Natural Resources for Human Health

eISSN: 2583-1194

Original Research

Received 30 June 2026
Revised 05 Aug 2026
Accepted 18 Aug 2026

Natural Resources for Human Health 2026, Vol.6(18s):1079–1096

KEYWORDS:
Audio-Visual Distraction, Behaviour Management, Dental Anxiety, Facial Image Scale, Modeling, Pediatric Dentistry, Tell-Show-Do.

Comparative Evaluation of Tell-Show-Do, Modeling and Audiovisual Distraction in Children Receiving Pediatric Dental Treatment: A Randomized Controlled Clinical Trial

Aditya Saxena[1], Lakshmi Pallavi K[2], Suchita Sharma[3], Sudipta Kar[4], Harikrishnan S[5], Dheeraj Kumar Sharma[6]

[1]Professor, Department of Pediatric & Preventive Dentistry, I.T.S Dental College, Hospital & Research Centre, Greater Noida, Uttar Pradesh, India adisaxen85@gmail.com
[2]Additional Professor, Department of Pediatric & Preventive Dentistry, Srinivas Institute of Dental Sciences, Mukka, Mangalore, Karnataka, India pallavi.laksh@gmail.com
[3]Associate Professor, Department of Prosthodontics and Crown & Bridge, Rajasthan Dental College & Hospital, Nirwan University, Jaipur, Rajasthan, India drsuchitank@gmail.com
[4]Professor, Department of Paediatric and Preventive Dentistry, Guru Nanak Institute of Dental Sciences & Research, Kolkata West Bengal, India dr.sudiptakar96@gmail.com
[5]Reader, Department of Pediatric & Preventive Dentistry, Srinivas Institute of Dental Sciences, Mukka, Mangalore, Karnataka, India drharikrishnanz@gmail.com
[6]Assistant Professor, Department of Prosthodontics and Crown & Bridge, Rajasthan Dental College & Hospital, Nirwan University, Jaipur, Rajasthan, India docdheerajsharma@gmail.com
Corresponding Author: Aditya Saxena, adisaxen85@gmail.com

ABSTRACT:

Background: Behavioural management is an essential component of pediatric dental care, particularly during dental procedures, where anxiety, negative behaviour, and physiological stress may interfere with treatment. Tell-Show-Do (TSD), Modeling, and Audio-Visual Distraction (AVD) are commonly used approaches for improving children's behavioural adaptation during dental treatment.

Aim: To compare the effectiveness of TSD, video modeling, and AVD in reducing dental anxiety and improving behavioural and physiological responses during stainless steel crown (SSC) preparation in children.

Materials & Methods: A comparative three-group clinical study was conducted among 120 children, equally allocated to a TSD group (n=40), Modeling group (n=40), and AVD group (n=40). Dental anxiety was assessed using the Facial Image Scale (FIS) at baseline, during treatment, and immediately after treatment. Behaviour was assessed using the Frankl Behaviour Rating Scale. Heart rate was recorded before, during, and after treatment, while total treatment duration was recorded in minutes. Continuous variables were compared using one-way analysis of variance (ANOVA), followed by Tukey's honestly significant difference (HSD) post-hoc test when appropriate. Within-group changes in FIS scores were evaluated using paired-samples t-tests. Categorical

Natural Resources for Human Health
eISSN: 2583-1194

behavioural data were analyzed using frequencies and percentages and compared between groups using an appropriate categorical-data test. Statistical significance was set at probability (p) <0.05.

Results: Baseline FIS scores were comparable among the TSD, Modeling, and AVD groups (2.81±0.60, 2.55±0.61, and 2.71±0.62, respectively; p=0.155). During treatment, FIS scores were significantly different among the groups (2.54±0.46, 1.90±0.55, and 1.56±0.38, respectively; p<0.001), with the lowest anxiety observed in the AVD group. Post-treatment FIS scores were also significantly lower in the AVD group (1.43±0.33) compared with the Modeling (1.79±0.43) and TSD (2.35±0.48) groups (p<0.001). Significant reductions in FIS scores from baseline to post-treatment were observed in all three groups, with mean changes of −0.464, −0.763, and −1.283 in the TSD, Modeling, and AVD groups, respectively (all p<0.001). Favourable Frankl behaviour was observed in 67.5% of children in the TSD group, 82.5% in the Modeling group, and 92.5% in the AVD group. During treatment, mean heart rates were 91.98 ± 8.42, 88.46±7.50, and 84.90±8.38 beats / min in the TSD, Modeling, and AVD groups, respectively (p<0.001). Mean treatment duration was significantly shorter in the AVD group (26.66±4.06 min) than in the Modeling (30.09±4.08 min) and TSD (31.27±4.53 min) groups (p<0.001).

Conclusion: All three behavioural management approaches were associated with improved anxiety scores following treatment; however, AVD demonstrated the most favourable overall outcomes, with lower dental anxiety, more favourable behaviour, lower treatment-related heart rate, and shorter treatment duration compared with conventional TSD and Modeling.

INTRODUCTION

Pediatric treatment requires careful consideration of both the child's oral condition and their psychological response to dental care. Unlike adults, children may have limited ability to understand dental procedures, anticipate their duration, or cope with unfamiliar clinical environments. Fear, anxiety, apprehension, and previous unpleasant dental experiences can adversely influence cooperation and may interfere with the successful delivery of treatment. Therefore, effective behavioral guidance is an important component of pediatric dental care, particularly when procedures are lengthy, unfamiliar, or require sustained patient cooperation [1].

Dental anxiety in children may manifest as crying, avoidance, refusal to open the mouth, disruptive movements, or other forms of uncooperative behavior. Such responses can make treatment more difficult for the clinician and may increase treatment time and stress for both the child and the dental team. Moreover, negative experiences during childhood may contribute to the development of persistent dental fear and avoidance of dental care later in life [2]. Consequently, contemporary pediatric dentistry emphasizes behavior guidance approaches that promote communication, establish trust, reduce anxiety, and facilitate a positive dental experience rather than relying exclusively on restrictive techniques [3].

Among non-pharmacological behavior guidance methods, Tell-Show-Do (TSD) remains one of the most widely used approaches in pediatric dentistry. The technique involves verbally explaining a procedure using age-appropriate language, demonstrating the procedure or relevant instruments in a non-threatening manner, and subsequently performing the procedure as described. By progressively familiarizing the child with the dental environment and reducing uncertainty, TSD can improve understanding and cooperation while helping establish a trusting relationship between the child and dental professional [4]. However, the effectiveness of TSD may vary according to the child's age, developmental maturity, previous dental experiences, and baseline anxiety.

Modeling is another behavioral technique based on observational learning. In this approach, children observe another individual, such as a peer, sibling, parent, or video-based model, demonstrating appropriate behavior during a dental procedure. Observing a model successfully undergoing treatment may reduce fear associated with unfamiliar procedures and provide the child with a behavioral template to follow. The technique is particularly relevant to children who benefit from

visual learning and may find it easier to understand a procedure by observing it rather than through verbal explanation alone [5].

The increasing availability of digital technologies has also encouraged the use of audiovisual distraction (AVD) as a non-pharmacological strategy for managing dental anxiety. It may involve headphones, videos, cartoons, music, or other age-appropriate visual and auditory content delivered through digital devices. By directing the child's attention toward an engaging external stimulus, AVD may reduce awareness of dental stimuli and unpleasant procedural sensations. Several studies have reported beneficial effects of AVD on anxiety, fear, pain perception, and cooperation during pediatric dental procedures [6, 7].

Behavior management strategies may be particularly important in pediatric because treatment can involve procedures that require prolonged mouth opening, multiple clinical appointments, impression procedures, tooth preparation, or placement and adjustment of prosthetic appliances. These procedures may be unfamiliar to children and can generate apprehension if they do not understand what will happen during treatment. Selecting an appropriate behavioral technique may therefore influence not only immediate cooperation but also the child's overall perception of dental care [8].

