EFFECT OF TWO DISTRACTION TECHNIQUES ON CHILDREN'S BEHAVIOUR, ANXIETY AND PAIN IN THE DENTAL SETTING

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ABSTRACT

Aim: The aim of the current study was to evaluate the influence of using virtual reality (VR) eyeglasses on anxiety and pain perception during pulp therapy treatment in pediatric patients.

Methodology: 60 children, aged 4-6 years who were planned to receive vital pulp therapy (pulpotomy) in the mandibular primary molars were randomly divided into two equal groups (30 child per group); an experimental group (non-pharmacological behavior management and VR were used) and a control group (non-pharmacological behavior management was used). The behavior and anxiety of each child were recorded during dental examination, during and after treatment using Frankl behavior rating scale and Venham picture test respectively. Pain perception was recorded using Wong Baker's face pain scale at end of treatment.

Results: There were a significant improvement in the child behavior, pain perception and anxiety score (p<0.05) with use of VR eyeglasses during dental treatment.

Conclusion: Results of the current study demonstrated that VR eyeglasses could successfully decrease pain perception, anxiety and improve behavior during dental treatment.

KEYWORD: Dental, Child, Anxiety, Pain, Behavior, Distraction, Virtual reality.

INTRODUCTION

Most pediatric patients are fearful and apprehensive on their first visit to the dentist because of the dental equipment and the new experience (**Kaur et al., 2015).** While, anxiety is defined as uncomfortable feelings and sensations that is linked to actual or potential trauma to tissues (**Lin et al., 2017**), dental anxiety is described as ''distressed expectation of dental visit to the degree that child can refuse treatment (**Seligman et al., 2016).**

In addition, pain management during dental procedures is critical for effective behavior guidance

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as the child's first dental experience is critical in shaping his or her attitude toward dentistry **(Vishwakarma et al., 2017)**. Preventing pain will improve the dentist-patient relationship, create confidence, reduce fear and anxiety, and improve positive dental attitudes for future visits **(Talo et al., 2017).**

In general, child behavior during dental visits can be managed through non-pharmacological or pharmacological approaches according to situation. Distraction is considered as one of well-used behavioral modification techniques during children dental visits **(Anthonappa et al., 2017)**. Also, VR is considered as a feasible distractive technique for control of child anxiety, pain and behavior during dental visit **(Atzori et al., 2018; Koticha et al., 2019)**.

Systematic review of **Custodo et al., 2020; Cunningham et al., 2021** demonstrated the limited well-designed clinical trial in assessment of VR effectiveness in anxiety, pain and behavior control for children during dental visits, thus the current study was designed as a step in formation of evidence of VR effusiveness as distractive approach during dental visit.

PATIENTS AND METHODS

Ethical approval

The current study was approved by ethics committee of Faculty of Dentistry, Minia University (approval number 284) and performed in compliance with Helsinki declaration and international conference on harmonization guidelines for good clinical practice. All parents / guardians of the eligible children assigned an informed consent after through explanation of the study experiment while for those refused to participate; their children were managed according to routine protocol of institution.

Randomization and allocation

Sixty eligible children were randomly divided into two equal groups by independent investigator using block randomization through online databases for clinical trials at **https://www.sealedenvelope. com/simple-randomiser/v1/lists.** The allocation concealment was performed using folded printed letters that placed within an aluminum foil. The letter included the patient's identification code, name, time, date and the group number. The envelope opened at the time of treatment with an independent nurse. Children assigned into two groups of 3 0 participants per group as following:

- ***Group (1):*** Intervention group (Non-pharmacological management and VR).

- ***Group (2):*** Control group (Non-pharmacological management).

Eligibility standards

The inclusions criteria were set as following; 1. Children age of 4-6 years old, 2.No previous dental experience involving local anesthesia (LA) administration, 3. Healthy children classified as class I or II according to ASA scale, and 4. Presence of mandibular primary molars indicated for vital pulp therapy. While exclusion criteria included; A. Patient with emotional or behavioral problems, B.Children with score more than or equal 25 on the screen child anxiety related disorders scale (SCARED), and C.Those with visual and/or auditory impairment.

Clinical steps

The procedures were conducted on two successive sessions by the same pediatric dentist with at least 5 years of experience; in first session: The parents were requested to fill out SCARED questionnaire parent version (Table 1).it is a 41 item inventory rated on a 3 point likert- type scale. The purpose of this instrument is to screen for signs of anxiety disorders in children. After the examination,

a treatment plan was determined and discussed with the parent\guardian then the child was introduced to the dental procedures using psychological behavior management techniques particularly tell-show-do technique (TSD).

