

Evaluation of Effect on Desensitisation by Snoezelen in Pediatric Practice

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Abstract: Title: Effect of virtual games and Snoezelen environment in the behavioural management of children aged four to six years. Aim: Dental anxiety is an aversive emotional state of apprehension or worry in anticipation of feared stimulus of dental treatment. Appropriate behaviour management techniques (BMTs) enable children to reduce anxiety and facilitate the delivery of adequate oral health care. Virtual games during any dental procedure by the easily available mobile can be an innovative idea of distraction by audio - visual method. Child's behaviour can be modified by setting up of dental office, a warm and relaxing environment, that helps the children to be relieved of anxiety about the dental situation. The aim of the study was to assess the effectiveness of mobile games and Snoezelen environment on dental anxiety levels. Method: Children aged 4 - 6 years were randomly divided into 2 groups based on age, gender and anxiety level recorded using facial image scale. Group 1: virtual game group: The child is given a smart phone which contain child's favourite game. Group 2: Snoezelen environment: The child is made to enter a room which is converted into Snoezelen effect. At baseline, oxygen saturation was recorded using pulse oximeter. Child's anxiety level post treatment is measured using the facial image scale, Venham picture test and oxygen saturation is recorded after their treatment. Result: Data was expressed as Mean, Standard deviation, Median and Interquartile Range. Statistical Software version 20 was used to analyse the data. Facial Scale was analysed using Kruskal Wallis test and Mann Whitney U test showed no significance difference in median scores between virtual vs Snoezelen. (P=0.419). Venham scale was analysed using One - way ANOVA showed no significance difference in mean scores between virtual vs Snoezelen. (P=0.342). Comparison of Oxygen Saturation Levels Pre and Post intervention showed a significant difference in mean scores in virtual game group (P= 0.0261) and Snoezelen room (P= 0.000000183). Post treatment oxygen saturation level was analysed using One - way ANOVA showed a significance difference in mean scores oxygen saturation level between the 2 groups. (P=0.292) Conclusion: Virtual games and Snoezelen environment was effective in alleviating the dental anxiety in children attending paediatric dental clinic.

Keywords: Dental Anxiety, Virtual games, Snoezelen environment, Tell - Show - Do, VPT & facial image scale, oxygen saturation, pulse oximeter.

1. Introduction

Dental anxiety is an aversive emotional state of apprehension or worry in anticipation of the feared stimulus of dental treatment and dental fear is a primitive response developed in an individual to protect himself from harm and self - destruction. As a result, fear and anxiety are both common emotions displayed by children in a dental setting, challenging the team, making it a common deterrent factor that parents, and paediatric dentists must understand. ^[1] If not properly channelled, fear can lead to dental phobia, where the child can completely restrain himself from dentistry and eventually transfer this anxiety to his next generation, so it becomes imperative to explore the source of the initiation of fear. ^[2]

Among the types of fear, subjective fear is more dangerous as it involves a vivid imagination gained from the descriptions that others around the child make, which will be expressed in him in an exaggerated, manifold pattern and has no bounds. Sources of subjective fear could be from television, friends, or others, but the ones transmitted by the mother are very significant, influential, and deeply rooted in the child, and literature endorses that maternal anxiety plays a major role in anxiety provocation in the child. The various schools of psychological thought agree that anxiety is a personality trait, but they have various opinions concerning its origin, the strongest being that it is a trait that is

transmitted by parents. Thus, anxiety and fear are potentially problematic entities in child management.

Children envision the dental office as an anxiety - triggering environment, characterised by subjective fear, bright lights, a specific odour, and invasive contact in the mouth and thus, relate it to the probability of pain. The potential anxiety that is developed here requires a range of behavioural management techniques, such as a psychological approach, a physical approach, and a pharmacological approach, as recommended in paediatric dentistry, to guide the child to accept treatment and to allow the oral healthcare team to work safely and apply the least restrictive techniques as far as possible.

Nonpharmacological interventions include virtual reality, audio - visual distraction, musical distraction, reinforcement, stop - signalling, "tell - show - do, " hands over mouth, modelling, and so on. Nonpharmacological interventions can overcome the several disadvantages caused by pharmacological management and produce a positive effect on reducing dental anxiety in children undergoing dental treatment, and can be as effective as pharmacological treatments, and may gain more acceptance from parents, patients, and practitioners.

