

Techniques for Managing Behaviour in Pediatric Dentistry: Comparative Study of Live Modelling and Tell–Show–Do Based on Children’s Heart Rates during Treatment

Nada Farhat-McHayleh, DDS, DEA, PhD; Alice Harfouche, DDS, CAGS, MSc; Philippe Souaid, DDS, MSc

Contact Author

Dr. Farhat-McHayleh
Email: nadamch@hotmail.com



ABSTRACT

Background and Objectives: Tell–show–do is the most popular technique for managing children’s behaviour in dentists’ offices. Live modelling is used less frequently, despite the satisfactory results obtained in studies conducted during the 1980s. The purpose of this study was to compare the effects of these 2 techniques on children’s heart rates during dental treatments, heart rate being the simplest biological parameter to measure and an increase in heart rate being the most common physiologic indicator of anxiety and fear.

Materials and Methods: For this randomized, controlled, parallel-group single-centre clinical trial, children 5 to 9 years of age presenting for the first time to the Saint Joseph University dental care centre in Beirut, Lebanon, were divided into 3 groups: those in groups A and B were prepared for dental treatment by means of live modelling, the mother serving as the model for children in group A and the father as the model for children in group B. The children in group C were prepared by a pediatric dentist using the tell–show–do method. Each child’s heart rate was monitored during treatment, which consisted of an oral examination and cleaning.

Results: A total of 155 children met the study criteria and participated in the study. Children who received live modelling with the mother as model had lower heart rates than those who received live modelling with the father as model and those who were prepared by the tell–show–do method ($p < 0.01$). The model used for live modelling (father or mother) and the child’s age were determining factors in the results obtained.

Conclusions: Live modelling is a technique worth practising in pediatric dentistry.

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For many children, a visit to the dentist’s office is a stressful event that can elicit feelings of fear and anxiety. These emotions cause behavioural changes during dental treatment, which can affect the quality

of care.^{1–5} Several techniques for managing children’s behaviour in dental offices have been developed to address this problem. However, it was pointed out at the American Academy of Pediatric Dentistry conference

in 2003 that over the past few decades, there have been more studies on pharmacologic management techniques than on nonpharmacologic techniques.⁶ In addition, the clinical protocols for many of these studies have lacked rigour.⁶⁻⁹ Several epidemiologic inquiries have revealed that the nonpharmacologic technique called “tell-show-do,” which consists of explaining and demonstrating the operation of the instruments used during treatment, remains the most commonly used technique in pediatric dentistry.^{6,10-12}

The literature refers to modelling as a nonpharmacologic technique worth exploring. According to a recent review by Baghdadi,⁴ modelling was described by Bandura in 1967 as the process of acquiring behaviour through observation of a model. Greenbaum and Melamed¹³ reported that the first study of modelling in pediatric dentistry was conducted in 1969, and several other studies followed in the 1980s.^{11,14} According to these studies, 2 forms of modelling, live and filmed, are effective in reducing children’s fear and anxiety about dental treatments and promoting adaptive behaviour.^{8,13-16} Although modelling has become fairly standard in a number of fields such as medicine,^{17,18} sports,¹⁹ dietetics²⁰ and others,¹⁶ it is not yet commonly practised in pediatric dentistry.^{4,16,21}

In response to the recommendations of the American Academy of Pediatric Dentistry^{6,7} on the need to study nonpharmacologic behaviour-management techniques by means of rigorous clinical protocols, we undertook a clinical study with the primary goal of comparing the effects of live modelling and the tell-show-do method on children’s heart rates during dental treatment. Heart rate was chosen for analysis because it is the simplest biological parameter to measure and because an increase in heart rate is the most common physiologic indicator of anxiety and fear.²²⁻²⁵

The secondary objectives of the study were to identify which of the child’s 2 parents represented the model most suitable for live modelling and to determine whether the child’s age was a determining factor in the results obtained.

