

# Effect of Three Behavior Guidance Techniques on Anxiety Indicators of Children Undergoing Diagnosis and Preventive Dental Care

Priyanka Karekar\*/Mohammed Nadeem Bijle\*\*/ Hrishikesh Walimbe\*\*\*

**Objective(s):** To assess the effect of three behavior guidance techniques on anxiety indicators of children undergoing diagnosis and preventive dental care. **Study Design:** Sixty-three subjects (7-9 years) were divided into three groups as per the behavior guidance technique namely tell-show-do, live and filmed modeling (using Tablet Computer) to receive diagnostic (Oral examination & radiographic assessment using intraoral periapical radiographs) and preventive dental care (Oral prophylaxis and topical fluoride application). Anxiety indicators—Facial Image Scale (FIS) scores and heart rate were recorded before, during and after diagnosis/preventive treatment. Three-way repeated measures ANOVA with post-hoc analysis was performed at significance of  $p$ -value  $< 0.05$ . **Results:** There was a statistically significant difference in the anxiety indicators of children under the influence of different behavior guidance approaches undergoing diagnosis/preventive treatments except for mean heart rate of children while oral examination. Multiple comparison results reveal that the mean FIS scores and heart rate of children with modeling techniques were significantly better as compared to tell-show-do technique with no significant difference between the two modeling techniques. **Conclusion:** This study suggests that the modeling techniques (filmed and live) seem to be an efficient behavioral guidance approach for children aged 7-9 years undergoing routine diagnosis and preventive dental care as compared to tell-show-do technique.

**Keywords:** behavior, children, dental anxiety, dental care.

## INTRODUCTION

Appropriately administered behavior management or guidance at initial patient contact might be beneficial and can instill a positive dental attitude. Non-pharmacological and pharmacological management are the two aspects of behavior guidance whereby the former uses communication, behavior shaping and fundamentals of behavior management. The pharmacological approach includes the use of medications to control the patient's behavior with certain risks. Most often, the uncooperative behavior of children attending the dental care cannot be managed by non-pharmacological behavior management techniques. Thus, pharmacological interventions (sedation and general anesthesia) might be required with unavoidable risks. A study on approximately 20,000 pediatric dental cases done under general anesthesia showed that the intubation of children with upper respiratory tract infections (URTI) increases the risk of airway complications like obstruction and bronchospasm by 11-folds.<sup>1</sup> Most of the parents prefer non-pharmacological management of behavior as compared to the pharmacological management.<sup>2</sup> Therefore, proper employment of non-pharmacological behavior guidance technique can help prevent unavoidable risks. The patient might develop a positive approach towards future dental appointments.

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Communication management suggests different strategies for the sound communication establishment with pediatric patients. However, these strategies appear to be suggestions rather than standardized established techniques. The non-structural evidence of communication strategies makes it a trial and error artistry that lacks definitive assembly. Aversive conditioning, a non-pharmacological behavior management technique is a restraint enabled positive reinforcement method. It includes the use of harsh strategies like hand over mouth exercise (HOME). Aversive conditioning is gradually losing its social acceptance. Moreover, it is seldom recommended for routine use. Behavior shaping techniques are based on the established principles of social learning theory. Commonly used behavior shaping techniques are tell-show-do (TSD), modeling and reinforcement therapy. Reinforcement therapy cannot be generalized since it depends upon the behavior and response of the patient towards the applied therapy. TSD and modeling are well-known structured approaches. Many pediatric dentists throughout the globe use TSD and modeling for efficient patient management. Since its inception, TSD is considered as the cornerstone of behavior management. Modeling is a process of acquiring behavior through observation of a model.<sup>3</sup> Live modeling was found to be an effective behavior-shaping tool. Filmed modeling technique (a modification of live modeling) was introduced as the live model might not always be available in the operator.<sup>4</sup> Therefore, the behavior shaping tools – TSD and modeling (live and filmed) seem promising for shaping the behavior of the pediatric dental patients.

