Original Research Article

Effectiveness and Comparison of Different Behaviour Guidance Techniques in Pediatric Dental Patients- A Randomized Control Study

Abstract:

Background

Dental anxiety is the normal psychological response to a dental stimulus that has been interpreted as harmful or dangerous to the individual. It can be experienced as a level of uneasiness around dental appointments or specific dental procedures. To overcome this, Pediatric dentists use various methods to reduce anxiety and improve children's cooperation.

Aims: The aim of the study is to compare the effectiveness of different behaviour management techniques in anxious pediatric patients aged 5-10 years, based on HR, BP, and Anxiety scales.

Material and Method: Sixty children aged 5-10 years were divided into three groups: Group 1 Tell-Show-Do (n=20), Group 2 Virtual Reality (n=20), and Group 3 Control (n=20). In each group, Restoration (n=10) and oral prophylaxis (n=10) were performed by the same operator for every child. The Control group was treated without using behaviour techniques, while the Audio-Visual group used virtual reality. BP was recorded before and after the procedure, and heart rate (HR) was recorded before, during, and after the procedure using a pulse oximeter. Anxiety levels were measured using Venham's Picture Test (VPT) and Venham's Clinical Rating Scale (VCRS). One-way ANOVA was used for Intergroup comparison and the post-hoc Tukey test was used for Multiple Intergroup comparisons with a Significance level set at 5%

Result: The VR group showed statistically significant results with higher reduction of HR, BP, VPT, and VCRS scores compared to the TSD and control groups**.**

Conclusion: The Virtual Reality method is more effective than TSD method in reducing anxiety in children undergoing Restoration and Oral Prophylaxis

Key words: Anxiety, Behaviour Guidance, Tell show do, Virtual reality, Venham's Picture Test, Venham's Clinical Rating Scale.

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Highlight of this study

Main Conclusion: VR is significantly more effective than TSD in reducing anxiety in pediatric dental patients, as evidenced by greater reductions in HR, BP, VPT, and VCRS scores.

Implications: Integrating VR into pediatric dentistry enhances patient comfort, supports modern protocols, and encourages further research. Training and resources for VR implementation are needed to improve patient experiences and reduce future dental anxiety.

Introduction

For a long time, dental treatment has posed a challenge for dentists due to child's fear and anxiety. Aim of Dental professionals is to provide an anxiety-free environment while delivering top-quality dental care. Achieving this goal requires the application of their acquired skills and experience.[1]

The clinical environment, the clinician, and the instruments are significant anxiety-provoking factors for children [2], often leading to avoidance and neglect of dental care.[3] Dental anxiety is defined as the distressed anticipation of a dental visit, to the extent that a child may avoid treatment altogether.[1] Dental fear is an unpleasant emotional response to specific frightening stimuli encountered in the dental office.[4] To manage these issues, various behaviour shaping and modification techniques are available, which help provide quality care to children.[2]

Pediatric dentists use various behavior management techniques to address children's anxiety during dental visits, ranging from relaxation methods to general anesthesia. In 1972, the American Association of Pedodontic Diplomates highlighted the benefits of psychological approaches over physical restraints and pharmacological methods, though the latter can cause complications like nausea, vomiting, and respiratory issues. On the other hand, non-pharmacological methods such as Tell-Show-Do (TSD), modelling, voice control, hypnosis, [4,5]biofeedback with guided imagery, and distraction techniques like storytelling and the use of audio and audiovisual aids focus on addressing the psychological aspects of the child's experience.[4,6,7]These techniques do not carry the risk of side effects and can lead to better acceptance of dental treatment by reducing fear and anxiety.

