

# Comparative Analysis for Alleviating Anxiety by Using Three Different Distraction Techniques- Painting, Audio Aid, Audio-Video Aid (A Random Control Trail)

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**Abstract:** Dental fear and anxiety (DFA) is common in children and often results in avoidance of dental treatment. Distraction techniques are frequently used to manage anxiety and improve cooperation. **Aim:** Comparative analysis for alleviating anxiety by using three different distraction techniques- painting, audio aid, audio-video aid (A random control trail)". **Materials and Methods:** A total of 123 children aged 6–13 years were randomly assigned to four groups (n = 32 each). Group 1 received a painting distraction aid, Group 2 an audio-video aid, Group 3 an audio aid, and Group 4 served as the control. All children underwent routine dental procedures, and anxiety levels were assessed using the Nobita and Shizuka scales before and after treatment. **Statistical Analysis:** Data were analyzed using SPSS version 23. Normality was confirmed using the Shapiro–Wilk test. Paired t-tests assessed intragroup changes, and unpaired t-tests assessed intergroup differences, with significance set at  $p < 0.05$ . **Results:** All intervention groups showed significant reductions in anxiety among both males and females. The painting group demonstrated the greatest decrease in mean anxiety scores. Females showed a larger reduction than males. Intergroup comparisons revealed significant differences in the painting and audio groups, while the audio-video group was not statistically significant. **Conclusion:** Distraction techniques effectively reduce dental anxiety in children. Painting proved to be the most effective method and may be recommended as a preferred behavior management strategy in pediatric dentistry.

**Keywords:** Dental anxiety in children, Distraction methods in dentistry, Painting as behavior support, Audio and video aid, Pediatric dental care

## 1. Introduction

Children's dental fear and anxiety (DFA) is common and, if poorly managed, leads to delayed care and worsening oral health<sup>1</sup>. Dental anxiety involves general negative expectations about dental visits, while dental fear is a specific emotional response to dental stimuli<sup>2,3</sup>. Behavior management techniques are pharmacological and non-pharmacological; among the latter, distraction is an ideal non-invasive strategy for managing children<sup>4</sup>. Distraction a behavior guidance technique defined by the American Academy of Pediatric Dentistry (AAPD) as "the technique of diverting the patient's attention from what may be perceived as an unpleasant procedure"<sup>5</sup>. Since the 1970s, research has supported distraction as an effective coping strategy for anxiety. Practices such as yoga and meditation, which refocus attention, are now also used in dentistry worldwide, where distraction has been successfully applied for over a decade to reduce procedure-related discomfort<sup>6</sup>. Distraction reduces pain by shifting attention. According to Melzack and Wall's gate control theory, stimulating larger A and B nerve fibers with pressure or vibration closes a neural gate, thereby reducing nociceptive pain signals.<sup>7,8</sup> Audio and audio-visual distractions are commonly used techniques. Music, in particular, reduces pain, anxiety, and tension by diverting attention from unpleasant stimuli and providing a familiar, calming focus<sup>6</sup>. Audiovisual (AV) distraction is a passive,

non-pharmacological technique that combines visual and auditory stimuli to divert attention from unpleasant procedures. Using occlusive headsets, it effectively blocks external stimuli and provides engaging content such as cartoons, music, games, and movies<sup>9</sup>. Art therapy is used to manage behavioral issues by reducing stress and aggression. Painting, a key form, enables nonverbal expression and interpersonal communication through spontaneous image creation<sup>10</sup>. The purpose of the study is to evaluate three distraction tactics with a control group in order to lessen anxiety, as there are no studies that compare the use of audio, audiovisual, and painting.

### Subjects and Methods:

The present study comparative analysis for alleviating anxiety by using three different distraction techniques – painting, audio aid, audio-video aid (a random controlled trail) has been carried out in the Department of Paediatric and Preventive Dentistry, Mallareddy Dental college for woman, Suraram, Hyderabad, Telangana.