Although TSD, modeling, and AVD have each been investigated as approaches for improving children's behavior during dental treatment, their relative effectiveness may differ depending on the treatment setting, child characteristics, and nature of the procedure. Direct comparisons among these three techniques specifically in children undergoing pediatric treatment remain comparatively limited. A systematic comparison may therefore help identify practical and effective approaches for improving cooperation and reducing treatment-related anxiety in this population [9].

Accordingly, the present study was designed to comparatively evaluate the effectiveness of TSD, video modeling, and AVD in children undergoing stainless steel crown (SSC) preparation, with emphasis on their ability to reduce anxiety, facilitate cooperative behavior, and improve physiological response and treatment efficiency.

MATERIALS & METHODS

Study Design & Study Population

A comparative, three-group clinical study was conducted at a tertiary care centre from January to March 2026 to evaluate and compare the effectiveness of three behavioural management approaches, TSD, video modeling, and AVD, during stainless steel crown (SSC) preparation in children. A total of 120 children were equally allocated to three groups of 40 via SNOSE (sequentially numbered, opaque, sealed envelopes) method. Group I received conventional TSD, Group II received video modeling, and Group III received AVD. All participants completed the planned SSC preparation.

Inclusion Criteria

Children were included if they met any of the following criteria:

- Children aged 6–9 years requiring SSC preparation on a primary molar
- Children able to understand and respond to the Facial Image Scale (FIS) and Frankl Behaviour Rating Scale
- Children whose heart rate could be recorded at baseline, during treatment, and after treatment
- Children whose parent or legal guardian provided informed consent

Exclusion Criteria

Children were excluded if they met any of the following criteria:

- Presence of systemic disease or significant medical conditions that could influence anxiety, behaviour, or heart rate
- Presence of developmental, cognitive, or neurological conditions that could interfere with understanding or responding to the behavioural assessments
- Hearing or visual impairment that could interfere with the Modeling or AVD interventions
- Use of medications that could affect anxiety, behaviour, or heart rate

- Requirement for emergency dental treatment rather than the planned procedure
- Inability or unwillingness to cooperate with the planned intervention or assessments
- Incomplete treatment or missing FIS, Frankl Behaviour Rating, heart-rate, or treatment-duration records

Group Allocation and Behavioural Interventions

The participants were equally divided into three intervention groups:

Group I – TSD (n = 40): The operator explained each step (*tell*), showed the instruments (*show*), then performed the step as described (*do*)

Group II – Video modeling (n = 40): Before treatment, children watched a two-minute video of a child of similar age cooperating during the same procedure

Group III – AVD (n = 40): During treatment, children wore a **[**Meta Quest 2 or other Augmented Reality/ Virtual Reality (AR/VR) headset with headphones showing cartoons/games

The assigned behavioural management approaches were applied during the planned pediatric treatment. Behavioural, anxiety-related, and physiological responses were assessed at predefined stages before, during, and after treatment.

Assessment of Dental Anxiety

Dental anxiety was assessed using the FIS. Scores were recorded at three assessment points:

1. **Baseline**, before initiation of treatment;
2. **During treatment**; and
3. **Immediately after completion of treatment**

The FIS score was recorded as a continuous outcome variable for intergroup statistical comparison. Baseline FIS scores were assessed to establish comparability of anxiety levels among the three groups before treatment, whereas subsequent measurements were used to evaluate anxiety levels during and after treatment.The baseline FIS scores were comparable among the three groups, with mean scores of 2.81 ± 0.60 in the TSD group, 2.55 ± 0.61 in the Modeling group, and 2.71 ± 0.62 in the AVD group.

Behavioural Assessment

Behaviour during the dental procedure was assessed using the Frankl Behaviour Rating Scale, which categorizes child behaviour into four levels:

1. Definitely negative;
2. Negative;
3. Positive; and
4. Definitely positive

The four-category distribution was retained for intergroup comparison. For descriptive interpretation, positive and definitely positive ratings were considered favourable behaviour, whereas negative and definitely negative ratings were considered unfavourable behaviour. The Frankl Behaviour Rating was treated as a categorical variable and expressed using frequencies and percentages. The distribution of behavioural categories was compared among the three intervention groups.

Physiological Assessment

Heart rate was recorded as a physiological indicator of the child's response to pediatric treatment. Heart rate was assessed at three stages:

- **Before treatment**, to establish the baseline physiological response;
- **During treatment**, to evaluate the physiological response during the dental procedure; and

- **Immediately after treatment**, to assess the post-treatment physiological response

Heart rate was recorded in beats per minute (beats / min) and analyzed as a continuous variable. Baseline heart rate was used to assess comparability among the three groups before treatment, while during-treatment and post-treatment measurements were compared to determine differences in physiological responses associated with the three behavioural management approaches.

Assessment of Treatment Duration

Treatment duration was recorded for each participant from initiation to completion of the planned pediatric procedure. The duration was expressed in minutes and analyzed as a continuous variable. The mean treatment duration was compared among the TSD, Modeling, and AVD groups.

Outcome Measures

The study assessed behavioural, anxiety-related, physiological, and procedural outcomes.

The principal outcome measures included:

- FIS score during treatment;
- Change in FIS score from baseline to post-treatment; and
- Frankl Behaviour Rating

The physiological and procedural outcome measures included:

- Heart rate before treatment;
- Heart rate during treatment;
- Heart rate after treatment; and
- Total treatment duration

These outcome measures were used to compare the behavioural management approaches with respect to anxiety, behavioural response, physiological response, and treatment efficiency.

Statistical Analysis: All statistical analyses were performed using the International Business Machines Statistical Package for the Social Sciences (IBM SPSS) Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), standard error (SE), minimum and maximum values, whereas categorical variables were presented as frequencies and percentages. One-way analysis of variance (ANOVA) was used to compare continuous variables among the three study groups, including FIS scores, heart rate and treatment duration. When a statistically significant difference was observed by ANOVA, Tukey's honestly significant difference (HSD) post-hoc test was performed for pairwise comparisons. Changes in FIS scores from baseline to post-treatment within each group were assessed using a paired-samples t-test. Frankl Behaviour Rating was analyzed as a categorical variable using frequencies and percentages and compared between the study groups using an appropriate categorical-data test. A p-value of <0.05 was considered statistically significant, while $p<0.001$ was considered highly statistically significant.

RESULTS

Table 1 & Figure 1 summarize the distribution of the study participants. A total of 120 children were included and equally assigned to three intervention groups, with 40 participants in each group: TSD (Group I), Modeling (Group II), and AVD (Group III). All participants completed the planned pediatric treatment.

Table 1: Study population

Group	Sample size	Mean age ± SD (years)	Male, n	Female, n (%)
TSD	40	8.00 ± 1.46	20	20
Modeling	40	7.97 ± 1.66	19	21
AVD	40	8.14 ± 1.36	18	22

