

Comparative Evaluation of the Effectiveness of Custom-designed Dental Storybook versus Tell-Show-Do Technique on Dental Anxiety and Behavior of Children: A Randomized Controlled Trial

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Abstract

Background: Dental anxiety disorders are common in dentistry and can be significant barriers to maintaining oral health. This study aimed to evaluate and compare the effectiveness of a custom-designed dental storybook versus the tell-show-do technique on children's dental anxiety and behavior during cavity preparation and composite restoration procedures.

Methods: Forty-eight children aged 4 to 8 years were randomly divided into two equal groups: Group A, which received the custom-designed dental storybook, and Group B, which received the tell-show-do technique (TSD) before cavity preparation and composite restoration. Anxiety was assessed using the Venham Picture Scale (VPS) and pulse rate, while behavior was assessed using the Frankl Behavior Rating Scale (FBRS).

Results: There were no statistically significant differences in VPS and FBRS scores between the two groups at any time points, with P-values of 0.096 and 0.097 for Group A, and P-values of 1 and 0.223 for Group B. However, a statistically significant difference in pulse rate was observed at different times in both groups, with P-values of 0.001 for Group A and <0.001 for Group B. Additionally, no statistically significant differences were found between Group A and Group B regarding VPS, FBRS, or pulse rate at different periods.

Conclusion: Both the custom-designed dental storybook and the tell-show-do technique effectively reduced dental anxiety, as indicated by a decrease in pulse rate. However, there were no significant differences in dental anxiety levels or child behavior between the two techniques.

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1 Introduction

Dental anxiety disorders are common issues in the field of dentistry and often serve as major barriers to maintaining oral health due to the tendency to avoid dental care. Individuals suffering from dental anxiety disorders usually experience a decline in their oral health. This poor oral health, coupled with the recognition of having a dental avoidance issue, can lead to feelings of embarrassment, a decrease in social functioning, and potentially a lowered quality of life ¹.

A systematic review conducted by Grisolia *et al.*, 2021 indicated that the overall global prevalence of dental anxiety is estimated at 23.9% among children and adolescents. The pooled prevalence rates for preschoolers, school-aged children, and adolescents have been reported as 36.5%, 25.8%, and 13.3%, respectively ². In Egypt, a study found that 21.4% of children aged 4 to 6 years exhibited behavioral concerns ³. Another study indicated

that among children aged 6 to 10 years, approximately 46% were non-anxious, 30.2% were potentially anxious, and only 23% were classified as very anxious. Additionally, it was observed that girls were significantly more likely to experience dental anxiety than boys ⁴.

The typical approach of a pediatric dentist is to treat children in a setting that minimizes anxiety, ensuring the delivery of high-quality dental care ⁵. The American Academy of Pediatric Dentistry (AAPD) has suggested a variety of behavior management strategies to address the noncompliant actions of children during dental visits. These strategies vary from simple behavioral management methods (such as Tell-Show-Do, distraction, positive reinforcement, and voice control) to more complex and invasive techniques, including protective stabilization, sedation, and general anesthesia ⁶.

The tell-show-do (TSD) approach was developed by Addelston in 1959. This technique involves describing the treatment to the child patient using language they understand, demonstrating the different dental tools needed for that specific treatment, presenting the same procedure on live models, and ultimately carrying out the treatment precisely as outlined to the child ⁵.

Conversely, introducing children to supportive information about dentistry, like visuals or storybooks depicting fun dental experiences, can provide them with comfort and mentally ready them for their dental appointments. The application of storytelling in healthcare serves various purposes: it educates patients and their families, encourages particular qualities, and fosters certain behaviors ⁷. Storybooks play a significant role in fostering positive behaviors by presenting constructive role models and behavioral patterns through characters that children can relate to ⁸.

Research on the impact of preparatory information prior to dental appointments has produced varied outcomes. Alsaadoon et al. and Deshpande et al. introduced children to a dental storybook, which resulted in a decrease in dental anxiety ^{7, 9}. On the other hand, having prior information about dental care did not show a notable impact on dental anxiety in Nigerian children ¹⁰. Likewise, Olumide et al. investigated whether children's anxiety about dental visits was affected by viewing brochures containing encouraging dental information. The findings revealed no decrease in anticipatory anxiety after the children received preparatory information ¹¹.