While during the second session, LA, pulpotomy procedure and stainless steel crowns (SSCs) were performed. Children in the experimental group showed the VR eyeglasses before beginning of the treatment and explained about their working. One of the popular cartoon series ('Tom and Jerry, Batman or Sponge Bob) started according to the child preference and the volume of audio adjusted to allow the child to listen instructions from the operator. Then inferior alveolar nerve block administered followed by a primary mandibular molar pulp

therapy. The behavior of each child recorded during dental examination and after finishing of pulpotomy procedures using the Frankl behavior rating scale (FBRS).

To evaluate the child anxiety the video stopped at the following 4 occasions; 1.after dental examination, 2.after administration of LA, 3.after finishing pulpotomy procedures, and 4.after finishing placement of SSCs and at each time the child anxiety was measured using Venham Picture Scale. At the end of the treatment, the child was asked to register self- reported pain during treatment using Wong Baker Scale. For the control group the same procedures were done without the use of VR eyeglasses.

TABLE (1): Screen for Child Anxiety Related Disorders (SCARED)

	0 Not True or Hardly Ever True	1 Somewhat True or Sometimes True	2 Very True or Often True
1. When my child feels frightened, it is hard for him/her to breathe			
2. My child gets headaches when he/she is at school.			
3. My child doesn't like to be with people he/she doesn't know well			
4. My child gets scared if he/she sleeps away from home			
5. My child worries about other people liking him/her			
6. When my child gets frightened, he/she feels like passing out			
7. My child is nervous.			
8. My child follows me wherever I go			
9. People tell me that my child looks nervous.			
10. My child feels nervous with people he/she doesn't know well.			
11. My child gets stomachaches at school.			

	0 Not True or Hardly Ever True	1 Somewhat True or Sometimes True	2 Very True or Often True
12. When my child gets frightened, he/she feels like he/she is going crazy.			
13. My child worries about sleeping alone			
14. My child worries about being as good as other kids			
15. When my child gets frightened, he/she feels like things are not real.			
16. My child has nightmares about something bad happening to his/her parents			
17. My child worries about going to school			
18. When my child gets frightened, his/her heart beats fast			
19. He/she gets shaky			
20. My child has nightmares about something bad happening to him/her			
21. My child worries about things working out for him/her			
22. When my child gets frightened, he/she sweats a lot			
23. My child is a worrier.			
24. My child gets really frightened for no reason at all.			
25. My child is afraid to be alone in the house			
26. It is hard for my child to talk with people he/she doesn't know well			
27. When my child gets frightened, he/she feels like he/she is choking			
28. People tell me that my child worries too much.			
29. My child doesn't like to be away from his/her family			
30. My child is afraid of having anxiety (or panic) attacks			
31. My child worries that something bad might happen to his/her parents.			
32. My child feels shy with people he/she doesn't know well			

	0 Not True or Hardly Ever True	1 Somewhat True or Sometimes True	2 Very True or Often True
33. My child worries about what is going to happen in the future.			
34. When my child gets frightened, he/she feels like throwing up.			
35. My child worries about how well he/she does things			
36. My child is scared to go to school			
37. My child worries about things that have already happened			
38. When my child gets frightened, he/she feels dizzy			
39. My child feels nervous when he/she is with other children or adults and he/she has to do something while they watch him/her (for example: read aloud, speak, play a game, play a sport.)			
40. My child feels nervous when he/she is going to parties, dances, or any place where there will be people that he/she doesn't know well.			
41. My child is shy			

Scoring

A total score of ≥ 25 may indicate the presence of an Anxiety Disorder. Scores higher than 30 are more specific.

Statistical Data Analysis

Collected data were tabulated and analyzed using SPSS software package version 22.0. (Armonk, NY: IBM Corp). The following statistical tests used; Kolmogorov-Smirnov test (testing normal distribution of data), Fisher's Exact test and Chi-Squared test (used for categorical data of independent groups), McNemar's test (used for paired nominal data), and unpaired Student t-test (used for continuous data of two independent groups). The level of significance level was set to ≤ 0.05 and 95%.

RESULTS

The average scores of dental anxieties among children treated with traditional distraction method were higher than their peers treated with AV method. However, the differences were statistically significant following administration of LA and after final restoration placement. After LA administration, the means scores of dental anxiety in the control and intervention groups were 5 ± 2.13 and 3.97 ± 1.43 [Mean difference of 0.47; 95% CI of 0.09;1.97] respectively. After SSC placement the Venham's Picture Scale average scores in the control and intervention groups were 4.33 ± 2.01 and 3 ± 1.98 [Mean difference of 0.52; 95% CI of -2.36; -0.30] respectively (Table 2).

Regarding the frequencies of FBRS at baseline: in the control group, half of children (n = 15) (50%)

were rated as positive and negative while in the intervention group 19 children (63.3%) showed signs of negative behavior. The difference was not statistically significant (p = 0.44). After finishing the procedure, the findings showed a statistically significant improvement in the frequency of children with positive behavior in the intervention group (p = 0.04). The signs of positive behavior reported in 21 children (70%) in the intervention group. While in the control group the number of children with positive behavior were lower than that reported before beginning the treatment (n = 13) (43.3%) (Table 3).

