Effect of Audiovisual Modeling on 5–10-year-old Children’s Anxiety and Cooperation Behavior in First and Second Dental Visits

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OBJECTIVES: Assessing the effect of audiovisual modeling distraction on anxiety and cooperation behavior in 1st and 2nd dental visits of Saudi children aged 5–10 year-old in Qassim province.

MATERIALS AND METHODS: Randomized controlled clinical trial conducted at College of Dentistry, Qassim University. After exclusion of nonconformity cases, sample size consisted of 98 patients distributed equally to test and control groups based on children’s anxiety level. Quantification of children’s behavior was based on Venham Scale for anxiety level and behavior rating scale was based on Frankle scale. Ratings were performed by a dentist other than the treating dentist and who was blinded on study procedure. Statistical analyses were carried out at a significance level of <0.05 and 0.01.

RESULTS: No statistical difference was detected for children in Group I (without audiovisual modeling) during their 1st and 2nd visits for anxiety and cooperation scales (p = 0.855 and 0.787, respectively). For group II (before and after audiovisual modeling), a statistically significant difference was found in anxiety and cooperation levels of children in the 2nd visit in relation to 1st visit (p = 0.010 and 0.000, respectively). Regarding studied groups in the 2nd visit, a statistically significant difference was found in group II as children who were watching the cartoon film in the 2nd visit before any dental treatment were less anxious and more cooperative with the dentist (p = 0.004 and 0.000, respectively).

CONCLUSION: Audiovisual modeling in the form of a film/video is successful in reducing disruptive behavior in children during their dental treatment producing a less anxious and more cooperative patient.

KEYWORDS: Anxiety and behavior, Audiovisual modeling, Frankle Scale, Randomized controlled clinical trial, Venham scale.

How to cite this article: Sedky NA, Hasson AHA. Effect of Audiovisual Modeling on 5–10-year-old Children’s Anxiety and Cooperation Behavior in First and Second Dental Visits. Int J Experiment Dent Sci 2018;7(2):54-62.

Source of support: Nil
Conflict of interest: None

INTRODUCTION

Anxiety has been defined as a state of imprecise fearfulness towards a specific condition that does not essentially have previous experience.

Dental anxiety and the avoidance of circumstances that include dental treatment and healthcare have commonly been assumed to be the source of serious oral health problems in children and adults. High levels of anxiety avoid a patient from fully cooperating with the dentist, which can result in time wasting for the dentist and unnecessary difficulties during treatment implementation and, most importantly, can restrict the effectiveness of the dental treatment and avoid the early detection of pathological conditions. It was precisely recognized that children with higher levels of dental anxiety have a greater number of untreated carious teeth. Thus, dental anxiety might affect the quality of dental care that a patient receives. Furthermore, the treatment of anxious patients is one of the most stressful aspects to the dentists during performing their works. It was found that many professionals consider children who reveal uncooperative behavior to be one of the utmost difficulties in dental practice. Given that there is a connection between dental anxiety and uncooperative behavior, it is important for dentists to be able to assess anxiety in their patients, this is to determine who are in need for special care concerning their fear.

Providing effective dental treatment to a child patient necessitates thorough knowledge to identify dental Anxiety and cooperation behavior and its management by the application of techniques concerned with behavioral management. Taking into consideration these concerns, a dentist who does not focus on the psychological needs of a child will immediately be challenged by an uncooperative patient. In 1990, Pinkham et al. indicated that management of behavior is as fundamental as dexterity and knowledge of the material to be used which is essential for clinical success in pediatric dentistry. Likewise, a study was carried out by Wright in 1983.
revealed that every dental team should keep two main points in mind that they should carry out dental treatment effectively and efficiently as well as encourage a positive attitude in the child.11

Modeling belongs to learning by observation and children may repeat behavior displayed by the model in a similar situation. It was expressed by Bandura in 1968 as a procedure which can decrease children’s fear and avoidance behavior.12,13 Modeling can be implemented in two forms: live or filmed one. Studies on modeling have revealed its therapeutic effect in the management of anxiety14,15 and educational effect in enhancing the coping skills of children in medical stressful situations.16