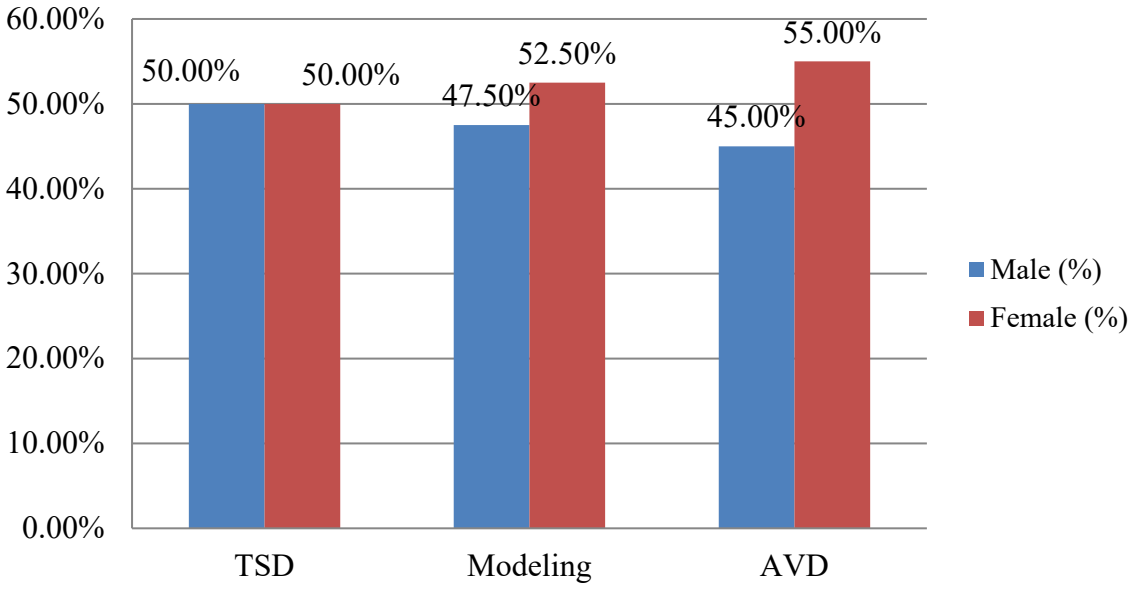


Figure 1: Distribution of study participants according to the intervention groups

Table 2 & Figure 2 present the baseline FIS scores across the three study groups. The mean FIS score was 2.81 ± 0.60 in the TSD group, 2.55 ± 0.61 in the Modeling group, and 2.71 ± 0.62 in the AVD group. The corresponding standard errors were 0.095, 0.097, and 0.098, respectively. FIS scores ranged from 1.00 to 4.00 in each group. One-way ANOVA demonstrated no statistically significant difference in baseline FIS scores among the three groups ($F = 1.897$, $p = 0.155$), indicating that the groups were comparable in terms of anxiety levels before the interventions.

Table 2: Baseline FIS among the Study Groups

Group	Mean	SD	SE	Minimum	Maximum	F-statistic	p-value
TSD	2.81	0.60	0.095	1.00	4.00	1.897	0.155
Modeling	2.55	0.61	0.097	1.00	4.00		
AVD	2.71	0.62	0.098	1.00	4.00		

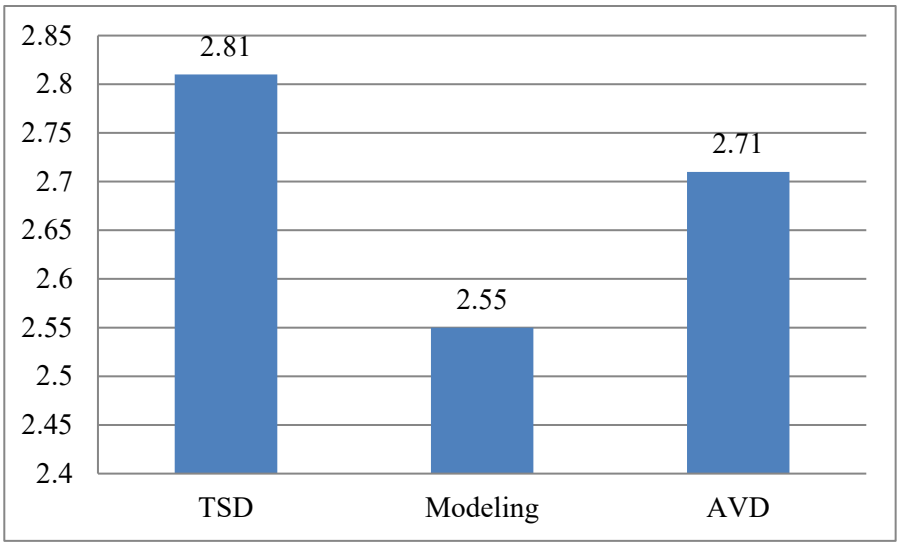


Figure 2: Comparison of baseline FIS scores among the TSD, Modeling, and AVD groups

Table 3 & Figure 3 summarize the FIS scores observed during treatment in the three intervention groups. The mean FIS score was 2.54 ± 0.46 for the TSD group, 1.90 ± 0.55 for the Modeling group, and 1.56 ± 0.38 for the AVD group. The respective standard errors were 0.073, 0.087, and 0.060. The observed FIS scores ranged from 1.00 to 4.00 in the TSD group and from 1.00 to 3.00 in both the Modeling and AVD groups. One-way ANOVA demonstrated a statistically significant difference in FIS scores among the three groups ($F = 45.199$, $p < 0.001$), indicating significant differences in children's anxiety levels during treatment according to the behavioral management approach employed.

Table 3: Intergroup comparison of FIS during treatment between the groups

Group	Mean	SD	SE	Minimum	Maximum	F	p-value
TSD	2.54	0.46	0.073	1.00	4.00	45.199	<0.001
Modeling	1.90	0.55	0.087	1.00	3.00		
AVD	1.56	0.38	0.060	1.00	3.00		

Table 4 summarizes the pairwise group comparisons from Tukey's post-hoc analysis. Statistically significant differences were identified across all three comparisons. The AVD group had a significantly lower mean FIS score than the Modeling group (mean difference = 0.339, $p = 0.004$) and the TSD group (mean difference = 0.977, $p < 0.001$). In addition, the Modeling group showed a significantly lower mean FIS score than the TSD group (mean difference = 0.637, $p < 0.001$). Overall, the results demonstrated a progressive difference in anxiety levels, with the lowest FIS scores observed in the AVD group, followed by the Modeling group, while the TSD group recorded the highest scores during treatment.

Table 4: Post-hoc Tukey analysis

Comparison	Mean difference	p-adjusted	Significant
AVD vs Modeling	0.339	0.004	Significant
AVD vs TSD	0.977	<0.001	Significant
Modeling vs TSD	0.637	<0.001	Significant

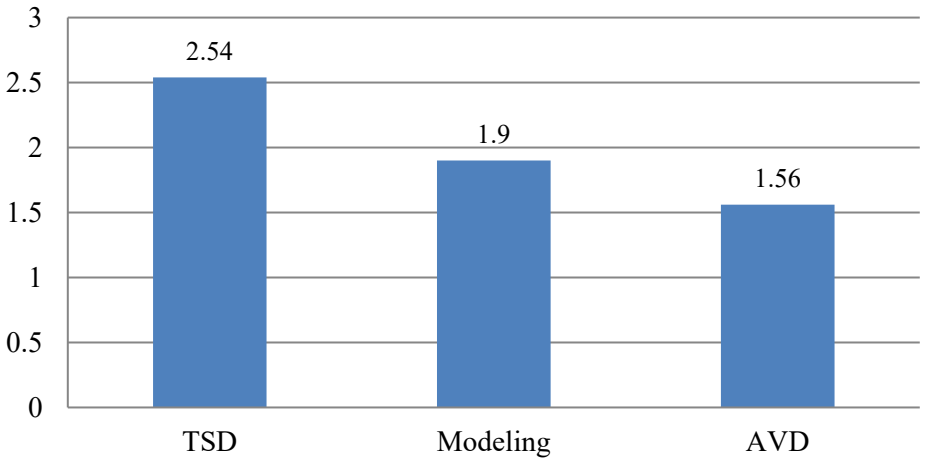


Figure 3: Comparison of FIS scores during treatment among the TSD, Modeling, and AV groups

Table 5 & Figure 4 present the FIS scores assessed after completion of treatment. The mean FIS score was 2.35 ± 0.48 in the TSD group, 1.79 ± 0.43 in the Modeling group, and 1.43 ± 0.33 in the AVD group. The corresponding standard errors were 0.076, 0.068, and 0.052, respectively. The observed FIS scores ranged from 1.00 to 4.00 in the TSD group, 1.00 to 3.00 in the Modeling group, and 1.00 to 2.00 in the AVD group. One-way ANOVA showed a statistically significant difference in post-treatment FIS scores among the three groups ($F = 49.629$, $p < 0.001$). The lowest mean FIS score was recorded in the AVD group (1.43 ± 0.33), followed by the Modeling group (1.79 ± 0.43), whereas the TSD group had the highest mean score (2.35 ± 0.48). These findings demonstrate significant differences in post-treatment anxiety levels among the three behavioral management approaches.