The Tell-Show-Do (TSD) technique, introduced by Addelston in 1959, is one of the most commonly used non-pharmacological behaviour modification techniques. Based on the principles of learning theory, the TSD method involves informing the child about the procedure

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in advance and providing a demonstration using a simulator to show exactly what will happen before the procedure begins.[8]

Distraction is defined as a state of mind that diverts attention away from unpleasant stimuli. Virtual reality (VR) distraction is a novel technique for behaviour management in children.[9] VR helps the child forget the actual environment by immersing them in a computer-generated, stress-free atmosphere, making it more effective than other distraction techniques.[10] By using virtual reality glasses, the child's senses, such as vision and hearing, are actively engaged, thereby reducing anxiety.[2]The present study compared the effectiveness of various behaviour management techniques, such as Tell-Show-Do (TSD) and audio-visual aids, with virtual reality distraction in reducing anxiety levels in patients aged 5–10 years undergoing dental restorative procedures and oral prophylaxis. The evaluation was based on measurements of HR, BP, and anxiety scales. The aim of the present study to determine which technique is most effective in managing anxiety in pediatric dental patients.

Materials and method

Study design

The present study was conducted in the Department of Pediatric and Preventive Dentistry at Kalka Dental College, Uttar Pradesh. It was a comparative interventional study aimed at evaluating the effectiveness of various behaviour management techniques in reducing anxiety in pediatric dental patients. The study protocol was approved by the Institutional Ethical committee, and informed consent was obtained from the parents, along with a brief medical and dental history of the child. The study was conducted over a period of three months, with sample collection carried out during the Department's OPD timings.

Study population

The present study carried out in 60 children, aged between 5 to10 years, who were selected based on their first dental visit.

Inclusion criteria

- Children aged between 5 to 10 years
- No previous dental experience (first dental visit)
- Without history of systemic disorder.
- No learning disability.

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- Patient requiring minor restoration and oral prophylaxis

Exclusion criteria

- Child with any physically and mentally disability.
- Child having previous experienced dental visit.
- Tooth with carious pulp involvement

Material used

1. Virtual reality box, BEEBIRD VR HEADSET. (Fig:1 a)
2. DR VAKU Swadesi Finger pulse oximeter to record physiological parameters (Fig:1 b)
3. Blood pressure apparatus, BM 27 Blood pressure monitor (Fig: 1 c)
4. Subjective scales to record self-reporting pain-Venham's Picture Test (VPT) – Fig 2
5. Objective scale- Venham's Clinical Anxiety Rating Scale (VCARS) to record anxiety levels of children. (Table:1)

The Venham's Clinical Anxiety Rating Scale (VCRS) [13,14] is used by clinicians to measure a child's situational anxiety. This interval rating scale is reliable, valid, and can be easily integrated into clinical or research activities. It is a six-point scale, with each point anchored in objective, specific, and readily observable behaviour. **(Table:1)**

Methodology

A total number of sixty children, aged between 5 to 10 years with Frankl rating scale of 3 were enrolled in the study based on the criteria, The children were randomly selected and divided into three groups:

Group 1 Tell-Show-Do

Group 2 Audio-Visual with Virtual Reality

Group 3 Control group

Each group consisted of 20 children, subdivided into two subgroups, each receiving different procedures—minor restoration and oral prophylaxis. Both procedures were performed by the same operator for every child (**Table: 2**). The control group received treatment without any behaviour management, while the audio-visual group was treated using virtual reality. In the VR group, distraction was achieved using a VR box and an Android phone playing a 3D video with audio (VR Chota Bheem) **(Figure 3)**. In the TSD group, behaviour management was

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conducted using the conventional Tell-Show-Do (TSD) technique. The children's pre distraction anxiety levels were measured both subjectively using the Venham's Picture Test and objectively using blood pressure, heart rate (measured with a pulse oximeter), and the Venham's Clinical Rating Scale before the procedure. During the procedure heart rate was measured and post-distraction anxiety levels were also assessed using the same methods: subjectively with the Venham's Picture Test **(figure 4)** and objectively with blood pressure, heart rate (measured with a pulse oximeter), and the Venham's Clinical Rating Scale. The study flowchart provides a summary of the methodology used in the study **(Flow chart 1).**

Statistical Analysis

The data obtained was entered in Microsoft Excel Spreadsheet and was subjected to statistical analysis. All analyses were carried out using SPSS Version 27, IBM, Chicago, USA). The data was subjected to normality test using Shapiro Wilk test. One-Way ANOVA and Post-hoc Tukey test was used. The level of significance was set at 5%.

