



Assessment of sensory adaptation by snoezelen environment for the reduction of dental fear and anxiety during the first dental visit in children - A randomized control trial

Original Research

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Abstract :

Background: The dental environment plays an important role in dental anxiety reduction in children as the loud noise of dental equipment, the smell of medicines, and the innate fear of children

Aim: To evaluate the effectiveness of the snoezelen environment in the reduction of dental fear and anxiety during first dental visit in children in pedodontics dental operator

Materials & methods: A randomized control trial was conducted among 126 children aged between 6 to 9 years reporting to the Department of Pedodontics and Preventive Dentistry, Saveetha Dental College & Hospital, Chennai. Participants were randomly assigned to either the study group (Snoezelen environment) or the control group (standard dental operator). The dental fear and anxiety levels of each participant were assessed using validated scales before and after the dental procedure.

Results: Data was expressed as Mean, Standard deviation, Median, and Interquartile Range. Statistical Software version 20 was used to analyze the data. The facial image scale and CBFSS scale were analyzed using paired t-test and chi-square test showed a significant difference in median scores between the study and control group. ($P < 0.05$). FIS and CBFSS were assessed using paired t-tests that showed a significant difference in mean scores between the study and control group ($P < 0.05$). Post-treatment anxiety levels were analyzed using Bonferroni Multiple Comparisons Multiple Comparisons showed no significant difference in mean scores between the 2 groups ($P > 0.05$).

Conclusion: Snoezelen's approach has shown promising evidence in reducing dental fear and anxiety in children and improving cooperative behavior in the preparation of children for future dental care.

Keywords – Dental fear and anxiety, Snoezelen environment, first dental visit

I. INTRODUCTION

Dental anxiety is a deterring problem that affects the delivery of dental care to children and appears to develop mostly in childhood and adolescence. It is a feeling of apprehension about dental treatment that is not necessarily connected to a specific external stimulus. Also, it is one form of emotion, which is associated with a change in blood pressure and heart rate. Prevalence of dental anxiety in Chennai is about 23.6%⁽¹⁾. Childhood dental anxiety is not only distressing for the child and family as it limits the children with poor oral health outcomes and increases the cost of future specialist dental services. The most common fear-inducing aspects of the dental treatment are the procedures related to the environment which evokes anxiety and fearful behavior in dental settings⁽²⁾. It has been seen that children considered cooperative prospectively concluded that most children younger than 7 or 8 years had shown distressing behavior for procedures involving needles, and forceps which was evoked mainly by the environment and made them more fearful⁽³⁾⁽⁴⁾. The Snoezelen environment (also known as a multisensory environment) has been recognized for its effectiveness in reducing dental fear and anxiety in children during dental procedures. The term "Snoezelen" is derived from two Dutch words: "snuffelen" (to explore) and "doezelen" (to relax). It was originally developed in the 1970s to provide sensory stimulation and relaxation for individuals with developmental disabilities, but its applications have since expanded to various settings, including pediatric dentistry⁽⁵⁾. Considering the facts, the concept of "Snoezelen" or controlled multisensory stimulation refers to a specially

equipped room(s), where the management (i.e., nature, quantity, arrangement, and intensity of stimulation) is controlled with an environment designed to stimulate the senses by means of light, sound, touch, smell, and taste was used for this study⁽⁶⁾⁽⁷⁾. These environments are relaxing spaces that help to reduce agitation and dental anxiety, but they can also engage and delight the user, stimulate reactions, and encourage communication. These methods adopted by pediatric dentists should alleviate dental anxiety during treatment procedures and are primarily aimed at avoiding unpleasant and unproductive confrontations with the child. The primary intention is to establish communication with the child in an acceptable, less anxiety-provoking environment that will facilitate the development of the child's confidence and allow the dentist to carry out procedures with minimal disruption. An environment that is less anxiety-provoking will help to establish communication and will help in managing children who are particularly fearful or anxious or for whom a disability prevents them. With this aim, this study was done to evaluate the effectiveness of the Snoezelen environment on dental fear and dental anxiety in children undergoing their first dental visit

II. MATERIALS AND METHODS

This randomized controlled trial was done in Saveetha Dental College and Hospital, Chennai, India after the study protocol had been approved by the institutional ethical committee [IHEC/SDC/FACULTY/22/PEDO/112] in a total of 126 children aged between 4 to 9 years reporting to the Department of Pedodontics and Preventive Dentistry, Saveetha Dental College & Hospital, Chennai

III. Sample size Calculation:

Desired level of significance (alpha): 0.05 (5%), Desired power (1 - beta): 0.95 (95%), Expected effect size (Cohen's d): Based on a pilot study and effect size of 0.50, the total sample size required for this study was approximately 126 participants.