Table 5: Intergroup comparison of FIS after treatment between the groups

Group	Mean	SD	SE	Minimum	Maximum	F	p-value
TSD	2.35	0.48	0.076	1.00	4.00	49.629	<0.001
Modeling	1.79	0.43	0.068	1.00	3.00		
AVD	1.43	0.33	0.052	1.00	2.00		

Table 6 presents the results of Tukey's post-hoc analysis, which identified statistically significant differences in all three pairwise comparisons. The AVD group had significantly lower FIS scores than both the Modeling group (mean difference = 0.358, $p < 0.001$) and the TSD group (mean difference = 0.922, $p < 0.001$). Similarly, the Modeling group demonstrated significantly lower FIS scores than the TSD group (mean difference = 0.564, $p < 0.001$). Overall, the findings indicate that AVD was associated with the lowest post-treatment anxiety levels, followed by Modeling, whereas TSD exhibited the highest FIS scores.

Table 6: Tukey post-hoc comparisons

Comparison	Mean difference	P value	Significant
AVD vs Modeling	0.358	<0.001	Significant
AVD vs TSD	0.922	<0.001	Significant
Modeling vs TSD	0.564	<0.001	Significant

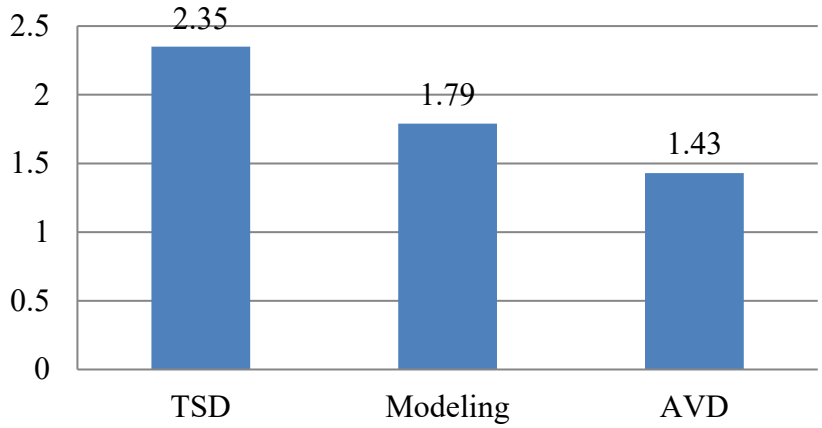


Figure 4: Comparison of post-treatment FIS scores among the TSD, Modeling, and AVD groups

Table 7 & Figure 5 demonstrate a significant decline in FIS scores from baseline to post-treatment in all three intervention groups. In the TSD group, the mean FIS score decreased from 2.81 ± 0.60 at baseline to 2.35 ± 0.48 following treatment, corresponding to a mean change of −0.464. This reduction was statistically significant ($t = 3.614$, $p < 0.001$). In the Modeling group, the mean FIS score declined from 2.55 ± 0.61 to 1.79 ± 0.43, resulting in a mean reduction of −0.763, which was also statistically significant ($t = 6.870$, $p < 0.001$). The greatest reduction was observed in the AVD group, where the mean FIS score decreased from 2.71 ± 0.62 at baseline to 1.43 ± 0.33 after treatment. The mean change was −1.283, with a highly significant within-group difference ($t = 11.637$, $p < 0.001$). Overall, all three behavioral management techniques produced significant reductions in FIS scores from baseline to post-treatment. However, the magnitude of reduction was greatest with AVD (−1.283), followed by Modeling (−0.763) and TSD (−0.464), suggesting that AVD was the most effective approach for reducing anxiety in this simulated study.

Table 7: Intragroup comparison of change in FIS Scores from Baseline to Post Treatment

Group	Baseline FIS	Post-treatment FIS	Mean change	t	p-value
TSD	2.81 ± 0.60	2.35 ± 0.48	-0.464	3.614	<0.001
Modeling	2.55 ± 0.61	1.79 ± 0.43	-0.763	6.870	<0.001
AVD	2.71 ± 0.62	1.43 ± 0.33	-1.283	11.637	<0.001

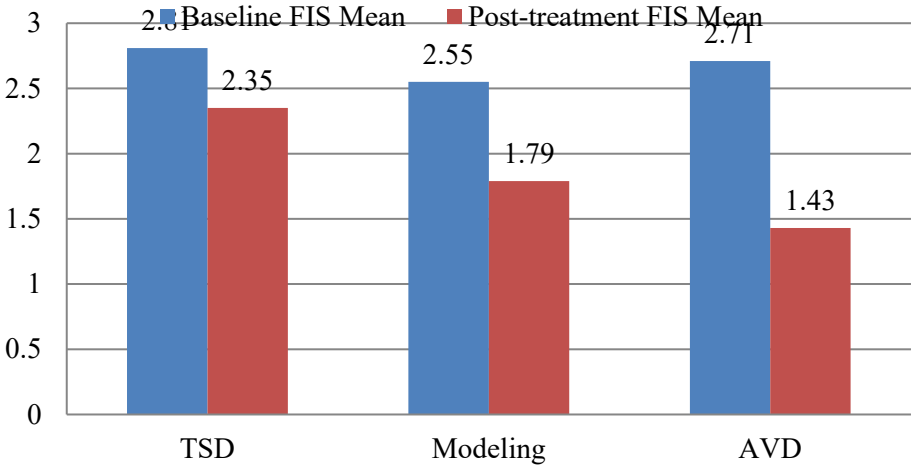


Figure 5: Comparison of changes in FIS scores from baseline to post-treatment across the three behavioral management groups

Table 8 & Figure 6 illustrate the distribution of children according to the Frankl Behaviour Rating Scale across the three intervention groups. In the TSD group, 3 children (7.5%) exhibited definitely negative behaviour, 10 (25.0%) demonstrated negative behaviour, 17 (42.5%) displayed positive behaviour, and 10 (25.0%) demonstrated definitely positive behaviour. Overall, 67.5% of children in this group exhibited favourablebehaviour, corresponding to either positive or definitely positive ratings. In the Modeling group, 1 child (2.5%) was rated as definitely negative, 6 (15.0%) as negative, 19 (47.5%) as positive, and 14 (35.0%) as definitely positive. Thus, 82.5% of children demonstrated favourablebehaviour, indicating a greater proportion of positive responses compared with the TSD group. The AVD group showed the most favourablebehavioural distribution. No child (0.0%) was rated as definitely negative, while 3 (7.5%) demonstrated negative behaviour, 16 (40.0%) exhibited positive behaviour, and 21 (52.5%) demonstrated definitely positive behaviour. Consequently, favourablebehaviour was observed in 92.5% of children in the AVD group. When positive and definitely positive ratings were considered together, favourablebehaviour was observed in 67.5%, 82.5%, and 92.5% of children in the TSD, Modeling, and AVD groups, respectively. Conversely, negative or definitely negative behaviour was recorded in 32.5%, 17.5%, and 7.5% of children, respectively. The findings indicate a progressive improvement in behavioural responses across the interventions, with the AVD group demonstrating the most favourablebehavioural profile, followed by the Modeling and TSD groups.