Result

On intergroup and intragroup comparisons of blood pressure and heart rate, the mean blood pressure (BP) before treatment for Group I (Tell Show Do), Group II (Virtual Reality), and Group III (Control) was 138.75±7.8, 137.88±8.2, and 135.6±9.0, respectively. However, after the intervention, the BP reduced to 126.82±11.2 in Group I and 121.64±7.2 in Group II. This reduction in BP observed in Group I and Group II was statistically significant (p-value <0.001). Intergroup comparisons also showed statistical significance in BP between the three groups (p-value <0.001). Additionally, the mean heart rate (HR) was found to be significantly reduced after the intervention in Group I and Group II, with statistical significance also observed in intergroup comparisons (p-value <0.001) **(Table 3).**

On intergroup and intragroup comparisons of VPT and VCRS, the results indicate that Group I and Group II significantly reduced VPT and VCRS scores after the intervention (p-value <0.05) **(Table 4)**.

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Post hoc comparisons of all the outcomes confirmed a statistically significant difference between Group I and Group III, as well as between Group II and Group III, for all outcomes except VCRS. **(Table 5)**

Discussion

In pediatric dentistry, the long-term success of any treatment greatly depends on the child's level of cooperation. It is very important to determine to deliver pain free treatment involves use of Behaviour management with various distraction aids. As a pediatric dentist, employing various behaviour management strategies is essential to achieving this cooperation, which in turn is fundamental to the success of operative procedures.[15] Various studies conducted in India states that the prevalence of dental anxiety among children aged 5 to 10 years was found to be 6.3%. In Europe, as well as in countries like Australia, Canada, and the US, dental anxiety affects approximately 9% of children and adolescents. Numerous instruments have been developed to measure dental anxiety and fear, reflecting the importance and widespread nature of this issue.[16]

Virtual reality as a distraction tool has gained popularising over recent years, studies have also demonstrated that distractions can be an effective intervention for individuals undergoing stressful procedures. For instance, patients undergoing dental treatments with distraction reported reduced anxiety, discomfort, and distress.[17,18] The present study was designed to assess and compare the efficiency of Tell Show Do and Audiovisual distraction by using with Virtual reality box in reducing child anxiety during dental treatment. The age group of 5 to 10 years was selected for the study because dental problems are particularly challenging to treat in this age range. Children in this group tend to exhibit more disruptive behaviour, have higher levels of dental anxiety, and are generally more difficult to manage.[3]

The first dental visit is crucial for shaping a child's attitude toward dental treatment. The primary goal of the dentist should be to ensure a positive and successful first visit. Therefore, in this study, only children with no prior dental experience were included to eliminate any influence of past dental experiences on their behaviour. The most common fear in the dental clinic that leads to unfavourable behaviour is the fear of the noise and vibration of the drill. Therefore, this study specifically considered oral prophylaxis and restorative treatment.[19]

Therefore, it is essential to identify and quantify this anxiety. According to Buchanan,[20] an ideal scale should meet the following criteria:

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1. Be concise to maximize response from the children and minimize administration time.
2. Include items most relevant to the child's dental experience.
3. Effectively capture the child's attention.
4. Be straightforward to score and interpret.

In this study, Venham's Picture Test (VPT) was used as it is one of the most reliable measures of self-reported anxiety in children. It is easy to administer and score, consisting of eight cards, each depicting children in various dental situations. Each card features two figures: one where a child appears happy and another where the child looks distressed. A score was recorded for each card when the "high fear" picture was selected, and these scores were summed to give a total out of eight. Higher scores indicate greater fear.[11] Additionally, Venham's Clinical Anxiety Rating is an effective and dependable method for assessing anxiety in children.