IV. Study Design:

A randomized control trial was conducted in children aged between 6 to 9 years reporting to the Department of Pedodontics and Preventive Dentistry, Saveetha Dental College & Hospital, Chennai. This study protocol was done following the consort guidelines for randomized control trials and the children were divided randomly into two groups, group 1: Test group and group 2: Control group, with 63 subjects in each group. Participants were randomly assigned to either the study group (Snoezelen environment) or the control group (standard dental operatory) using a computer-generated randomization sequence. The allocation was concealed from the investigators until consent was obtained. Randomization:

V: Intervention: a. Study Group (Snoezelen Environment): Children in the experimental group underwent dental procedures in a specially designed Snoezelen environment. The Snoezelen environment consists of a partially dimmed room with lighting effects, vibroacoustic stimuli, and deep pressure. Snoezelen equipment used for the study consisted of 1 colored light spray, 1 sensory play set, lavender essential oil, 1 aroma diffuser, 1 solar color projector, 1 gel color wheel, 1 maxi interactive bubble tube, and seating. b. Control Group (Standard Dental Operatory): Children in the control group received dental treatment in a standard dental operatory without any additional sensory interventions.

VI. Inclusion Criteria:

- 1) Children aged four to nine years.
- 2) Children who are attending their first dental visit.
- 3) Children who fall under negative and definitively negative Frankl's behavior rating scale.
- 4) Children who fall under a sad and very sad facial image scale.

VII. Exclusion Criteria:

- 1) Children who are physically, mentally, and medically compromised.
- 2) Children who need emergency treatment.
- 3) Parents who are willing to give informed consent and willing to participate

The purpose of the study was explained to the children and their caregivers, and written informed parental consent was obtained prior to the study.

Parents were informed regarding the study and informed consent was obtained from them. The purpose of the study was explained to the children and their caregivers, and written informed parental consent was obtained prior to the study.

VIII. Outcome Measures:

Dental Fear and Anxiety Assessment:

The dental fear and anxiety levels of each participant were assessed using validated scales before and after the dental procedure. Scales for assessing dental fear and anxiety in children included the Facial Image Scale (FIS) and the Dental Subscale of the Children's Fear Survey Schedule (CFSS-DS). The same trained investigator administered the scales to ensure consistency.

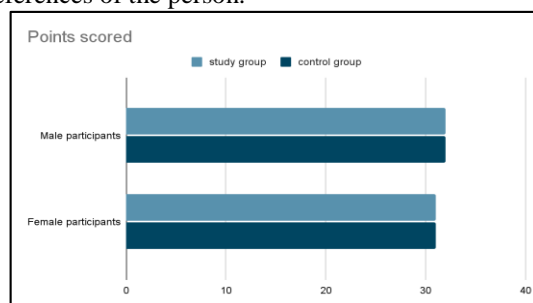
The primary outcome measured the change in dental fear and anxiety levels from pre- to post-dental procedure, as measured by the prevalidated scales.

IX. Data Analysis:

Data analysis was performed using paired t-tests to compare the changes in dental fear and anxiety levels between the experimental and control groups. Statistical significance was set at $p < 0.05$.

X. RESULTS

The results of the study show that multi-sensory stimulation is found to be effective as it uses classes of automatic stimuli (sensory experiences) that are matched to the preferences of the person.



Graph 1 shows the number of male and female participants in the test and control group. There were 70 male and 56 female child participants in the study.

Group			Mean±SD	Std Error Mean
Study Group (n=63)	Pre-Test	CBFSS	64.42±2.48	.31249
		FIS	4.0±0.82	.21158
	Post Test	CBFSS	19.6190	.45111
		FIS	1.2222	.65649
Control Group (n=63)	Pre-Test	CBFSS	65.0476	.10370
		FIS	3.9048	.05280
	Post Test	CBFSS	63.0952	.10544
		FIS	3.8889	.10640

Table 1: shows the mean, standard deviation, and standard error of the mean (SD) of the pre-treatment scores (before the dental procedure) and the post-treatment scores (after the dental procedure) for both the experimental group (Snoezelen environment) and the control group (standard dental operator).

Group			Correlation	Significance
Study Group (n=63)	Pre & Post Test	CBFSS	.022	0.163
	Pre & Post Test	FIS	.000	0.00
Control Group (n=63)	Pre & Post Control	CBFSS	.431	0.00
	Pre & Post Control	FIS	-.061	0.636

Table 2: Shows the chi-square test values and correlation of the pre-treatment scores (before the dental procedure) and the post-treatment scores (after the dental procedure) for both the experimental group (Snoezelen environment) and the control group (standard dental operator).

