Comparative Study of Behavioral Management Techniques on Orthodontic Treatment Acceptance in Children with Special Health Care Needs

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HOW TO CITE:

Ashish Jain, Priyadarshini H.R, Md Kalim Ullah, Shanthini Devi Subramaniam, Anissa Lokman, 6Sai Prannoy Nagella (2026). Comparative Study of Behavioral Management Techniques on Orthodontic Treatment Acceptance in Children with Special Health Care Needs. International Journal of Special Education, 41(3s), 742-751.

ABSTRACT:

Background: Orthodontic treatment in children with special health care needs (SHCN) is often complicated by behavioral challenges, anxiety, and reduced cooperation. Effective behavioral management is essential to enhance treatment acceptance and ensure successful clinical outcomes. However, evidence comparing different behavioral techniques specifically in SHCN populations undergoing orthodontic procedures remains limited.

Aim: To compare the effectiveness of different behavioral management techniques on Orthodontic treatment acceptance in children with SHCN.

Materials and Methods: This prospective randomized controlled clinical trial included 60 children aged 6–14 years diagnosed with SHCN requiring orthodontic treatment. Participants were randomly allocated into three groups (n=20 each): Group I (tell-show-do), Group II (audiovisual distraction), and Group III (combination of tell-show-do and positive reinforcement). Baseline demographic data and anxiety levels were recorded. Orthodontic procedures were standardized across all groups. Treatment acceptance was assessed using the Frankl Behavior Rating Scale, procedure completion rate, and physiological parameter (heart rate). Observations were recorded at baseline, first visit, 2 weeks, and 1 month. Data were analyzed using ANOVA, repeated measures ANOVA, Chi-square test, and t-tests with significance set at $p < 0.05$.

Results: All groups demonstrated significant improvement in behavior

and reduction in anxiety over time. However, Group III showed the highest increase in Frankl scores ($p < 0.01$), highest procedure completion rate (90%), and greatest reduction in heart rate (mean reduction: −12.6 bpm). Audiovisual distraction (Group II) was more effective than tell-show-do alone (Group I), particularly during initial visits. Intergroup comparisons revealed statistically significant differences favoring the combination technique.

Conclusion: The combination of tell-show-do and positive reinforcement is significantly more effective than individual behavioral techniques in improving Orthodontic treatment acceptance among children with SHCN. A multimodal behavioral approach is recommended for optimal clinical outcomes in this population. This study supports Sustainable Development Goals (SDG) 3, 4 and 17 by enhancing equitable access to orthodontic care through effective behavioral management strategies in children with special health care needs.

Keywords: Audiovisual distraction, Behavior management, Orthodontic treatment acceptance, SDG 3, 4, 17, Special health care needs, Tell-show-do.

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Introduction

Orthodontic treatment in children with special health care needs (SHCN) presents a unique intersection of clinical complexity and behavioral management. SHCN is a broad term encompassing individuals with physical, developmental, intellectual, sensory, or emotional impairments that require specialized health care services [1]. These children often exhibit heightened anxiety, communication difficulties, cognitive limitations, and reduced adaptive behaviors, all of which can significantly influence their acceptance of dental and orthodontic procedures. As orthodontic care increasingly emphasizes early intervention and preventive strategies, understanding how to effectively manage the behavior of SHCN children has become a critical component of successful treatment outcomes [2].

Orthodontic treatment, unlike many other dental procedures, typically requires multiple visits, prolonged chair time, and a high degree of patient cooperation. Procedures such as impression taking, appliance placement, activation, retainers and maintenance demand both physical compliance and psychological readiness [3]. For children with special health care needs (SHCN), these requirements can be particularly challenging due to sensory sensitivities, fear of unfamiliar environments, and difficulties in understanding procedural steps. Consequently, behavioral management techniques play a pivotal role in facilitating treatment acceptance and ensuring continuity of care [4].

Behavioral management in pediatric dentistry and orthodontics encompasses a wide range of strategies designed to alleviate anxiety, build trust, and promote cooperative behavior. These techniques can be broadly categorized into non-pharmacological and pharmacological approaches. Non-pharmacological methods include tell-show-do, positive reinforcement, modeling, desensitization, distraction, voice control, and parental presence or absence. These approaches aim to modify the child's perception of dental treatment through communication, psychological conditioning, and environmental adaptation [5]. On the other hand, pharmacological techniques such as sedation and general anesthesia are often reserved for cases where non-invasive methods are insufficient, particularly in children with severe behavioral challenges or complex medical conditions [6].