There are limited studies that have tested the effectiveness of a custom-designed dental storybook for specific dental procedures. This study aims to evaluate and compare the effectiveness of the custom-designed dental storybook vs the tell-show-do technique on children's dental anxiety and behavior during cavity preparation and composite restoration procedures.

The study is guided by a null hypothesis, which states that there will be no significant differences between the custom-designed dental storybook and the tell-show-do technique.

2 Materials and Methods

2.1 Ethical Approval

The study received approval from the Ethical Committee of Scientific Research at the Faculty of Dentistry, October University for Modern Sciences and Arts, under the reference number REC-23111-4. This randomized controlled trial (RCT) has been outlined following the CONSORT checklist for guidelines on writing and publishing RCTs ¹². The study was registered on ClinicalTrials.gov (NCT06711367) in November 2024.

2.2 Sample Size Calculation

In a previous study conducted by Lekhwani et al. in 2023 ¹³, the Venham Anxiety Scale for the tell-show-do group showed a normal distribution after the operative procedure, with a standard deviation of 0.675. If the true difference in the means between the experimental and control groups is 0.8, a sample size of 12 patients per group will be the minimal sample required to reject the null hypothesis, which states that the population means of the experimental and control groups are equal, with a probability (power) of 0.8. The Type I error probability associated with this hypothesis test is

0.05. The sample size was increased to 24 patients in each group to ensure more reliable and accurate results. The sample size was calculated using PS Power and Sample for Windows, version 3.1.6, employing an independent t-test.

2.3 Study Design

This research is a randomized controlled trial that included 48 children between the ages of 4 to 8 years. It employed a single-blind, parallel design with two groups and a 1:1 allocation ratio. The structure of the study followed the CONSORT 2010 Flow Diagram, as depicted in **Figure 1**.

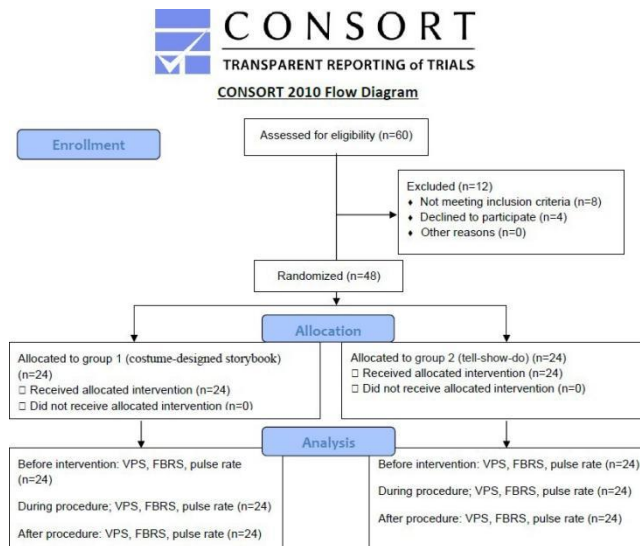


Fig 1. CONSORT flow diagram.

2.4 Eligibility criteria

Inclusion and exclusion criteria have been determined as follows:

Inclusion criteria:

- Healthy children
- Children and parents must be able to read and understand Arabic
- The child requires cavity preparation and composite restoration.

Exclusion criteria:

- Children with special health care needs, including those with complete audiovisual impairment.
- Children with learning difficulties or intellectual disabilities.
- Children who do not speak Arabic.

2.5 Recruitment

All eligible participants were recruited from the Pediatric Dentistry clinic at the Faculty of Dentistry, October University for Modern Sciences and Arts. The participants were split into two groups: group A was given a custom-designed dental storybook that detailed the diagnosis and procedures for occlusal composite restoration. In contrast, group B was provided with traditional behavior management methods, specifically verbal communication and the tell-show-do approach. The legal guardians of the qualified participants who opted to participate in this study reviewed and signed the informed consent form. This form outlined all the steps, advantages, and risks associated with the study.

