

# Effect of VR Box as Distraction Aid on Children's Behaviour during Dental Treatment: A Randomized Controlled Clinical Trial

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**Abstract:** ***Aim:** The aim of this study was to evaluate the effectiveness of VR Box as distraction techniques in the management of anxious pediatric patients during dental treatment. **Study design:** A randomized clinical trial carried out on 30 children aged between 5 and 12 years to investigate the effect of VR Box in reducing the dental anxiety of children in three dental visit. **Methodology:** 30 children were randomly divided into two groups; Group A (Control group) : dental treatment carried out with basic behavior guidance techniques and without using any type of distraction aids. Group B: dental treatment carried out with using VR Box' and wire headphone. The participants were selected from children attending the department of Pedodontic and Preventive Dentistry, Kalka Dental College And Hospital , Meerut . All of the children who experienced an dental treatment in 3 visit with/without distraction were assessed by using a combination of measures: VPT , VARS , Pulse rate and BP. **Results:** In Intragroup comparison visit wise , the Sbp , Dbp , PR,VPT and VAS found to be statistical significant (p=0.001). In inter group comparison between Control and AV group there was a statistical significant difference during 1<sup>st</sup> visit with a significant value of p = 0.001 for Sbp , Dbp ,and VAS where as p=0.018 for VPT and for PR P= 0.046. At second visit of intergroup comparison between Control, AV group there is statistical significant with p = 0.001 for Sbp, Dbp VAS and VPT except for PR = 0.032. At third visit of inter group comparison between Control and AV group there is statistical significant different with p= 0.001 for Sbp, Dbp, PR ,VAS and VPT. **Conclusions:** Audio-visual with VR Box distraction technique is an effective means for the management of anxious pediatric patients .*

**Keywords:** Distraction; Behavior management; Children's dental anxiety

## 1. Introduction

Although the operative dentistry may be perfect the appointment is a failure if the child departs in tears" - **Mc Elroy (1895)**

The term Anxiety has been defined as a nonspecific feeling of apprehension towards a concrete situation that does not necessarily involve a previous experience. Dental anxiety and fear in children has been recognized as a problem in patient management for many years. It is often reported as dental anxiety lead to irregular dental attendance, delay in seeking dental care or even avoidance of dental care. The literature has shown that the Etiology of dental anxiety/fear is a multidimensional phenomenon, and stimuli (real or imaginative) can contribute to the development.

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.<sup>1</sup> In this regard 'the needle' is considered as the biggest reason of the pediatric dental patients' fear.<sup>2</sup> 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.<sup>3-6</sup> A variety of behavioral management techniques has emerged to manage dental fear including pharmacological and non pharmacological methods.<sup>7</sup>

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 . Using audiovisual aids for distraction during dental injection can alleviate dental anxiety by distracting two types of sensations; hearing and seeing.<sup>8</sup>

If a dentist is aware of the level of anxiety, fear and phobia of his patients, he/she is not only able to guide about the patient's behaviour, but can also take measures to alleviate these during operatory procedures Therefore, the aim of this study was to evaluate the effectiveness of 'VR Box' in the management of anxious pediatric patients during their three visit with different dental procedure .

## 2. Materials and Method

The patients is selected randomly by stratified random sampling to one of the following two group:-

Group 1: Treatment with conventional method

Group 2: Treatment with audio – visual aids (passive- audio and visual )

15 patients are selected randomly for each group with an age between 5 to 12 years old. As this is the age group which shows most disruptive or negative behavior and is the most common age where the patients visit the dentist for the first time ,Nino J et al .2010; Ghimire A. et al 2013; Meera R et al .2008 .This is the age which is most difficult to manage and on the other hand relying on response of very young children is

questionable hence these age group was selected as they have better cognitive development and motor skill to give appropriate feedback as there was no communication barrier with the operator. The treatment procedure was not beyond the 30 min . Altar RH et al (2015) in his study state that the children showed more distress and uncooperative behaviour when the dental procedure went beyond 30 min<sup>9</sup> the dental appointment and visit time was scheduled according to the patients comfort.