Among non-pharmacological strategies, the tell-show-do technique is widely regarded as a

foundational method in Pediatric dental care. It involves explaining the procedure in simple terms, demonstrating it using models or instruments, and then performing the procedure. This sequential approach helps reduce fear of the unknown and fosters a sense of predictability. Similarly, positive reinforcementthrough verbal praise, rewards, or tokens—encourages desirable behavior and enhances motivation [7]. Modeling, whether live or via audiovisual aids, allows children to observe and imitate cooperative behavior exhibited by peers. Desensitization gradually exposes the child to dental stimuli in a controlled manner, reducing anxiety over time. Distraction techniques, including audiovisual media, divert the child's attention away from potentially distressing stimuli, thereby improving compliance [8].

Despite the availability of these techniques, their effectiveness may vary significantly among children with different types and severities of special needs. For instance, children with autism spectrum disorder (ASD) may respond better to structured routines and visual supports, while those with attention-deficit/hyperactivity disorder (ADHD) may benefit more from short, engaging sessions with frequent reinforcement [9]. Similarly, children with intellectual disabilities may require simplified communication and repeated exposure to build familiarity. These variations underscore the need for individualized behavioral management plans tailored to each child's specific condition, cognitive level, and emotional profile [10].

In recent years, there has been growing interest in comparing the efficacy of different behavioral management techniques in improving orthodontic treatment acceptance among SHCN children [11]. Treatment acceptance is a multifaceted outcome that includes the child's willingness to undergo procedures, level of cooperation during treatment, and adherence to follow-up visits and appliance care. High treatment acceptance not only enhances clinical efficiency but also contributes to better oral health outcomes, reduced treatment duration, and improved patient and caregiver satisfaction [12].

However, existing literature on this topic remains fragmented, with most studies focusing on general Pediatric populations or isolated behavioral techniques. There is a paucity of comprehensive comparative studies that evaluate multiple behavioral strategies specifically in the context of Orthodontic treatment for SHCN children [13]. Furthermore, variations in study design, outcome measures, and patient characteristics make it difficult to draw definitive conclusions regarding the most effective approaches. This gap highlights the need for systematic investigations that assess and compare different behavioral management techniques using standardized protocols and validated assessment tools [14].

Another important consideration is the role of caregivers and dental professionals in influencing treatment acceptance. Caregivers often serve as primary decision-makers and emotional anchors for special health care needs (SHCN) children, and their attitudes toward dental care can significantly impact the child's behaviour [15]. Similarly, the training, experience, and communication skills of orthodontists and dental staff play a crucial role in implementing behavioral strategies effectively. A multidisciplinary approach involving pediatric dentists, orthodontists, psychologists, and caregivers is therefore essential for optimizing behavioral outcomes [16].

In addition to traditional methods, technological advancements have introduced innovative behavioral management tools such as virtual reality (VR), mobile applications, and interactive games [17]. These tools offer immersive and engaging experiences that can reduce anxiety and improve cooperation, particularly in tech-savvy children. While promising, their applicability and effectiveness in SHCN populations require further exploration through well-designed clinical studies [18].

Given these considerations, the present study aims to conduct a comparative evaluation of various behavioral management techniques and their impact on Orthodontic treatment acceptance in children with SHCN [19]. By identifying the most effective strategies and understanding their differential effects across various conditions, this research seeks to contribute to evidence-based clinical practices. Ultimately, enhancing treatment acceptance in this vulnerable population is not only

a matter of clinical success but also a step toward ensuring equitable access to oral health care and improving the overall quality of life for children with SHCN.

Methodology

The present study was designed as a prospective, randomized, controlled clinical trial to evaluate and compare the effectiveness of different behavioral management techniques on Orthodontic treatment acceptance in children with SHCN. The study was conducted in the Department of Orthodontics in collaboration with the Department of Pediatric and Preventive Dentistry at a tertiary care dental institution over a period of 12 months. Ethical approval was obtained from the Institutional Ethics Committee prior to commencement, and written informed consent was secured from the parents or legal guardians of all participating children.

