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Effect of Virtual Reality Distraction in Reducing Pain and Anxiety During Local Anaesthesia Procedures in 6-12 years old Paediatric Patient:A Randomized Clinical Trial.

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ABSTRACT:
BACKGROUND:Various distraction methods have been employed in dentistry with significant success in alleviating anxiety in young patients, particularly during the delivery of local anaesthesia. A comparatively new approach in this area is virtual reality. This study aimed to assess the impact of virtual reality distraction on levels of anxiety and pain experienced by 6-12 years old paediatric patients during local anaesthesia procedures .
METHODS:This study includes 60 patients within 6-12 years of age who come to Department of paediatric and preventive dentistry in Adhiparasakthi Dental college and hospital.
The participants were categorized into three distinct groups. Group 1 received local anaesthesia with the aid of virtual reality goggles as a distraction technique, Group 2 received local anaesthesia while viewing cartoon videos, and Group 3, serving as the control group, received local anaesthesia without the use of virtual reality goggles or cartoon videos.The assessment of the patient's anxiety and fear levels was conducted utilizing two distinct scales. The FACIAL IMAGE SCALE was employed to evaluate the patient's anxiety, while the WONG-BAKER PAIN RATING SCALE was used to measure their pain level.
RESULTS:Both the Facial Image Scale (FIS) and the WBPS show significant differences between the groups, as indicated by the p-values (0.000*), which are less than the threshold of 0.05. The VIDEO and CONTROL groups tend to have higher scores on both scales compared to the VR group.These differences suggest that the VR group might be experiencing lower levels of well-being or facial image perception compared to the VIDEO and CONTROL groups.
CONCLUSION:It has been concluded that using virtual reality (VR) as a distraction strategy helps paediatric patients feel less anxious and in pain during dental procedures compared to video and control groups

KEYWORDS : Anxiety, Distraction, Infiltration anaesthesia, Pain, Virtual reality

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I. INTRODUCTION

Techniques for guiding behaviour, including both non-drug and drug approaches, are employed to reduce anxiety, foster a positive attitude towards dental care, and ensure the delivery of high-quality oral health services effectively and safely for infants, children, adolescents, and individuals with special health care requirements[1]. According to the theory proposed by McCaul and Mallot, a person's awareness of pain is diminished when they are distracted from an aversive stimulus[2].

Dental fear/phobia is described as when the disturbed expectation interferes with normal functioning, whereas dental anxiety is defined as the upset expectation of a dental visit to the extent that a kid may delay treatment [3, 4].

The goal of the "distraction" technique is to get a patient's attention to shift from their present behaviour to something else. It is a behavioural technique that helps patients manage short-term stress[5].Stimuli that can influence a patient's response yet are incompatible with disruptive behaviour are known as distractions. Various distractions include playing video games [6,7],

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listening to music [8], watching videos (Weisenberg et al. 1995) [9], and watching television with images, cartoons, and audio stories, among other things[10].

In paediatric dentistry, virtual reality (VR) is a cutting-edge technology intended to improve dental treatment outcomes and the experience of young patients. Children's fear and anxiety related to dental visits can be reduced by immersing them in a virtual world. This helps to create a good attitude towards oral health and serves as a distraction during treatment. Before receiving genuine treatment, children can experience dental operations in a non-threatening manner thanks to this technology, which can lessen their anxiety and suffering.

Virtual reality (VR) and virtual worlds have seen a surge in behavioural study in recent years. The term "VR" describes a human-computer interface that allows the user to engage with the computer-generated environment in a dynamic manner.

The purpose of our study was to assess how virtual reality distraction affected the anxiety and pain experienced by paediatric children aged 6 to 12 during local anaesthesia procedures

II. METHODS:

This randomized controlled trial was conducted in Department of Paediatric and Preventive Dentistry at Adhiparasakthi Dental College and Hospital Melmaruvathur .