An initial appointment of a child patient comprises of acquaintance to the dental environment. Primary screening and preventive care can be implemented at first dental visit. Invasive treatments like administration of local anesthetics or pulp therapy are generally not recommended unless an inevitable emergency. Primary screening that involves oral examination and radiographic assessment whereas preventive care such as oral prophylaxis and professionally delivered fluoride application is a routine exercise during the first appointment especially for cooperative and potentially cooperative children. Furthermore, these exercises should be clubbed with established behavior shaping approaches to manage the child's behavior well. It could stand beneficial to lead the patient through further dental appointments.<sup>5</sup> However, with TSD and modeling (live and filmed) techniques available as structured behavior shaping tools, there appears a need to assess the most efficient tool for patient management during the first appointment whereby oral examination, radiographic assessment, oral prophylaxis and professional application of topical fluorides is performed. Apart, TSD and modeling are conventional behavior guidance tools. The behavior of current generation children is changing rapidly and the effect of these tools on their behavior warrants investigation.

The efficiency of the behavior management tool can be assessed by patient's visual analogs and physiological parameters termed as anxiety indicators. Anxiety and fear are primary emotions of the child during the first dental visit.<sup>6</sup> The primary emotions have a dependable outcome on the physiological parameters and facial expressions. Therefore, their measurements can define the adaptability of a child in the dental clinic under the influence of applied behavior guidance tool.

Thus, the aim of this study was to assess the effect of three behavior guidance techniques (TSD, live modeling, and filmed modeling) on anxiety indicators of children undergoing diagnosis (oral and radiographic examination) and preventive dental care (oral prophylaxis and topical fluoride application).

### MATERIALS AND METHOD

The study commenced after due clearance from the Institutional Scientific and Ethics Committee of Dr. D. Y. Patil Dental College and Hospital, Pimpri, Pune, Maharashtra, India (IEC/DYPDCH/PEDO/04) which works in concordance with ethical principles laid down by Indian Council of Medical Research and World Medical Association Declaration of Helsinki, 2013.

Based on the results of the preliminary study, the sample size was calculated using G\*Power v. 3.1.9.2 (Franz Faul, Universitat Kiel, Germany) software. Initially, the variables – Facial Image Scale (FIS) score and heart rate (from the preliminary data) were assessed for computing the inputs to determine sample size. Finally, the computed data for inputs from the FIS scores were used to conclude the total sample size for the final study since it projected the maximum value amongst the two variables assessed. The estimated effect size (0.43) from variances within group and variance explained by the effect was calculated. The correlation amongst repeated measures (0.53) was also determined. Thus, the software quantified a total sample size of 63 for three groups with three repeated measurements in each group at the significance of p-value < 0.05.

Sixty-three healthy pediatric patients aged 7-9 years with no previous dental experience visiting the department for the first time for general oral examination and preventive care were recruited for the study. The inclusion criteria were subjects with co-operative or potentially co-operative behavior rating score from Wright's et al. (1975) classification of child's behavior.<sup>7</sup> Patients unable to communicate, having previous dental experience, and lacking cooperative ability were excluded from the study. In order to seek informed consent, the parents/guardian of the potential subjects were provided with the patient information sheet with details of the research in English and local language. The participation of the subjects was on a voluntary basis, and the patients were assured that their non-participation would not lead to delay in regular dental care. As pre-determined, patients who did not provide informed consent were excluded from the study. However, none of the potential subjects denied providing the consent.

Cooperative patients aged 7-9 years were recruited as live models along the duration of the study following an informed consent taken from the parents. These patients were not included as experimental subjects but were scheduled for appointment as per the subjects included in the study.

The patients were randomly allocated to 3 different groups depending upon the behavior guidance technique to receive diagnostic and preventive dental care. The allocation was done based on randomized block design with each experimental block representing a behavior guidance technique. A total of 63 subjects with 21 in each block were finally recruited to receive diagnostic and preventive care namely oral examination, radiographic assessment using intra-oral periapical radiographs for primary screening, oral prophylaxis, and topical fluoride application.

