Effect of Virtual Reality on Pediatric Patients During Restorative Treatments

SARAH DARST, CARLA ALVAREZ, ALEXANDER ALCARAZ
HERMAN OSTROW SCHOOL OF DENTISTRY OF USC | ADVANCED PEDIATRIC DENTISTRY

Herman Ostrow School of Dentistry of USC

INTRODUCTION

Dental fear and anxiety are common emotional experiences that develop during early childhood and adolescence.[1] Dental anxiety can be present in children even when dental procedures are painless. Dental anxiety presents as fear and apprehension due to a response to internal and external danger typically accompanied by restlessness, tension, tachycardia, and dyspnea.[2] The American Academy of Pediatric Dentistry (AAPD) recommends nonpharmacological techniques such as distraction to manage behavior during dental treatment.[4] Audiovisual distraction is a non-aversive approach that diverts children's attention.[5] Virtual reality (VR) is a type of audiovisual distraction that enables users to immerse themselves in a virtual world through visual, auditory, tactile, and olfactory sensations.[2] Previous studies have found VR systems to be beneficial during dental treatment for patients with moderate fear and anxiety, but current literature is limited to children aged four to ten years.[3]

PURPOSE

The purpose of this pilot study is to further investigate the effect of VR as an audiovisual distraction technique for children ages 8-15 and evaluate the effect of VR on behavior, anxiety, and pain during restorative dental appointments. The goal of this pilot study is to estimate average values and determine confidence intervals to plan for larger subsequent randomized control studies.

METHODS

This study is a randomized controlled trial with a crossover design. IRB approval was obtained. Patients ages 8-15 requiring two or more appointments for restorative dental treatment were recruited at the Herman Ostrow School of Dentistry of USC, Los Angeles, CA. The enrolled patients served as their own experimental and control groups. The participants were randomly assigned to wear the StarlightTM VR system (Figure 1) for one appointment and receive basic behavior guidance techniques for the other appointment. Behavior was assessed using the Frankl and Houpt Scale. Anxiety was measured by heart rate at specific time points throughout the restorative procedure. Data was collected, analyzed, and alterations to a future protocol will be made based on the results of this pilot study.

Figure 1- Starlight™ Virtual Reality System

RESULTS

Five patients enrolled in the pilot study. Two patients were unable to tolerate the VR system and dropped out. Three patients were able to receive treatment using both VR and basic behavior guidance technique (Table 1).

1. Patient A and C had improved behavior while wearing VR when compared to basic behavior guidance control (Figure 3).
2. Patient A and C had lower heart rate trends while wearing VR when compared to basic behavior guidance control (Figure 4).
3. Patient E had consistently positive behavior throughout the study with variable heart rate trends (Figure 3, Figure 4).
4. The behavior based on the Houpt Score was similar or improved while wearing VR for all patients when compared to the basic behavior guidance control (Figure 3)
5. The behavior based on the Frankl Score was similar or improved for all patients while wearing VR when compared to the basic behavior guidance control (Figure 2).

Restorative Dental Treatment Rendered			
Patient	Virtual Reality (VR)	Basic Behavior Guidance (BBG)	Assigned Study Arm
A	#3-MO Composite #14, #19 Sealants	#30-O, #T-MO Composite	BBG 1st
B	#30- MO Composite #M, #R Extractions	N/A	VR 1st
C	#B-DO, #I-DO, #J- MO Composite	#L, #S Extraction	VR 1st
D	#30-O, #T-MO Composite #S- Extraction	N/A	VR 1st
E	#7-ML, #8-DL Composite	#10- DIFL Composite	BBG 1st

Table 1- The treatment rendered and respective study arms of each study participant

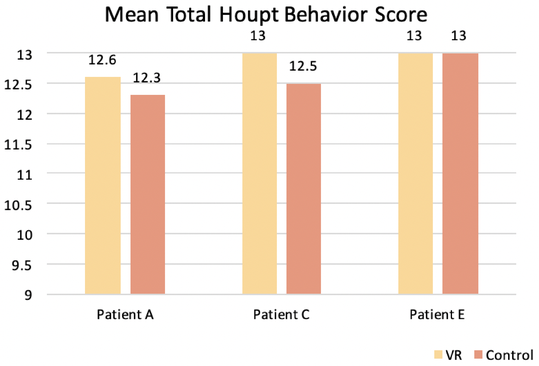

Figure 3- The total Houpt Scores for the three patients that completed both the VR and the control appointments (Patients A, C, E) were averaged between the two blind scorers and are compared.