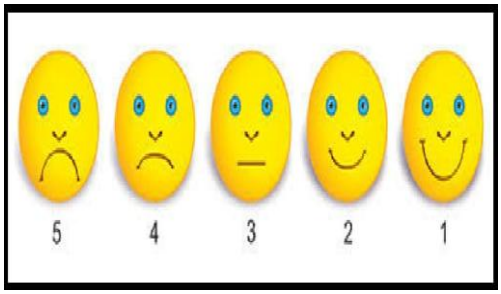
Healthy and cooperative 6 to 12 years old children ,with no known allergy or sensitivity to local anaesthesia ,who needed non urgent dental treatment under local anaesthesia , Patients who are systemically healthy were included in this study.

Patients with history of epilepsy and anxiety disorder, patients those who are not willing to participate in the study, Patient who are physically challenged , were excluded from the study. Procedure explained to the patient and signed in the informed consent.

This study includes 60 patients within 6-12 years of age who come to Department of Paediatric and Preventive Dentistry in Adhiparasakthi Dental college and hospital. The population was divided into 3 groups. Group-1 receive local anaesthesia by using virtual reality googles as a distraction aid , Group-2 receive local anaesthesia while watching cartoon videos,Group-3 receive local anaesthesia without using virtual reality googles and without watching cartoon videos [control group].

At the beginning of the dental visit ,subjects were asked to choose a video from a list of popular cartoon shows . In the test group-1 the subjects wore VR goggles (JIO virtual reality headset) connected to a mobile phone and the chosen video was played .In the test group 2 cartoons video was played in the mobile phone ,the subjects were asked to watch the video. In the control group ,none of the distraction aids were used . The sounds of the videos were played on the speakers of the mobile phone (test group) . No headphones were used in either group.

Two scales were used to measure the fear and anxiety levels of the patient .FACIAL IMAGE SCALE was used to measure the anxiety level of patient, WONG- BAKER PAIN RATING SCALE was used to measure the pain level of the patient.



FACIAL IMAGE SCALE

III.RESULTS:

TABLE 1 REPRSENTS THE DESCRIPTIVE DATA ON AGE WISE DISTRIBUTION AMONG THE STUDY POPULATION

PARAMETER	OPTIONS	FREQEUNCY	PERCENTAGE
	6 years	5	20.0
	7 years	3	15.0

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VIDEO GROUP AGE IN YEARS	8 years	3	15.0
	9 years	4	20.0
	10 years	1	5.0
	11 years	2	10.0
	12 years	2	5.0
VR GROUP AGE IN YEARS	6 years	9	40.0
	7 years	3	15.0
	8 years	1	5.0
	11 years	5	25.0
	12 years	2	10.0
CONTROL GROUP AGE IN YEARS	6 years	3	10.0
	7 years	2	10.0
	8 years	4	20.0
	9 years	2	10.0
	10 years	3	15.0
	12 years	6	25.0

Table 1 provides the descriptive data on age-wise distribution among the study population across three groups: VIDEO GROUP :Age Distribution: The age distribution among the video group ranges from 6 to 12 years .Most common ages: 6 years (20%), 9 years (20%).Other notable ages: 7 years, 8 years (15% each), and 11 years (10%).Least common ages: , 10 years, and 12 years, each with only 5% or fewer.VR GROUP:Age Distribution: The VR group has ages ranging from 6 to 12 years.Most common age: 6 years (40%).Other notable ages: 11 years (25%), 7 years (15%).Least common ages: 8 years (5%), and 12 years (10%).CONTROL GROUP:Age Distribution: The control group spans ages from 6 to 12 years. Most common ages: 12 years (25%) and 8 years (20%).Other notable ages: 10 years (15%), 7 years and 9 years (10% each).Least common age: 6 years (5%).