Table 8: Intergroup Comparison of FranklBehaviour Rating between the Groups

Group	Definitely negative	Negative	Positive	Definitely positive
TSD	3 (7.5%)	10 (25.0%)	17 (42.5%)	10 (25.0%)
Modeling	1 (2.5%)	6 (15.0%)	19 (47.5%)	14 (35.0%)
AVD	0 (0.0%)	3 (7.5%)	16 (40.0%)	21 (52.5%)

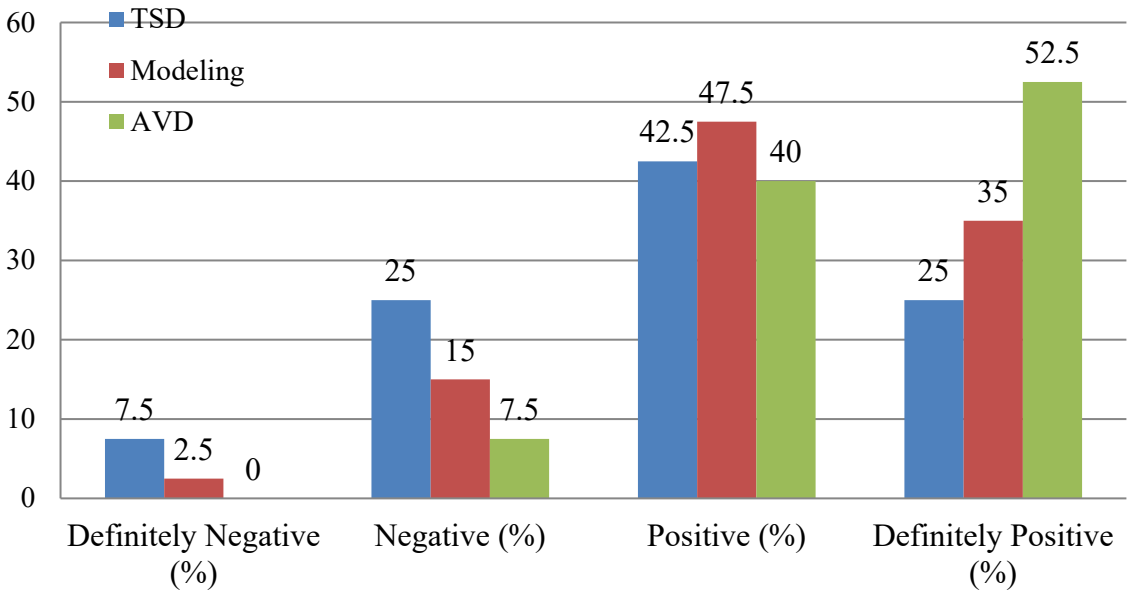


Figure 6: Distribution of Frankl Behaviour Rating categories across the TSD, Modeling, and AVD groups

Table 9 & Figure 7 present the baseline heart rate measurements recorded before initiation of treatment. The mean heart rate was 88.65 ± 7.84 beats / min in the TSD group, 87.12 ± 7.51 beats / min in the Modeling group, and 85.93 ± 8.02 beats / min in the AVD group. The corresponding standard errors were 1.24, 1.19, and 1.27 beats / min, respectively. The observed heart rate ranged from 72–104 beats/min in the TSD group, 73–103 beats/min in the Modeling group, and 71–103 beats/min in the AVD group. One-way ANOVA demonstrated that the difference in baseline heart rate among the three groups was not statistically significant ($F = 1.426$, $p = 0.245$). These findings indicate that the intervention groups were statistically comparable with respect to baseline heart rate before the commencement of pediatric treatment.

Table 9: Heart rate before treatment

Group	Mean (beats/min)	SD	SE	Minimum	Maximum	F	p-value
TSD	88.65	7.84	1.24	72	104	1.426	0.245
Modeling	87.12	7.51	1.19	73	103		
AVD	85.93	8.02	1.27	71	103		

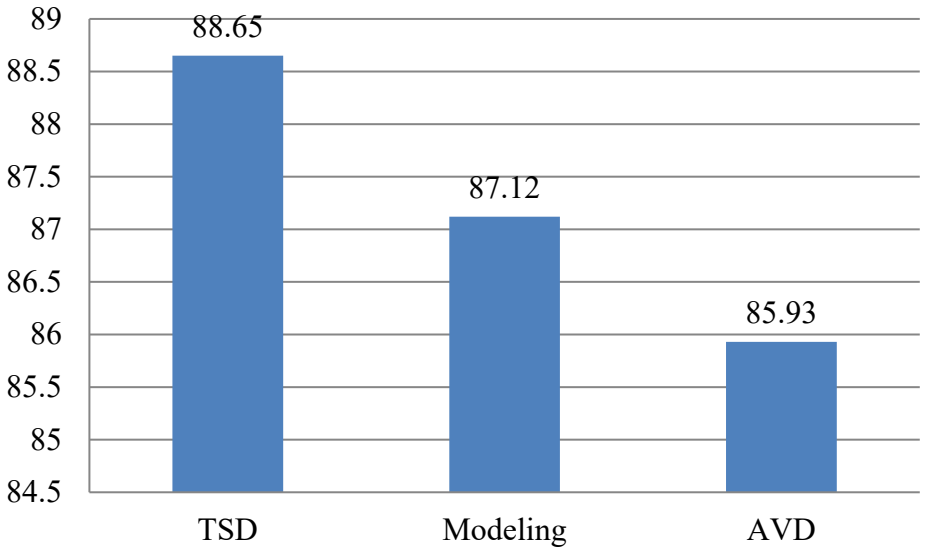


Figure 7: Mean baseline heart rate among the TSD, Modeling, and AVD groups

Table 10 & Figure 8 summarize the heart rate measurements recorded during treatment in the three intervention groups. The mean heart rate was 91.98 ± 8.42 beats / min in the TSD group, 88.46 ± 7.50 beats / min in the Modeling group, and 84.90 ± 8.38 beats / min in the AVD group. The corresponding standard errors were 1.33, 1.19, and 1.33 beats / min, respectively. The recorded heart rate values ranged from 75–109 beats / min in the TSD group, 74–104 beats /min in the Modeling group, and 69–102 beats / min in the AVD group. One-way ANOVA revealed a statistically significant difference in heart rate among the three groups during treatment ($F = 7.619$, $p < 0.001$). The TSD group exhibited the highest mean heart rate, while the AVD group demonstrated the lowest, with the Modeling group showing an intermediate value. These findings indicate that heart rate responses varied significantly according to the behavioural intervention used during pediatric treatment.

Table 10: Heart rate during treatment

Group	Mean (beats / min)	SD	SE	Minimum	Maximum	F	p-value
TSD	91.98	8.42	1.33	75	109	7.619	<0.001
Modeling	88.46	7.50	1.19	74	104		
AVD	84.90	8.38	1.33	69	102		

Table 11 presents the results of Tukey's post-hoc analysis for intergroup comparisons of heart rate during treatment. The AVD group demonstrated a significantly lower mean heart rate than the TSD group, with a mean difference of 7.079 beats / min ($p < 0.001$). In contrast, the comparison between the AVD and Modeling groups did not reach statistical significance (mean difference = 3.558 beats / min, $p = 0.126$). Likewise, no statistically significant difference was observed between the

Modeling and TSD groups (mean difference = 3.522 beats/min, p = 0.132). Overall, the AVD group exhibited the lowest mean heart rate during treatment, suggesting a comparatively lower physiological response. However, among the pairwise comparisons, a statistically significant difference was observed only between the AVD and TSD groups.