Materials and Methods

Study Sample

The study sample consisted of children 5 to 9 years of age, randomly divided into the following 3 groups:

- Group A: children who were prepared for dental treatment by the live modelling technique with the mother as model
- Group B: children who were prepared for dental treatment by the live modelling technique with the father as model
- Group C: children who were prepared for dental treatment with the tell-show-do technique, presented by the pediatric dentist who performed the treatment

The study was a randomized, controlled, parallel-group single-centre clinical trial with comparative analysis of the 3 patient groups. Each group was subdivided by age (5 to < 7 years and 7 to < 9 years) to determine whether age was a determining factor.

Selection Criteria

Children were eligible for the study if they presented for a first visit to the dental care centre within the faculty of dentistry at Saint Joseph University in Beirut, Lebanon, accompanied by both parents. Eligibility for inclusion was also contingent upon the parents having the mental and physical capacity to serve as models. The following children were excluded from the study: those from single-parent families, those with mental or cognitive problems that could compromise their understanding of the trial or its conduct, those who were undergoing medical treatment that might affect heart rate and those with heart-beat disorders. Children were also excluded if either the mother or the father had mental problems or language barriers that might compromise their understanding of the trial or its conduct or if they had a health problem that might prevent them from participating as models.

Children were excluded from the analysis if they or their parents abandoned the study by choice or for any other reason.

Data Collection

Each child’s heart rate was monitored during the entire treatment (oral examination and cleaning) with a pulse oximeter. The oximeter was clipped to the thumb of the child’s left hand. To reduce the risk of recording errors, a pediatric dentist ensured that the child did not move by gently holding the child’s hand.²⁶ An assistant manually transcribed the data posted on the oximeter screen into the child’s file at 30-second intervals for a total of 12 data points.

Study Procedure

Parents were asked to complete a questionnaire covering the following elements: marital status, level of education, number of children in the family, the child’s oral hygiene habits and the child’s previous behaviour in a medical setting. Both parents were informed in detail about how the study would be conducted and about their right to refuse or discontinue participation at any time and were then asked to sign a consent form.

The duration of each trial was 14 minutes: 5 minutes for the psychological preparation (either live modelling or tell-show-do), 3.5 minutes for attaching the oximeter and 5.5 minutes for performing the dental treatment (oral examination and cleaning).

For groups A and B, the child observed the mother or father, respectively, sitting in the dental chair and undergoing oral examination and cleaning (by the

Table 1 Distribution of children undergoing nonpharmacologic methods of behaviour management during dental care, by group and age

Group ^a	Age class; no. (%) of group		Total
	5 to < 7 years	7 to < 9 years	
A	32 (60)	21 (40)	53 (100)
B	23 (45)	28 (55)	51 (100)
C	20 (39)	31 (61)	51 (100)
Total	75 (48)	80 (52)	155 (100)

^aGroup A = live modelling with mother as model, group B = live modelling with father as model, group C = tell-show-do method.

Table 2 Multiple comparisons of mean heart rates for children prepared for dental treatment in 3 different ways (Bonferroni test)

Heart rate measurement ^a	Comparison of study groups ^b	Difference between group mean heart rates (beats/min)	p value
Mean T1-T3	Group A v. group B	-1.78	≥ 0.05
	Group A v. group C	-3.63	≥ 0.05
	Group B v. group C	-1.85	≥ 0.05
Mean T10-T12	Group A v. group B	-7.51	0.001
	Group A v. group C	-10.11	< 0.001
	Group B v. group C	-2.60	≥ 0.05
Mean T1-T12	Group A v. group B	-5.19	0.034
	Group A v. group C	-6.50	0.005
	Group B v. group C	-1.30	≥ 0.05

^aThe letter T followed by a number from 1 to 12 represents the time of specific measurements of heart rate (at 30-second intervals during treatment).

^bGroup A = live modelling with mother as model, group B = live modelling with father as model, group C = tell-show-do method.

tell-show-do method). The child was encouraged to participate in the session by asking questions about the instruments and how they work. He or she then sat in the chair and underwent oral examination and cleaning. The child's heart rate was recorded as described above. For children in group C, the tell-show-do procedure was performed by the pediatric dentist without live modelling but with the child's active participation and with recording of heart rate, both as described above.

The same pediatric dentist (N.F.-M.) examined all children.