### Sample size determination:

Sample size was calculated from a previous reference article (Chandana Krishna Shree CH et al 2022)<sup>39</sup> using the formula  $n \geq \frac{(1+\sqrt{g-1})(z_{1-\alpha} / 2 + Z_{1-\beta})^2}{d^2 + Z^2 1-\alpha/2 \sqrt{g-1} / 2(1+\sqrt{g-1})}$

$g$  = group

$n$  = sample size )

$z = 1.96$  (95% level of significance)  $z_{1-\beta}$  = power of the study at 80%

$d$  = effect size from reference article.  $n \geq 123$

123 for 4 groups

A minimum of 31 participants per group was required and rounded to 32 (16 boys and 16 girls) to avoid gender bias. Following IEC approval and informed consent/assent, participants were enrolled based on inclusion and exclusion criteria.

#### Inclusion criteria:

Children aged 6–13 years with no prior dental experience and a Frankl behavior rating of 3 or 4.

#### Exclusion criteria:

Children without parental consent, requiring emergency care, with Frankl ratings 1 or 2, unwilling to participate, or allergic to paints.

#### Clinical setting:

Ethical approval was obtained from the Institutional Ethics Committee, Malla Reddy Dental College for Women (MRDCW/IEC/AP/02/2023). The study was conducted from December 2023 to August 2024, with participants randomized using an online tool to minimize bias.

Set #1

92,32,120,7,110,73,41,106,43,8,96,40,52,63,29,50,121,65,118,22,33,1,17,122,101,11,114,9,64,61,39

Set #2

89,57,113,77,70,122,38,28,65,64,98,66,91,29,74,95,102,33,107,9,4,117,116,85,67,4

9,15,114,45,96,16,22

Set #3

55,101,107,76,92,20,127,68,29,45,120,110,53,7,109,122,111,71,77,75,46,103,23,91,123,67,

83,51,13,17,74,113

Set #4

116,122,64,6,45,108,1,66,90,102,81,61,123,67,78,118,11,117,54,105,33,27,74,128,8,23,56,49,5,35,42,83

#### Blinding:

This is a single blinded clinical trial in which the child participant is blinded to the type of intervention used.

#### Method of study progression:

Standardization was ensured, and prior appointments were scheduled. Parents received detailed explanations and provided informed consent/assent. Children were randomized into groups using an online tool. Preoperative anxiety was assessed in all groups; distraction aids were used during treatment in three intervention groups, while the control group received none. Postoperative anxiety was recorded after the procedure.

- Group 1: Painting aid intervention involved an assistant using acrylic paints and brushes to paint the child's favorite cartoon characters on their hands during the dental procedure.
- Group 2: Audio-video aid intervention used mobile devices to play the child's favorite cartoons (e.g., Tom and Jerry) during treatment.
- Group 3: Audio intervention provided children with headphones (Boat) playing music as a distraction. Group 4: Control group children received no intervention, serving as a baseline for comparison.

#### Assessment of anxiety:

Preoperative anxiety was measured in the waiting area to avoid influence from the dental setting. During treatment, each group received a distraction, and post-procedure anxiety was assessed on the chair. The Nobita and Shizuka scale, adapted from the Chotta Bheem-Chutki scale, uses six cartoon-based faces to depict emotions from very happy to very sad—Nobita for boys and Shizuka for girls.

Scores: 1 – Happy, 2 – Sad, 3 – Crying, 4 – Angry, 5 – Shouting, 6 – Running.

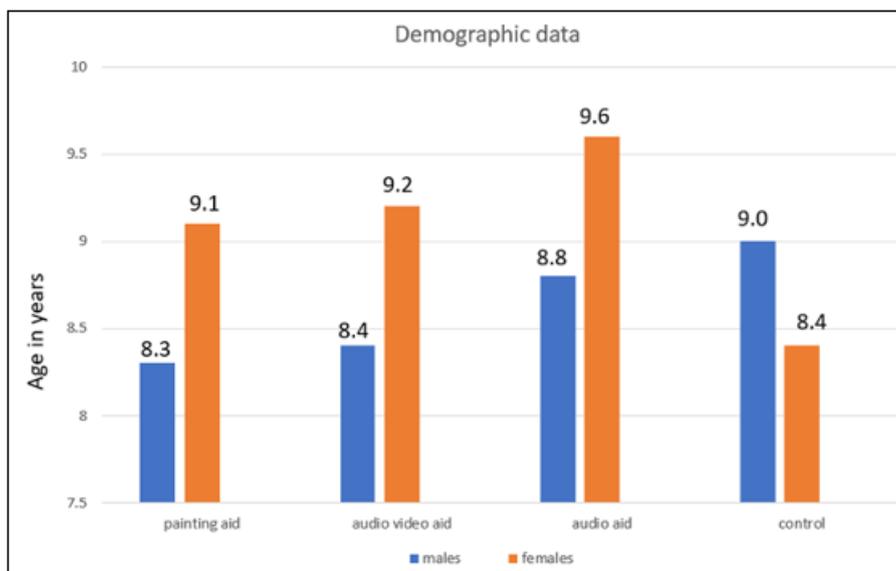
A trained pediatric dentist explained the anxiety scale to the children. Pre- and post-operative scores were recorded on the data sheet and analyzed statistically.