TABLE 2 REPRSENTS THE DESCRIPTIVE DATA ON GENDER WISE DISTRIBUTION AMONG THE STUDY POPULATION

PARAMETER	**OPTIONS**	**FREQEUNCY**	**PERCENTAGE**
VIDEO GROUP GENDER	**FEMALE**	12	60.0
	MALE	8	40.0
VR GROUP GENDER	**FEMALE**	4	20.0
	MALE	16	80.0
CONTROL GROUP GENDER	**FEMALE**	8	40.0
	MALE	12	60.0

Table 2 provides the descriptive data on gender-wise distribution among the study population across three groups: VIDEO GROUP:Gender Distribution:Female: 12 participants (60%)Male: 8 participants (40%) Observation: The VIDEO GROUP has a higher proportion of females (60%) compared to males (40%).VR GROUP:Gender Distribution:Female: 4 participants (20%)Male: 16 participants (80%)Observation: The VR GROUP has a significantly higher proportion of males (80%) compared to females (20%) CONTROL GROUP:Gender Distribution:Female: 8 participants (40%)Male: 12 participants (60%)Observation: The CONTROL GROUP shows a higher proportion of males (60%) compared to females (40%).

TABLE 3 REPRSENTS THE INTERGROUP COMPARISON BETWEEN THE PARAMETERS IN THE STUDY IN WHICH FACIAL IMAGE SCALE AND WBPS AMONG THE THREE DIFFERENT STUDY GROUPS BY USING ANOVA TEST

SCALE	**GROUPS**	**N**	**MEAN**	**S.D**	**95% CONFIDENCE INTERVAL**		**MEAN SQUARE**	**SIG**
					LOWER	**UPPER**		
	VIDEO	**20**	3.85	.671	3.54	4.16	36.517	.000*

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FIS	**VR**	**20**	1.80	.696	1.47	2.13		
	CONTROL	**20**	4.35	.671	4.04	4.66		
WBPS	**VIDEO**	**20**	7.60	1.536	6.88	8.32	240.200	.000*
	VR	**20**	1.50	1.277	.90	2.10		
	CONTROL	**20**	7.40	1.603	6.65	8.15		

***P value less than or equal to 0.05 is considered statistically significant different**

Table 3 and Graph 1 presents the intergroup comparison of Facial Image Scale (FIS) and WBPS among three different study groups (VIDEO, VR, and CONTROL) using the ANOVA test. The CONTROL group has the highest mean score (4.35), followed by the VIDEO group (3.85), and the VR group has the lowest mean score (1.80).The significant p-value (0.000*) indicates that there is a statistically significant difference between the three groups in terms of their scores on the Facial Image Scale (FIS). In WBPSThe VIDEO group has the highest mean score (7.60), followed by the CONTROL group (7.40), while the VR group has the lowest mean score (1.50).The significant p-value (0.000*) indicates that there is a statistically significant difference between the three groups in terms of their WBPS scores. Both the Facial Image Scale (FIS) and the WBPS show significant differences between the groups, as indicated by the p-values (0.000*), which are less than the threshold of 0.05. The VIDEO and CONTROL groups tend to have higher scores on both scales compared to the VR group.These differences suggest that the VR group might be experiencing lower levels of well-being or facial image perception compared to the VIDEO and CONTROL groups.

TABLE 4 REPRSENTS THE GENDER WISE INTRAGROUPCOMPARISON BETWEEN THE FACTORS IN THE STUDY USING STUDENT T TEST

SCALE	GROUP	GENDER	MEAN	S.D	95% CONFIDENCE INTERVAL		MEAN DIFFERENCE	SIG
					LOWER	UPPER		
FIS	**VIDEO**	**MALE**	3.75	.707	-.822	.489	-.167	.600
		FEMALE	3.92	.669				
WBPS	**VIDEO**	**MALE**	8.00	1.852	-.810	2.143	.667	.355
		FEMALE	7.33	1.303				
FIS	**VR**	**MALE**	1.69	.602	-1.355	.230	-.563	.153
		FEMALE	2.25	.957				
WBPS	**VR**	**MALE**	1.25	1.238	-2.662	.162	-1.250	**0.079**
		FEMALE	2.50	1.000				
FIS	**CONTROL**	**MALE**	4.50	.674	-.25928	1.00928	.37500	**0.230**
		FEMALE	4.12	.640				
WBPS	**CONTROL**	**MALE**	7.83	1.585	-.40167	2.56834	1.08333	**0.143**
		FEMALE	6.75	1.488				