Statistical Analysis

The data from the 3 groups were subjected to the following statistical tests. The Kolmogorov-Smirnov test was used to establish the normality of distribution of the results, and Levene's test was used to establish homogeneity of variances. The 3 groups were compared by analysis

of variance (ANOVA), and the Bonferroni test was used for multiple pairwise comparisons between the groups.

Results

A total of 155 children (69 girls and 86 boys) met the study criteria and participated in the study: 53 in group A, 51 in group B and 51 in group C (Table 1).

All examination and cleaning appointments were completed for each group. The Kolmogorov-Smirnov test confirmed the normality of distributions, and Levene's test confirmed the homogeneity of variances.

Average heart rate over the entire treatment period was significantly lower among children in group A (live modelling by mother) than among those in group B (live modelling by father; $p = 0.034$) and group C (tell-show-do method; $p = 0.005$) (Table 2). This difference was particularly evident during the cleaning, which involved the use of rotating instruments and was therefore

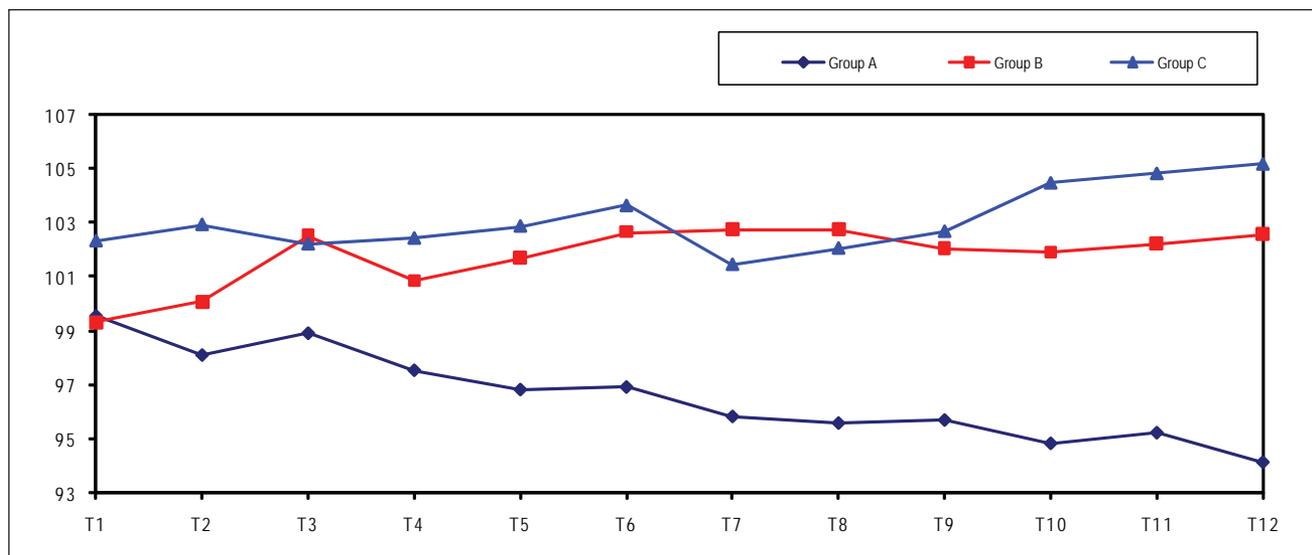


Figure 1: Mean heart rate of children in group A (live modelling with mother as model), group B (live modelling with father as model) and group C (tell–show–do) at 12 time points (T1 through T12) over a 5.5-minute dental treatment (30-second intervals).

considered the most stressful part of treatment. This period was represented by heart rate measurements from T6 (at 2 minutes, 30 seconds) to T12 (at 5 minutes, 30 seconds); the mean difference between groups A and C for T12 was 11.1 beats/min (Fig. 1).