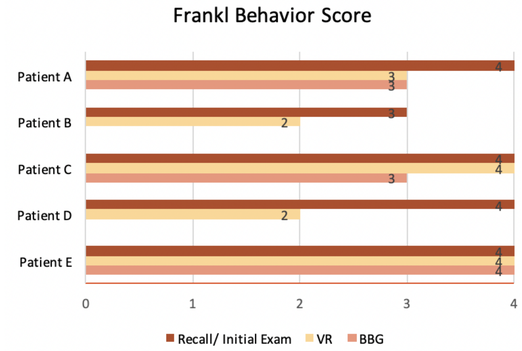

Figure 2- The Frank Scores assigned to each patient at their recall/comprehensive exam, and their completed restorative appointments

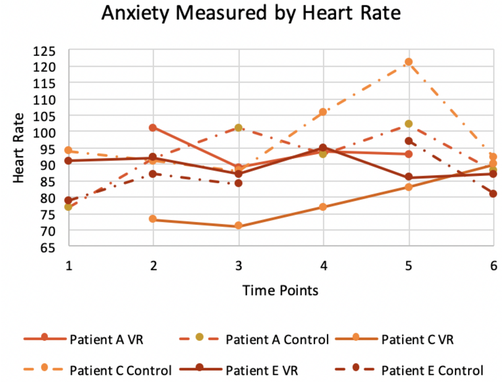

Figure 4- The heart rates of the three patients who completed an appointment with VR and a control appointment

DISCUSSION

The limitations and complications from this pilot study helped refine the protocol, study design, and data collection methods for a future randomized control trial. These changes will include:

1. A standardization of restorative treatments to only include the placement of dental sealants. The pilot study had variability in the dental treatments being rendered for each enrolled patient. Placement of sealants will be used to limit the amount of time the patients have to wear the VR goggles
2. The Face, Legs, Activity, Cry, and Consolability (FLACC) will be used in future studies to better assess the behavior of an awake child. Houpt Scale was used in the pilot study to analyze behavior, but is traditionally used to analyze behavior during dental sedation, thus is not the best representation of the behavior during the appointment.
3. Outcome measures such as pain and anxiety will be measured by the Face Pain Scale- Revised (FPS-R) and heart rate respectively.
4. A change in the VR device because the Starlight Experience goggles were too bulky for younger patients, fogged up easily, and caused disruptions to the dental restorative treatment and data collection.
5. Inclusion criteria will be expanded to include ages 6-17.

CONCLUSIONS

VR may improve behavior and decrease anxiety in pediatric patients during dental restorative treatment. A future randomized control trial will be developed to help to determine the significance of behavior improvement and anxiety reduction with the use of VR.

REFERENCES:

1. Sharma A, Kumar D, Anand A, Mittal V, Singh A, Aggarwal N. Factors predicting behavior management problems during initial dental examination in children aged 2 to 8 years. International Journal of Clinical Pediatric Dentistry Vol 10, issue 1:5–9, 2017.
2. Mladenovic R, Djordjevic F. Effectiveness of virtual reality as a distraction on anxiety and pain during impacted mandibular third molar surgery under local Anesthesia. J Stomatol Oral Maxillofac Surg. 2021;122(4):e15-e20.
3. Custódio NB, Costa FDS, Cademartori MG, da Costa VPP, Goettems ML. Effectiveness of Virtual Reality Glasses as a Distraction for Children During Dental Care. Pediatr Dent. 2020;42(2):93-102.
4. merican Academy of Pediatric Dentistry. Behavior guidance for the pediatric dental patient. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2020:292-310.
5. Al-Khotani A, Bello LA, Christidis N. Effects of audiovisual distraction on children's behavior during dental treatment: a randomized controlled clinical trial. Acta Odontol Scand. 2016;74(6):494-501.