

# Comparative Evaluation Of Audio Analgesia, Aroma Therapy, Visual Distraction Using Laser Projector And Snoezelen Environment On Pain Perception And Anxiety In Children Undergoing Dental Treatment Requiring Inferior Alveolar Nerve Block In Children 6-10 Years

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## Abstract:

**Aim and objectives:** The aim and the objective of the study was to compare and evaluate audio analgesia, aroma therapy, Visual distraction using LASER projector and Snoezelen environment on pain perception and anxiety in children undergoing dental treatment requiring IANB in children 6-10 years.

**Materials and method:** A sample size of 50 was taken and the participants were divided into five groups: Group 1: Control group, GROUP 2: Audio analgesia, Group 3: Aroma therapy, Group 4: Visual distraction using LASER projector, Group 5: Snoezelen environment. After administration of local anesthesia Pain perception was evaluated by the FIS and anxiety was evaluated by the pulse rate and oxygen saturation level by using Pulse oximeter. The results of this study were tabulated and statistically analyzed.

**Result:** The Snoezelen Environment was found to be significantly more effective as compared to audio analgesia, aroma therapy and visual distraction using laser projector. Used separately in children undergoing procedures requiring an inferior alveolar nerve block.

**Conclusion:** The Snoezelen Environment proved most effective, for reducing anxiety and pain in children undergoing procedures requiring an IANB.

**Keywords:** - Paediatric Dental anxiety, Visual distraction, Aroma therapy, Audio analgesia, Snoezelen Environment

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## INTRODUCTION

Dental anxiety is a significant concern in paediatric dentistry, affecting a large proportion of children and often leading to avoidance of necessary dental care.<sup>1</sup> Studies indicate that children aged 6–9 years, particularly girls, are highly susceptible to dental fear, which negatively impacts their oral health.<sup>2</sup> Dental treatment is openly viewed as an unpleasant experience in our society. Fear and anxiety associated with dental

treatment are well-recognized factors and hurt patients' willingness to get dental treatment.<sup>3</sup> Early identification of children experiencing anxiety is important for timely behavioural intervention. To assess dental fear and anxiety, four types of measurement parameters are commonly used: physiological means (such as pulse rate and basal skin response), psychological/psychometric means (including Venham's picture test, Children Fear Survey Schedule-Dental Subscale, and Dental Anxiety

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Scale), projective means (like the Children's Dental Fear Picture Test), and behavioural means (such as the Frankel scale).<sup>4</sup> Distracters may be active or passive. Audiovisual distraction passively targets hearing and sight, while playing a game is an active method that adds kinesthetic engagement. Watching videos and playing games on mobile devices are popular with children and can be used by dentists to distract paediatric patients.<sup>5</sup> Consequently, nonpharmacological approaches, particularly sensory distraction techniques, have gained traction in paediatric dental care. These methods aim to alleviate anxiety by engaging children's senses through sight, sound, smell, touch, and taste.<sup>6</sup> Sensory triggers such as the sight of needles, the sound of drills, and the smell of dental materials are common anxiety-inducing factors in dental settings.<sup>7</sup> Addressing these provocations is crucial to creating a more comfortable environment for paediatric patients. Techniques such as visual distraction cards, music therapy, aromatherapy, acupressure, and sweeteners have shown the potential to reduce anxiety and improve cooperation during dental procedures.<sup>8</sup> A child's behaviour in the dental clinic is affected by several factors, and their modification can be accomplished through various strategies. Factors under the dentist's control include the setup 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.<sup>9</sup>

## MATERIALS AND METHODS

The study was conducted in the Department of Paediatric and Preventive Dentistry, Indraprastha Dental College and Hospital, Ghaziabad India, after approval from the institutional Ethical Committee. 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 aged six to ten years.
- 2) Children who are coming for their first dental visit.
- 3) Children who fall under the Facial image scale.
- 4) Children who required Inferior Alveolar Nerve block.