A child's behaviour in the dental clinic is affected by several factors, and their modification can be accomplished through

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various strategies. Factors under the dentist's control include the set-up of the dental office; a warm and relaxing environment, with the operatory environment made colourful and lively, can create a pleasant environment that relieves the children of anxiety about the dental situation. Indeed, studies have found that changing aspects of the clinic environment, including appearance and odour, can influence perceived anxiety. The Snoezelen environment consists of a combination of a partially lit room with special lighting effects, relaxing music, and aromas. This environment provides sensory stimulation to children. With the presence of various instruments and materials, the child can encounter a range of experiences, including sensory, visual, tactile, and auditory, to induce relaxation.

In this era of virtual learning, studies have shown virtual games can improve spatial skills, visual attention, problem-solving skills, fine motor coordination, computer literacy, and academic performance (Wright et al., 2001). Virtual activities have increased children's cognitive test scores and helped to improve performance in science and science-related areas (Fish et al. 2008).^[3]

Virtual games during any dental procedure on the most easily available mobile device can be an innovative idea of distraction by audio-visual method and reframing, where the child's attention and perception are taken away from the situation. They can also be used as a part of positive activity reinforcer, and this interest and engrossment of cognition by the active participation of the child can help the clinician ease the child through the procedure and at the same time instil a positive behaviour in the child.

The purpose of the study was to compare interactive virtual games and the Snoezelen environment to traditional Tell-Show-Do in terms of how well they reduced anxiety.

2. Methodology

The study was conducted in the Department of Pediatric and Preventive Dentistry after the approval from the Ethical Committee of KVG Dental College. The parent / local guardian of the selected subject was explained about the study in English or in native language and informed written consent was obtained.

Selection Criteria

Inclusion Criteria:

- 1) Children of age four to six years.
- 2) Children who are coming for their first dental visit.
- 3) Children who fall under negative Frankl's behavior rating scale.
- 4) Children who fall under sad and very sad facial image scale.

Exclusion Criteria:

- 1) Children who are physically, mentally and medically compromised.
- 2) Patient requiring emergency treatment.
- 3) Parents who are willing to allow their child to participate.

- 4) Children who are not willing to enter the Snoezelen environment (for example: autistic children)

A list of subjects satisfying the inclusion criteria / exclusion criteria of our study was prepared from the outpatient register of the Department of Pediatric and Preventive Dentistry.

Children classified as NEGATIVE according to Frankel's behavioral rating scale and sad and very sad according to Facial Image Scale were selected for the study.

Among all the willing participants 40 subjects were randomly included in the study. Subjects were randomized into 2 groups based on gender and anxiety level recorded using facial image scale.

Group 1: Virtual Game

Group 2: Snoezelen Environment

A detailed medical history and Drug history of the children is recorded. The procedure was explained to both the child and the parent.

In group I - Virtual Game: A smart phone is given to subjects which contain dental related mobile game in the presence of parents. The game consist of variety of dental stimulated treatments which the child could play during the treatment.

In group II - Snoezelen environment: The child along with parents were made to enter the room which is converted into Snoezelen effect that is combination of a partially lit room with special lighting effects, relaxing music, and aromas. This environment provides sensory stimulation to children during the treatment.

Physiological parameters such as oxygen saturation level was recorded using pulse oximeter in all three groups before and after the treatment.

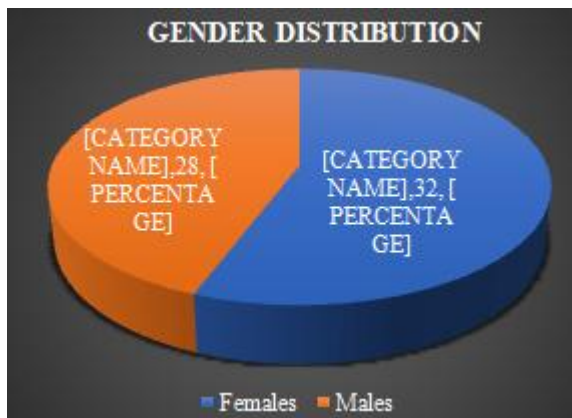
Oral prophylaxis, polishing and fluoride application procedures as indicated were done. The anxiety levels of subjects towards treatment were checked using the facial image scale Venham picture test.

The data obtained from the study was tabulated and then subjected to statistical analysis. The results were statistically analysed using mean \pm standard deviation. For Facial scale analysis was done using Kruskal Wallis test and Mann Whitney test. For Venham scale and oxygen saturation level One way ANOVA and Bonferroni multiple comparison test was used to analyze the data.