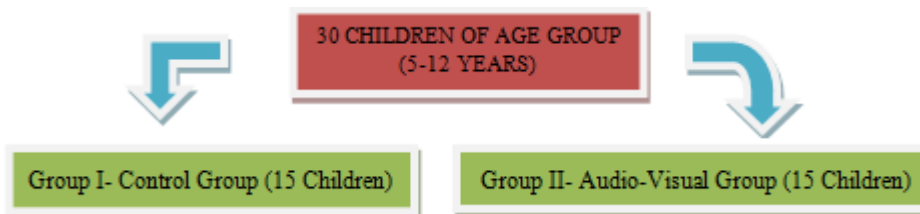


Figure 1: Study Flow Chart

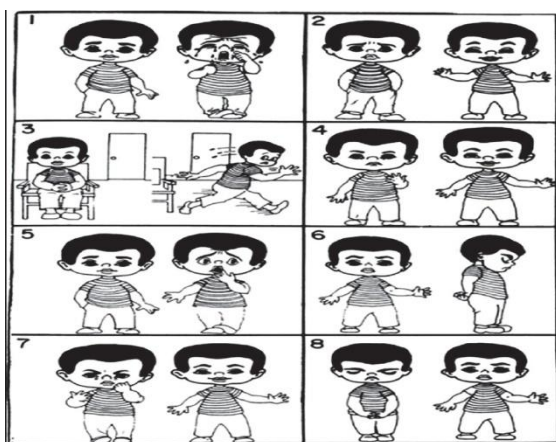


Figure 2: Venham Picture Test.

- touch dentist hand or instrument, but not pull at it). Child interprets situations with reasonable accuracy and continues to work to cope with his/her anxiety.
- 4) = Shows reluctance entire situations, difficulty in correctly accessing situational threat. Pronounced verbal protest, crying. Using hand to try to stop procedure. Protest out of proportions to threat. Copes with situations with great reluctance.
- 5) = Anxiety interferes with ability to access situations. General crying not related to threatening. More permanent body movement. Child can be reached through verbal communications, and eventually with reluctance and great effort he or she begins the work of coping with the threat.
- 6) = Child out of contact with the reality of the threat. General loud crying, unable to listen to verbal communications, make no effort to cope with threat. Actively involved in escape behaviour. Physical restraint required.

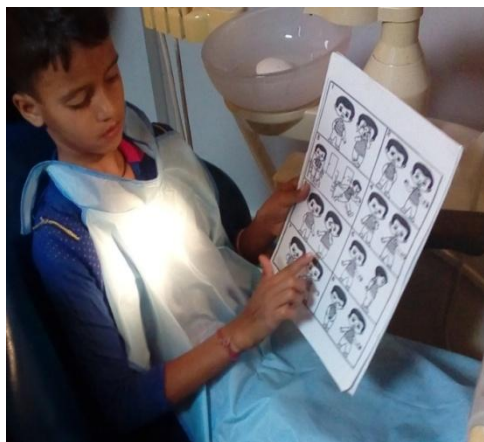


Figure 4: Illustration of VPT.

Figure 3: Venham’s Anxiety Rating Scale

- 1) = Relax, smiling, willing and able to converse.
- 2) = Uneasy, concerned. During stressful procedure may protest briefly and quietly to indicate discomfort. Hand remain down or partially rest to signal discomfort. Child willing and able to interpret experience as requested. Tense facial expressions, may have tear in eyes.
- 3) = Child appears scared. Tone of voice, questions and answer reflect anxiety. During stressful procedure, verbal protest, quiet, crying, hand tense and rest (not interfering much- may



Figure 5: Local anesthesia under AV aids (VR Box)

Each patients had three dental visit as First visit - dental screening and prophylaxis. Second visit – Restoration of teeth without LA. Third visit – Pulpectomy / Pulpotomy / Extraction / deep caries management with local anesthesia.

This study was approved by ethical committee of the institute and written informed consent was obtained from children and their guardians before commencement of the study. During each patients visit BP and Pulse rate of patients was recorded

which was used for physiological assessment of child's anxiety level pre and post treatment and the Venham's picture test (VPT) and Venham's clinical anxiety rating scale (VCRS) used to evaluate child's anxiety level pre and post treatment.

### 3. Statistical Analysis

The data for the present study was analyzed using the SPSS statistical software 21 version (Chicago Inc). The descriptive statistics include mean, standard deviation. The inter group comparison was done using the one way ANOVA. The level of the significance for the present study was at  $p < 0.05$ .