Group	t	df	Sig. (2-tailed)
Study Group CBFSS	117.536	62	.000
Control Group CBFSS	3.171	62	.002
Study Group FIS	23.872	62	.000
Control Group FIS	.103	62	.918

Table 3: shows the paired t-test values along with the p-value of study and control comparing the pre- and post-treatment scores within each group which indicates a significant change in dental fear and anxiety from before to after the dental procedure for each group.

Study group	Control group	Mean Difference	P-value	95% Confidence Interval	
				Lower Bound	Upper Bound
Snoezelen environment	Standard dental operator	0.042	0.208	0.142	0.35

Table 3: shows the chi square-test values along with the p-value of study and control group

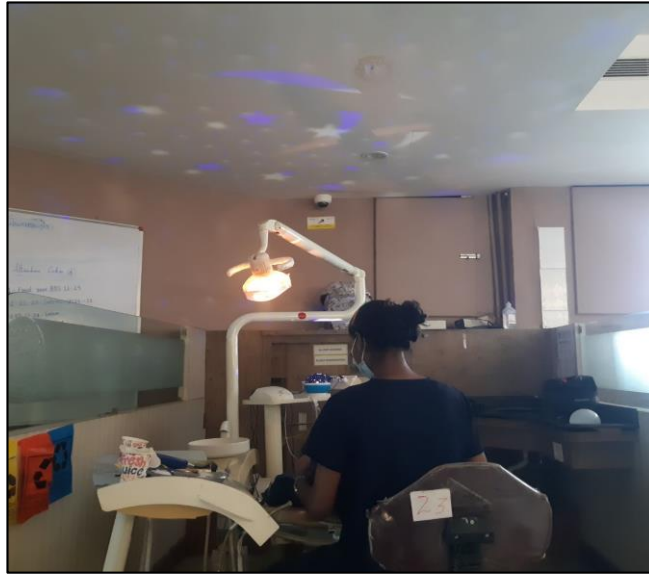


Figure 1 shows the operator working on a child in a Snoezelen multisensory environment

XI. DISCUSSION

The innovative therapeutic behavioral approach adapted to the dental setting based on the Snoezelen multisensory environment demonstrated in this study by means of both behavioral and physiological parameters that the Snoezelen multisensory environment had a significant positive effect on children⁽⁸⁾. The behavior of the child when undergoing diagnosis and radiographic examination during a dental appointment is a major factor that influences one's anxiety and the highest level is seen in children who refuse during the stage of diagnosis. The general environment created by the dental hospital mainly by dentists and supporting staff relies on the kind of rapport between child and dentist which is solely based on the trust created at the place for ensuring the best treatment through better behavior guidance. This sets up a treatment alliance wherein the child who has developed a good rapport with the dentist has a lesser level of anxiety toward dental treatment. This study's findings suggest that the mean duration and magnitude of anxious behavior reported a significant reduction in children treated under the Snoezelen multisensory environment compared to the standard dental operator. The cooperation levels recorded in the Snoezelen multisensory environment were significantly higher than in the standard dental operator⁽⁹⁾ ⁽¹⁰⁾. Our study population consisted of both anxious boys (56%) and girls (44%) and there was no significant difference in gender distribution ($p < 0.001$), which was in accordance with a study done by Elif et al wherein it was seen that, no significant differences among the gender, age, education levels and the anxiety scores and similar to studies by Klingberg et al which showed higher levels of dental anxiety among boys. ⁽¹¹⁾

The "Snoezelen chamber," is a well-lit room with slow-moving light, soothing sound, and precise tactile feeling, fulfilled by multisensory stimuli. The first step was to partially dim the room to resist any unpleasant visual sensation. To distract the kids from the usual loud sounds of the dental equipment, pleasant music⁽¹²⁾ was played in the background to mask the second sensory stimulus, which is the "noise" (e.g., airtor and suction). An aroma diffuser was utilized to mask the "smell" which is the third sensory stimulus, by removing the characteristic hospital odor. These results were comparable to those of a study by Shapiro et al. which concluded, that the nervous behaviors 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 who underwent treatment in the sensory-adapted dental environment (SADE) were more at ease and cooperative during the dental operation than those in the control group, which was supported by the similar findings of a prior study by Cermak et al.⁽¹³⁾

In primates, neurophysiological studies combining neuronal and behavioral measures have demonstrated that increasing attention to a stimulus enhances the responsiveness and selectivity of the neurons that process that stimulus and inhibit the activity of neurons not involved in the attention process. Similar processes have been reported among humans. This physiological explanation suggests that when attention is distracted, the processing of pain signals is correspondingly reduced. Based on these studies the hypothesis of our study was to modify the dental environment, with a concomitant change in sensory stimuli, so that it's more comforting for the children causing an 'altered state' with a concomitant reduction in aware anxiety.⁽¹⁴⁾ Modifying the sensory environment 'cushion' and thus 'protecting' the subject from harsh stimuli, reduced aversive visual, auditory, and tactile intensity while offering soothing visual, auditory, and tactile stimuli. The modified sensory environment results in the children's attention being focused less on discomforting or noxious stimuli. ⁽¹⁵⁾

The preparations for the Snoezelen environment *per se* might constitute an independent added calming effect on the children by providing more close and personal attention and also time for explanations and mental preparation. Moreover, the procedure might have had a calming effect on the pediatric dentist him/herself. These potential modifying factors were not within the realms of the present study evaluation, but should be considered. Parents, too, may be calmed by the sensory-adapted dental environment and thereby indirectly affect their children. In the present study, however, parents did not accompany their children during the exposure to the snoezelen environment.