3. Results

This study is a randomized control study that evaluates the effectiveness of interactive virtual game and Snoezelen environment in reducing the anxiety. Data was collected and processed using Excel. The statistical tests used for the analysis of the result were Mean \pm standard deviation. For Facial scale analysis was done using Kruskal Wallis test and Mann Whitney test. For Venham scale and oxygen saturation level One way ANOVA and Bonferroni multiple

comparison test was used to analyse the data. Statistical Software version 20 was used to analyse the data. The study was conducted from August 2021 - November 2022. A total of 60 samples have been taken for the study with age group of 4 - 7 years and 32 (56%) females and 28 (44%) males participated in the study, the subjects were randomly divided into two groups based on anxiety level which was measured using facial image scale. (Graph 1)



Graph 1: Distribution of Gender

Table 1: Anxiety level post treatment which was recorded using Facial Image Scale which was analysed using Kruskal Wallis test (P < 0.001)

	Median	IQR
Virtual Gam	2.00	2.00, 3.00
Snoezelen environment group	2.50	2.00, 3.00

Interpretation: Anxiety level post treatment which was recorded using Facial Image Scale showed reduction in Virtual game group with a median value of 2.00 followed by Snoezelen environment group with a median value of 2.50. (Table 1)

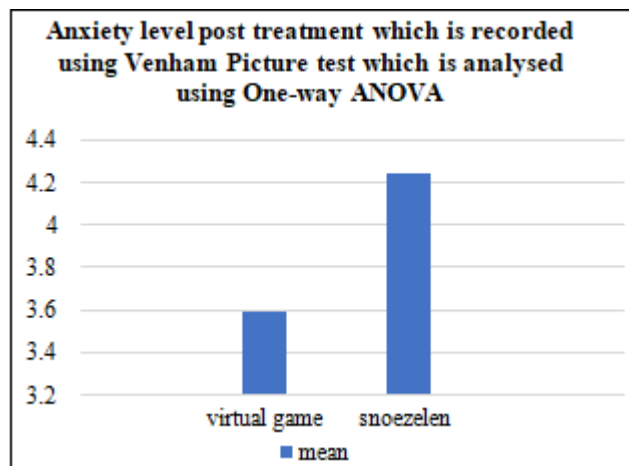
Table 2: Anxiety level post treatment which was recorded using Facial Image Scale which was analysed using Mann Whitney U test (P < 0.001)

	N	Mean	Std. Deviation
Virtual Game group	20	3.60	0.940
Snoezelen environment group	20	4.25	1.552

Interpretation: When comparing the anxiety levels which was recorded using Facial image scale. There is no significance difference in median scores between virtual vs Snoezelen environment group. (P=0.419) (Table 2)

Table 3: Anxiety level post treatment which was recorded using Venham Picture test which was analysed using One - way ANOVA (P < 0.001)

	Virtual games vs Snoezelen environment
Mann - Whitney U	173.000
Wilcoxon W	383.000
Z	-.809
P	0.419



Graph 2: Anxiety level post treatment which was recorded using Venham Picture test which was analysed using One - way ANOVA (P < 0.001)

Interpretation: Anxiety level post treatment which was recorded using Venham Picture test showed reduction in Virtual game group with a mean ± standard value of 3.60 ± 0.940 followed by Snoezelen environment group with a mean value of 4.25 ± 1.552. (Table 3 and Graph 2)

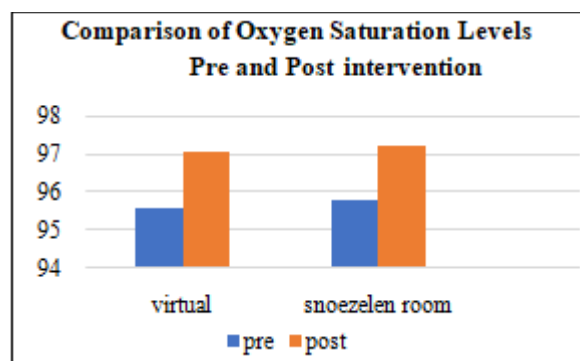
Table 4: Anxiety level post treatment which was recorded using Venham Picture test which was analysed using Bonferroni Multiple Comparisons Multiple Comparisons (P < 0.001)

(I) group	(J) group	Mean Difference (I - J)	P	95% Confidence Interval	
				Lower Bound	Upper Bound
Virtual Games	Snoezelen environment	-.650	0.342	-1.65	.35

Interpretation: The results revealed the mean scores of virtual games and Snoezelen environment groups are not significantly different. (P=0.342) (Table 4)