Participant recruitment occurred from December 2024 to June 2025.

2.6 Randomization and allocation concealment

An investigator operating independently conducted a computer-based simple randomization through Randomness and Integrity Services Ltd (<http://www.random.org>). Participants were assigned to the two groups at random utilizing a sequence generator, maintaining a 1:1 allocation ratio. A collection of sealed and opaque envelopes containing the allocation sequence is utilized for each participant enrolled in the study, each envelope is opened in order.

2.7 Blinding

This study was a single-blind trial. While the assessor was blinded to the group assignments, the participants and the investigators administering the interventions could not be blinded due to the differences in the behavior management techniques employed in the study.

2.8 Outcomes

The primary outcome was to assess dental anxiety using the Venham Picture Scale (VPS)¹⁴. Secondary outcomes included measuring dental anxiety through pulse rate, as well as evaluating the child's behavior using Frankl Behavior Rating Scale (FBRS)¹⁵.

2.9 Treatment protocol

An oral examination was conducted for participants who required occlusal cavity preparation and composite restoration without the use of local anesthesia. The parents or legal guardians of the selected children provided informed consent. The baseline levels of VPS, FBRS, and pulse rate were assessed using a Zacurate finger pulse oximeter (Einstein Associated LLC, China). Following this, the children were randomly assigned to either the intervention group or the control group by an independent investigator who was not involved in the treatment or outcomes assessment.

The intervention group (Group A) received a custom- designed storybook in the Arabic language. The concept and scenario of the dental story were developed by the research authors, and then the narrative was crafted by a faculty member from the Arts and Design at October University for Modern Sciences and Arts. Subsequently, the story was

reviewed by experts in pediatric dentistry. The dental story tells the story of a young boy visiting the dental clinic with his mother for a checkup. During the examination, the dentist discovers a cavity. The story then describes the steps of cavity preparation followed by a demonstration of the composite restoration procedures. It uses simple language, such as washing the tooth, and using a magic light for curing the material (Supplementary file 1). The control group (Group B) was managed using conventional behavior management techniques, which included verbal communication and the tell-show-do approach. Each child was treated by a different pediatric resident who was unaware of the participants' group allocations. The VPS, FBRS, and pulse rates were measured during the procedures (after cavity preparation and before the composite restoration placement) and again after the completion of the procedures.

2.10 Statistical analysis

For statistical analysis, mean values and standard deviations were calculated for each group in each test. Normality of the data was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The VPS and FBRS exhibited a non-parametric (not normal) distribution (Scores), while the pulse rate data showed a parametric (normal) distribution.

For the non-parametric data, the Mann-Whitney test was used to compare two groups with unrelated samples, while the Friedman test was employed to compare more than two related samples. The Wilcoxon test was used for comparisons between two related groups. For parametric data, an independent samples t-test was used for comparisons between two unrelated groups, and repeated measures ANOVA followed by paired samples t-tests were utilized for comparisons involving more than two related groups. The significance level was set at $P \leq 0.05$. Statistical analysis was conducted using IBM® SPSS® Statistics Version 25 for Windows.

3 Results

A total of 48 children, consisting of 24 boys and 24 girls, were randomly assigned to two groups: a custom-designed dental storybook group (Group A, $n = 24$) and a tell-show-do group (Group B, $n = 24$). The children's age ranged from 4.5 to 8 years, with an average

age of 6.5 years.

In Group A, there was no statistically significant difference in VPS and FBRS before the intervention, during the procedure, and after the procedure, with P values of 0.096 and 0.097, respectively (Tables 1 and 2). However, there was a statistically significant difference in pulse rate at different times, with a P value of 0.001. Specifically, significant differences were observed between the pulse rates before the intervention and during the procedure, as well as after the procedure, with a P value of 0.001 (Table 3).

In Group B, there was also no statistically significant difference in VPS and FBRS before the intervention, during the procedure, and after the procedure, with P values of 1 and 0.223, respectively (Tables 1 and 2). Similarly, there was a statistically significant difference in pulse rate at different time points, with a P value of <0.001 . Significant differences were found between the pulse rates before the intervention and during the procedure, as well as after the procedure, with a P value of <0.001 (Table 3).