***P value less than or equal to 0.05 is considered statistically significant different**

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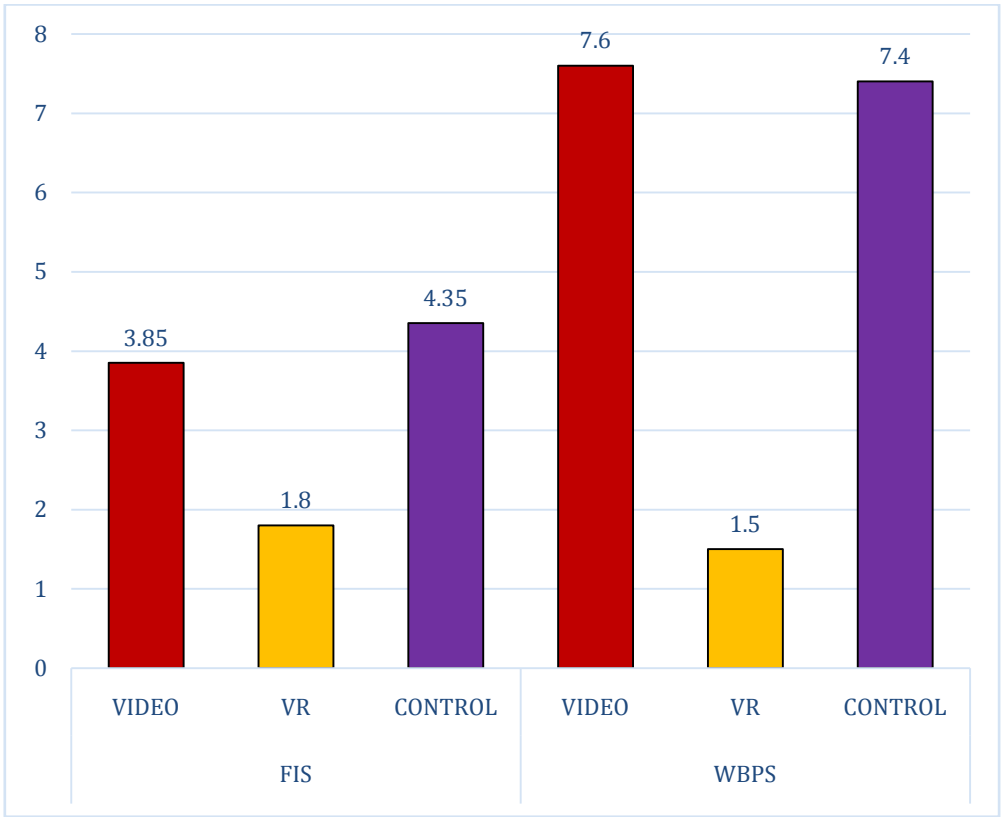
Table 4 and Graph 2represents the gender-wise intragroup comparison of factors in the study using the Student's t-test. The results for Facial Image Scale (FIS) and WBPS are given for MALE and FEMALE participants in each of the three groups (VIDEO, VR, and CONTROL). The gender difference in FIS scores for the VIDEO group is not statistically significant (p = 0.600). This suggests that the male and female participants in the VIDEO group have similar perceptions on the Facial Image Scale. The gender difference in WBPS scores for the VIDEO group is also not statistically significant (p = 0.355). This indicates that males and females in the VIDEO group report similar levels of well-being. The gender difference in FIS scores for the VR group is not statistically significant (p = 0.153). While there is a difference between males and females in this group, it is not significant enough to suggest a reliable gender difference in facial image perception. The gender difference in WBPS scores for the VR group is not statistically significant (p = 0.079). Although there is a larger difference between males and females in this group, the difference is not significant enough to conclude that gender impacts well-being or psychological scores in the VR group. The gender difference in FIS scores for the CONTROL group is not statistically significant (p = 0.230). This indicates that male and female participants in the CONTROL group have similar perceptions regarding facial image. he gender difference in WBPS scores for the CONTROL group is also not statistically significant (p = 0.143). There is no significant difference in well-being between male and female participants in the CONTROL group. No significant gender differences were found in any of the scales (FIS or WBPS) across all three groups (VIDEO, VR, and CONTROL), as the p-values are all greater than 0.05. While there are some differences between males and females in terms of mean scores, they do not reach statistical significance in any of the groups.This suggests that, within each group, gender does not have a significant impact on the Facial Image Scale or Well-Being and Psychological Scale scores.