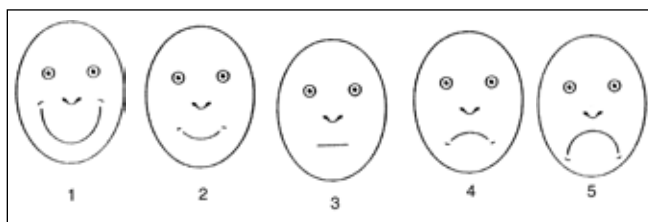
## Behavior Guidance Tools

Patients in TSD block were explained and shown the operation of the instruments which were to be used during the diagnostic and preventive dental care. The explanation and display of the instruments and procedures were done sequentially using the conventional approach for TSD. Subjects with live modeling technique were made familiar to the recruited live model before the start of the procedure. For every diagnostic and preventive procedure, the assigned model's behavior was demonstrated during the treatment. Filmed modeling block subjects were shown a pre-recorded video clip of specified diagnostic or preventive treatment being performed on the child of the similar age group on a tablet (Samsung Galaxy Tab E, Samsung India Electronics Private Limited, New Delhi, India). The 10-minute video clip was made at the department with the help of a professional videographer. The video demonstrated a cooperative child patient aged eight years undergoing diagnosis and preventive dental treatments implemented in the study.

## Anxiety Indicators

Facial Image Scale (FIS) scores and heart rate were used as anxiety indicators. FIS with image scores (**Figure 1**) was used as visual analog indicator. The scale ranged on 5-point ordinal values from 1 – very happy; 2 – happy; 3 – in between; 4 – unhappy and 5 – very unhappy. Heart rate as a physiological parameter was recorded with the help of a pulse oximeter (Oxi-stat 1010 plus, EMCO Meditek Pvt. Ltd., Mumbai, India). FIS scores and heart rate were recorded for all subjects before, during and after the individual diagnostic and preventive treatment.

**Figure 1: Facial Image Scale (FIS)**



## Statistical Analysis

The data collected from the subjects was entered into MS Office Excel 2016 (Microsoft Office 365, Washington, USA) for further analysis using SPSS v. 23.0 (IBM Statistics Inc., Chicago, USA). The recorded data for FIS scores in all groups was recoded in the reverse direction to read as – 1: very unhappy, 2: unhappy, 3: in between, 4: happy and 5: very happy in order to highlight the highest state of happiness with the maximum ordinal value. Since the data was collected at different set time points with uniformity for all the diagnostic and preventive treatments under different behavior guidance interventions, repeated measures ANOVA was chosen as a test for statistical analysis. The assumptions (normality of data and sphericity of variances) to satisfy the applicability of repeated measures ANOVA were assessed for FIS scores and heart rates. Normality of the data at different time points was checked using Shapiro-Wilk test, and the sphericity of the variances was determined using Mauchly's test of sphericity whereby p-value was > 0.05 for the FIS scores and heart rate at all-time points irrespective of the interventions and treatments. Therefore, considering

three different behavioral guidance approaches and three time-points (before, during and after) for all diagnostic and preventive treatments, the outcome variables—heart rate and FIS scores were analyzed using three-way repeated measures ANOVA with multiple comparisons by post-hoc analysis using Bonferroni's correction. The statistical significance limit was set at 5%.