There was no statistically significant difference between Group A and Group B regarding VPS, FBRS, and pulse rate at different periods (Tables 1, 2, and 3).

Table 1. The mean, standard deviation (SD) median scores of VPS of different groups.

Variables	VPS						
	Group A (custom-designed storybook)		(custom-dental)	Group B (Tell-show-do)			p-value
	Mean	SD	Median	Mean	SD	Median	
Before	1.25	1.3	1.00	1.00	2.2	0.00	0.103
intervention		9			8		ns
During the procedure	1.00	2.28	0.00	1.00	2.28	0.00	1ns
After the procedure	1.17	2.70	0.00	1.00	2.28	0.00	0.601
p-value	0.096ns			1ns			

ns: non-significant ($p > 0.05$)

Table 2. The mean, standard deviation (SD) median scores of FBRS of different groups.

Variables	FBRS						
	Group A (custom-designed dental storybook)			Group B (Tell-show-do)			p-value
	Mean	SD	Median	Mean	SD	Median	
Before intervention	2.83	0.38	3.00	3.08	0.28	3.00	0.051ns
During the procedure	2.92	0.50	3.00	3.17	0.38	3.00	0.062ns
After the procedure	3.08	0.50	3.00	3.25	0.44	3.00	0.251ns
p-value	0.097ns			0.223ns			

ns: non-significant (p>0.05)

Table 3. The mean, standard deviation (SD) median scores of Pulse rate of different groups.

Variables	Pulse rate				
	Group A (custom-designed dental storybook)		Group B (Tell-show-do)		p-value
	Mean	SD	Mean	SD	
Before intervention	98.42	3.48	100.58	4.19	0.693ns
During the procedure	94.58	3.38	94.83	3.58	0.960ns
After the procedure	90.58	2.32	90.33	3.71	0.955ns
p-value	0.001*		<0.001*		

* Significant (p<0.05), ns: non-significant (p>0.05)

4 Discussion

Anxiety is an emotional condition often described as a fear of what is uncertain. It typically manifests as a negative feeling that occurs before an actual encounter with the threatening stimuli. As noted by Agras *et al.*, dental appointments and procedures rank as the fifth most prevalent source of anxiety, particularly prominent among children ¹⁶.

Addressing a child's anxiety regarding dental treatments is crucial not only for alleviating immediate fears but also for preventing ongoing apprehension into adulthood. Patients with high levels of fear needed about

20% more time in the dental chair than their less fearful counterparts, emphasizing the necessity for dentists to learn and implement various techniques to reduce fear and anxiety ⁹.

Behavior management techniques that do not involve medications, such as tell-show-do, distraction, modeling, desensitization, and verbal communication, are frequently utilized by pediatric dentists to manage children's anxiety during pre-treatment visits. Among the different strategies available, this study sought to investigate a psychological method using a specially designed dental storybook as a behavior management tool. Storytelling is a powerful and cost-effective technique that has a soothing impact on the body, provides a sense of comfort, and enhances memory retention. The storybook was created to illustrate the processes of diagnosis, cavity preparation, and composite restoration, helping children feel more at ease with dental procedures and providing preliminary information before treatment. After explaining the procedure, dentists are more likely to gain a child's trust, which reduces anxiety levels. Once a welcoming environment tailored for children is established, anxiety tends to lessen, subsequently enhancing the dental experience ¹⁷.

The age of a child significantly influences both dental treatment and levels of anxiety. Our research focuses on the 4-8-year age group. Abbasi *et al.* noted that dental anxiety is particularly common among younger individuals ⁵. Children in this age range lack a conceptual framework, which complicates their ability to understand their feelings ¹⁸. During this developmental stage, children are actively forming new ideas, exploring their surroundings, and making connections with familiar objects. As a result, this group represents a challenging demographic but is also more receptive to fostering a positive attitude toward dental care ¹⁹.

