not necessarily connected to a specific external stimulus. Distraction is a useful technique of diverting the patient's attention from what may be perceived as an unpleasant procedure. This enables decreased perception of unpleasantness and averting negative or avoidance behaviour. In newer dental practices, the utilization of visual stimuli, either alone or in combination with audio stimulation, has been found to be effective in diverting patients' attention. This involves exposing them to two-dimensional (2-D) or three-

dimensional (3-D) videos. These techniques aim to engage patients and provide a more immersive experience, which can help alleviate anxiety and distract them from the dental procedures being performed.

Indeed, various methods such as VR audiovisual systems, AV eyeglass systems, or A/V distraction techniques have been employed in dental practices. In our study, audiovisual eyewear was used, which can be a potent distraction compared to watching videos on a screen. This is because occlusive eyewear projects images directly in front of the user's eyes, effectively blocking out surrounding visual and auditory stimuli. For these methods to be effective, they should be age-appropriate and visually appealing to the recipient, ensuring maximum engagement and distraction during dental procedures.

The mean pulse rate value in Group II after restoration (98.38) was found to be greater than the mean pulse rate value before extraction (89.08), and this difference was statistically significant. When the pulse rate increases after a dental procedure relative to before, it indicates that the child may be experiencing anxiety. This suggests that pulse rate is an important parameter for assessing anxiety levels in children undergoing dental procedures.

In the present study, in the intergroup comparison, VR eyeglasses demonstrated their effectiveness in reducing pulse rate compared to the control group. These findings are consistent with previous studies conducted by Koticha P et al. According to Hoffman et al., The Virtual reality may also have analgesic potential for other painful procedures. A study done by Nilson et al. observed that self-reported, observed pain and distress scores were low in patients who wore VR glasses. These studies concluded that the use of audiovisual distraction during dental treatment was more effective in managing anxious children compared to using audio distraction alone. Therefore, the incorporation of VR eyeglasses and audiovisual distraction techniques could be beneficial in alleviating anxiety and improving the overall experience for children during dental procedures.

The changes in oxygen saturation in groups, group I (96.85 and 95.38) and group II (95.54 and 93.62), before and after the restorative procedure were observed when VR eyeglasses were used. The results were contradictory to the results of the study conducted by Koticha P et al; in that study the Oxygen saturation before and after the procedures were non-significant.

The Venham's Picture Test used in the present study yielded non-significant values with Group I before and after the restorative procedure while wearing the VR eyeglasses. These results align with similar studies conducted by Sullivan et al. A similar study done by Prabhakar et al., compared the efficacy of AV distraction with audio distraction and concluded that audiovisual distraction technique was more effective in managing anxious paediatric dental patient as compared to audio distraction technique. In this study the distraction technique was done while doing the restorative procedure and the AV distraction technique was effective similar results were observed in a study done by Hoge et al., where children wearing video eyewear glasses demonstrated significantly less disruptive behaviour than those in the control group in children undergoing restorative dental treatment. This study demonstrates there was no significant differences were found in the measures of anxiety obtained with the Venham's Picture Test. However, these findings contradict the study conducted by Baghdadi, who found a significant difference in the Venham's Picture Test scores during dental treatment between the audio distraction technique and the control situation. According to Khandelwal M et al, AVD technique is simple, passive, and non-invasive means of behaviour management and can be used alternatively in managing anxious paediatric dental patients.

Limitations

The limitation of the present study was its smaller sample size. A larger sample size, especially in a general clinical setting, might have provided more robust results and helped to elucidate any differences in the effectiveness of AV distraction due to anxiety and behaviour measures.

CONCLUSION

The present study confirms the efficacy of virtual reality distraction as a means of the behaviour management technique. The use of VR as a distraction technique improved the physiologic parameter of children aged between 6–10 years but does not reduce the patient's self-reported

anxiety according to Venham's picture test used. In our era of digital dentistry, use of virtual reality audiovisual aid can be an adjunct in reducing the anxiety of children.

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