#### Statistical analysis:

Statistical analysis was done using SPSS v23. Data were normally distributed using Shapiro-Wilk test. Pre- and post-intervention anxiety scores were compared using paired t tests within groups and unpaired t tests between groups, with significance set at  $p < 0.05$ ; all three intervention groups showed significant results.

## 2. Results

The study included 128 children, 32 per group, with an equal male-to-female ratio. Graph1: Demographic data

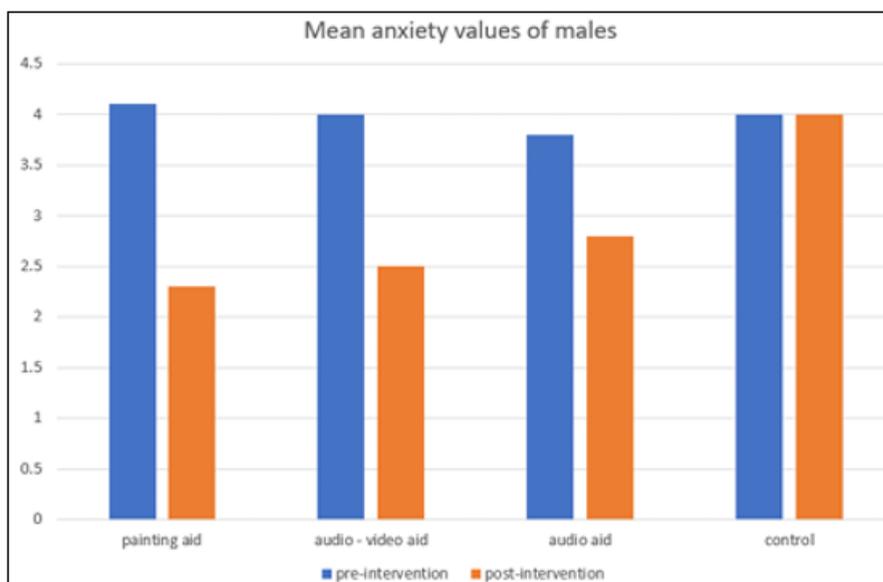


**Mean age of enrolled children in the study:**

Graph 1 represents the demographic data with respect to age among males and females who participated in the study. The mean age of males and females is 8.3 and 9.1 for the painting aid group, 8.4 and 9.2 for the audio-video aid group, 8.4 and 9.2 for the audio aid group, and 8.8 and 9.6 for the control group.

**Table 1:** Intra group comparison of mean anxiety values before and after intervention in males

Males		N	Mean	Std. Deviation	t	P Value
Painting	Before	16	4.1	1.40831	5.724	.000
	After	16	2.3	.68313		
Audio-Video	Before	16	4.0	1.50555	3.985	.001
	After	16	2.5	.73030		
Audio	Before	16	3.8	1.39044	3.038	.008
	After	16	2.8	.85635		
Control	Before	16	4.0	1.50555	0.000	1.000
	After	16	4.0	1.50555		