The Snoezelen environment is a holistic approach that incorporates a carefully curated blend of sensory stimuli. Although the current findings unequivocally indicate a favorable outcome, it remains uncertain, given the limitations of the current study, whether

a specific component holds greater influence or if it is the synergy of these components that contributes to the positive result. The application of a Snoezelen multisensory environment has demonstrated a potential effect on the relaxation of children during oral care. This promising approach demands further research for more complex dental treatments.⁽¹⁶⁾

In a pedodontic dental operatory, which can be an intimidating and anxiety-inducing environment for children due to the noise of drills, and the smell of medicine, the Snoezelen approach offers a more calming and comfortable experience and provided a controlled space wherein children can engage their senses through various stimuli, such as gentle lights, soothing sounds, tactile materials, and visual displays. This sensory stimulation distracts the child from dental procedures and creates a positive association with the dental setting.⁽¹⁷⁾ The environmental factors that can cause anxiety prior to dental treatment is mainly the waiting room experience, specifically the amount of time spent awaiting treatment and the waiting room atmosphere.⁽¹⁸⁾ The multisensory elements in the Snoezelen environment helped to divert the child's attention away from the dental treatment, thereby reducing dental anxiety and fear. By focusing on calming and enjoyable sensory experiences due to the change in the sensory environment, the child's stress levels can be lowered during the dental procedure. Each child's preferences regarding the use of audiovisual distractions such as favorite cartoon video can be accommodated in the Snoezelen environment, making the dental visit more individualized and tailored to their comfort. This personalized approach enhances the child's sense of control and reduces anxiety. The positive and enjoyable experiences in the Snoezelen environment are reinforced with positive feedback, praise, and rewards, creating a cycle of positive reinforcement associated with dental visits create a more relaxed and less anxious environment, wherein children cooperate better during the dental procedure, making it easier for the dentist to perform the necessary treatments.⁽¹⁸⁾

In this study, it was noted that the Snoezelen-based multi-sensory dental environments were implemented with various visual, tactile, and auditory adaptations to reduce dental fear and anxiety in children. But, it's essential to note that individual child responses may vary. Some children responded more positively to this approach than others. The Snoezelen environment allowed children to become familiar with the dental operation in a non-threatening way wherein they can explore the surroundings and interact with the sensory stimuli before their actual dental appointment, which improves building self-confidence and alleviates the fear of the unknown. The future creation of a comfort-oriented, homelike dental environment using Snoezelen multisensory-themed interactive devices can play a vital role in fostering positive behaviors expressed by children with special needs. Anecdotal evidence strongly suggests that persons with special needs are calmer and more receptive to dental care without the need for sedation or general anesthesia when introduced to care in this type of environment.⁽¹⁹⁾

Limitations of the study are the smaller sample size and future research should be focused on conducting randomized control trials with larger sample sizes to detect statistically significant differences between groups and also on the acceptance of the different types of flavors of aroma diffusers which reduces dental anxiety in children. It also should be noted that the study population was not optimally representative and the dental procedure was minimally invasive. The basic statistical analyses excluded the investigation of potential interactions, modifiers, and confounders. It was also not possible to ensure observer blindness during the recording (by video). This needs to be considered as an inescapable potential 'Rosenthal effect' source of variation, which could potentially affect reliability. Future integration of pupillometry with other psychophysiological indices can also aid in assessing the efficacy of interventions for stress and anxiety, such as the implementation of a Snoezelen environment in a pedodontic dental operatory.

XII. CONCLUSION

Snoezelen's approach has shown promising evidence in reducing dental fear and anxiety in children and improving child behavior and cooperation in the preparation of children for future dental care. The effectiveness of the Snoezelen environment should not replace other behavior management techniques used by pediatric dentists but rather complement them as part of a comprehensive approach to ensure better behavior guidance can be adopted for them.

X111. Acknowledgment

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the tilted expression, "One of us (R.B.G.) thanks..." Instead, try "R.B.G. thanks". Put applicable sponsor acknowledgments here; DONOT place them on the first page of your paper or as a footnote.

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