Table 5: Comparison of Oxygen Saturation Levels Pre and Post intervention

	Pre	Post	P Value
Virtual	95.60 ± 0.59	97.05 ± 0.82	0.000000183
Snoezelen environment	95.8 ± 0.76	97.2 ± 0.69	0.000000498



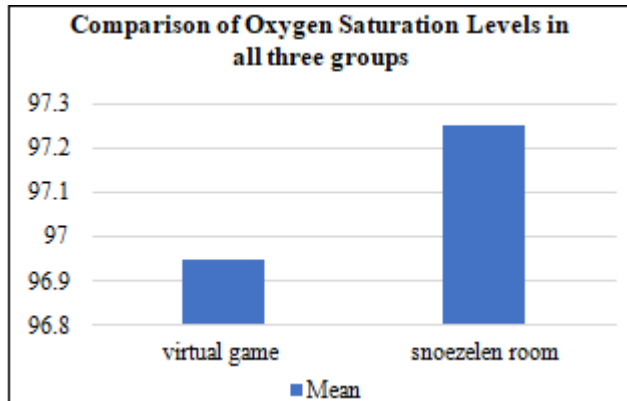
Graph 3: Comparison of Oxygen Saturation Levels Pre and Post intervention

Interpretation: The results revealed a significant difference in mean scores of Pre and Post intervention in virtual game

group ($P= 0.000000183$) and Snoezelen environment ($P= 0.000000498$). (Table 5 and Graph 3)

Table 6: Comparison of Oxygen Saturation Levels in all three groups

	N	Mean	Std. Deviation
Virtual Games	20	96.95	.945
Snoezelen environment	20	97.25	.716



Graph 4: Comparison of Oxygen Saturation Levels in all three groups

Interpretation: The results revealed no significance difference in mean scores oxygen saturation level between the 2 groups. ($P=0.292$) (Table 6 and Graph 4)

4. Discussion

Dental anxiety (DA) is a feeling of fear that something frightful will occur during dental treatment. It is associated with a sense of losing control. Anxiety is a complex construct with physical, cognitive, and emotional components. The prevalence of dental anxiety is 5 - 20 % in most of the populations which are seen more in children, and this tends to decrease as age advances^[54, 55]. Our study aimed to assess and compare the effectiveness of virtual games and the Snoezelen environment on dental anxiety levels with conventional Tell - Show - Do in children aged 4 - 6 years.

The current study included children of 4 - 6 years because the prevalence of dental anxiety in 5 to 7 - years - old children was 17.4%.^[56] According to **Piaget**, the preoperational stage is the second phase of cognitive development, when children conceptualise things symbolically but rely their reasoning on aesthetics rather than logic. This time span encompasses the pre - conceptual (2 - 4 years) and intuitive stages (4 - 7 years). The intuitive stage ushers in prelogical reasoning. The young child starts to create images and concepts that are more intricate and complicated. These young children at the intuitive stage may be challenged to control behaviourally.

In this study, we selected these intuitive - stage kids who could be challenging for the dentists to manage their behaviour. Children younger than 4 years old without the cognitive capacity to comprehend the study were not included. Egocentrism, centralism, and a lack of conservation are characteristics of this age group. The child's understanding is primarily based on what he observes. The

most captivating and striking aspect of the stimuli determines how he responds to it or how he understands an object or an event. The child has a unique, self - centred perspective on the world. The child cannot assume the perspective of another person and thinks that the world was made for them sharing their desires and emotions thinking that everyone else sees the world the same way they do. The child builds his or her knowledge of dentistry in the dental office through watching, touching, handling, and using dental tools and equipment. This enables the child to be respected as a valuable individual in his own right. Since their cognitions, emotions, and even mental comprehension evolve as they age, as seen in a study done by **Sharath et al.**^[44]

Our study population consisted of both anxious boys (44%) and girls (56%) and there was no significant difference in gender distribution ($p<0.001$), which is in accordance with a study done by **Elif et al**^[61] that showed, no significant differences were found between the gender, age, education levels and the anxiety scores. In disparity, a study done by **Shim et al**^[62] concluded that higher levels of dental anxiety are seen among girls whereas according to **Klingberg et al**^[63] higher levels of dental anxiety are seen among boys.

Our study included children visiting the dentist for the first time as they frequently behave badly when they visit. Since anxiety can be present in different ways, frequently as disruptive or interruptive behaviours, anxiety during dental treatment might hinder the proper provision of oral care. The very first treatment that the child undergoes with the dentist is of vital importance as it is the determining factor for further dental treatments later in life. If a child has a negative experience with their first dental procedure, they may develop a distrust on dentists in the future, which could compromise their oral health. During the child's initial dental visit, the dental team should use appropriate behaviour advice to establish in the kid a pleasant attitude in order to deliver successful and efficient treatment.