#### Exclusion Criteria:

- 1) Children who are physically, mentally and medically compromised.
- 2) Patient requiring emergency treatment.
- 3) Parents who were not willing to allow their child to participate.

## METHODOLOGY

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

Children classified as sad and very sad according to the Facial Image Scale were selected for the study.

- For the present study total of 50 subjects were divided into five groups.
- GROUP 1: Control group
- GROUP 2: Aroma therapy
- GROUP 3: Audio analgesia
- GROUP 4: Visual distraction using LASER projector
- GROUP 5: Snoezelen environment

Each group experienced a distinct sensory distraction intervention [Figure 1]. Group 1 –control group. Group 2 – olfactory distraction utilised lemongrass essential oil diffused in the operatory to create a calming aroma [Figure 2]. Group 3 – Auditory distraction, the music played during the procedure consists of child-friendly, relaxing songs selected by the patient. Before the treatment begins, the child's favourite songs are compiled into a playlist, ensuring the music is tailored to the child's preferences. This personalised selection helps to enhance the distraction effect, promoting a calming environment during the dental procedure [Figure 3]. Group 4 – Visual distraction using LASER projector [Figure 4], and Group 5– Snoezelen environment [Figure 5]

Pre- and post-treatment anxiety levels were assessed using the Facial Image Scale (FIS) [Figure 7], and physiological parameters, including pulse rate and oxygen saturation (SpO<sub>2</sub>), were measured with a pulse oximeter. Data analysis was conducted using SPSS version 24.0, with categorical variables summarised as frequencies and continuous variables expressed as means and standard deviations. Comparisons among groups were performed using Chi-square tests, while anxiety reduction was analysed with one-way ANOVA, with statistical significance set at  $P < 0.05$ . This approach ensured a robust evaluation of the effectiveness of sensory distraction techniques in reducing paediatric dental anxiety.

Comparative Evaluation Of Audio Analgesia, Aroma Therapy, Visual Distraction Using Laser Projector And Snoezelen Environment On Pain Perception And Anxiety In Children Undergoing Dental Treatment Requiring Inferior Alveolar Nerve Block In Children 6-10 Years



<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
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Figure 1- Different sensory tools

A- Speaker (soothing music) B- Aroma Diffuser C- LASER projector D- Snoezelen room