The first dental visit is fundamental in the construction of the child’s attitude with regard to dentistry and the success of future treatment. The technique of “Tell Show Do” is frequently applied by pediatric dentists in the management of children’s anxiety at a pretreatment visit. It determines that before anything is done, the child be told what will be done and then shown by some simulation exactly what will happen before the procedure is started. The technique of “Tell Show Do” is performed by the dentists themselves in the operatory room, and is based on the principle of learning theory.13,17

It has been proposed to practice the live or filmed modeling technique as an effective intervention to prepare the child for a dental visit.18 Live models such as parents, peers or relatives are used for pre-appointment teaching of the predictable behavior to the child patient.19-21 Several studies have assessed the effectiveness of the modeling through a film in the reduction of child’s dental anxiety.22-28 It has been revealed that filmed modeling can be effective as well as live modeling in addition to desensitization methods.22,24 In contrast to the other social learning based methods, filmed modeling does not take time by the dentist and the dental team although it has not achieved its appropriate situation.18

In 2013, Mungara et al.29 studied the dental fear of the pediatric patients between 5 years-old and 9 years-old, the researchers found that the most fear aggravating stimulus for the studied children was injection and the least was to open the mouth and having someone look at them.29

With this background, this study was undertaken to assess the effect of audiovisual modeling distraction on anxiety and cooperation behavior in the first and second dental visits of Saudi children aged 5–10 years-old in Qassim province. The results obtained would serve as baseline data for planning a treatment modality aimed at the minimization of preoperative anxiety and fear for children to fully cooperate in dental visits and enabling them to receive better dental treatment.

**MATERIAL AND METHODS**

A randomized controlled clinical trial (RCT) was conducted and completed at the Department of Ortho and Pediatric Dentistry, College of Dentistry, Qassim University, Kingdom of Saudi Arabia, between June 2016 and March 2017, after obtaining approval from the Ethics Committee of the Dental Research Center of Qassim University. A total of 150 pediatric patients aged 5 to 10 years (mean age = 7.33 years, SD = ±1.62 years) requiring a dental treatment were recruited for this study. Some criteria were taken into account in this study, the inclusion criteria were:

- The absence of any systemic diseases and hospitalization.
- The absence of any psychiatric disorders, anxiety, and history of social or specific phobia for any reason.
- The absence of previous bad dental experience.
- Not having experienced any harmful accidents like (severe accidents, abduction, eye-witnessing a crime, sexual abuse, and physical abuse).
- The absence of any psychopathological familial history including divorce, familial violence, and child abuse.

Prior to starting any visit and after being disclosed the nature of the study, the parents were asked to sign an informed consent form to approve the participation in the study as well as a questionnaire covering the parents’ and children’s demographic and social information.

In the treatment room, the mother sat down and was asked not to talk neither to the child nor to the dentist and also not to intervene in any form in case of her child was not cooperative. A video camera was located on the top of the dental unit light pole after being hidden from view and was focused on the child’s head and hands to record child’s behavior during the 1st and 2nd visits.

At the first visit, before splitting the groups, the dentist started with asking the child his/her name and age; then the dentist tried to manage child’s behavior by Tell-Show-Do technique and all children were subjected to just a diagnosis, prophylaxis with paste and rubber cup as well as fluoride therapy to increase their familiarity with dental procedures. At the end of the first visit, the necessary evaluations were prescribed for the child’s anxiety and cooperation.30 Out of the 150 children who completed the first visit, and after the exclusion of nonconformity cases, the sample size consisted of 98 pediatric patients distributed as follows based on children’s anxiety level (Venham scaling rate):30

- Score (0) relaxed: 10 (20.41%) children
- Score (1) uneasy: 26 (53.06%) children
- Score (2) tense: 16 (32.65%) children
The selected children were randomly allocated into two equal groups (test and control groups) by a stratified sampling technique based on Venham scaling rate. The first group (group I), included those children treated without any audiovisual modeling (control group); while the second group (group II), included the children treated with the audiovisual modeling (test group). Then the date of the second visit was set for one week later for both groups.