**Graph 2:** Mean anxiety scores of males before and after the intervention period in each study group

**Intra-group comparison of mean anxiety values in study groups in males:**

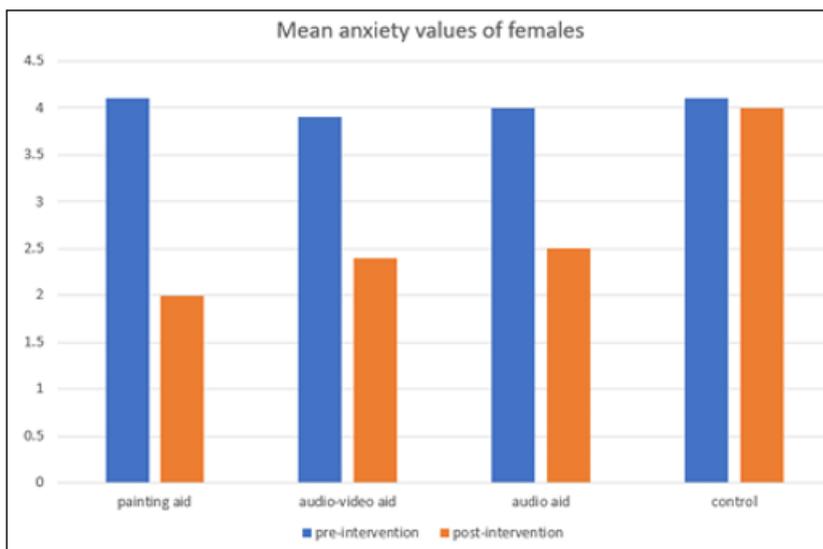
Table 1 and graph 2 represent the intragroup comparison of mean anxiety values before and after intervention in three study groups and 1 control group in males.

A paired t-test was used to compare the mean anxiety scores of the male participants in each study group before and after the intervention. Anxiety was reduced more in the painting aid intervention group with the least mean anxiety of 2.3 than in the audio-video aid and audio aid groups with mean anxiety scores of 2.5 and 2.8, respectively. There is no decrease in

anxiety in the control group before or after the therapeutic procedure. P value was found to be significant in all three intervention groups in males ( $p < 0.05$ ).

**Table 2:** Intra group comparison of mean anxiety values before and after intervention in females

Males		N	Mean	Std. Deviation	t	P Value
Painting	Before	16	4.1	1.40831	4.867	.000
	After	16	2.0	.73030		
Audio-Video	Before	16	3.9	1.36015	4.070	.001
	After	16	2.4	.72744		
Audio	Before	16	4.0	.96609	3.051	.008
	After	16	2.5	1.36626		
Control	Before	16	4.1	1.52616	.164	.872
	After	16	4.0	1.54919		



**Graph 3:** Mean anxiety scores of females before and after the intervention period in each study group

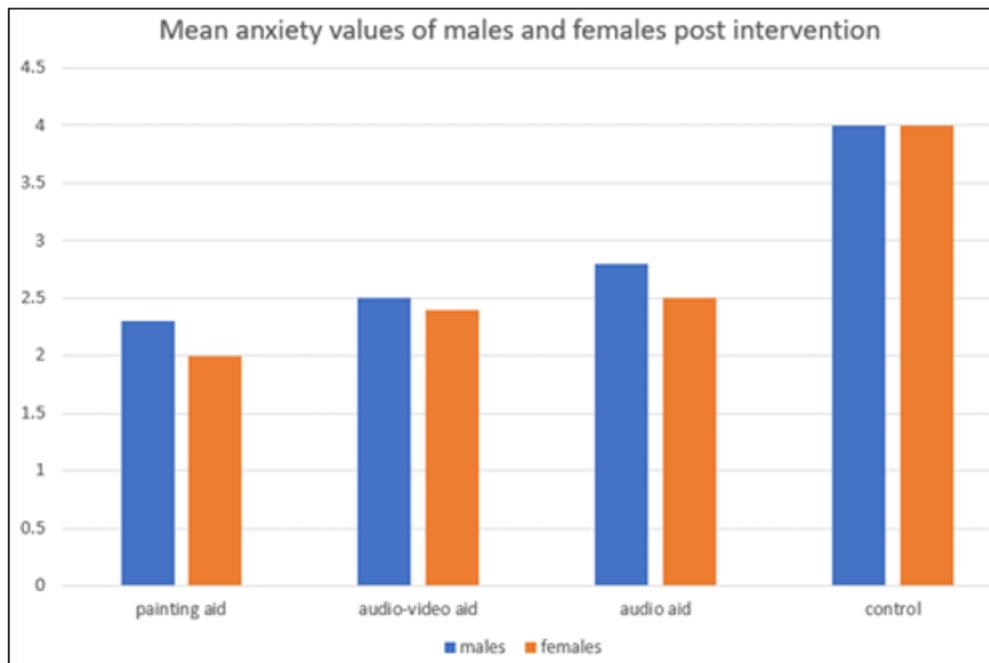
**Intra-group comparison of mean anxiety values in study groups in females:**