According to Messer[21], heart rate and blood pressure are reliable indicators of anxiety and are among the most accepted methods for measuring physiological changes. Therefore, in this study, heart rate was used as a physiological parameter to measure anxiety. AVD creates pleasant memories and a good attitude toward dental visits, influencing future appointments. However, it is not recommended for children who are disruptive, refuse treatment, or insist on controlling the situation.[3]

In present study, we employed different procedures such as oral prophylaxis using a hand scaler and minor restorative treatment with an airotor. Among the three groups, the audiovisual group proved to be the most efficient. Within this group, the oral prophylaxis subgroup exhibited lower anxiety levels, as measured by the anxiety scale, blood pressure, and heart rate, compared to the restorative subgroup in the post-treatment phase. The tell-show-do group showed similar results, with lower anxiety levels in the oral prophylaxis subgroup compared to the minor restorative subgroup in the post-treatment phase. **(Table: 2)**

Overall, the audiovisual group with the virtual reality box was more effective than the tell-show-do group. The increased anxiety in the restorative group was attributed to the noise produced by the airotor. Stimuli present in every dental operatory, such as bright lights, loud noises, and an unfamiliar environment, can readily provoke and increase anxiety.[21,22]

The present study results showed that the virtual reality group (Group II) was more effective than the Tell Show Do group (Group I) in reducing anxiety levels and increasing the likelihood of cooperative behaviour in children during dental treatment. Analysis of VPT and VCARS

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revealed a significant decline in anxiety when the behaviour management technique was applied. The greatest decline in anxiety was observed in the Audiovisual Distraction with Virtual Reality Box group (Group II), as measured by anxiety scale scores, followed by the Tell-Show-Do method (Group I). This finding coincides with the results of Khandelwal D et al., (2018)[3] who also found that Audiovisual Distraction was more effective in reducing anxiety compared to the Tell-Show-Do method, as assessed using anxiety scales. According to Greeshma SG et al. (2022),[9]and Prabhakar AR et al. (2007),[24] all parameters indicated that children were most relaxed in the VR group, followed by the audio group, and were least relaxed in the TSD group during dental visits. These findings are consistent with findings of present study. Considering the results from both anxiety scales and physiological findings, it is clear that AVD is more effective in reducing anxiety than TSD.

Limitation of Study

A limitation of this study is that cognitive development varies between a 5-year-old and a 10-year-old, leading to different reactions to anxiety-inducing situations. Additionally, anxiety was not measured biochemically, such as through salivary cortisol, catecholamines, or skin conductance temperature. The study also had a small sample size and a narrow age range of 5 to 10 years. Increasing the sample size and including a wider age range would have helped validate the use of virtual reality boxes across different age groups.

Conclusion

Following conclusions were drawn from the study

The principal findings of this in vivo study are as follows:

- Post-distraction heart rates were lowest in the VR distraction group compared to TSD groups.
- Post-distraction blood pressure was highest in the TSD group compared to the VR distraction group.
- Post-distraction VPT and VCARS scores were better in the VR distraction group compared to the audio distraction and TSD groups and also showed better difference in physiological parameters.

On overall the audiovisual distraction technique using virtual reality has been found to be more effective in managing anxiety in pediatric dental patients compared to the Tell-Show-

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Do method and a traditional dental setup. VR glasses present a potential, safe, and non-invasive way to distract children during dental procedures. Despite the limitations of this study, using VR with Android mobile devices as a distraction tool significantly aids children in overcoming dental anxiety during minor procedures. This approach can be an excellent method for encouraging patient cooperation and strengthening the bond between the patient and the pediatric dentist.