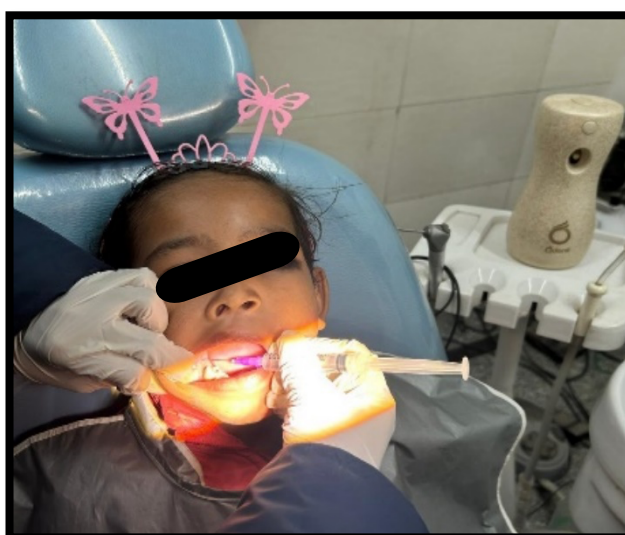


Figure 2- Aromatherapy

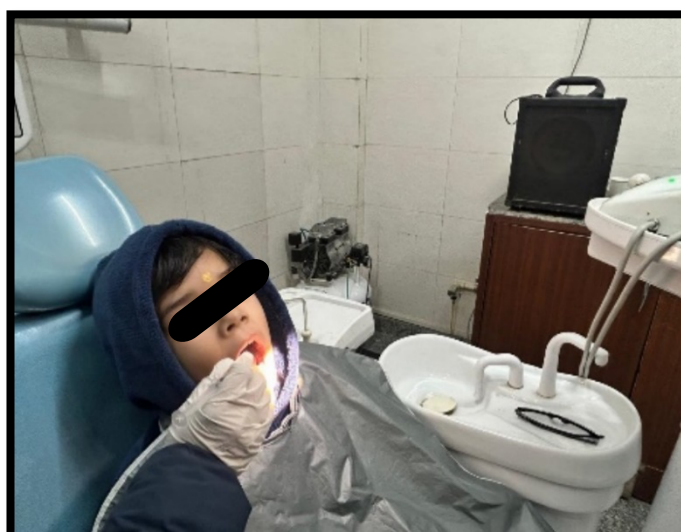


Figure 3- Audio analgesia

Comparative Evaluation Of Audio Analgesia, Aroma Therapy, Visual Distraction Using Laser Projector And Snoezelen Environment On Pain Perception And Anxiety In Children Undergoing Dental Treatment Requiring Inferior Alveolar Nerve Block In Children 6-10 Years



Figure 4- Visual distraction using LASER projector



Figure 5- Snoezelen environment

**RESULT**

The study aimed to evaluate the effectiveness of five different interventions—Control (no intervention), Audio Analgesia, Aroma Therapy, Visual Distraction using a Laser Projector, and the Snoezelen Environment—in reducing pain perception and anxiety in children aged 6–10 undergoing dental procedures involving an inferior alveolar nerve block. Descriptive analysis indicated that the (Group I) Control group exhibited significant increases in both anxiety and pulse rate, accompanied by decreased oxygen saturation, reflecting elevated psychological and physiological

stress during the procedure. Conversely, the (Group II) audio analgesia group demonstrated minor reductions in anxiety and pulse rate; however, these changes did not reach statistical significance, indicating that audio analgesia may have limited clinical utility as a standalone intervention. Similarly, neither aroma therapy (Group III) nor visual distraction using a laser projector (Group IV) demonstrated meaningful improvements in anxiety (FIS), pulse rate (PR), or oxygen saturation (OXY), implying that these interventions failed to significantly alleviate procedural stress. However, the Snoezelen environment (Group V) stood out for its

Comparative Evaluation Of Audio Analgesia, Aroma Therapy, Visual Distraction Using Laser Projector And Snoezelen Environment On Pain Perception And Anxiety In Children Undergoing Dental Treatment Requiring Inferior Alveolar Nerve Block In Children 6-10 Years

significant calming effect. Children in this group exhibited a marked reduction in anxiety scores (from 3.7 to 2.6), a decrease in pulse rate (from 92 to 83.8 bpm), and an improvement in oxygen saturation (from 94.2% to 96.9%), all with statistically significant p-values, indicating a strong emotional and physiological soothing effect. (Table No. 1) The effectiveness of these techniques was further validated by one-way ANOVA analysis, which showed statistically significant differences among the groups for all three variables—FIS ( $p = 0.000$ ), PR ( $p = 0.000$ ), and OXY ( $p = 0.010$ ). (Table no. 2,3,4,5.) Post-hoc comparisons confirmed that the Snoezelen group significantly

outperformed all others in reducing anxiety and pulse rate, and was the only intervention to significantly enhance oxygen saturation compared to the control group. While audio analgesia showed some benefit over the control group, it was not statistically significant. Meanwhile, the aroma therapy and laser distraction groups demonstrated either no benefit or slight increases in stress indicators. Overall, the Snoezelen environment emerged as the most effective strategy for minimizing anxiety and improving physiological responses in children undergoing invasive dental procedures. (Table no. 6)

**Table 1:** Descriptive data of 5 groups in reducing pain perception and anxiety in children aged 6-10 years during dental treatment requiring an inferior alveolar nerve block