**Table 2 and graph 3 represent the intra group comparison of mean anxiety values before and after intervention in three study groups and 1 control group in females.**

A paired t-test was used to determine the mean anxiety in females across the three intervention groups. The painting aid group showed the greatest reduction in anxiety with the lowest mean anxiety score following therapeutic procedures, with a mean anxiety score of 2.0. The audiovisual aid group followed with a mean anxiety score of 2.4, and the audio aid group with a mean anxiety score of 2.5. The control group, which received no intervention, showed the least amount of anxiety reduction, with a higher post-mean anxiety value of 4.0. The level of significance was set at ( $p < 0.05$ ), and it was found that the p-value is significant ( $p < 0.05$ ) in all three intervention groups.

**Table 3:** Inter - group comparison of mean anxiety score between males and females

Groups		N	Mean	Std. Deviation	t	P Value
Painting Before	Males	16	4.1250	1.40831	.000	1.000
	Females	16	4.1250	1.40831		
Painting After	Males	16	2.2500	.68313	1.000	.325
	Females	16	2.000	.73030		
Audio-Video After	Males	16	4.000	1.50555	.246	.807
	Females	16	3.8750	1.36015		
Audio-Video Before	Males	16	2.5000	.73030	.243	.810
	Females	16	2.4375	.72744		
Audio Before	Males	16	3.7500	1.39044	.591	.559
	Females	16	4.0000	.96609		
Audio After	Males	16	2.7500	.85635	.620	.540
	Females	16	2.5000	1.36626		
Control Before	Males	16	4.0000	1.50555	.117	.908
	Females	16	4.0625	1.52616		
Control After	Males	16	4.0000	1.50555	.000	1.000
	Females	16	4.0000	1.54919		



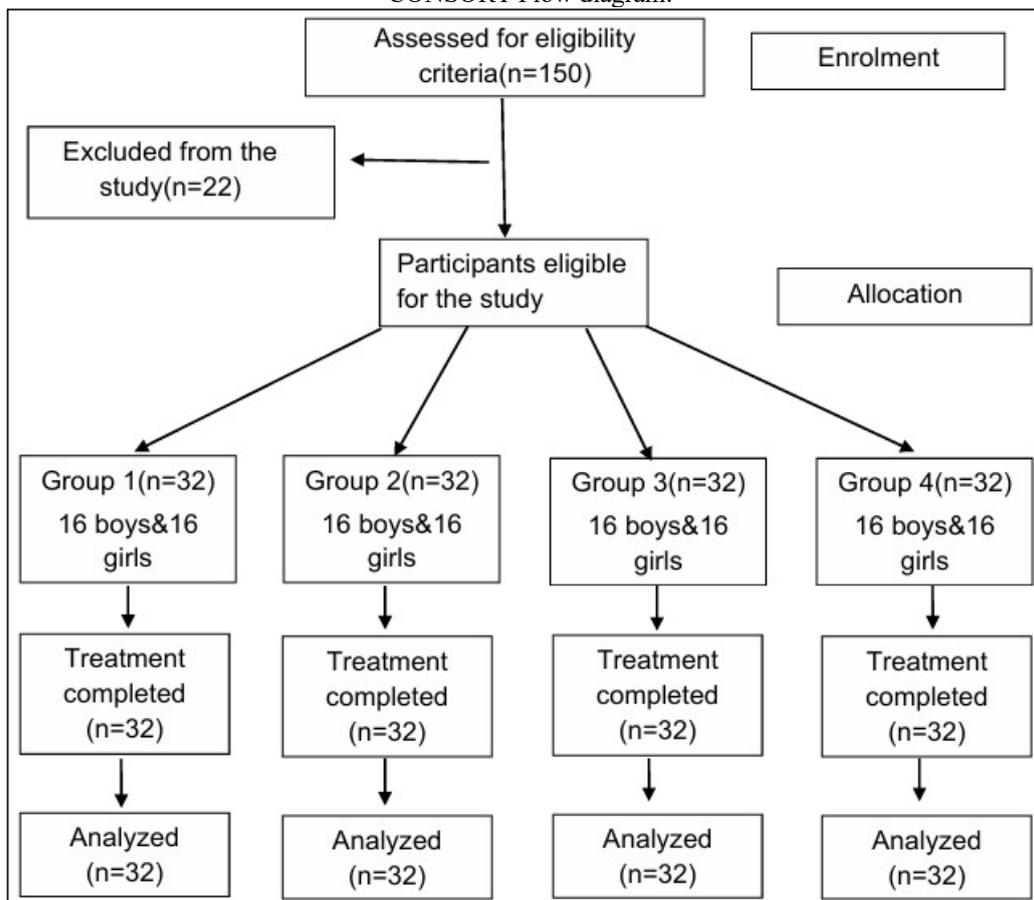
**Graph 4:** Mean anxiety scores of males and females in each study group after the intervention.

