



Effectiveness of audio visual distraction using virtual reality eyeglasses versus tablet device in child behavioral management during inferior alveolar nerve block

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ABSTRACT

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Aim: The aim of this study was to evaluate the effectiveness of two different audiovisual distraction techniques, e.g. audio-visual (AV) eyeglasses – virtual reality box (VR Box) or a Tablet) in the management of anxious pediatric patients during inferior alveolar nerve block (IAN) block.

Study design: A randomized clinical trial carried out on 102 children (60 boys and 42 girls) aged between 6 and 10 years (mean age of 7.4 years) to investigate the effect of using VR eyeglasses 'VR Box' and tablet device with wireless headphone in reducing the dental anxiety of children during IAN administration.

Methodology: 102 children were randomly divided into three groups; Group A (Control group): IAN administrated with basic behavior guidance techniques and without using any type of distraction aids. Group B: IAN administrated with using AV eyeglasses 'VR Box' and wireless headphone. Group C: IAN administrated with using tablet device and wireless headphones. The participants were selected from children attending the department of the pediatric dentistry at the Faculty of Dentistry, Damascus University, who required local anesthesia (LA) administration in the mandibular arch. All of the children who experienced an IAN block with/without distraction were assessed by using a combination of measures: Wong–Baker FACES (self-report), pulse rate (physiological) and behavior (using FLACC behavior rating scale ('external evaluator')).

Results: 101 children completed the study out of 102 children. There was no statistically significant difference in the anxiety of audiovisual groups as reported by the Wong–Baker FACES values ($p = 0.536$) and FLACC scale ($p = 0.454$). However, there was a statistically significant difference in the anxiety and pain level in pulse rate ($p = 0.043$).

Conclusions: Distraction using video shown on tablet device was the best in relieving dental anxiety and pain during IAN block. Although using 'VR Box' had no added advantage in a majority of children, 'VR Box' was more acceptable in older patients (8-10 years) than younger patients and gave the children some exciting experiences which may lead to far better behavior in the next dental visits.

Key words: Distraction; Behavior management; Children's dental anxiety.

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INTRODUCTION

Researchers have found that one of the most provocation aspects of child behavior management is poor pain control. Even though it is challenging but it is important that clinicians must try their best to reduce pain and discomfort during dental treatment, especially injection procedure.¹ In this regard 'the needle' is considered as the biggest reason of the pediatric dental patients' fear.²

Dental fear and anxiety can have negative impact on the outcome of the dental treatment, even more on the patients' oral health related to quality of life as many studies have reported.³⁻⁶ A variety of behavioral management techniques has emerged to manage dental fear including pharmacological and non-pharmacological methods.⁷ Previous studies have stated that use of distraction during dental treatment is useful to patients by reducing their distress and in turn decrease their perception of pain sensation especially during injections with local anesthesia.⁸

Most children could be made unaware of receiving the injection with the use of topical anesthetic, distraction and a good injection technique.⁹ It was observed that audiovisual distraction technique was superior in managing anxious pediatric dental patients than using audio distraction alone.¹⁰ Using audiovisual aids for distraction during dental injection can alleviate dental anxiety by distracting two types of sensations; hearing and seeing.¹¹ Recently, several studies have shown that AV eyeglasses are effective in distracting pediatric patients during dental procedures.^{12,13}

Therefore, the aim of this study was to evaluate the effectiveness of two different audiovisual distraction techniques (AV eyeglasses 'VR Box' vs. tablet) in the management of anxious pediatric patients during IAN block.

METHODOLOGY

The sample size was a total of 102 children, which was calculated using G-Power 3.1 statistical program with ($\alpha=0.05$, and Power=0.95). The informed consent was taken from parents or legal guardians before the procedures were carried out.

The 102 subjects were randomized into 3 groups. A random allocation list was generated using a

randomization website 'Random.org'. This single-blind randomized clinical trial (RCT) was designed and conducted according to the CONSORT statement over a period of 6 months from April 2017 to October 2017.