Variables	Control Group (Group 1)	Audio Analgesia (Group 2)	Aroma Therapy (Group 3)	Visual Distraction By Laser Projector (Group 4)	Snoezelen Environment (Group 5)
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
FIS PRE	2.80 $\pm$ 0.789	3 $\pm$ 0.667	3.8 $\pm$ 0.919	3.8 $\pm$ 0.919	3.70 $\pm$ 0.675
FIS POST	3.90 $\pm$ 1.101	3.7 $\pm$ 0.949	3.4 $\pm$ 0.699	3.4 $\pm$ 0.689	2.60 $\pm$ 0.516
PR PRE	87.3 $\pm$ 7.15	88.6 $\pm$ 6.398	90.6 $\pm$ 6.620	90.6 $\pm$ 6.620	92 $\pm$ 5.477
PR POST	94.8 $\pm$ 5.673	92.5 $\pm$ 7.706	85.5 $\pm$ 5.740	85.5 $\pm$ 5.740	83.8 $\pm$ 3.645
OXY PRE	98.1 $\pm$ 1.287	95.9 $\pm$ 3.414	95.8 $\pm$ 2.044	95.8 $\pm$ 2.044	94.2 $\pm$ 2.098
OXY POST	95.9 $\pm$ 1.792	96.1 $\pm$ 2.025	97 1.886	97 $\pm$ 1.886	96.9 $\pm$ 2.424

**Table 2:** Effectiveness of Control group in reducing pain perception and anxiety in children aged 6-10 years during dental treatment requiring an inferior alveolar nerve block

Variables	Mean	Std. Deviation	t-value	p-value
FIS PRE – FIS POST	-0.700	1.160	-1.909	0.089
PR PRE – PR POST	-3.900	9.012	-1.369	0.204
OXY PRE – OXY POST	-0.200	4.237	-0.149	0.885

$p \leq 0.05$  – Significant, CI = 95 %

**Table 3:** Effectiveness of audio analgesia in reducing pain perception and anxiety in children aged 6-10 years during dental treatment requiring an inferior alveolar nerve block.

Variables	Mean	Std. Deviation	t-value	p-value
FIS PRE – FIS POST	0.400	1.174	1.078	0.309
PR PRE – PR POST	5.100	9.024	1.787	0.108
OXY PRE – OXY POST	-1.200	3.190	-1.189	0.265

$p \leq 0.05$  – Significant, CI = 95 %

**Table 4:** Impact of aroma therapy on anxiety levels and pain perception in the same pediatric population undergoing dental procedures

Variables	Mean	Std. Deviation	t-value	p-value
FIS PRE – FIS POST	0.400	1.174	1.078	0.309
PR PRE – PR POST	5.100	9.024	1.787	0.108

Comparative Evaluation Of Audio Analgesia, Aroma Therapy, Visual Distraction Using Laser Projector And Snoezelen Environment On Pain Perception And Anxiety In Children Undergoing Dental Treatment Requiring Inferior Alveolar Nerve Block In Children 6-10 Years

<b>OXY PRE – OXY POST</b>	-1.200	3.190	-1.189	0.265
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**p ≤ 0.05 – Significant, CI = 95 %**

**Table 5:** Effectiveness of visual distraction using a LASER projector in managing pain and anxiety during dental treatments in children aged 6-10.

Variables	Mean	Std. Deviation	t-value	p-value
FIS PRE – FIS POST	1.100	0.738	0.233	<b>.001</b>
PR PRE – PR POST	8.200	6.197	1.960	<b>.002</b>
OXY PRE – OXY POST	-2.700	2.163	0.684	<b>.003</b>

**p ≤ 0.05 – Significant, CI = 95 %**

**Table 6:** Efficacy of the Snoezelen environment in alleviating anxiety and pain perception during dental procedures requiring an inferior alveolar nerve block in children

Variables	Mean	Std. Deviation	t-value	p-value
<b>FIS PRE – FIS POST</b>	-1.100	0.876	-3.973	<b>.003</b>
<b>PR PRE – PR POST</b>	-7.500	5.759	-4.118	<b>.003</b>
<b>OXY PRE – OXY POST</b>	2.200	0.919	7.571	<b>.000</b>