The study population consisted of children aged 6 to 14 years who were diagnosed with SHCN, including but not limited to ASD, ADHD, mild to moderate intellectual disability, and cerebral palsy. Children who required interceptive or fixed Orthodontic treatment and had no prior Orthodontic exposure were included in the study.

Exclusion criteria comprised children with severe systemic illnesses contraindicating dental procedures, those requiring treatment under general anesthesia, and those with profound cognitive impairment rendering communication impossible.

A total sample size of 60 participants was determined based on power analysis to detect a clinically significant difference in treatment acceptance between groups, with a confidence level of 95% and power of 80%. The participants were randomly allocated into three equal groups (n = 20 each) using a computer-generated randomization sequence. Group I received the tell-show-do technique, Group II was managed using audiovisual distraction, and Group III received a combination of tell-show-do and positive reinforcement. Allocation concealment was ensured using sealed opaque envelopes.

Baseline assessment was carried out prior to initiation of orthodontic procedures. Demographic data including age, gender, and type of SHCN were recorded. The child's baseline anxiety level was assessed using the Frankl Behavior Rating Scale, which categorizes behavior into four levels ranging from definitely negative to definitely positive. Additionally, physiological parameters such as heart rate were recorded as an objective indicator of anxiety.

All participants underwent a standardized orthodontic procedure, including oral examination, impression taking, and placement of a removable orthodontic appliance. Each behavioural management technique was consistently applied according to predefined protocols. In the tell-show-do group, procedures were explained in simple language, demonstrated using instruments or models, and then performed. In the audiovisual distraction group, children were exposed to cartoons or animated videos through a screen or virtual device during the procedure. In the combination group, tell-show-do was supplemented with positive reinforcement in the form of verbal praise and small rewards following cooperative behavior.

Treatment acceptance was evaluated using both subjective and objective measures. The primary outcome measure was the Frankl Behavior Rating Scale recorded during each visit. Secondary outcomes included procedure completion without interruption, duration of treatment session, and need for additional behavioral intervention. Heart rate was monitored throughout the procedure to assess changes in physiological anxiety response. Observations were recorded at baseline, during the first visit, and at subsequent follow-up visits at 2 weeks and 1 month.

Data were systematically recorded and entered into a statistical software package for analysis. Descriptive statistics were used to summarize demographic variables. Intergroup comparisons of behavioral scores were performed using one-way analysis of variance (ANOVA), followed by post hoc Tukey tests to identify pairwise differences. Intragroup comparisons over time were analyzed using repeated measures ANOVA. Categorical

variables such as procedure completion were analyzed using the Chi-square test. Heart rate variations were compared using paired and unpaired t-tests where appropriate. A p-value of less than 0.05 was considered statistically significant.

The selection of these statistical tests was based on the nature of the data and study design. ANOVA was used to compare mean differences across more than two groups, while repeated measures ANOVA allowed assessment of behavioral changes over multiple time points within the same group. The Chi-square test was appropriate for categorical outcomes such as treatment completion, and t-tests were used for continuous variables like heart rate to determine differences between and within groups.

To ensure reliability and minimize bias, all procedures were performed by a single trained orthodontist, and behavioral assessments were carried out by a blinded examiner. Calibration of the examiner was performed prior to the study to ensure consistency in scoring. The study adhered to standardized protocols throughout to maintain internal validity and reproducibility of results.

This methodological approach was designed to provide a comprehensive and systematic evaluation of behavioral management techniques, allowing for meaningful comparison of their effectiveness in improving orthodontic treatment acceptance among children with SHCN

Results

The results of the present study demonstrated notable differences in orthodontic treatment acceptance among children with SHCN managed with different behavioral techniques. A total of 60 participants completed the study, with no dropouts reported, ensuring complete data analysis across all groups.

At baseline, the demographic characteristics and behavioral scores were comparable across all three groups, indicating successful randomization. As shown in **Table 1**, there was no statistically significant difference in mean age, gender distribution, or baseline Frankl behavior scores among the groups ($p > 0.05$).