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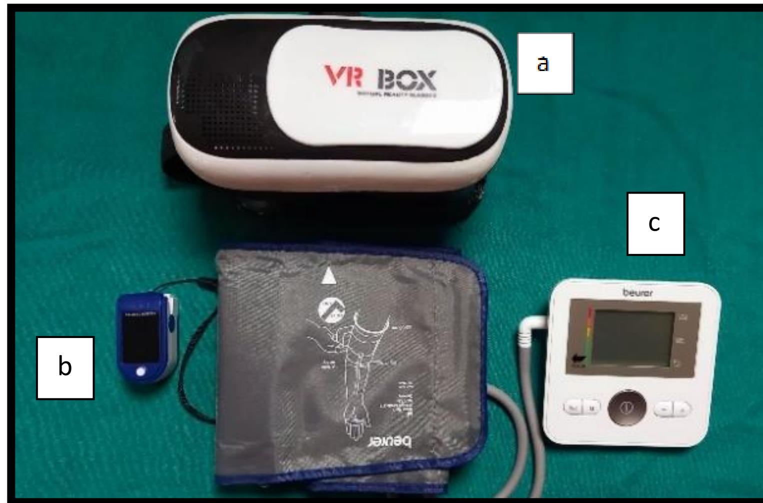

Figure 1 a:VR Box, b: Pulse Oximeter , C: Blood Pressure Appartus

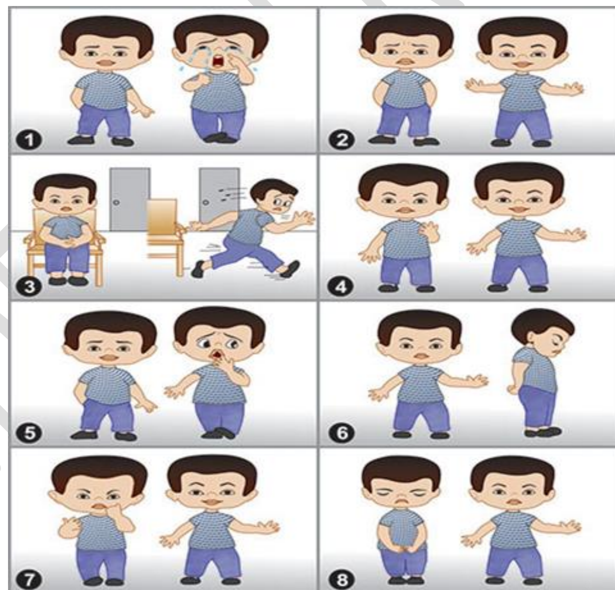

Figure 2: The Venham Picture Test Scale[8]

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Figure.3 Audio-visual distraction with VR box as a Behaviour management

Figure 4: Subject expressing the level of anxiety using VPT scale

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Table 1: Venham clinical rating anxiety scale (VCRS)[13,14]

0=Relaxed: smiling, willing, able to converse, displays behaviour desired by the dentist
1=Uneasy: concerned, may protest briefly to indicate discomfort, hands remain down or partially raised. Tense facial expression, 'high chest'. Capable of cooperating
2=Tense: tone of voice, questions and answers reflect anxiety. During stressful procedure, verbal protest, crying, hands tense and raised, but not interfering very much. Protest more distracting and troublesome. Child still complies with request to cooperate.
3=Reluctant: pronounced verbal protest, crying. Using hands to try to stop procedure. Treatment proceeds with difficulty.
4=Interference: general crying, body movements sometimes needing physical restraint. Protest disrupts procedure
5=Out of contact: hard loud swearing, screaming unable to listen, trying to escape. Physical restraint required

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Table 2: Descriptive statistics of study participants

Intervention Groups	Mean Blood pressure (mm/Hg)		Mean Heart Rate (beats / min)		Mean VPT (scale)		Mean VCRS (scale)	
	Before	After	Before	After	Before	After	Before	After
Group I Tell Show Do								
Scaling group (10)	139.75	126.32	106.67	91.8	6.3	4.1	4.2	2.5
Restoration group (10)	137.75	126.92	105.67	92.8	6.1	4.3	4.4	2.9
Total (20)	**138.75**	**126.62**	**106.17**	**92.4**	**6.2**	**4.2**	**4.0**	**2.7**