**p ≤ 0.05 – Significant, CI = 95**

**Table 7:** Intergroup comparison among all groups to evaluate the anxiety and pain perception during dental procedures requiring an inferior alveolar nerve block in children

Dependent Variable	(I) GROUP	(J) GROUP	Mean Difference (I-J)	Sig.	
<b>FIS</b>	<b>Control Group</b>	<b>Audio Analgesia</b>	-0.400	0.910	
		<b>Aroma Therapy</b>	-1.500*	<b>0.019*</b>	
		<b>Visual Distraction by Laser Projector</b>	-1.500*	<b>0.019*</b>	
		<b>Snoezelen Environment</b>	-2.200*	<b>0.000**</b>	
	<b>Audio Analgesia</b>	<b>Aroma Therapy</b>	-1.100	0.144	
		<b>Visual Distraction by Laser Projector</b>	-1.100	0.144	
		<b>Snoezelen Environment</b>	-1.800*	<b>0.003**</b>	
	<b>Aroma Therapy</b>	<b>Visual Distraction by Laser Projector</b>	0.000	1.000	
		<b>Snoezelen Environment</b>	-0.700	0.565	
	<b>Visual Distraction by Laser Projector</b>	<b>Snoezelen Environment</b>	-0.700	0.565	
		<b>PR</b>	<b>Control Group</b>	<b>Audio Analgesia</b>	-3.600
	<b>Aroma Therapy</b>			-12.600*	<b>0.008*</b>
<b>Visual Distraction by Laser Projector</b>	-12.600*			<b>0.008*</b>	
<b>Snoezelen Environment</b>	-15.700*			<b>0.001**</b>	
<b>Audio Analgesia</b>	<b>Aroma Therapy</b>		-9.000	0.101	
	<b>Visual Distraction by Laser Projector</b>		-9.000	0.101	
	<b>Snoezelen Environment</b>		-12.100*	<b>0.012*</b>	
<b>Aroma Therapy</b>	<b>Visual Distraction by Laser Projector</b>		0.000	1.000	
	<b>Snoezelen Environment</b>		-3.100	0.905	

Comparative Evaluation Of Audio Analgesia, Aroma Therapy, Visual Distraction Using Laser Projector And Snoezelen Environment On Pain Perception And Anxiety In Children Undergoing Dental Treatment Requiring Inferior Alveolar Nerve Block In Children 6-10 Years

	<b>Visual Distraction by Laser Projector</b>	<b>Snoezelen Environment</b>	-3.100	0.905
<b>OXY</b>	<b>Control Group</b>	<b>Audio Analgesia</b>	2.400	0.379
		<b>Aroma Therapy</b>	3.400	0.094
		<b>Visual Distraction by Laser Projector</b>	3.400	0.094
		<b>Snoezelen Environment</b>	4.900*	<b>0.005**</b>
	<b>Audio Analgesia</b>	<b>Aroma Therapy</b>	1.000	0.942
		<b>Visual Distraction by Laser Projector</b>	1.000	0.942
		<b>Snoezelen Environment</b>	2.500	0.338
	<b>Aroma Therapy</b>	<b>Visual Distraction by Laser Projector</b>	0.000	1.000
		<b>Snoezelen Environment</b>	1.500	0.788
	<b>Visual Distraction by Laser Projector</b>	<b>Snoezelen Environment</b>	1.500	0.788

**p ≤ 0.05 – Significant, CI = 95 %**

**DISCUSSION**

Dental fear and anxiety (DFA) are significant barriers to successful pediatric dental care, often leading to behavioural challenges and extended treatment times.<sup>9</sup> This study evaluated and compared the efficacy of four sensory distraction techniques - Audio Analgesia, Aroma Therapy, Visual Distraction with a Laser Projector, and the Snoezelen Environment—in reducing anxiety and physiological stress in children aged 6 to 10 years, using three key parameters: Facial Image Scale (FIS) for anxiety, Pulse Rate (PR) for physiological stress, and Oxygen Saturation (OXY) as an indicator of calmness and relaxation.