**Inter - group comparison of mean anxiety score between males and females**

Table 3 and graph 4 represent the mean anxiety levels of males and females, which were compared using an unpaired t-test. Following the treatment procedure, statistical

insignificance ( $p > 0.05$ ) was noticed in all the intervention groups when intergroup comparison was made. Both male and female children showed similar reductions in anxiety post-intervention.

CONSORT Flow diagram:



### 3. Discussion

Dental fear and anxiety commonly originate in childhood, persist into adulthood, and result in avoidance of dental care, untreated oral disease, and a self-perpetuating cycle of poor oral health. Evidence indicates that individuals with DFA exhibit significantly worse oral health and reduced oral health-related quality of life compared with non-anxious individuals<sup>41,42,3</sup>.

Early identification and prevention of DFA are essential for improving oral health outcomes and dental experiences. Childhood interventions using behavioral techniques, education, and positive reinforcement, along with trust-building, child-friendly environments, can reduce long-term anxiety.

DFA is now widely recognized as a key determinant of oral health behavior and psychological well-being<sup>41,43</sup>. Dental fear and anxiety in children are multifactorial, involving behavioral, emotional, cognitive, and physiological responses influenced by personal, psychological, and environmental factors, often stemming from negative experiences, fear of pain, unfamiliar procedures, and individual traits.<sup>45,46,47</sup>

Cognitive immaturity and socially learned fears from parents or peers can increase dental anxiety in children. Early, family-centered care and positive first visits help prevent dental phobia and support long-term oral health<sup>3,34</sup>. A child's emotional state before the first dental visit influences cooperation and future attendance, making early anxiety management essential for lifelong dental compliance<sup>43</sup>.

Early dental experiences shape children's attitudes toward oral care; effective anxiety management promotes cooperation and positive long-term oral health outcomes<sup>48</sup>. A supportive, empathetic dental environment, with caregiver involvement and appropriate behavior guidance, is essential to minimize fear in children<sup>49</sup>. Managing anxiety at the first dental visit helps prevent dental phobia and supports lifelong oral health. The AAPD emphasizes behavior guidance to ensure safe, effective care for children and individuals with special health care needs<sup>50</sup>.

Non-pharmacological methods include psychotherapeutic and communication strategies e.g., Tell-Show-Do, positive reinforcement, distraction, hypnosis, while pharmacological approaches involve sedation or general anesthesia<sup>51</sup>.

In the present study non-pharmacological intervention by use of three different distraction techniques (painting, audio, audio-video aids) are used to alleviate anxiety.

Distraction techniques, rooted in Cognitive Behavioral Therapy (CBT), redirect children's attention from dental anxiety to positive stimuli, reducing fear, improving cooperation, and enhancing the dental experience<sup>52</sup>. Distraction interrupts negative thoughts by engaging children in alternative tasks such as videos, music, games, conversation, toys, or storytelling, effectively reducing dental anxiety<sup>54</sup>.