Group II Audio-visual								
Scaling group (10)	135.88	121.92	104.22	88.4	6.5	3.0	4.4	2.0
Restoration group (10)	139.88	121.32	103.12	90.2	6.7	3.6	4.6	2.4
Total (20)	**137.88**	**121.64**	**103.67**	**89.6**	**6.6**	**3.3**	**4.5**	**2.2**
Group III Control Group								
Scaling group (10)	137.8	132.4	106.43	102.6	6.8	6.6	4.8	4.0
Restoration group (10)	133.4	132.4	104.23	103.4	7.1	6.6	4.6	4.4
Total (20)	**135.6**	**132.4**	**105.33**	**103.0**	**6.9**	**6.6**	**4.7**	**4.2**

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Table 3 Intergroup and intragroup comparisons of blood pressure and heart rate, the mean blood pressure (BP) before treatment for Group I (Tell Show Do), Group II (Virtual Reality), Group III (Control)

	Intervention Groups	**Time period**		
		Before Intervention	**After Intervention**	**p-value**
	Group I - Tell Show Do			
	(n=20)	138.75±7.8	126.82±11.2	**<0.001***

Blood pressure (mm/Hg) M±S.D	Group II - Audio-visual Group			
	(n=20)	137.88±8.2	121.64±7.2	**<0.001***
	Group III - Control Group			
	(n=20)	135.6±9.0	132.4±6.7	0.36
	p-value	0.16	***0.04**	
Heart rate (beats per minute) M±S.D	Group I - Tell Show Do			
	(n=20)	106.17±9.7	92.4±7.8	**<0.001***
	Group II - Audio-visual			
	(n=20)	103.67±9.7	89.6±7.2	**<0.001***
	Group III - Control Group			
	(n=20)	105.33±9.2	103.0±9.3	**0.28**
	p-value	0.73	**0.03***	

One Way ANOVA test; Paired t-test; *p-value<0.05 – statistically significant

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Table 4 Intergroup and Intra group comparisons of VPT and VCRS

Outcome	Intervention Groups	Time period		p-value
		Before Intervention	**After Intervention**	
VPT M±S.D	Group I - Tell Show Do (n=20)	6.2±0.97	4.2±0.89	**0.03***
	Group II - Audio-visual Group (n=20)	6.6±0.93	3.8±0.67	**0.04***
	Group III - Control Group (n=20)	6.9±0.97	6.6±1.1	0.16
	p-value	0.73	**0.02***	
VCRS M±S.D	Group I - Tell Show Do (n=20)	4.2±0.34	2.7±0.22	**0.01***
	Group II - Audio-visual (n=20)	4.5±0.67	2.2±0.32	**0.01***
	Group III - Control Group (n=20)	4.7±0.78	4.2±0.91	0.46

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	p-value	0.82	0.14	

One Way ANOVA test; Paired t-test; *p-value<0.05 – statistically significant

Table 5: Post Hoc comparisons of all outcomes between three study groups

		Mean difference	p-value
Blood pressure	**Group I vs Group II**	5.18	0.24
	Group I vs Group III	-5.58	**<0.001***
	Group II vs Group III	-10.76	**<0.001***
Heart rate	**Group I vs Group II**	2.8	0.31
	Group I vs Group III	-10.6	**<0.001***
	Group II vs Group III	-13.4	**<0.001***
VPT	**Group I vs Group II**	0.4	0.22
	Group I vs Group III	-2.4	**<0.001***
	Group II vs Group III	-2.8	**<0.001***
VCRS	**Group I vs Group II**	0.5	0.16
	Group I vs Group III	1.5	0.06
	Group II vs Group III	2.0	0.08

Post Hoc Tukey test; *p-value<0.05 – statistically significant

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