## RESULTS

The mean  $\pm$  standard deviation (SD) of FIS scores and heart rate of children undergoing diagnosis and preventive dental care under the influence of different behavior guidance techniques are presented in Table 1 and Table 2 respectively. All the initially selected patients participated in all the phases of the study, and there were no losses or refusals by the patient or caretakers. There was a statistically significant difference (p-value < 0.001) in the mean–FIS scores and heart rate of the children before, during and after the diagnosis/treatment irrespective of the behavior guidance intervention. The recoded mean FIS scores before and after the treatment (with all behavior guidance interventions) were significantly higher as compared to during treatment scores (Table 1). Similarly, the mean heart rate of children before and after the treatment was significantly lower as compared to during treatment mean heart rate under all three behavior guidance techniques used in the study (Table 2). The estimated anxiety indicators (FIS score and heart rate) of children undergoing diagnosis and preventive dental care under the influence of different behavior guidance techniques are presented as mean  $\pm$  standard error (SE) in Table 3. There was a statistically significant difference in the anxiety indicators of children under the influence of different behavior guidance approaches undergoing all the diagnosis and preventive treatments except for mean heart rate of children undergoing oral examination. Multiple comparisons for heart rates of children undergoing diagnosis/preventive therapy (except oral examination) revealed that there was a statistically significant difference between the children receiving behavior guidance using TSD and filmed modeling whereby the group receiving filmed modeling had the lowest mean heart rate. There was no significant difference in the mean heart rates of children undergoing diagnosis/preventive therapy (except oral examination) between the ones under the influence of filmed and live modeling. The recoded mean FIS scores (of children) were significantly higher in filmed modeling group as compared to TSD group of children undergoing diagnosis/preventive care except for children undergoing oral prophylaxis whereby the mean FIS scores for live modeling group was significantly higher as compared to children under the influence of TSD. There was no significant difference in the mean FIS scores of children under the influence of live and filmed modeling. This non-significant difference was irrespective of the children undergoing diagnostic or preventive therapy.

**Table 1: Facial Image Scale (FIS) scores of children undergoing diagnosis and preventive dental care under the influence of different behavior guidance techniques.**

Facial Image Scale Scores (Mean ± SD)					
Intervention	Before (B)	During (D)	After (A)	p-value	Multiple Comparison
Oral Examination					
Tell-Show-Do	4.52 ± 0.60	3.57 ± 0.75	4.48 ± 0.51		
Live Modeling	4.67 ± 0.57	3.71 ± 0.64	4.71 ± 0.46	< 0.001	
Filmed Modeling	4.95 ± 0.22	4.14 ± 0.57	4.81 ± 0.80		
IOPA					
Tell-Show-Do	4.52 ± 0.60	3.05 ± 0.67	4.62 ± 0.59		
Live Modeling	4.76 ± 0.44	3.48 ± 0.68	4.76 ± 0.44	< 0.001	
Filmed Modeling	4.81 ± 0.40	3.67 ± 0.48	4.76 ± 0.44		
Oral Prophylaxis					
					(B) = (A) > (D)
Tell-Show-Do	4.48 ± 0.60	3.10 ± 0.54	4.48 ± 0.51		
Live Modeling	4.81 ± 0.40	3.48 ± 0.68	4.76 ± 0.54	< 0.001	
Filmed Modeling	4.62 ± 0.50	3.57 ± 0.51	4.76 ± 0.44		
Topical Fluoride Varnish					
Tell-Show-Do	4.48 ± 0.51	3.57 ± 0.51	4.52 ± 0.51		
Live Modeling	4.71 ± 0.56	3.81 ± 0.60	4.81 ± 0.40	< 0.001	
Filmed Modeling	4.81 ± 0.51	4.00 ± 0.32	4.86 ± 0.36		

\*Abbreviation: IOPA - Intra-oral Periapical Radiograph, SD - Standard Deviation.

Please note: FIS scores are recoded in the reverse direction with maximum value implying highest state of happiness.

**Table 2: Heart rate of children undergoing diagnosis and preventive dental care under the influence of different behavior guidance techniques.**

Heart Rate (Mean ± SD)					
Intervention	Before (B)	During (D)	After (A)	p-value	Multiple Comparison
Oral Examination					
Tell-Show-Do	96.86 ± 12.26	104.24 ± 12.52	97.19 ± 12.43		
Live Modeling	91.81 ± 7.45	98.81 ± 8.62	91.81 ± 7.6	< 0.001	
Filmed Modeling	89.95 ± 8.03	96.24 ± 8.21	91.33 ± 8.27		
IOPA					
Tell-Show-Do	96.62 ± 9.71	109.24 ± 11.52	98.33 ± 11.34		
Live Modeling	93.10 ± 11.21	100.48 ± 11.20	93.05 ± 10.35	< 0.001	
Filmed Modeling	89.05 ± 7.36	97.67 ± 7.19	90.57 ± 6.87		
Oral Prophylaxis					
					(D) > (B) = (A)
Tell-Show-Do	97.38 ± 12.25	109.81 ± 12.38	99.05 ± 11.91		
Live Modeling	92.90 ± 8.70	100.00 ± 9.76	92.05 ± 9.03	< 0.001	
Filmed Modeling	90.71 ± 8.10	98.10 ± 9.34	90.76 ± 8.91		
Topical Fluoride Varnish					
Tell-Show-Do	97.00 ± 11.44	104.95 ± 10.55	97.76 ± 9.94		
Live Modeling	93.00 ± 9.95	99.33 ± 11.01	91.71 ± 10.61	< 0.001	
Filmed Modeling	90.19 ± 9.28	95.10 ± 9.56	90.43 ± 9.89		