Table 11: Post Hoc analysis

Comparison	Mean Difference	p-adjusted	Significant
AVD vs Modeling	3.558	0.126	Non-Significant
AVDvs TSD	7.079	<0.001	Significant
Modeling vs TSD	3.522	0.132	Non-Significant

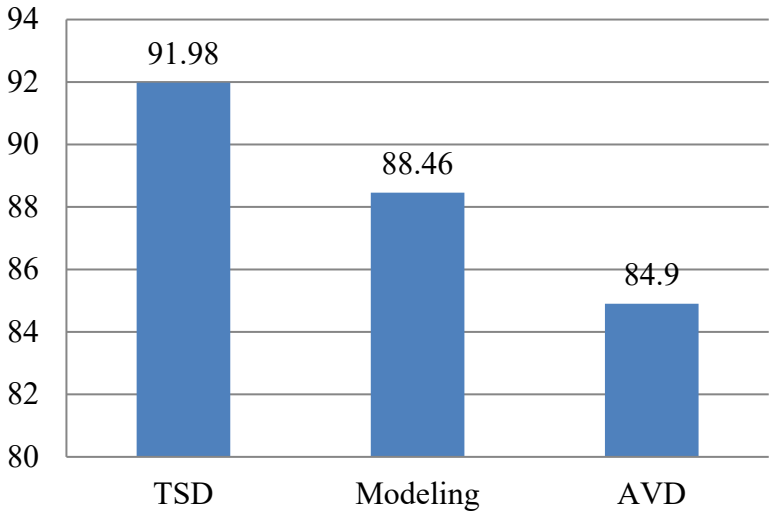


Figure 8: Comparison of mean heart rate during treatment among the TSD, Modeling, and AVD groups

Table 12 & Figure 9 present the heart rate values recorded immediately after completion of the treatment procedure. The mean post-treatment heart rate was 89.74±7.65 beats / min in the TSD group, 86.21±7.18 beats / min in the Modeling group, and 82.68±7.91 beats/min in the AVD group. The corresponding standard errors were 1.21, 1.14, and 1.25 beats / min, respectively.

The observed heart rate values ranged from 73–105 beats / min in the TSD group, 72–101 beats / min in the Modeling group, and 68–99 beats / min in the AVD group. One-way ANOVA demonstrated a statistically significant difference in post-treatment heart rate among the three groups (F = 6.284, p = 0.003). The TSD group recorded the highest mean heart rate, whereas the AVD group exhibited the lowest, with the Modeling group showing an intermediate value. These results indicate significant differences in physiological heart rate responses following treatment across the three behavioural intervention groups.

Table 12: Heart rate after treatment

Group	Mean (beats/min)	SD	SE	Minimum	Maximum	F	p-value
TSD	89.74	7.65	1.21	73	105	6.284	0.003
Modeling	86.21	7.18	1.14	72	101		
AVD	82.68	7.91	1.25	68	99		

Table 13 presents the intergroup comparisons of post-treatment heart rate obtained using Tukey's post-hoc test. The mean heart rate was significantly higher in the TSD group than in the AVD group, with a mean difference of 7.06 beats / min ($p = 0.001$). In comparison, the difference between the TSD and Modeling groups was not statistically significant (mean difference = 3.53 beats / min, $p = 0.098$). Similarly, no statistically significant difference was detected between the Modeling and AVD groups (mean difference = 3.53 beats / min, $p = 0.098$). Overall, the AVD group exhibited the lowest post-treatment heart rate, indicating a comparatively more favourable physiological response after pediatric treatment. However, among the pairwise comparisons, statistical significance was observed only between the TSD and AVD groups.

Table 13: Post Hoc analysis

Comparison	Mean Difference (beats/min)	p-adjusted	Significant
TSD vs Modeling	3.53	0.098	Non-Significant
TSD vs AVD	7.06	0.001	Significant
Modeling vs AVD	3.53	0.098	Non-Significant

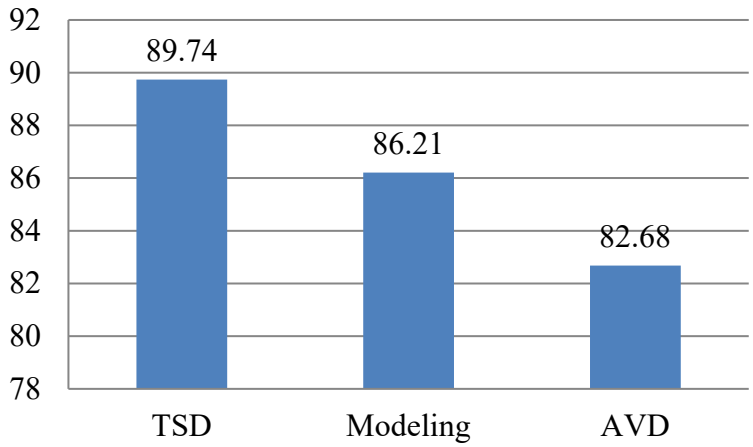


Figure 9: Comparison of mean post-treatment heart rate among the TSD, Modeling, and AVD groups

Table 14 & Figure 10 present the treatment duration recorded across the three intervention groups. The mean treatment duration was 31.27 ± 4.53 minutes in the TSD group, 30.09 ± 4.08 minutes in the Modeling group, and 26.66 ± 4.06 minutes in the AVD group. The corresponding standard errors were 0.716, 0.645, and 0.642 minutes, respectively. The treatment duration ranged from 21–40 minutes in the TSD group, 22–39 minutes in the Modeling group, and 19–35 minutes in the AVD group. One-way ANOVA demonstrated a statistically significant difference in treatment duration among the three groups ($F = 12.818$, $p < 0.001$). The AVD group had the shortest mean treatment duration (26.66 ± 4.06 minutes), followed by the Modeling group (30.09 ± 4.08 minutes) and the TSD group (31.27 ± 4.53 minutes). These findings indicate that treatment duration differed significantly among the three behavioural intervention groups, with AVD associated with the shortest overall treatment time.

Table 14: Treatment duration between the different modalities

Group	Mean (min)	SD	SE	Minimum	Maximum	F	p-value
TSD	31.27	4.53	0.716	21	40	12.818	<0.001
Modeling	30.09	4.08	0.645	22	39		
AVD	26.66	4.06	0.642	19	35		

Table 15 presents the intergroup comparisons of treatment duration obtained through Tukey's post-hoc analysis. The AVD group demonstrated a significantly shorter mean treatment duration than the Modeling group, with a mean difference of 3.431 minutes ($p = 0.001$). Similarly, treatment duration was significantly shorter in the AVD group than in the TSD group, with a mean difference of 4.607 minutes ($p < 0.001$). The comparison between the Modeling and TSD groups did not reveal a statistically significant difference in treatment duration (mean difference = 1.176 minutes, $p = 0.430$). Overall, the findings demonstrate that AVD significantly reduced treatment duration compared with both TSD and Modeling, whereas no significant difference was observed between the TSD and Modeling groups.

Table 15: Post Hoc analysis

Comparison	Mean difference (min)	P value	Significant
AVD vs Modeling	3.431	0.001	Significant
AVD vs TSD	4.607	<0.001	Significant
Modeling vs TSD	1.176	0.430	Non-Significant

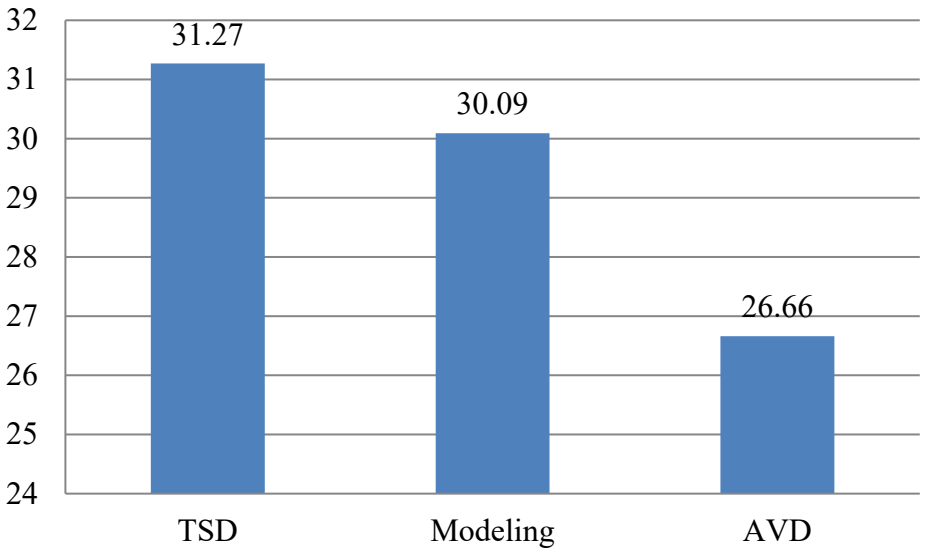


Figure 10: Comparison of mean treatment duration across the TSD, Modeling, and AVD groups