The participants were selected from children attending the Department of Pediatric Dentistry, Faculty of Dentistry, Damascus University, based on the following inclusion criteria:

- 1 age group between 6 and 10 years
- 2 with no previous dental experience
- 3 without any systemic or mental disorders
- 4 who could be categorized under definitely positive or positive ratings of Frank scale
- 5 who required LA administration in the mandibular arch (IAN block)

AV eyeglasses (VR Box): The AV eyeglasses (BlackBug™ Virtual Reality Glasses 3D VR Box Headsets, China) were used in the current study as an entertainment system, which can block the visual field of the child completely and the sound were delivered by a wireless headphone. The device was connected to a mobile phone (Asus Zenfone 2 Deluxe™, Asus®) capable of playing MP4 audio-visual files. A single episode of a cartoon series was selected by the patient from one of the following popular cartoons in Syria: 'Tom and Jerry', 'Gumball', 'Pink Panther' or 'SpongeBob', and was played throughout the injection procedure.

Tablet: The tablet (Innjo F2™, China) capable of playing MP4 audio-visual files, was fixed on the hand of the dental chair using tablet holder (AboveTEK™ tablet holder, China)

Pain assessment scale: The Wong-Baker FACES pain rating scale was used in this study to measure pain after delivering inferior alveolar block injection. Children were asked to choose one of the scale's faces that best described how they felt during the procedure (Figure 1).



Figure 1: Wong-Baker FACES pain rating scale

Behavior assessment scale:

The 'Face, Legs, Activity, Cry, Consolability' scale (FLACC scale, Table 1) was used in this study due to the reliability that was proved by Dak-Albab et al., in Syrian Arab Republic.¹⁴

Pulse rate measures: The pulse rate was recorded for the first time when patients were seated on the dental chair and immediately after IAN block was finished. Then, the difference between the two measures was calculated.

Intervention: 102 children were randomized into three groups according to the distraction type:

Group A (Control group): IAN administered with basic behavior guidance techniques and without using any type of distraction aids.

Group B: IAN administered with using AV eyeglasses 'VR Box' and wireless headphone.

Group C: IAN administered with using tablet device and wireless headphone.

For each child patient, a disposable oral examination kit and a traditional oral anesthesia kit (27-gauge long needle, 2 % lidocaine (1:100,000 epinephrine) solution, and an aspirating syringe) was used in this study.

In group B and C, children were asked to choose one episode of the popular cartoon series – 'Tom and Jerry', 'Gumball', 'Pink Panther' or 'SpongeBob'. The first measure of pulse rate was recorded directly when the patient seated comfortably on the dental chair. Afterwards, a 20% benzocaine topical anesthetic gel was applied after drying the injection area for 30 seconds protocol (McDonald et al. 2016). During the application of the topical anesthetic, children were prepared for the injection. Then, inferior alveolar nerve block was administered following the standard protocol (McDonald et al. 2016) by a single researcher (AM) (Figures 2 & 3).

After anesthesia was given, the second pulse rate was recorded and the children were asked to choose a face that described their status from one of the Wong-Baker faces scale.

For each patient, all of the body responses were video

Table 1: FLACC scale

Behavior	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting, back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams, sobs, frequent complaints
Consolability	Content, relaxed	Reassured by touching, hugging or being talked to, distractible	Difficult to console or comfort

Each category is scored on the 0-2 scale which results in a total score of 0-10.

0 = Relaxed and comfortable; 1-3 = Mild discomfort; 4-6 = Moderate pain; 7-10 = Severe discomfort/pain

recorded during the whole procedure and then were evaluated by an external evaluator to determine the children behavioral score according to FLACC scale.

Statistical analysis: The statistical analysis was carried out using SPSS 21.0 software (SPSS, Inc, Chicago, Ill). One-way Anova was used to study the differences between the three groups according to behavioral scales scores (FLACC score, Wong-Baker faces scale and pulse rate).