In the second visit, following describing what the child had to undergo for the dental treatment explained in a simple and easy-to-understand method, the required modality of treatment was performed. Similar treatments were tried to be included for all children. The majority of children received treatments in the form of pulpotomy for deciduous molars followed by application of stainless steel crowns, and some of them received restorative treatment in the form of amalgam and composite filling restorations, and the minority of the participants needed extraction. It should be noted that the treatment procedures in both groups followed a normal distribution. Group I received their treatment without any audiovisual intervention, while group II obtained their dental treatment after watching a cartoon film aimed at teaching the child how to perform dental care (the film displayed the same procedure consisting of Tell-Show-Do, prophylaxis with paste and rubber cup as well as fluoride therapy on a similar age as the studied age group) and how much damage caused as a result of the negligence of dental care. The produced film had been approved by three pediatric dentists and movie, in general, was exciting for the children because it was designed specifically for this age group.

In both sessions and for all children, all parameters in the form of the attending dentist, dental assistant, the working environment, time and duration of the appointment (30 minutes for each child), and the type of dialogues were constant. It was taken into consideration the children’s general condition as they should not be tired, hungry nor having any disease; also the session was scheduled in the afternoon, not during the school time and activity time of the child.

The quantification of the children’s behavior was based on Venham scale for anxiety level, and a behavior rating scale was based on the Frankel scale (Table 2). The ratings were performed by inspecting the recorded camera videos for the participating children by a dentist other than the dentist who was treating the patients and who was blinded on the study procedure.

### Statistical Analysis

Statistical analysis was conducted using the statistical package for social sciences program (SPSS 22.0 for Windows, SPSS Inc., Chicago, USA). All statistical analyses were carried out at a significance level less than 0.05 and 0.01. The data were analyzed and subjected to descriptive statistics like frequencies, percentages, cross-tabulation, means, and standard deviations. Paired samples t-test was used to investigate associations between variables in each group before and after intervention (audiovisual’s presence/absence) and finally, Independent samples t-test was employed to investigate the effect on the studied groups after intervention.

### RESULTS

In the current study, out of the 150 children who were screened and completed the 1st visit only 98 children met the research criteria. So, the final sample constituted 98

| Table 1: Venham 6-point Index to obtain anxiety level |
|------------------------------------------------------|
| Rating | Description |
|--------|-------------|
| 0      | Relaxed: Smiling, willing, able to converse, displays behavior desired by the dentist. |
| 1      | Uneasy: Concerned, may protest briefly to indicate discomfort, hands remain down or partially raised. Tense facial expression, 'high chest'. Capable of cooperating. |
| 2      | Tense: Tone of voice, questions and answers reflect anxiety. During stressful procedure, verbal protest, crying, hands tense and raised, but not interfering very much. Protest more distracting and troublesome. Child still complies with request to cooperate. |
| 3      | Reluctant: Pronounced verbal protest, crying. Using hands to try to stop procedure. Treatment proceeds with difficulty. |
| 4      | Interference: General crying, body movements sometimes needing physical restraint. Protest disrupts procedure. |
| 5      | Out of contact: Hard loud swearing, screaming unable to listen, trying to escape. Physical restraint required. |

| Table 2: Frankel 4-point Index to obtain cooperation level |
|-----------------------------------------------------------|
| Rating | Description |
|--------|-------------|
| 1      | Definitely negative: Refusal of treatment, crying forcefully, fearful, or any other overt evidence of extreme negativism |
| 2      | Negative: Reluctant to accept treatment, uncooperative, some evidence of negative attitude but not pronounced, sullen, withdrawn |
| 3      | Positive: Acceptance of treatment, at times cautious, willingness to comply with the dentist, at times with reservation but patient follows the dentist’s directions cooperatively. |
| 4      | Definitely positive: Good rapport with the dentist, interested in the dental procedures, laughing and enjoying the situation |
children, 56 girls and 42 boys (57.1% and 42.9%, respectively), with a mean age of 7.33 years (SD = +1.62 years).

Table 3 reveals the relation between group I in the 1st and 2nd visits (without audiovisual modeling) and anxiety as well as cooperation levels. No statistical difference was detected for children in Group I during their 1st and 2nd dental visits neither for the anxiety nor for the cooperation scales (\(\chi^2 = 1.958, p = 0.855\), and \(\chi^2 = 1.059, p = 0.787\), respectively).