DISCUSSION

Behavioral cooperation is a critical determinant of successful pediatric dental treatment, particularly during procedures that may require prolonged attention and repeated clinical interactions. The present study comparatively evaluated TSD, modeling, and AVD as non-pharmacological behavioral guidance approaches. Among 120 children (40 per group) with comparable baseline anxiety (FIS, $p = 0.155$) and heart rate ($p = 0.245$), AVD produced the lowest anxiety during treatment (FIS 1.56 ± 0.38) and after treatment (1.43 ± 0.33), followed by modeling (1.90 ± 0.55 and 1.79 ± 0.43), while TSD produced the highest scores (2.54 ± 0.46 and 2.35 ± 0.48; both $p < 0.001$). AVD also gave the most favorable Frankl ratings (92.5% positive or definitely positive, versus 82.5% for modeling and 67.5% for TSD), the lowest heart rate, and the shortest treatment time. The findings suggest that the manner in which information is delivered and the child's attention is directed can substantially influence behavioral adaptation during dental treatment. Rather than representing competing approaches, these techniques address different components of dental anxiety and cooperation.

The potential benefit of AVD may be attributed to its ability to redirect the child's attention away from dental stimuli. Prabhakar et al. (2007) [10] demonstrated that auditory and AVD could positively influence behavioral responses among anxious pediatric dental patients. Similarly, the AVD group in the present study showed the largest reduction in FIS from

baseline to post-treatment (−1.283, $p < 0.001$), compared with −0.763 for modeling and −0.464 for TSD, which supports the use of engaging AV stimuli as a means of reducing attention toward potentially threatening aspects of the dental environment. The significantly lower heart rate in the AVD group than in the TSD group during treatment (mean difference 7.08 beats / min, $p < 0.001$) and after treatment (7.06 beats /min, $p = 0.001$) points in the same direction, although the differences between AVD and modeling were not significant. The simultaneous engagement of visual and auditory pathways may provide a stronger competing stimulus than auditory distraction alone, which may be particularly advantageous during procedures requiring sustained cooperation. The shorter treatment time with AVD (26.66 ± 4.06 minutes, versus 30.09 ± 4.08 for modeling and 31.27 ± 4.53 for TSD; $p < 0.001$) may indicate that better cooperation also improved efficiency, which is relevant to the long appointments of dental procedures.

These findings are consistent with the observations of Asl Aminabadi et al. (2012) [11], who reported reduced pain and anxiety with VR distraction among young children undergoing dental treatment. Although VR provides greater sensory immersion than conventional AVD, both approaches operate through the fundamental mechanism of attentional diversion. Thus, visually engaging interventions may be particularly useful for children who have difficulty regulating anxiety in an unfamiliar clinical environment.

Kharouba et al. (2020) [12] similarly demonstrated the usefulness of television distraction in comparison with TSD during pediatric dental treatment. The distinction between these techniques is clinically important. It reduces anxiety by increasing familiarity and predictability through sequential explanation and demonstration, whereas AVD minimizes attention directed toward the procedure itself. Consequently, children whose anxiety is primarily related to uncertainty may respond favorably to TSD, while those who are more reactive to clinical sights, sounds, or procedural stimuli may benefit from distraction. In the present study, TSD produced the weakest anxiety and behavior outcomes, which may indicate that explanation and demonstration alone were insufficient for children whose anxiety was driven by the clinical stimuli of treatment.

Evidence on behavior guidance specifically within pediatric care remains limited, with most available reports addressing space maintainers and impression procedures. Qurota'ayun and Sari [13] described a case in which TSD was combined with enhanced control and positive reinforcement during impression taking for space maintainer fabrication, and reported improved cooperation, reduced anxiety and gag reflex, and successful impressions. In a randomized comparison that included children needing space maintenance, Bhowmick S et al. (2025) [14] found AVD to be an effective approach for managing anxiety. Although these reports differ in design and the first is a single case, they indicate that behavior guidance is relevant to the impression, try-in, and delivery stages of care, where gagging, prolonged mouth opening, and unfamiliar materials may heighten anxiety. The present findings extend this limited evidence by comparing three techniques directly within a setting.

TSD nevertheless remains a fundamental behavior guidance technique because it provides children with developmentally appropriate information and a predictable sequence of events. By progressing from explanation to demonstration and finally to treatment, TSD may enhance a child's sense of familiarity and control. This is supported by the present data: TSD still produced a significant reduction in FIS from baseline (2.81 to 2.35, $p < 0.001$), although the reduction was smaller than with modeling or AVD. Balakrishnan et al. (2024) [15], in a randomized controlled trial involving children aged 6–12 years, further emphasized the value of structured behavioral management techniques in improving children's responses to dental treatment. Their findings support individualized selection of behavior guidance strategies according to age, comprehension, and anxiety level rather than assuming that a single technique is universally effective.

Modeling provides a complementary mechanism based on observational learning, whereby children observe another individual demonstrating appropriate behavior during dental treatment. By providing a concrete example of what to expect, modeling may reduce uncertainty and help children develop confidence before experiencing the procedure themselves. Paryab and Arab (2014) [5] compared filmed modeling with conventional TSD among children aged 4–6 years and reported that filmed modeling could serve as an effective alternative for preparing children before dental treatment. Although significant differences between the two approaches were not observed, their findings support the feasibility of using an observed treatment experience to familiarize children with dental procedures.

More recently, Gaikwad and Varkey (2026) [16] compared filmed modeling integrated with TSD against TSD alone and reported greater reductions in anxiety with filmed modeling, further supporting the role of observational learning in pediatric behaviour guidance. In contrast to Paryab and Arab (2014) [5], modeling in the present study produced significantly lower FIS scores than TSD during treatment (mean difference 0.637, $p < 0.001$) and after treatment (0.564, $p < 0.001$), with more

favorable Frankl ratings (82.5% versus 67.5%). This difference may reflect the older children studied here (mean age about 8 years) and the longer, multi-step nature of procedures. However, modeling did not significantly reduce heart rate (3.52 beats / min, p = 0.132) or treatment duration (1.176 minutes, p = 0.430) compared with TSD, suggesting that its benefit was mainly on reported anxiety and behavior rather than on physiological or time measures. These findings suggest that modeling may be particularly valuable when children encounter unfamiliar procedures because it transforms an abstract verbal explanation into a visually observable treatment experience. In pediatric dental procedures, where treatment may involve impressions, tooth preparation, prosthesis insertion or adjustment, and multiple clinical visits, such visual preparation may increase familiarity, establish realistic expectations, and reduce anticipatory apprehension. Thus, modeling may function not merely as an alternative to TSD but as a complementary strategy that strengthens the child's understanding and behavioral readiness before treatment.