\*Abbreviation: SD – Standard Deviation, IOPA – Intra-oral Periapical Radiograph.

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**Table 3: Effect on estimated anxiety indicators of children undergoing diagnosis and preventive dental care under the influence of different behavior guidance techniques.**

Anxiety indicators as FIS Score and Heart Rate (Mean ± SE)					
Intervention	Tell-Show-Do (1)	Live Modeling (2)	Filmed Modeling (3)	p-value	Multiple Comparison
FIS Score					
OE	4.19 ± 0.09	4.37 ± 0.09	4.64 ± 0.09	0.006	(3) > (1)
IOPA	4.06 ± 0.08	4.33 ± 0.08	4.41 ± 0.08	0.010	(3) > (1)
OP	4.02 ± 0.08	4.35 ± 0.08	4.32 ± 0.08	0.016	(2) > (1)
TFV	4.19 ± 0.08	4.44 ± 0.08	4.56 ± 0.08	0.007	(3) > (1)
Heart Rate					
OE	99.43 ± 2.07	94.14 ± 2.07	92.51 ± 2.07	0.054	NS
IOPA	101.40 ± 2.06	95.54 ± 2.06	92.43 ± 2.06	0.011	(1) > (3)
OP	102.08 ± 2.15	94.98 ± 2.15	93.19 ± 2.15	0.012	(1) > (3)
TFV	99.91 ± 2.19	94.68 ± 2.19	91.90 ± 2.19	0.039	(1) > (3)

\*Abbreviation: SE – Standard Error; OE – Oral Examination; IOPA – Intra-oral Periapical Radiograph; OP – Oral Prophylaxis; TFV – Topical Fluoride Varnish; NS – Non-significant.

Please note: FIS scores are recoded in the reverse direction with maximum value implying highest state of happiness.

## DISCUSSION

Filmed modeling seems to be an efficient behavior shaping technique as compared to TSD in children with initial contact to dental operatory possibly for oral examination and preventive dental care. However, there was no significant difference observed between the live modeling and filmed modeling.

Dental fear and anxiety prevalence in children and adolescents appear to be widespread ranging from 5-20%.<sup>8,9</sup> Countering measures for such emotional unease can be managed by either pharmacological or non-pharmacological behavior guidance approaches. As aforementioned, non-pharmacological behavior guidance approaches are preferred over pharmacological measures by many parents and children.<sup>2</sup> However, structured non-pharmacological behavior guidance mainly comprise of behavior shaping tools–TSD and modeling. Hence, TSD and modeling were implemented in this study for the investigation of their effects on anxiety indicators.

Most children become uncooperative during dental treatment due to the equipment and its unpleasant noise exposure. The rationale for uncooperative behavior can be related to the direct use of dental equipment without preconditioning the child to dental operatory. Therefore, the contributors of this study focused on the behavior shaping tools which condition the behavior of the child slowly by reinforcing successive approximations of the desired behavior until the behavior comes into being. Given the necessity of preconditioning, the use of these shaping tools should be brought into effect from the point of initial patients contact. During the first dental visit, oral examination and preventive therapies are routine recommended procedures. The effect of behavior shaping tools during initial contact procedures might have a greater impact on the forthcoming appointments. Also, behavior shaping might help the operator to improve communication thereby assist in providing the child with appropriate coping strategies.<sup>10</sup> In order to standardize the behavior shaping techniques in the study, a single operator (PK) dissemination of shaping tools, examination, and preventive procedures was performed. Also, an independent observer (HW) conducted the recording of the anxiety indicators.