### 4. Results

In Intragroup comparison visit wise, the Sbp, Dbp, PR, VPT and VAS of all group (i.e Control group and AV Group) found to be statistical significant ( $p = 0.001$ ).

In intragroup comparison visit wise the control group shows ascending in anxiety level from 1st day visit to the last day of visit. As the last day visit being the most invasive dental procedure like pulpectomy, pulpotomy, extraction with LA etc (Table 1). Where as in AV group the anxiety level descent as with the consecutive visit.

In inter group comparison between Control and AV group there was a statistical significant difference during 1st visit with a significant value of  $p = 0.001$  for Sbp, Dbp, and VAS where as  $p = 0.018$  for VPT and for PR  $P = 0.046$  (Table 4)

At second visit of intergroup comparison between Control and AV group there is statistical significant with  $p = 0.001$  for Sbp, Dbp VAS and VPT except for PR = 0.032 (Table 5) At third visit of inter group comparison between Control and AV group there is statistical significant different with  $p = 0.001$  for Sbp, Dbp, PR, VAS and VPT (Table 6).

**Table 1: Intragroup Comparison Visit Wise –Control Group**

Parametres	Ist Visit	IInd Visit	IIIrd Visit	P value	Significance
Systolic Blood Pressure	98.66±13.36	105.40±14.52	114.00±14.38	0.001	Significant
Diastolic Blood Pressure	68.46±6.42	72.53±6.81	78.66±6.72	0.001	Significant
Pulse Rate	110.67±11.22	114.60±9.14	121.47±10.14	0.001	Significant
VPT	4.26±1.86	5.33±1.23	6.60±1.18	0.001	Significant
VAS	0.66±0.61	1.00±0.37	1.66±0.51	0.001	Significant

**Table 2: Intragroup Comparison Visit Wise –Av Group**

Parametres	Ist Visit	IInd Visit	IIIrd Visit	P value	Significance
Systolic Blood Pressure	108.00±14.40	100.73±12.37	94.53±12.36	0.001	Significant
Diastolic Blood Pressure	74.66±5.87	71.00±5.15	65.20±5.05	0.001	Significant
Pulse Rate	108.13±11.53	103.60±11.35	98.20±11.79	0.001	Significant
VPT	2.86±1.45	2.13±1.24	1.26±1.98	0.001	Significant
VAS	0.26±0.45	0.06±0.25	0.00±0.00	0.001	Significant

**Table 3: Intergroup Comparison –Ist Visit**

Parametres	Control	AV	P value	Significance
Systolic Blood Pressure	111.93±10.24	98.66±13.36	0.001	Significant
Diastolic Blood Pressure	79.60±5.82	68.46±6.42	0.001	Significant
Pulse Rate	111.73±30.99	108.13±11.53	0.046	Significant
VPT	4.26±1.86	2.71±1.06	0.018	Significant
VAS	0.66±0.61	0.26±0.45	0.001	Significant

**Table 4: Intergroup Comparison –IInd Visit**

Parametres	Control	AV	P value	Significance
Systolic Blood Pressure	105.40±14.52	100.73±12.37	0.001	Significant
Diastolic Blood Pressure	72.93±6.14	71.00±5.15	0.001	Significant
Pulse Rate	114.60±9.14	103.60±11.35	0.032	Significant
VPT	5.33±1.23	2.13±1.24	0.001	Significant
VAS	1.00±0.37	0.06±0.25	0.001	Significant

**Table 5: Intergroup Comparison –IIIrd Visit**

Parametres	Control	AV	P value	Significance
Systolic Blood Pressure	114.00±14.38	94.53±12.36	0.001	Significant
Diastolic Blood Pressure	78.66±6.72	65.20±5.05	0.001	Significant
Pulse Rate	121.47±10.14	98.20±11.79	0.001	Significant
VPT	6.60±1.18	1.26±1.98	0.001	Significant
VAS	1.66±0.51	0.00±0.00	0.001	Significant

### 5. Discussion

The rate of prevalence of dental anxiety is 5-20% in most of the populations which is seen more in children and this tends to decrease as age advances. It is also revealed that females are

more prone to dental anxiety as compared to their male counterparts. The relation of dental anxiety with the incidence of caries is well documented thus signifying their avoidance for dental visits.<sup>10</sup>



In the Intragroup comparison visit wise , the Sbp , Dbp, PR,VPT and VAS of all group ( i.e Control group and AV Group ) found to be statistical significant ( $p=0.001$ ) .