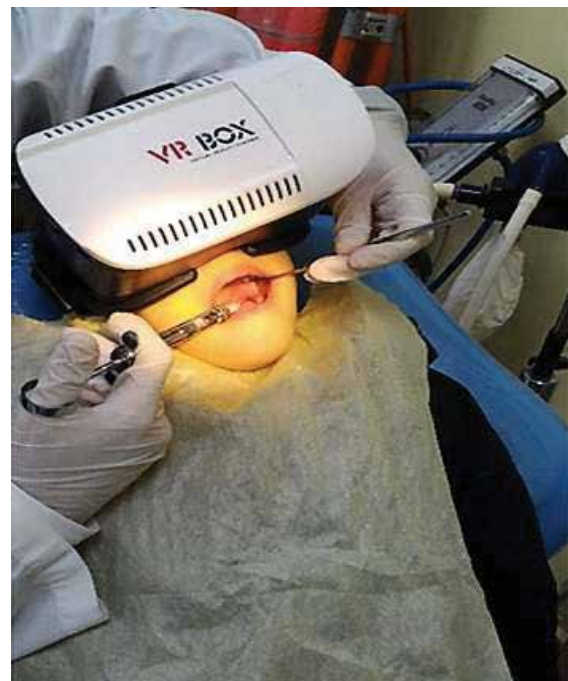


Figure 2: Use of AV eyeglasses 'VR Box' and wireless headphone for distraction



Figure 3: Use of video on tablet and wireless headphone for distraction

Independent T-test was used to evaluate the three scales in all three groups according to gender. The

Table 2: Normality of data using Kolmogorov-Smirnov table

Test of Normality	Group-L	Group-M	Group-C
Scale	Kolmogorov-Smirnov		
	Statistic	Df	Sig
FLACC scale	1,064	67	0,293
W-P FACES	1,112	67	0,186
Heart rate	0,691	67	0.269

Table 3: One-way Anova to study the difference in the three scales in three groups

Scale	Source	Degree of freedom	p value
FLACC scale	Between the Groups	2	0.456
	Intra the group	99	
	Total	101	
W-P FACES	Between the Groups	2	0.538
	Intra the group	99	
	Total	101	
Heart rate	Between the Groups	2	0.043
	Intra the group	99	
	Total	101	

Pvalue < 0.05

differences were considered statistically significant when p-value was less than 0.05.

RESULTS

A total of 102 children, 101 children (60 boys and 41 girls, mean age 7.4) completed the study, whereas one patient was excluded due to behavioral problems.

In all groups, pain and behavioral scales scores (Heart pulse rate, W-P faces, FLACC) were recorded. Normality of data was tested using Kolmogorov-Smirnov (Table 2). Then one-way Anova statistical test was done, significant difference was noticed between three groups in the heart pulse rate scale ($P=0.0430$) and no significant difference was noticed between three groups in the W-P faces ($p = 0.536$) and FLACC scales ($p = 0.454$) (Table 3).

Bonferroni test was used for multiple-correction comparison for heart pulse rate results as shown in (Table 4).

As noted in Table 3, there was significant difference between Group A and Group C ($p = 0.037$). Nevertheless, there were no significant differences between Group A and Group B ($p = 0.671$) or between Group B and Group C ($p = 0.626$).

In control group, pulse rate was higher than in Group C. All Sig for Kolmogorov-Smirnov test were higher than 0.05, all data was normally distributed.

There were no statistical differences between the three groups in FLACC scale and W-P faces scale, however, statistical differences were founded in pulse rates between the three groups (Table 4).