Table 1: Baseline Demographic and Behavioral Characteristics

Parameter	Group I (Tell-Show-Do)	Group II (AV Distraction)	Group III (Combination)	p-value
Mean Age (years)	9.1 ± 2.2	9.4 ± 2.1	9.3 ± 2.0	0.87
Gender (Male/Female)	11 / 9	10 / 10	12 / 8	0.79
Baseline Frankl Score	1.85 ± 0.67	1.80 ± 0.62	1.90 ± 0.64	0.91
Mean Heart Rate (bpm)	102.3 ± 8.5	103.1 ± 7.9	101.8 ± 8.2	0.88

During the first orthodontic visit, a significant improvement in behavior was observed in all groups, with the most pronounced improvement seen in Group III (combination technique). As presented in **Table 2**, the mean Frankl score increased significantly in Group III compared to Groups I and II ($p < 0.05$).

Table 2: Comparison of Frankl Behavior Scores During First Visit

Group	Mean Frankl Score (Visit 1)	Mean Change from Baseline	p-value (Intergroup)
Group I (Tell-Show-Do)	2.40 ± 0.68	+0.55	
Group II (AV Distraction)	2.55 ± 0.60	+0.75	
Group III (Combination)	3.10 ± 0.57	+1.20	**0.003***

*Statistically significant

At the 2-week follow-up, further improvement in cooperative behavior was observed. Group III continued to demonstrate the highest mean Frankl scores, followed by Group II and Group I. As illustrated in **Table 3**, the difference between groups remained statistically significant ($p < 0.01$).

Table 3: Frankl Behavior Scores at 2-Week Follow-Up

Group	Mean Frankl Score (2 Weeks)	Intragroup Improvement	p-value
Group I (Tell-Show-Do)	2.85 ± 0.59	Significant	
Group II (AV Distraction)	3.05 ± 0.52	Significant	
Group III (Combination)	3.55 ± 0.50	Highly Significant	**0.001***

In terms of treatment acceptance measured by successful procedure completion without interruption, Group III exhibited the highest success rate. As shown in **Table 4**, 90% of children in Group III completed the procedure successfully compared to 70% in Group II and 60% in Group I. This difference was statistically significant ($p < 0.05$).

Table 4: Procedure Completion Rate (Treatment Acceptance)

Group	Completed (%)	Not Completed (%)	p-value
Group I (Tell-Show-Do)	12 (60%)	8 (40%)	
Group II (AV Distraction)	14 (70%)	6 (30%)	
Group III (Combination)	18 (90%)	2 (10%)	**0.04***

Physiological response, measured through heart rate, also showed a reduction in anxiety levels across all groups, with the greatest reduction observed in Group III. As depicted in **Table 5**, the mean heart rate decreased significantly from baseline to the final visit in all groups, with Group III showing the most substantial decline ($p < 0.01$).

Table 5: Comparison of Heart Rate (bpm) Across Visits

Group	Baseline HR	Final Visit HR	Mean Reduction	p-value
Group I (Tell-Show-Do)	102.3 ± 8.5	94.6 ± 7.2	−7.7	
Group II (AV Distraction)	103.1 ± 7.9	92.8 ± 6.9	−10.3	
Group III (Combination)	101.8 ± 8.2	89.2 ± 6.5	−12.6	**0.002***

Overall, the results clearly indicate that while all behavioral management techniques improved orthodontic treatment acceptance among SHCN children, the combination of tell-show-do and positive reinforcement was significantly more effective. This group consistently demonstrated

higher behavioral scores, greater procedure completion rates, and a more pronounced reduction in physiological anxiety, as evidenced by heart rate measurements.

Discussion

The present study evaluated the comparative effectiveness of different behavioral management techniques on orthodontic treatment acceptance in children with SHCN. The findings demonstrated that although all three techniquestell-show-do, audiovisual distraction, and a combination of tell-show-do with positive reinforcementsignificantly improved patient cooperation and reduced anxiety, the combination approach proved to be the most effective. Children in this group exhibited higher Frankl behavior scores, greater treatment acceptance, and more pronounced reductions in physiological anxiety indicators such as heart rate. These findings highlight the importance of integrating multiple behavioral strategies to address the diverse and complex needs of SHCN children.

The improved outcomes observed with the combination technique can be attributed to its dual mechanism of action. While tell-show-do reduces fear by increasing predictability and familiarity with the procedure, positive reinforcement enhances motivation by rewarding cooperative behavior. Together, these strategies not only address cognitive understanding but also reinforce emotional engagement, leading to better compliance. This is particularly relevant in SHCN populations where behavioral responses are often influenced by both cognitive limitations and emotional sensitivity.