GRAPHS

GRAPH 1 REPRESENTS THE MEAN COMPARISON BETWEEN THE PARAMETERS IN THE STUDY WITH RESPECT TO VARIOUS GROUPS PARTICIPATED



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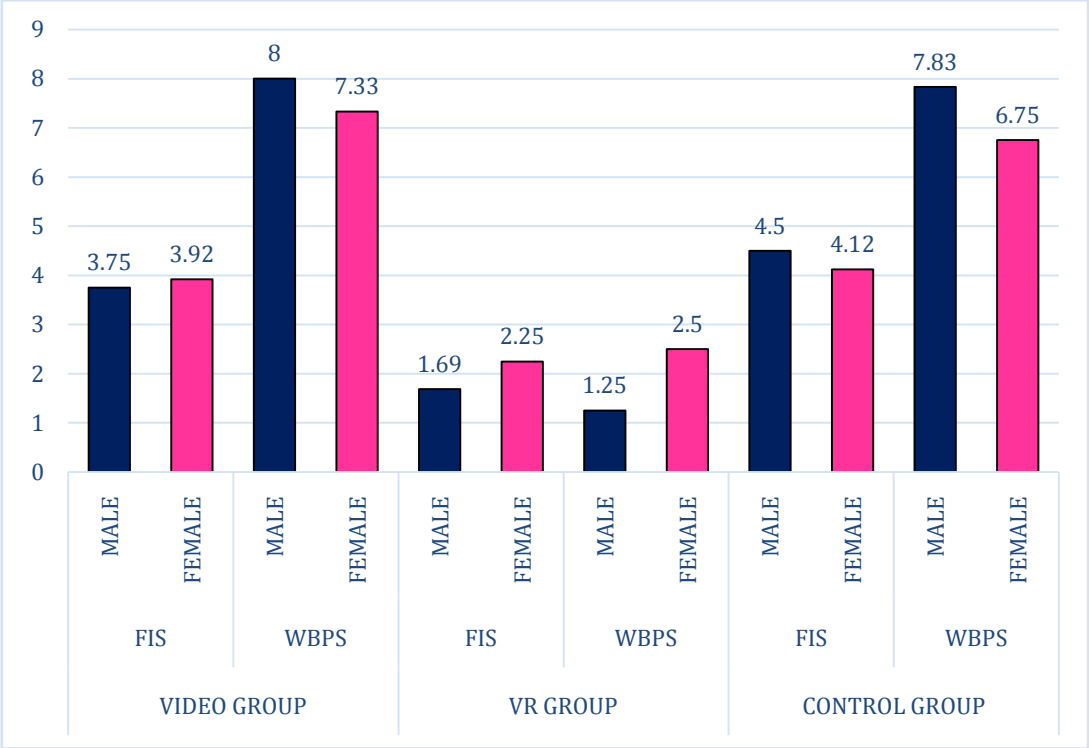
GRAPH 2 REPRSENTS THE MEAN DISTRIBUTION BETWEEN GENDERS IN THE DIFFERENT GROUPS WITH THE STUDY PARAMETERS



IV.DISCUSSION:

Virtual reality (VR) has been shown to be an effective distraction technique for lowering pain and anxiety in paediatric patients undergoing local anaesthesia procedures, according to the results of this randomized clinical trial. Our findings are consistent with earlier research showing the benefits of virtual reality in healthcare settings. Patients' perceived pain and anxiety can be decreased by immersing them in a virtual world, which can successfully distract them from the discomfort of the procedure (Li et al., 2021)[8].