Distraction reduces immediate anxiety and fosters positive dental associations over time. When age-appropriate, individualized, and delivered by trained, empathetic staff, it

enhances children's sense of control and comfort<sup>48</sup>. Integrating distraction within a CBT-based behavioral approach emphasizes psychological well-being in pediatric dentistry, enabling patient-centered care that supports effective treatment and fosters positive long-term attitudes toward oral health<sup>55</sup>.

The literature describes various developmentally appropriate methods to assess pediatric dental anxiety, including physiological measures, psychometric scales, and projective techniques. Physiological measures like blood pressure and pulse rate objectively assess anxiety but require equipment and may not reflect children's subjective fear experiences<sup>56</sup>. Psychological tools complement physiological measures. While Corah's Dental Anxiety Scale targets adults, the Modified Child Dental Anxiety Scale provides an age-appropriate assessment for children<sup>57,58</sup>. The CFSS-DS is a validated, widely used 15-item scale that assesses children's dental fear related to common dental stimuli and procedures<sup>56</sup>. Projective visual tools suit young children with limited verbal skills. The Children's Dental Fear Picture Test and Venham Picture Test use illustrated images to assess dental fear<sup>59</sup>. Buchanan and Niven used the Facial Image Scale (FIS), a simple five-face continuum, to assess children's dental anxiety; it is quick to administer and correlates well with comprehensive scales<sup>60</sup>.

These validated tools enable age- and development-appropriate assessment of pediatric dental anxiety, aiding tailored behavior management and outcome evaluation. To improve clarity and familiarity, the Nobita and Shizuka scales- adapted from the Chotta Bheem-Chutki scale—use six cartoon-based emotional expressions to assess anxiety in boys and girls, respectively<sup>40</sup>.

Santos NC et al. reported higher dental anxiety in younger and first-time dental visitors<sup>61</sup>. Sarapultseva

M. et al. found greater DFA prevalence in females and younger age groups<sup>62</sup>, while Uzel et al. reported higher anxiety in boys<sup>63</sup>. Therefore, this study includes equal numbers of boys and girls aged 6–13 years with no prior dental experience to better understand DFA.

Lim CY et al. described simple randomization as unbiased group assignment (e.g., coin toss), ensuring unpredictability and independence<sup>64</sup>. Karanicolas PJ et al. emphasized blinding as essential in RCTs<sup>65</sup>. Accordingly, this study used a randomized parallel-arm design with simple randomization and single blinding, where participants were unaware of treatment allocation.

Distraction is a widely used non-pharmacological technique in pediatric dentistry to reduce anxiety and improve cooperation<sup>66</sup>. Mahajan N et al. reported that audiovisual and print entertainment effectively lower anxiety<sup>27</sup>, while Singh D et al. demonstrated significant anxiety reduction using audio distraction<sup>37</sup>. Therefore, the present study employed painting, audiovisual, and audio distraction techniques due to their ease of use, minimal training requirements, and calming effect in busy clinical settings.

The study demonstrated a significant reduction in dental

anxiety scores in the intervention groups compared with the control group. These findings are consistent with studies by Bali K et al., Asokan et al., Singh et al., and Balanyuk I et al., all of whom reported that various distraction techniques significantly reduced anxiety in pediatric dental patients compared to controls<sup>13,34,37,67</sup>.

Painting, a key form of art therapy, provides nonverbal expression and is effective in reducing anxiety in children<sup>10</sup>. Studies by Nooruzi S et al<sup>68</sup>., Forouzandeh N et al<sup>10</sup>., Sadeghi N et al<sup>69</sup>., Ramdaniati S et al<sup>70</sup>., Macleod P et al<sup>71</sup>., Borji M et al<sup>72</sup>., and Babaei S et al<sup>73</sup>. support the role of painting and art-based distraction in lowering pediatric anxiety. The present study similarly found that painting significantly reduced intraoperative anxiety and was more effective than audiovisual distraction, differing from Mahajan N et al., likely due to procedural variations.