ANOVA by a single factor (age), followed by comparative analysis of the subgroup averages, revealed that age influenced the results in 2 ways (Tables 3 and 4). First, the effect of live modelling with the mother, relative to tell–show–do, was less powerful for the subgroup of 5 to < 7-year-olds than for the subgroup of 7 to < 9-year-olds (Table 3). However, for children 5 to < 7 years of age, the difference between groups A and C during use of rotating instruments remained highly significant, at 9.14 beats/min for the combined mean of T10, T11 and T12 (i.e., from 4 minutes, 30 seconds to 5 minutes, 30 seconds) ($p = 0.004$) (Table 4). Second, for the subgroup of 7 to < 9-year-olds, the effect of live modelling with the father increased when rotating instruments were used (Table 4), and the difference between groups B and C became statistically significant ($p = 0.038$).

Discussion

This study was undertaken to compare the effects of live modelling and the tell–show–do method in reducing children’s anxiety during dental treatments and to determine whether the particular model (mother or father) used in live modelling and the age of the child were determining factors. The comparison between groups A and C (Table 2) showed that live modelling with the mother as the model was more effective in reducing heart rate than the tell–show–do method ($p = 0.005$). Of the 2 categories of live models used, mothers represented the

most satisfactory model ($p = 0.034$). Although the effect of live modelling with the father increased when rotating instruments were used for the subgroup of 7 to < 9-year-olds, the results generally favoured group A (mother as model) over groups B and C for each of the 2 subgroups based on age.

Several assumptions may explain these results:

- Learning capacity (i.e., copying the model’s behaviour) improves with age.^{4,27,28}
- The child’s relationship with his or her father evolves with age, such that use of the father for modelling is favoured at older ages, when the father has become more integrated in the child’s life.

A future study might investigate whether children 5 to < 7 years of age are more influenced by models their own age. The results for age subgroups may be confirmed or rejected through future research with larger samples.

The procedure used in this study was carefully developed to reduce bias and false results. Randomization and inclusion and exclusion criteria were established to allow for appropriate sampling. The main outcome was a biological parameter, heart rate. This quantitative criterion has metrologic properties that allowed us to follow physiologic changes occurring during the study. Heart rate has been used as an outcome measure in numerous medical, paramedical and dental studies of fear and anxiety.^{22–25}

The measurement tool was the pulse oximeter. This tool is considered an excellent means of monitoring heart rate.²⁶ Similarity in terms of trial conditions, the time allowed for each stage of the treatment and interactions between the operator and the child was maintained for the 3 study groups.

Table 3 Multiple comparison (Bonferroni test) of mean heart rates in subgroups by age class, for specific time periods