Like other studies, ours showed that children between the ages of 6 and 12 who used virtual reality (VR) significantly reduced their anxiety and pain scores when compared to the control group (Miller et al., 2020) [9].VR's capacity to interact with the brain in ways that reduce the perception of unpleasant stimuli could be the reason for this (Gold et al., 2022)[10].

Although our study shows promise, there are certain drawbacks, such as the small sample size and the subjective nature of younger children's pain reporting. The long-term impacts of virtual reality and its suitability for a range of paediatric age groups and medical procedures should be the focus of future research (Cui et al., 2023)[11].

It has been demonstrated that using virtual reality (VR) as a diversion during paediatric local anaesthesia procedures greatly lowers pain and anxiety levels. Virtual reality (VR) was used to distract kids from unpleasant procedures, such as injections and minor surgeries, in a randomized clinical trial conducted by Sadeghi et al. [2023][12].

This strategy emphasizes the need for more research on the long-term effects and viability of VR in routine paediatric care, which is in line with the growing emphasis on kid-friendly medical environments. According to the research, virtual reality distraction can help young patients who are going through potentially upsetting medical procedures have a better overall experience (Sadeghi et al., 2023)[12].

Numerous studies corroborate these conclusions, with Hoffman et al. (2011) showing that VR can effectively lessen pain and anxiety in adolescents receiving burn care. Virtual reality

(VR) provides an immersive experience that diverts children's attention from the procedure, changing how they process pain and reactemotionally[13].Furthermore, Cummings and Hall's (2017) study found that children with high levels of procedural anxiety benefit most from VR distraction[14]. According to a study by McMahan et al. (2020), virtual reality (VR) considerably reduced the amount of distress that young patients experienced while undergoing medical procedure[15].

It is believed that cognitive overload, in which the immersive experience diverts the child's attention and reduces focus on the process, is the fundamental mechanism behind VR's effectiveness. Additionally, VR provides a fun, non-invasive, and kid-friendly substitute for pharmaceutical treatments, which may be especially helpful in paediatric dentistry, where reducing discomfort is crucial (Hockenberry et al., 2019)[16].

The potential of virtual reality (VR) as a distraction technique to lessen paediatric patients' pain and anxiety during medical procedures has drawn attention. The usefulness of virtual reality (VR) in reducing pain and anxiety in children aged 6 to 12 during local anaesthesia procedures was examined in this randomized clinical trial. According to the findings, kids who were exposed to virtual reality (VR) reported considerably less pain and anxiety than kids who were given traditional distraction techniques like watching TV or listening to music. This result is consistent with earlier research showing that virtual reality (VR) can effectively divert children's attention from the procedure, thereby reducing discomfort (Singh et al., 2018)[17].

Because VR is so immersive, it is believed to create a cognitive overload that blocks pain signals and lessens emotional reactions to the procedure. Furthermore, VR offers a fun and non-invasive substitute for pharmaceutical pain relief, which is especially helpful in paediatric dentistry where reducing discomfort is essential (Pattnaik et al., 2020)[18].

These results align with earlier research indicating that Virtual reality (VR) can capture a child's interest and foster a feeling of being fully engaged, which can help lessen their attention to the procedure and the pain associated with it (Carter et al., 2017)[19]. Moreover, VR offers a non-drug, child-friendly method for managing pain, which is particularly advantageous in paediatric dentistry, where reducing stress and discomfort is crucial (Jones et al., 2016)[20]. Although VR shows great potential, it is essential to consider its costs, accessibility, and the need for staff training for it to be effectively adopted on a larger scale. Additional research is necessary to evaluate its long-term impacts and the practicality of incorporating VR into standard paediatric dental practices.

V.CONCLUSION:

It has been concluded that using virtual reality (VR) as a distraction strategy helps paediatric patients feel less anxious and in pain during dental procedures. This randomized clinical study assessed how Virtual Reality goggle helps kids between the ages of 6 and 12 years receiving local anaesthesia to be co-operative. Comparing virtual reality (VR) to more conventional distraction techniques like watching videos or getting verbal reassurance, the results show that VR significantly reduced both perceived pain and anxiety.

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PICTURES:
VIRTUAL REALITY GOGGLES GROUP