Audiovisual distraction, combining auditory and visual stimuli, is an effective non-pharmacological strategy for reducing pediatric dental anxiety. The present study showed significantly lower anxiety with audiovisual distraction compared to controls, consistent with findings by Prabhakar AR et al<sup>38</sup>., Rajendran KR et al<sup>19</sup>., Jamil F<sup>26</sup>., Venham LL et al<sup>74</sup>., and Allani S et al<sup>36</sup>., Swarna K et al<sup>75</sup>. also highlighted the value of modern technologies, including audiovisual aids and digital media, in enhancing child cooperation and creating a stress-free dental environment.

Audio distraction through music reduces anxiety by diverting attention from unpleasant stimuli<sup>6</sup>. In the present study, music significantly lowered children's dental anxiety, consistent with findings by Zuhair M Alkahtani et al<sup>76</sup>., Singh D et al<sup>37</sup>., James J et al<sup>77</sup>., and supported by the network meta-analysis of Kong X et al<sup>78</sup>. While Sandeep N et al<sup>79</sup>. reported non-significant reductions and Aitken JC et al. found no benefit, these differences may be attributed to procedural variations, as the current study assessed anxiety only during the first dental visit.

In the present study, mean anxiety levels were higher in females, though not statistically significant, aligning with previous reports. Chaplin TM et al<sup>81</sup> and Bahrami F et al<sup>82</sup> noted greater anxiety vulnerability in females, while Shreya Kothari SK et al. reported higher dental anxiety in girls and highlighted the influence of gender, behavior, and dentist-child rapport<sup>83</sup>. Consistent with these findings, female children in the current study showed greater anxiety reduction with distraction. However, results differed from Felemban OM et al., possibly due to methodological differences, as their study focused solely on local anesthetic administration<sup>5</sup>.

In the present study, no statistically significant gender difference in mean anxiety levels was observed. This finding is consistent with studies by Karupiah M et al<sup>84</sup>., Tyagi P et al<sup>85</sup>., Aminabadi NA et al<sup>86</sup>., and Kalaiarasi A et al<sup>11</sup>., all of whom reported no significant gender-based differences in anxiety reduction following various distraction techniques, indicating similar anxiety perceptions among boys and girls.

Mahajan N et al. reported significant differences in parent-perceived anxiety with print and video distraction, contrasting with the present study, possibly due to methodological

differences such as multiple visits and reliance on parental reports<sup>27</sup>. The current single-visit, child-reported assessment aligns with studies by Alsibai E et al<sup>21</sup> and Asokan S et al<sup>34</sup>., but differs from findings by Khandelwal M et al<sup>35</sup> and Mahajan N et al<sup>27</sup>., which evaluated anxiety across multiple visits.

The present study assessed children's anxiety using the Nobita and Shizuka subjective scale, similar to Asokan S et al., who used the Chotta Bheem-Chutki scale<sup>34</sup>, and Allani S et al., who employed a facial image scale<sup>36</sup>. Self-reported anxiety assessment in this study aligns with methods used by Bali K et al<sup>13</sup> and Alqahtani AA et al<sup>14</sup>., who utilized the Modified Child Dental Anxiety Scale (MCDAS). In contrast, Greeshma GS et al<sup>32</sup>. combined subjective scales with objective measures, while Guinot Jimeno F et al<sup>30</sup> and Mahajan N et al<sup>27</sup> incorporated both child- and parent-reported scales. Anxiety assessment before and after treatment in the present study is consistent with approaches by Asokan S et al<sup>34</sup>., Alqahtani AA et al<sup>14</sup>., and Rajendran KR et al<sup>19</sup>., supporting the validity of the methodology.

Strengths of this study include simple, cost-effective, and clinically feasible distraction techniques, and it is the first to evaluate painting as an intraoperative distraction during a child's first dental visit.

#### 4. Limitations

The study relied solely on subjective anxiety measures, included only children with Frankl behavior ratings of 3 or 4, and required additional assistance for the painting intervention.

#### 5. Future Directions

Future research should use larger samples, assess long-term effects, compare advanced distractions (e.g., VR), consider age, temperament, and socio-cultural factors, and develop standardized protocols to train dental professionals for consistent, child-centered care.

#### 6. Conclusion

Distraction interventions significantly reduce children's dental anxiety, with painting proving most effective, followed by audiovisual and audio methods.

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