Since our study focused on the evaluation of the reduction of dental anxiety, we used a scale that fulfilled the validity and reliability of recording pre and post - test anxiety and so, used the Facial image scale. This scale was found to be a straightforward, valid, and reliable indicator of the young child's reaction to situational stress, according to research by **Venham, Gaulin - Kremer**^[47] and **Fathima et al**^[48]. It took a very short time (less than 1 min) to administer, and the score is just a reflection of the face chosen. To assess post - treatment anxiety, we used Venham Picture Test, as it is a reliable indicator of the child's emotional condition at that specific time, despite the inconclusive results. This observation was comparable to those discovered earlier by **Venham et al.**^[49] and **Alwin et al.**^[50]. In our study, we included children with anxiety levels of sad and very sad, which was recorded using the Facial Image Scale which indicated high dental anxiety.

Among the different nonpharmacological treatments, sensory adapted dental environment (SADE) is a unique therapy approach that has become increasingly popular. The "Snoezelen chamber," which is a well - lit room with slow - moving light, soothing sound, and precise tactile feeling, is

typically where this multisensory - stimulating environment is presented. Different functions were fulfilled by these multisensory stimuli. The first step was to partially dim the room to resist any unpleasant visual sensations. To distract the kids from the usual loud sounds of the dental equipment, pleasant music was played in the background to mask the second sensory stimulus, which is the "noise" (e. g., airtor and suction). An aroma diffuser was utilised to mask the "smell, " which is the third sensory stimulus, by removing the characteristic hospital odour. These results were comparable to those of a study by **Shapiro et al.** [4], that concluded, the nervous behaviours lasted less time in the sensory adapted dental environment (SADE) than they did in the control group. According to Venham's anxiety assessment scale, the children in SADE were more at ease and cooperative during the dental operation than those in the control group, which supported the findings of a prior study by **Cermak et al.** [7].

Virtual Game in my study offers a variety of engaging and enjoyable tasks for the patient to do on electronic devices that simulate the environment and noises of various dental treatments that the child will eventually experience. According to **Triberti et al** [60] the analgesic effects of virtual game distraction reduce negative emotions (i. e., anxiety) and lead to positive emotions by diverting attention from an unpleasant environment setting to a pleasant and absorbing virtual world.

The results of our study showed no significant difference between the virtual and Snoezelen environment groups when recorded using the Facial Image Scale and Venham Picture test. Although several studies have been made that focus on the individual advantages of each of these methodologies which are Virtual and Snoezelen groups respectively. There had been limited studies conducted on comparison between Virtual and Snoezelen that corroborated the unique evidence that had been identified from our study.

Our study also assesses physiological changes by one of the most reliable ways, that is with a pulse oximeter, which measures pulse rate and oxygen saturation. This device provides continuous percentage readings of the patient's arterial haemoglobin oxygenation in addition to pulse rate. According to **Shirakawa T et al** [59], increase in SpO2 indicates a decrease in anxiety. Results of our study for the SpO2 as a measure of anxiety have been varied in Pre and Post interventions, but there is no significant difference in mean scores of oxygen saturation level between the Virtual game group (96.95±0.945), Snoezelen environment group (97.25±0.716). This observation was comparable to the study stating that no connection was discovered between SpO2 and anxiety - inducing dental conditions by **Rayen et al** [51]. Although there was a rise in SpO2, **Prabhakar et al.** [5] and **Yelderman and New** [52] concluded that it was not statistically significant.

Children who fall under the formal operational stage and concrete operational stage of Piaget's theory can be the subject of future investigations in higher age groups. With a big sample size, additional research may be done to compare the Snoezelen environment and the virtual game group.

Paediatric Dental specialists will be able to lessen or eliminate dental anxiety by better understanding and employing various behaviour modification techniques. This will benefit paediatric patients as optimal treatment depends on a stress - free environment for the patient and the dentist.

5. Conclusion

By enabling children to learn appropriate behaviors and coping mechanisms that lessen anxiety and make it easier to provide optimal oral health care. Successful practice can be accomplished through the use of suitable behavior management techniques (BMTs). In conclusion, within the limitations of this study, virtual games and Snoezelen environment is effective in reducing the dental anxiety in children aged 4 - 6 years during their first dental visit. Further studies with much larger sample size required to substantiate our results.

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