On the other hand, and with regard to the children in Group II both in 1st and 2nd visits (before and after audiovisual modeling), a statistically significant difference was found in the anxiety level as well as in the cooperation level of children who had been exposed to watch the video prior to the second treatment session where 36.73% of children recorded score (0) in Venham scaling rate meaning that they were “relaxed” in 2nd visit in relation to only 10.20% in the 1st visit (\(\chi^2 = 15.208^*, p = 0.010\)), and 57.14% of the participating children were found to be “definitely positive” to cooperation with the dentist during the 2nd dental visit and after watching the video compared to just 14.29% in the 1st visit (\(\chi^2 = 23.451^*, p = 0.000\)), (Table 4).

Table 5 portrays the relationship between the studied groups (groups I and II) during their 2nd dental visit without and with the intervention with audiovisual modeling and anxiety as well as cooperation levels. A statistically significant difference was detected in group II with regard to anxiety and cooperation levels where the children who were watching the cartoon film in the 2nd visit prior to any dental treatment were less anxious and more cooperative with the dentist than their counterparts who received their dental treatment without any audiovisual intervention (\(\chi^2 = 17.479^*, p = 0.004\) and \(\chi^2 = 25.811^*, p = 0.000\), respectively).

Table 6 depicts the association between children in group I during their 1st and 2nd visits without intervention and those in group II in 1st and 2nd visits without intervention and audiovisual modeling and anxiety as well as cooperation levels.

**p <0.01, *p <0.05**
and with intervention. No statistical difference was found in the 2nd visit of group 1 participants in relation to their anxiety level and cooperation with the dentist (Venham scaling rate paired t-test = 0.771, p = 0.444 and Frankle scaling rate paired t-test = -0.256, p = 0.799). Conversely, regarding group II participants, less anxiety and more cooperation was reported among children comparing their scores in their 2nd visit with that of the 1st visit, where a statistically significant difference was registered between both visits (Venham scaling rate paired t-test = 5.815*, p = 0.000 and Frankle scaling rate independent samples t-test = -5.441*, p = 0.000).

Furthermore, results in Table 7 demonstrated that the intervention had a positive effect on the participating pediatric patients where a statistically significant difference was reported among both studied groups in their 2nd dental visit, as the children who were exposed to watching the video were significantly less anxious and more cooperative with their dentist than their counterparts who didn’t see any videos (Venham scaling rate independent samples t-test = 3.979*, p = 0.000 and Frankle scaling rate independent samples t-test = -4.789*, p = 0.000).

**DISCUSSION**

Uncooperative behavior and anxiety in patients are still identified to be among the most considerable problems in pediatric dentistry, so detecting and assessing dental

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**Table 5:** Relation between group I and group II in the 2nd visit (without and with audiovisual modeling) and anxiety as well as cooperation levels (N = 98)

| Venham scaling rate (anxiety level) | χ² (p) |
|------------------------------------|-------|
| Relaxed | Uneasy | Tense | Reluctant | Interference | Out of contact |
| Group I 2nd visit without video | Count | % within 2nd visit |
| 4 | 14 | 12 | 12 | 5 | 2 |
| Group II 2nd visit with video | Count | % within 2nd visit |
| 18 | 17 | 7 | 5 | 1 | 1 |
| | | | | 17.479* (0.004) |

**Frankle scaling rate (cooperation level) | χ² (p) |
| Definitely negative | Negative | Positive | Definitely positive |
| Group I 2nd visit without video | Count | % within 2nd visit |
| 8 | 15 | 20 | 6 |
| Group II 2nd visit with video | Count | % within 2nd visit |
| 16.3% | 30.6% | 40.8% | 12.2% |
| Group I 2nd visit with video | Count | % within 2nd visit |
| 1 | 9 | 11 | 28 |
| Group II 2nd visit with video | Count | % within 2nd visit |
| 2.0% | 18.4% | 22.4% | 57.1% |