In intragroup comparison visit wise the control group shows ascending in anxiety level from 1st day visit to the last day of visit. As the last day visit being the most invasive dental procedure like pulpectomy, pulpotomy, extraction with LA etc (Table 1) . which is in consistent to the study done by AL Khoteni A et al (2016). However that was not coinciding with the audiovisual group (VR Box) which showed a consistent decrease in the anxiety of children with the consecutive dental visits.

In the recent studies conducted by Asvanund et al<sup>11</sup> and Hoge et al<sup>12</sup> the result are corresponding to the current study where a significant reduction in anxiety and positive behavior was instilled via the AV aids during local anesthesia injection, dental restorative procedure and other conventional dental procedures in pediatric dental patients.

In the present study with inter group comparison, the increase of the anxiety level for the AV groups was less than that of control group. The superior results of the audio visual distraction aids can be explained on the fact that while watching and listening songs, story ,rhymes etc, children becomes more engrossed & concentrate more on the audio visual songs , story, rhymes etc , thus diverting their attention from the anxiety causing dental stimuli. The sights and sounds of the dental treatment are screened out, leading to further reduction of anxiety.

In our study the patients was given the option to choose one out of four- video song, cartoon, story and rhymes. According to Klen and Winklesteen<sup>13</sup> this will help the children to gain control over the unpleasant stimulus and give them a feeling of being in a familiar environment.

Locker et al in 1996 also suggested that dental anxiety was specifically related to invasive or painful treatment. In addition, this was also supported by Ruth Suzanne Maximo da Costa et al in the year 2012 who said that, pain during dental treatment is more associated to invasive procedures, tooth extractions and surgeries. Local anesthesia is referred to as a painful procedure generating anxiety.

In inter group comparison between Control and AV group there was a statistical significant difference during 1<sup>st</sup> visit with a significant value of  $p = 0.001$  for Sbp ,Dbp ,and VAS .Where as  $p=0.018$  for VPT and for PR  $P= 0.046$ .(Table 3) . At second visit of intergroup comparison between Control and AV group there is statistical significant with  $p = 0.001$  for Sbp, Dbp VAS and VPT except for PR = 0.032.(Table 4) . At third visit of inter group comparison between Control and AV group there is statistical significant different with  $p= 0.001$  for Sbp, Dbp, PR ,VAS and VPT.(Table 5).

Whereas the anxiety level of audiovisual group decreased in the second and third visit as the children were being distracted from the sight, sound and sensation of the air-rotor hand-piece while doing cavity preparation and the sight and prick of the needle during local anesthesia.

The VR Box Distraction in our study stand as the viable technique and is effective in managing the anxious pediatric patients which is in consistent to that of study done by **Shafi S et al (2015)**<sup>14</sup>. In contrast to our study 'VR Box' has no added advantage in child behavioral management and pain relieving during IAN block.<sup>15</sup> VR distraction is unique in that it is immersive and engaging, integrating many sensory experiences, and thus capturing greater degree of attention (Nicole et al 2005) becomes possible through the use of interactive virtual environments (VE).

VR refers to a human computer interface that enables the user to interact dynamically with the computer-generated environment. VR uses sophisticated systems such as head-mounted, wide field-of-view, 3D displays (HMDs) and motion sensing systems that measure the users head and present the 360 degree illusion of being completely surrounded by the virtual world. This application may be superior to traditional distraction because it offers more immersive images due to occlusive headsets that project the images right in front of the eyes of the user and depending on the model used, block out real world (visual, auditory, or both) stimuli. VR even combines the audio, visual and kinesthetic sensory modalities (Naser et al 2012) .Therefore, being the most immersive of all, it is expected to be superior to the less technologically advanced A/V distraction methods.

## 6. Conclusion

VR Box distraction is clinically viable technique with a high potential to alleviate pain/anxiety associated with various dental procedures. It has proved to be effective in majority of patients and seems to be safe technique that do not require any previous education and training .It can be used effectively in children, adolescents and adults by adjusting the images to the according developmental stages. However, still much research needs to be done to obtain a clearer picture of its full potential strength and limitations.

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