An important strength of the present investigation is its specific focus on pediatric treatment. Compared with routine dental procedures, pediatric care may require longer appointments, repeated visits, tolerance of unfamiliar clinical procedures, and sustained cooperation. Consequently, behavioral techniques that either establishes predictability, provide an observable behavioral model, or maintain attention away from stressful stimuli may have particular clinical value in this setting. Overall, the present findings support a patient-centered approach to behavioral guidance in pediatric patients. The progressive pattern observed here, with AVD followed by modeling and then TSD on anxiety and behavior, suggests that techniques that occupy or prepare the child may be more effective than explanation alone in this setting, although the choice should still be individualized. TSD facilitates familiarity and predictability, modeling provides observational learning, and AVD redirects attention from potentially anxiety-provoking stimuli. Their effectiveness may vary according to the child's developmental maturity, previous dental experiences, anxiety level, and the nature and duration of treatment. Therefore, behavioral management should be individualized rather than applied uniformly. The present study adds to the existing evidence by directly examining these approaches within pediatric care and highlights the potential value of selecting behavioral strategies according to the specific needs of each child.

Limitations

- **Single-center design:** The study was done at one tertiary care centre, which may limit generalizability to other geographic, socioeconomic, and clinical settings.
- **Modest sample size:** There were 40 children per group. This was enough to show significant differences in several outcomes, but larger multicentric studies would add power and external validity.
- **Short follow-up:** Only a single SSC preparation visit was assessed, so long-term effects and the influence on later dental visits are unknown.
- **Individual variability:** Temperament, previous dental experience, parental influence, and baseline anxiety may have affected responses despite standardized protocols.
- **Limited comparators:** Only TSD, video modeling, and AVD were compared, with no other behavioural or pharmacological strategies.
- **Subjective measures and blinding:** FIS and Frankl ratings involve some subjectivity, and the operator and children could not be blinded to the technique
- **Limited physiological and statistical data:** Heart rate was recorded at three time points only, and the Frankl distribution was described but not statistically tested.

CONCLUSION

The present study demonstrates that TSD, Modeling, and AVD are effective behavioural management approaches for pediatric dental treatment. Among the three, AVD showed the most favourable outcomes, particularly by improving cooperation and reducing treatment duration. Thus, AVD may be considered a useful adjunct for enhancing treatment efficiency and facilitating positive dental experiences in children. Selection of the behavioural technique should, however, be tailored to the individual child and clinical situation.

Conflicts of interest: Nil

Financial Support: None

REFERENCES

[1] Seligman LD, Hovey JD, Chacon K, Ollendick TH. Dental anxiety: An understudied problem in youth. Clin Psychol Rev. 2017 Jul;55:25-40. doi: 10.1016/j.cpr.2017.04.004. Epub 2017 Apr 19. PMID: 28478271.

[2] Gao X, Hamzah SH, Yiu CK, McGrath C, King NM. Dental fear and anxiety in children and adolescents: qualitative study using YouTube. J Med Internet Res. 2013 Feb 22;15(2):e29. doi: 10.2196/jmir.2290. PMID: 23435094; PMCID: PMC3636260.

[3] Mendoza-Mendoza A, Perea MB, Yañez-Vico RM, Iglesias-Linares A. Dental fear in children: the role of previous negative dental experiences. Clin Oral Investig. 2015 Apr;19(3):745-51. doi: 10.1007/s00784-014-1380-5. Epub 2014 Dec 12. PMID: 25502504.

[4] Elicherla NR, Saikiran KV, Anchala K, Elicherla SR, Nuvvula S. Evaluation of the effectiveness of tell-show-do and ask-tell-ask in the management of dental fear and anxiety: a double-blinded randomized control trial. J Dent Anesth Pain Med. 2024 Feb;24(1):57-65. doi: 10.17245/jdapm.2024.24.1.57. Epub 2024 Feb 1. PMID: 38362257; PMCID: PMC10864706.

[5] Paryab M, Arab Z. The effect of Filmed modeling on the anxious and cooperative behavior of 4-6 years old children during dental treatment: A randomized clinical trial study. Dent Res J (Isfahan). 2014 Jul;11(4):502-7. doi: 10.4103/1735-3327.139426. PMID: 25225565; PMCID: PMC4163830.

[6] Nuvvula S, Alahari S, Kamatham R, Challa RR. Effect of audiovisual distraction with 3D video glasses on dental anxiety of children experiencing administration of local analgesia: a randomised clinical trial. Eur Arch Paediatr Dent. 2015 Feb;16(1):43-50. doi: 10.1007/s40368-014-0145-9. Epub 2014 Sep 26. PMID: 25256207.

[7] Kaur R, Jindal R, Dua R, Mahajan S, Sethi K, Garg S. Comparative evaluation of the effectiveness of audio and audiovisual distraction aids in the management of anxious pediatric dental patients. J Indian Soc Pedod Prev Dent. 2015 Jul-Sep;33(3):192-203. doi: 10.4103/0970-4388.160357. PMID: 26156272.

[8] Al-Khotani A, Bello LA, Christidis N. Effects of audiovisual distraction on children's behaviour during dental treatment: a randomized controlled clinical trial. Acta OdontolScand. 2016 Aug;74(6):494-501. doi: 10.1080/00016357.2016.1206211. Epub 2016 Jul 13. PMID: 27409593; PMCID: PMC4960510.

[9] Sundaresan C, Haneef T, Anusha VR, Nabeeh PK, Gaffoor FMA. Comparative Evaluation of Behavioral Management Techniques in Reducing Dental Anxiety Among Children Aged 4-8 Years: A Randomized Clinical Trial. J Pharm Bioallied Sci. 2025 Dec; 17(Suppl 4):S3036-S3038. doi: 10.4103/jpbs.jpbs_992_25. Epub 2025 Dec 17. PMID: 41522938; PMCID: PMC12788482.

[10] Prabhakar AR, Marwah N, Raju OS. A comparison between audio and audiovisual distraction techniques in managing anxious pediatric dental patients. J Indian Soc Pedod Prev Dent. 2007 Oct-Dec;25(4):177-82. doi: 10.4103/0970-4388.37014. PMID: 18007104.

[11] Asl Aminabadi N, Erfanparast L, Sohrabi A, GhertasiOskouei S, Naghili A. The Impact of Virtual Reality Distraction on Pain and Anxiety during Dental Treatment in 4-6 Year-Old Children: a Randomized Controlled Clinical Trial. J Dent Res Dent Clin Dent Prospects. 2012 Fall;6(4):117-24. doi: 10.5681/joddd.2012.025. Epub 2012 Nov 12. PMID: 23277857; PMCID: PMC3529924.

[12] Kharouba J, Peretz B, Blumer S. The effect of television distraction versus Tell-Show-Do as behavioral management techniques in children undergoing dental treatments. Quintessence Int. 2020;51(6):486-494. doi: 10.3290/j.qi.a44366. PMID: 32253388.

[13] Qurota'ayun L, Sari ND. Combination of Basic Behavior Guidance for Children During Dental Impressions. JIKG (JurnalIlmuKedokteran Gigi). 2026 Jul 29:69-76.

[14] Bhowmick S, Bajana P, S Patel K, Sharma K, Varshini RA, Srija K, Surana P. Impact of tell show do and audio-visual distraction techniques on pediatric dental anxiety: A comparative study. Bioinformation. 2025 Jul 31;21(7):2221-2225. doi: 10.6026/973206300212221. PMID: 41170042; PMCID: PMC12569906.

[15] Balakrishnan P, Srinivasan D, Eagappan S. Comparative evaluation of three different behavior management techniques among children aged 6-12 years in dental practice: A single-center, double-blind, randomized controlled trial. Dent Med Probl. 2024 Sep-Oct;61(5):641-650. doi: 10.17219/dmp/169966. PMID: 39364621.

[16] Gaikwad AA, Varkey I. Comparison of Tell-Play-Do and filmed modeling with Tell-Show-Do versus Tell-Show-Do alone on child behavior among 4-7-year-old children: A randomized clinical trial. J Oral Biol Craniofac Res. 2026 May-Jun;16(3):101452. doi: 10.1016/j.jobcr.2026.101452. Epub 2026 Apr 21. PMID: 42058438; PMCID: PMC13122811.