**Table 6:** Paired t-test for group I in 1st and 2nd visits without audiovisual modeling and for group II in 1st and 2nd visits without and with audiovisual modeling

| Group I (without audiovisual modeling) | Paired differences | 95% confidence interval of the difference | df | Sig. (2-tailed) | Group I N (+SD) |
|---------------------------------------|-------------------|----------------------------------------|----|----------------|----------------|
| Mean | SD | Std. error mean | Lower | Upper |
| Venham scaling rate 1st visit–Venham scaling rate 2nd visit | 0.061 | 0.556 | 0.079 | -0.098 | 0.221 | 0.771 | 48 | 0.444 | 1st visit 2.18 (+1.333) |
| 2nd visit | 1.12 (+1.201) |
| Frankle scaling rate 1st visit–Frankle scaling rate 2nd Visit | -0.020 | 0.559 | 0.080 | -0.181 | 0.140 | -0.256 | 48 | 0.799 | 1st visit 2.47 (+0.915) |
| 2nd visit | 2.49 (+0.916) |

| Group II (with audiovisual modeling) | Paired differences | 95% confidence interval of the difference | df | Sig. (2-tailed) | Group II N (+SD) |
|-------------------------------------|--------------------|----------------------------------------|----|----------------|----------------|
| Mean | Std. deviation | Std. error mean | Lower | Upper |
| Venham scaling rate 1st visit–Venham scaling rate 2nd visit | 0.977 | 0.884 | 0.126 | 0.481 | 0.989 | 5.815* | 48 | 0.000 | 1st visit 2.11 (+1.242) |
| 2nd visit | 1.12 (+1.201) |
| Frankle scaling rate 1st visit–Frankle scaling rate 2nd Visit | -0.835 | 0.709 | 0.101 | -0.755 | -0.347 | -5.441** | 48 | 0.000 | 1st visit 2.51 (+1.000) |
| 2nd visit | 3.35 (+0.855) |

**p<0.01, *p<0.05**
Effect of Audiovisual Modeling on 5–10-year-old Children’s Anxiety and Cooperation Behavior in First and Second Dental Visits

Table 7: Independent samples test for group I and group II in 2nd visit (without and with audiovisual modeling) and anxiety as well as cooperation levels (N = 98)

|                      | Levene’s test for equality of variances | t-test for equality of means | 95% confidence interval of the difference | Group statistics | Mean (SD) |
|----------------------|----------------------------------------|-------------------------------|------------------------------------------|------------------|-----------|
|                      | F                                      | Sig.                         | t                                     | df               | Lower     | Upper     |
| Venham scaling rate  | Equal variances assumed                 | 0.830                        | 0.365                                  | 3.979*            | 96        | 1.000     | 0.251     | 0.501 | 1.499 | Group I (N = 49) | 2.12 (+1.285) |
| (anxiety level)      | Equal variances not assumed              |                              |                                        |                  |           |           |           |       |       | Group II (N = 49) | 1.12 (+1.201) |
|                      | F                                      | Sig.                         | t                                     | df               | Lower     | Upper     |
| Frankie scaling rate | Equal variances assumed                 | 0.212                        | 0.646                                  | -4.789**          | 96        | -0.857    | 0.179    | -1.212 | -0.502 | Group I (N = 49) | 2.49 (+0.916) |
| (cooperation level)  | Equal variances not assumed              |                              |                                        |                  |           |           |           |       |       | Group II (N = 49) | 3.35 (+0.855) |

*p <0.01, *p <0.05

Anxiety among child patients with some valid method of measurement is necessary. As each person has a limited capacity of attention, if the greater part of this attention can be caught by a distraction task, it will less be devoted to pain perception or any other anxiety-provoking situation so the anxiety will decrease. A number of non-pharmacological or psychological techniques aiming to manage patient behavior are present. Some approaches directed to improve the communication process, while others are proposed to eliminate inappropriate behavior or reduce anxiety. Most recommended procedures for modifying child behavior during dentistry have comprised a variety of forms of pre-exposure to the dental setting and procedures. There are techniques based on the Social Learning Theory, which accentuates the importance of observing and imitating the behaviors, attitudes, and emotional reactions of others. One such technique is the Tell-Show-Do technique, where several epidemiological studies have discovered its positive effect on the reduction of dental anxiety. Another one is modeling technique, Bandura, determined that modeling or learning by observation worked not only for gaining new behaviors but also for reducing undesirable behavior. The success of modeling in reducing dental fear and anxiety has been well documented in the past; in spite of this, it has not been widely applied as a routine behavior management technique. This study was designed to assess the effect of audiovisual modeling distraction on anxiety and cooperation behavior in Saudi children aged 5–10 years-old in Qassim Province during their first and second dental visits. The age group of 5 to 10 years was chosen for the present study as dental problems are difficult to treat in this age group as they reveal more disruptive behavior and dental anxiety and are extremely difficult to manage.