The findings of the present study are consistent with those reported by Kaur et al. (2025) [20], who evaluated behavioral management techniques in pediatric dental patients and found that combining tell-show-do with reinforcement strategies significantly improved cooperation compared to single techniques. Kaur et al. emphasized that reinforcement strengthens learned positive behaviors, which aligns with the current study's observation of sustained improvement across follow-up visits in the combination group. Similarly, the progressive increase in Frankl scores over time in our study supports the concept of behavioral conditioning through repeated positive experiences.

In comparison, Patil RU et al. (2024) [21] investigated the effectiveness of audiovisual distraction in reducing dental anxiety among children and reported significant reductions in anxiety levels and improved behavior during procedures. The present study also found that audiovisual distraction was more effective than tell-show-do alone, particularly in the initial visits. This may be due to the immediate engagement and sensory diversion provided by audiovisual stimuli, which can be particularly beneficial for children with attention deficits or heightened anxiety. The current study demonstrates that audiovisual distraction, while effective, may not sustain behavioral improvement to the same extent as combined techniques, especially over repeated orthodontic visits.

Furthermore, the results align with the findings of Sarangi S et al. (2015)[22], who studied behavior management in children with ASD and concluded that structured, multi-modal behavioral approaches yielded better cooperation than single-method interventions. They highlighted that children with neurodevelopmental disorders often require tailored strategies that address both communication barriers and behavioral reinforcement. The superior performance of the combination group in the present study supports this notion, as it integrates communication (tell-show-do) with behavioral reinforcement, thereby catering to multiple aspects of the child's needs.

In contrast, PS Lekhwani et al. (2023) [23] reported that tell-show-do alone was sufficient to achieve satisfactory cooperation in a majority of pediatric patients undergoing routine dental procedures. While this finding is valid in general pediatric populations, the current study suggests that SHCN children may require more comprehensive approaches. The relatively lower improvement in Group I (tell-show-do alone) in our study indicates that while this technique remains foundational, it may not be adequate as a standalone strategy for children with SHCN. This discrepancy underscores the importance of considering patient-specific

factors such as cognitive ability, sensory sensitivity, and behavioral baseline when selecting management techniques.

Another important observation in the present study was the significant reduction in heart rate across all groups, with the greatest decrease seen in the combination group. This objective measure of anxiety supports the subjective behavioral findings and reinforces the effectiveness of integrated behavioral approaches. Similar physiological improvements were reported by Jamil F et al. (2020) [24], who noted reduced pulse rates in children exposed to audiovisual distraction. However, the greater reduction observed in the combination group in the current study suggests that reinforcement strategies may play an additional role in calming the child beyond mere distraction.

The high procedure completion rate in Group III (90%) further emphasizes the clinical relevance of combining behavioral techniques. Successful completion of orthodontic procedures without interruption is a critical indicator of treatment acceptance, particularly in SHCN populations where missed or incomplete appointments can compromise treatment outcomes. The findings suggest that incorporating positive reinforcement alongside structured communication can significantly enhance compliance and reduce the need for more invasive approaches such as sedation or general anesthesia.

Despite these promising results, certain limitations of the study must be acknowledged. The sample size, although adequate for statistical analysis, was relatively small and may limit the generalizability of the findings. Additionally, the study included a heterogeneous group of SHCN conditions, and the response to behavioral techniques may vary across specific diagnoses. Future studies with larger, condition-specific cohorts are recommended to further validate and refine these findings.

Conclusion

In conclusion, the present study provides strong evidence that while individual behavioral management techniques are beneficial, a combined approach incorporating tell-show-do and positive reinforcement is significantly more effective in improving orthodontic treatment acceptance in children with SHCN. These findings are in agreement with previous research advocating for multi-modal behavioral strategies and highlight the need for individualized, patient-centered care in Pediatric Orthodontics. This study supports Sustainable Development Goals (SDG) 3 (Good Health and Well-being) by enhancing equitable access to orthodontic care through effective behavioral management strategies in children with special health care needs. It further contributes to SDG 4 (Quality Education) by emphasizing the need for enhanced training of dental professionals in evidence-based behavioral management techniques, thereby strengthening clinical competencies and patient communication skills. Additionally, the integration of multi-modal strategies reflects the spirit of SDG 17 (Partnerships for the Goals), underscoring the value of interdisciplinary collaboration among dental practitioners, caregivers, educators, and healthcare systems to optimize treatment outcomes in children with SHCN.

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