The age group of the patients selected for this study was 7 to 9 years because by this age the child develops sufficient communication skills to understand the behavior shaping techniques. The most important factor of this age group is the cognitive ability to understand the filmed modeling and live modeling techniques. Although with better cognitive ability but the recruited patients were of a relatively older age to have their first dental experience. TSD might prove to be better in younger children as compared to the age group included in this study since the understanding ability of video or live modeling in children > 6 years is higher as compared to younger children. Therefore, the study participants were better able to deal with the information. Hence, TSD had a significantly lower effect as compared to the modeling techniques.

The result of this study is in concordance with two previously conducted studies<sup>11,12</sup> on live modeling. It was concluded by the studies that the filmed modeling resulted in significant decrease of overall anxiety demonstrating its effectiveness. However, these two studies did not demonstrate a comparative evaluation of behavior shaping techniques to rule out the best possible method to guide behavior in a dental chair especially during the initial contact. This study observed that the anxiety scores in filmed modeling group were found to be better as compared to TSD with no significant difference to live modeling. The reduction of anxiety in filmed modeling group may be due to the observation of a model on a computer tablet used in the study. The use of the portable tablet might have proven attractive for gaining the positive behavior of children. Moreover, the exposure to the filmed modeling might have familiarized the children to the dental equipment sights, sounds, and respective procedures. Hence, the threat of the unknown was reduced or might have been even eliminated amongst these children. Although structured, TSD depends more upon communication skills of the operator (involving instructions in a step-wise fashion), which might vary with time. Thus, it can also be the reason that filmed modeling was found to be far better than TSD.

Nowadays, children are more attracted towards electronic gadgets especially the ones that are portable. Tablet (used in the

study) is one of the devices, which attracts most of the children. Therefore, watching a film on a tablet might help children on dental chair to develop a positive attitude and thereby co-operate well during the procedure. It was observed during the study that children under the influence of filmed modeling were more attentive and had increased acceptance to dental care as compared to the children under other two guidance techniques. Another advantage of filmed modeling in this study was that the child in the video was of the similar age. The authors of this study have an opinion that filmed modeling method of behavior shaping with the display on modern gadgets as tablets has a wide scope in making the child familiar with routine dental procedures. It is also recommended to use this tool and reduce the use of aversive conditioning and pharmacological techniques.

Heart rate is an acceptable physiological anxiety indicator. A long-standing validated instrument namely FIS can evaluate the pediatric patient's visual analogs for anxiety assessment.<sup>13</sup> Hence, FIS scores and heart rate determination can form the basis for the assessment of child's anxiety that indirectly can measure the effectiveness of behavior guidance tool once implemented. Therefore, heart rate and FIS scores were selected as anxiety indicators in the present study.

The results of the present study emphasize that the conventional techniques of behavior shaping collated with recent technologies can help in establishing desired behavior. Such modifications on modern portable gadgets can be explored further, and its effect on different anxiety indicators can help us assess the best possible method for behavior guidance further. This study demonstrates the possibility of filmed modelling technique with the help of portable electronic gadget (Tablet Computer) which can be used for behavior guidance of 7-9 years aged children visiting dental clinic the first time for routine examination and preventive therapies. It also emphasizes the need to rationalize appropriate dispersal of behavior guidance tools to achieve the desired behavior in successive appointments.

## CONCLUSION

The results of this study suggest that the modeling techniques – filmed and live modeling seem to be an efficient behavioral guidance approach for children undergoing routine diagnosis and preventive dental care as compared to tell-show-do technique. Currently, the use of filmed modeling as a behavior-shaping tool is limited in pediatric dental practice. Hence, for children aged 7-9 years providing information prior to the treatment (using filmed modeling techniques on recent gadgets like Tablet Computer) forms an efficient behavior guidance approach to perform the dental treatment effectively than giving information during treatment in sequential pattern (TSD).

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