In consistent with previous studies, the children in this study did not have any systemic disease and hospitalization, nor any psychiatric disorders and any psycho-pathological familial history as these variables can reinforce negative behaviors in children.

Furthermore, the time and duration of appointment of both sessions for all children was set as no more than 30 minutes for each child, as it has been previously proved that children revealed more distress and uncooperative behavior when the dental procedure went beyond 30 minutes, and to prevent these behavior changes of the children during dental procedures, the length of the visits in the present study were no longer than 30 minutes. For further control of unanticipated influence on the study outcomes, the dental appointments were planned in the afternoon. This arrangement was prepared not only to standardize the visit time for all children but also to eliminate the chance of misbehavior due to missing the school time or the activity time if the appointments were given in the morning since these times are necessary for this age group.
In the current study, children were subjected to the procedure of prophylaxis at the first visit and presented a cartoon film through a videotaped model in their second visit. Results of this study revealed that children who had been exposed to watch a video prior to their second treatment session were significantly less anxious “relaxed” and more cooperative “definitely positive to cooperation” comparing to their first dental session. These findings are in accord with that of Fields and Pinkham, and Rouleau et al., where they found that the presentation of a model through a film leads the children to demonstrate relatively little negative behavior towards dental treatment and the film presentation in addition to the procedure of prophylaxis before the film can have a positive impact on the child’s acquaintance and dental behaviors. Additionally, findings of this work are in harmony with that of Melamed et al., where they reported that children who were prepared for restorative procedures by watching a filmed peer model harmonize with the particular elements of the treatment session were more cooperative and presented less disruptive behaviors as they experienced similar treatment procedures. During treatment, these children also received lower ratings of anxiety by independent raters and dentists in comparison with children shown an irrelevant film.

Furthermore, results of this study demonstrated that the intervention had a positive effect on the contributing children where a statistically significant difference was registered among those who watch the videos and those who did not, where children who were exposed to watching the video were significantly less anxious and more cooperative with their dentist. This finding is consistent with that of Al-Khotani et al., where they found that there was a marginal difference in the observed mean cooperative behavior and anxiety between those who used audiovisual distraction and those who did not. Additionally, and in agreement with this work, Filcheck et al. stated that the presentation of attention-grabbing videotaped material had an impact in distracting the children from the feared stimuli and that it was taken into consideration as one of the highest attractive approaches for modifying children’s behavior during dental treatment.

Establishing positive memories is an important feature of the dental process for children. For this purpose, implementation of behavior management techniques from the commencement of dental treatment can reduce poor emotional consequences and decrease experience of pain. Recently, Rocha et al. emphasized the importance of distress management interventions to reduce negatively deformed memories. Anxious patients particularly may register more pain and develop a negative expectation for dental treatment in the future. So, addressing the memory of an experienced event is crucial to the coping process. According to the findings of the current study and for the temperament of children in all ages the use of audiovisual modeling stimulates pleasant memories and positive attitudes that will lead to less anxious and more cooperative child patient toward the dental experience.

Limitations
In the current study the sample size could be considered as a limitation, it is suggested that larger sample size and in a general clinical setting might have exposed the differences in the use of audiovisual modeling as indicated by anxiety and behavior measures. Another limitation is the exclusion of children with previous bad dental experience which might have influenced the results, this was chosen in order to achieve as a homogeneous group as possible.

Conclusion
Based on the findings of the current study, the presentation of audiovisual modeling in the form of a film/video demonstrating positive, coping behavior during a dental visit is effective in reducing disruptive behavior in children who are experiencing their dental treatment represented by less anxious and more cooperative child patient. This method of preparation for the dental procedure could be implemented easily in any dental office during routine dental procedures and administered by dental auxiliaries before dental treatment.

Recommendations
- Future research is recommended to investigate the modeling procedure with highly phobic children and those with dental management problems, including the mentally and physically handicapped children, this can help child patient to develop a positive attitude toward oral health.
- Further investigations on the children in other age ranges are suggested including preschool age children and adolescents.

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