Auditory distraction, especially relaxing music, was most effective in reducing anxiety, consistent with previous studies.<sup>10</sup> Recent trials also show that both binaural auditory beats and chosen music are effective audio distraction techniques for children.<sup>11</sup>

In contrast, Visual distractions, like virtual reality goggles and ceiling-mounted TVs, reduced anxiety but were less effective than auditory distractions.<sup>12</sup> Consistent with Mizumoto et al., visual stimuli help manage anxiety but may not fully divert attention from the dental setting. Combining visual with other sensory interventions appears most effective.<sup>13</sup>

Supporting this, Fakhrudin et al.<sup>14</sup> demonstrated the effectiveness of behavioural modification with visual distraction using intrasulcular local anesthesia in hearing disabled children during pulp therapy. In addition, Li et al.<sup>15</sup> explored eye behaviour with visual distraction for attention training in virtual reality, further highlighting the potential of visual engagement. Flores et al.<sup>16</sup> investigated distraction techniques in children with DFA.

A 2024 study by Padmanabhan et al.<sup>17</sup> confirmed that audiovisual distraction effectively reduces fear and anxiety during dental procedures. Tactile distraction via acupressure at the Hugu point yielded moderate anxiety reduction, supporting Kumar et al.'s findings.<sup>18</sup> Similarly, lemongrass aromatherapy demonstrated

calming effects consistent with Ghaderi F (2020) and Radha Lakshmi et al. (2020).<sup>19</sup>

Recent research, including a 2023 study by Yucel et al., suggests augmented reality may also serve as an innovative tool for anxiety reduction, highlighting the value of integrating sensory distractions with new technologies.<sup>20</sup>

Among the different nonpharmacological treatments, the 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 utilized 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.<sup>21</sup>, which concluded that 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.<sup>22</sup>

The observations from this study indicate that pulse rate in the music groups, especially in the instrumental music group, was lower as compared to the control group, thereby confirming the physiologic relaxation aspect of music. This indicates that audio distraction did result in a reduction of anxiety in pediatric dental patients, although the effect was not very significant. These results are consistent with several previous studies that

also found the music distraction technique to be used.<sup>23</sup> In contrast, our results contradicted a few studies that showed no effect of music distraction.<sup>24</sup>

Aromatherapy was found to be very effective in reducing anxiety levels of the children compared to the controls. Levels of anxiety reduction in the aromatherapy group were in accordance with the studies of Lehmer et al. and Kritsidima et al. in elderly dental patients waiting for a dental procedure. Lehmer et al. observed that women who were exposed to orange odour had a higher level of calmness.<sup>25</sup> Kritsidima et al. observed that lavender scent reduces anxiety in dental patients, though future visits were unaffected.<sup>26</sup>

The reduction in pulse rate could be due to the interaction of the essential oil with the parasympathetic nervous system to modulate anxiety.<sup>27</sup> Parasympathetic activity is increased by 12% and sympathetic activity is decreased by 16% with orange oil.<sup>28</sup> Hence, orange essential oil might have had a relaxant effect on respiration. The postoperative levels of oxygen saturation in the aromatherapy group did not show any significant change compared to the control group. It could be due to the subtle and insidious hypoxia due to inadvertent flexure of the neck, which might restrict the airway during dental manipulations, and the result showed insignificant changes in the level of oxygen saturation.<sup>29</sup>

### Conclusion

The Snoezelen Environment was most effective for lowering anxiety, pulse rate, and improving oxygen saturation. Aroma Therapy and Visual Distraction also helped reduce anxiety and pulse rate, while Audio Analgesia was less effective. The study underscores the value of a multisensory environment in paediatric dentistry to increase patient comfort and minimize stress.

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