DISCUSSION

In pediatric dentistry, there is a strong relationship between a child dental anxiety and successful dental treatment. Even more, the painful situations like needle insertion can result in fear and affect the behavioral of the child.¹⁵

The use of pharmacological aids can reduce the painful needle insertion into the tissue, as reported by Tugla et al. Benzocaine 20% gel has the

best pain relieving effect for needle insertion in children.¹⁶ Non-pharmacological methods also have been reported as a valuable method in relieving dental anxiety, VR eyewear can be used as a distraction method and decrease the amount of the children's anxiety during dental painful procedures.¹⁷

The use of pharmacological methods (topical anesthetic agent) along with non-pharmacological methods (AV distraction) has been considered as the best method in reducing needle insertion pain and child anxiety during dental anesthesia.¹⁸

Therefore, we used pharmacological method along with non-pharmacological during dental anesthesia in mandible (IAN Block).

Many researchers have used FLACC pain scale 'Face-Leg-Activity-Cry-Consolability' to evaluate patient discomfort during treatment,^{13,19} and the Royal College for Nursing recommended using FLACC scale to evaluate the pain in over 3-year-old children regardless of their cooperation level (20).

As our study results show, the use of AV eyeglasses 'VR Box' has no added advantage in child behavioral management and pain relieving during IAN block on all three assessment scales.

On the other hand, many articles concluded that the use of AV eyeglasses 'VR Box' resulted in less pain and less anxiety. In those studies, they used the AV eyeglasses 'VR Box' during the whole treatment procedures including LA administration. Therefore, it might increase the duration of watching the video on AV eyeglasses 'VR Box', thereby, more time of watching VR. Since most of the procedures will become non-painful and will have no pain feeling after delivering LA.^{17,21,22}

In addition, it has been noted in this study, that the use of AV eyeglasses 'VR Box' could be difficult to wear and it could block the practitioner vision of what's inside the mouth, especially the IAN Block site. Thereby, the dental procedures will be more difficult. Although, other studies used VR eyeglasses on older children which may be easy to use with.²³ VR eyeglasses might be helpful when used with special needs patients because it will block patient's vision from dental equipment. Such as, autism patients who are afraid from dental chair light.²¹

In contrast to our finding, some studies have found

Table 4: Bonferroni test for multiple-correction comparison for pulse rates

Group	Source	Means difference	p value	Decision
Group A	Group B	-2.879	0.671	No statistical difference
	Group C	-5.857*	0.037	Statistical differences Towards Group C
Group B	Group C	-2.978	0.626	No Statistical differences

Pvalue < 0.05

that the use of AV eyeglasses may provide better distraction than watching video on screen.²⁴ We noted that AV eyeglasses 'VR Box' had no added advantage in child behavioral management which was similar to the findings in the control group. This could be due to the fact that the use of AV eyeglasses 'VR Box' can block out the real world's vision, thus increasing the child anxiety from the new and threatening surrounding environment. This was similar to the child anxiety which was faced by the children in the control group from the vision of the dental instruments.²⁵

Nevertheless, audio visual distraction using tablet device, which was fixed to the dental chair, was superior in child behavioral management and pain control during IAN block compared to using AV eyeglasses 'VR Box' and control group.

However, another study found that watching cartoons on TV did not have any effect on distracting children during anesthesia or reducing their pain. The possible reason behind that, might be the younger children and there was no application of a topical anesthesia gel before the insertion of the needle. In addition to that, using wireless headphone in our study might have superior distraction effect. So that, the children were more focused on the shown cartoons.⁽²⁴⁾ It was noted that pulse rate was lower in the tablet device group compared to AV eyeglasses 'VR Box' and the control group. This added advantage was due to the useful audio and visual distraction from the dental instruments and no threatening vision block of the child patient.

LIMITATIONS

The limitation of this study was the inability of blinding the external investigator from child's use of the AV eyeglasses 'VR Box'. In addition, the size of the VR Box used in this study was a little too big for many children.

CONCLUSION

Within the limitations of this study it can be concluded that using video show on tablet device

gave the best result in relieving dental anxiety and pain during IAN block in children.

Although the use of AV eyeglasses 'VR Box' had no added advantage in a majority of children, but it was more acceptable in patients of 8-10 years than younger ones and gave the children some exciting experiences which may lead to better behavior in the next dental visits.

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