In the current study, dental anxiety was evaluated using the VPS and pulse rate. VPS is regarded as the most dependable method for self-reported anxiety among children ²⁰. However, there was no significant difference between the custom-designed dental storybook and the TSD groups, nor was there a significant difference between the different periods within each group. These results are inconsistent with those of Olumide *et al.* and Mittal *et al.* ^{11, 21}. In contrast, our results contradict those of Alsaadoon *et al.*, who found that dental anxiety decreased when using a dental storybook. This discrepancy may be attributed to the fact that Alsaadoon *et al.* read the story twice and did not employ any behavior management techniques in the control group ⁷.

Additionally, another possible explanation for our findings is that there are some limitations to the VPS anxiety scoring system. For instance, the scale features identical images that may be challenging for younger patients to relate to. Moreover, some figures on the VPS scale are ambiguous, making it difficult for children to make a selection²². Furthermore, all the images on the VPS cards depict males, which could pose difficulties when the young patient is female¹. In our research, it was particularly striking that numerous children chose an image of a happy child even when they were crying.

In this study, pulse rate was chosen as a physiological parameter to evaluate dental anxiety. It was noted that when anxiety is triggered, the body releases corticosteroids, glucagon, and catecholamines, which consequently raise the heart rate. When a child feels anxious or frightened, sympathetic stimulation occurs, increasing pulse rate^{9,23}. In the present study, we observed a significant decrease in the pulse rate of children during and after completing the procedures in both the intervention and control groups. However, there was no significant difference between the two groups. Deshpande et al. also reported a notable reduction in pulse rate for both groups, with a particularly significant decrease in the dental storybook group⁹. These results can be explained by the fact that their study involved two visits, and previous research indicates that child cooperation improved during the second visit^{18,24}. In addition, several factors can influence anxiety levels, including sex, age, family socioeconomic status, maternal education, and past adverse experiences²⁵.

One frequently utilized behavior rating system in clinical dentistry and research is the Frankl Scale. This scale classifies observed behaviors into four groups, ranging from undoubtedly negative to undoubtedly positive¹⁵. In the present study, there was no significant difference between the custom-designed dental storybook and the TSD groups, nor was there a substantial difference between the different periods within each group. Consequently, it can be inferred that the decrease in anxiety was temporary. These results agreed with Mittal et al., as it was demonstrated, observing positive visuals related to dentistry and dentists led to a temporary decrease in anticipatory anxiety²¹. In addition, it has been noted that a dental narrative can be more impactful for children who are visiting the dentist for the first time, as it often helps to alleviate the anxiety associated with the unfamiliar experience⁷. Furthermore, the AAPD guidelines indicate that employing positive imagery in dental practices can lead to varying levels of

anxiety reduction (ranging from minor to significant) and may have a minor impact on enhancing cooperative behavior²⁶. Ultimately, the null hypothesis was accepted because no significant difference existed in dental anxiety and child behavior between the two groups.

Future studies could investigate the lasting impacts of these methods on dental anxiety, adherence to follow-up appointments, and how gender and socioeconomic status influence responses to various behavior management approaches.

The current study revealed some limitations, particularly regarding the association between dental anxiety and previous dental experiences, which remains a contentious issue. Several factors, including age, gender, dental treatment, parental anxiety, and socioeconomic status, should be examined concerning anxiety. The sample for this study included children aged 4 to 8 who were able to communicate in Arabic; consequently, our findings may not be applicable to other populations. The character in the dental storybook was male, with a name that might be considered unsuitable for both girls and boys, with different names

5 Conclusion

The custom-designed dental storybook and tell-show-do techniques both reduced dental anxiety, as evidenced by a decrease in pulse rate. However, there were no significant differences in dental anxiety or the child's behavior between the two behavior management techniques.

Supplementary Information

Supplementary file (1): Custom-designed Dental Storybook

Authors' Contributions

Naglaa Ezzeldin: Formatted the concept and design of the study. Wrote the main manuscript text, reviewed, edited, and finalized the manuscript.

Radwa Yehia Khater: Formatted the concept and design of the study. Reviewed, edited, and finalized the manuscripts.

Conflict of interest

The authors declare no conflict of interest.

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