The pain average score in the traditional distraction (6.27 ± 2.72) group was higher than that in the AV group (5 ± 1.88). This difference between the two groups was statistically significant (p = 0.04). The mean difference between the two groups was 1.25 with 95% CI of (0.06; 2.49) (Table 4).

TABLE (2): Mean of Venham Picture Scale of the control and intervention groups

	Mean ± SD		Mean difference	SE	p*	95% CI of mean difference
	Control group	Intervention group				
Baselines	4.30 ± 2.28	3.40 ± 1.63	0.9	0.51	0.08	-0.12; 1.92
After LA	5 ± 2.13	3.97 ± 1.43	1.03	0.47	**0.03**	0.09;1.97
After pulpotomy	5.23 ± 1.91	4.90 ± 1.27	0.33	0.42	0.43	-0.50; 1.17
After final restoration	4.33 ± 2.01	3 ± 1.98	1.33	0.52	**0.01**	-2.36; -0.30

Student t-test, Level of significance set to ≤ 0.05

TABLE (3): Frequency distribution of Frankl Behaviour Rating Scales at the baselines and at end of tretment in the intervention and control groups

FBRS	Reporting time	Control group N(%)	Intervention group N(%)	p*
Negative	Baseline data	15(50)	19(63.3)	0.44
Positive		15(50)	11(36.7)	
Negative	End data	17(56.7)	9(30)	**0.04**
Positive		13(43.3)	21(70)	

Fisher's Exact test, Level of significance set to ≤ 0.05

TABLE (4): Mean of Wong Baker Face Scales of the control and intervention groups

WBFS	Control group	Intervention group	Mean Difference	SE	p*	95% CI of mean difference
Mean ± SD	6.27 ± 2.72	5 ± 1.88	1.27	0.60	0.04	0.06; 2.49

Student t-test, Level of significance set to ≤ 0.05

DISCUSSION

Dental anxiety significantly predicts pain and child behavior during and after dental treatment that highlights the importance of its control for providing optimal treatment and positive dental attitudes (**Lee et al., 2018**). However, many studies reported audiovisual distraction as an effective method to control dental anxiety (**Attar et al., 2015; Nuvvula et al., 2015; Panda et al., 2017**), they were considered as low evidence due to their poor design and high risk of bias (**Liu et al., 2019; Cunningham et al., 2021**). The current study hypothesized that there were no difference between using non-pharmacological behavior management alone or with VR in anxiety, pain perception and behavior of pediatric dental patient.

In order to establish the highest causal associations and level of evidence through the present study, randomized controlled trial design was followed through the study (**Zabor et al., 2020**). Random allocation of subjects were performed to minimize allocation bias thus providing similar chance of each participant to be included in each group and removing confounding by achieving groups that were similar in baseline characteristics (**Sedgwick, 2015**). Also allocation concealment was performed through using a printed letter which was covered with aluminum foil to hide the print and placed into opaque envelope thus minimize selection bias (**Bespalov et al., 2019**).

In addition, standardization was ensured through; definite eligibility criteria excluding any confounding factor that may affect accuracy of results as behavioral problems, anxiety disorders, visual and/or auditory impairment, and performance of same procedures and behavior management techniques by same investigator for all participants (**Jeddy et al., 2018**).

While SCARED questionnaire was used to evaluate the presence of childhood background anxiety disorders as being of long-term use with assured reliability excluding those with anxiety disorders background (**Behrens et_al., 2019**). In addition, Venham Picture Scale was selected to permit measurement of the state anxiety of children when visiting a dentist as being valid scale which is relatively easy to be administrated and is readily understood and accepted, by children (**Oliveira et al., 2020**). Also, the Frankl behavior rating scale was used which is one of the most reliable tool for behavior rating considered as the gold standard (**Suresh et al., 2020**)

The current study found that using virtual reality to distract children without anxiety problems during routine dental care decreased pain perception, reduced state anxiety, and improve patient behavior in agreement with previous studies of **Attar et al., 2015; Nuvvula et al., 2015; Panda et al., 2017**. These advantages may be related to more immersive images due to the occlusive headsets that project the images directly in front of the eyes of the user and block out real world (visual ,auditory, or both) stimuli. The child's attention is focused on what is happening in the virtual world rather than on the real world (*Atzori et al.,2018*)

The strength of this study is the well-designed randomized trial with appropriate sample size that can represent the whole population and add a remarkable step in building evidence of VR efficacy. The sole limitation of that study is lake of comparison with different audiovisual distractors.

CONCLUSION

Results of this study showed that VR eyewear could be successfully used to distract children during dental treatment. The VR can decrease the child anxiety, the amount of pain perceived in children, and help in improving patient cooperation.

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