Heart rate measurement ^a	Comparison of study groups ^b	Age 5 to < 7 years		Age 7 to < 9 years	
		Difference between group mean heart rates (beats/min)	p value	Difference between group mean heart rates (beats/min)	p value
T1	Group A v. group B	-4.21	≥ 0.05	2.25	≥ 0.05
	Group A v. group C	-5.22	≥ 0.05	-3.23	≥ 0.05
	Group B v. group C	-1.01	≥ 0.05	-5.48	≥ 0.05
T2	Group A v. group B	-4.66	≥ 0.05	-1.76	≥ 0.05
	Group A v. group C	-6.14	≥ 0.05	-6.45	≥ 0.05
	Group B v. group C	-1.48	≥ 0.05	-4.69	≥ 0.05
T3	Group A v. group B	-6.03	≥ 0.05	-3.57	≥ 0.05
	Group A v. group C	-2.50	≥ 0.05	-6.30	≥ 0.05
	Group B v. group C	3.53	≥ 0.05	-2.73	≥ 0.05
T4	Group A v. group B	-5.69	≥ 0.05	-3.99	≥ 0.05
	Group A v. group C	-3.88	≥ 0.05	-8.77	0.016
	Group B v. group C	1.81	≥ 0.05	-4.78	≥ 0.05
T5	Group A v. group B	-7.63	≥ 0.05	-4.38	≥ 0.05
	Group A v. group C	-6.87	≥ 0.05	-7.69	0.036
	Group B v. group C	0.76	≥ 0.05	-3.31	≥ 0.05
T6	Group A v. group B	-8.90	0.011	-4.60	≥ 0.05
	Group A v. group C	-6.23	≥ 0.05	-8.85	0.021
	Group B v. group C	2.67	≥ 0.05	-4.26	≥ 0.05
T7	Group A v. group B	-10.04	0.005	-6.62	≥ 0.05
	Group A v. group C	-4.15	≥ 0.05	-9.37	0.010
	Group B v. group C	5.89	≥ 0.05	-2.75	≥ 0.05
T8	Group A v. group B	-10.04	0.004	-7.79	0.018
	Group A v. group C	-4.72	≥ 0.05	-11.31	< 0.001
	Group B v. group C	5.33	≥ 0.05	-3.52	≥ 0.05
T9	Group A v. group B	-8.82	0.009	-7.20	0.043
	Group A v. group C	-6.35	≥ 0.05	-10.98	0.001
	Group B v. group C	2.47	≥ 0.05	-3.77	≥ 0.05
T10	Group A v. group B	-10.34	0.001	-7.19	0.047
	Group A v. group C	-8.90	0.007	-13.61	< 0.001
	Group B v. group C	1.44	≥ 0.05	-6.42	≥ 0.05
T11	Group A v. group B	-10.88	0.001	-6.08	≥ 0.05
	Group A v. group C	-8.78	0.011	-13.02	< 0.001
	Group B v. group C	2.10	≥ 0.05	-6.94	0.024
T12	Group A v. group B	-11.05	< 0.001	-8.99	0.011
	Group A v. group C	-9.74	0.002	-15.25	< 0.001
	Group B v. group C	1.31	≥ 0.05	-6.26	≥ 0.05
Mean T1-T12	Group A v. group B	-8.19	0.007	-4.99	≥ 0.05
	Group A v. group C	-6.12	≥ 0.05	-9.57	0.002
	Group B v. group C	2.07	≥ 0.05	-4.58	≥ 0.05

^aThe letter T followed by a number from 1 to 12 represents the time of specific measurement of heart rate (at 30-second intervals during treatment).

^bGroup A = live modelling with mother as model, group B = live modelling with father as model, group C = tell-show-do method.

Table 4 Multiple comparison (Bonferroni test) of mean heart rates in subgroups by age class, grouped by time period of measurement

Heart rate measurement ^a	Comparison of study groups ^b	Difference between group mean heart rates (beats/minute)	p value
5 to < 7 years			
Mean T1-T3	Group A v. group B	-4.97	≥ 0.05
	Group A v. group C	-4.62	≥ 0.05
	Group B v. group C	0.34	≥ 0.05
Mean T10-T12	Group A v. group B	-10.76	< 0.001
	Group A v. group C	-9.14	0.004
	Group B v. group C	1.61	≥ 0.05
Mean T1-T12	Group A v. group B	-8.19	0.007
	Group A v. group C	-6.12	≥ 0.05
	Group B v. group C	2.07	≥ 0.05
7 to < 9 years			
Mean T1-T3	Group A v. group B	-1.03	≥ 0.05
	Group A v. group C	-5.32	≥ 0.05
	Group B v. group C	-4.30	≥ 0.05
Mean T10-T12	Group A v. group B	-7.42	0.032
	Group A v. group C	-13.96	< 0.001
	Group B v. group C	-6.54	0.038
Mean T1-T12	Group A v. group B	-4.99	≥ 0.05
	Group A v. group C	-9.57	0.002
	Group B v. group C	-4.58	≥ 0.05

^aThe letter T followed by a number from 1 to 12 represents the time of specific measurement of heart rate (at 30-second intervals during treatment).

^bGroup A = live modelling with mother as model, group B = live modelling with father as model, group C = tell-show-do method.

Most studies of live modelling date back to the 1980s and 1990s^{8,11,13-16} and recent results are therefore unavailable; as such, comparisons of the current results with those of more recent studies were not feasible. However, at the conference of the American Academy of Pediatric Dentistry in 2003, several general principles were established to gauge the validity of behaviour-management techniques:⁶

- effectiveness: the potential of the technique to manage children's behaviour in the dentist's office
- social validity: acceptance of the technique by parents, as well as public perception of the technique
- risks associated with the technique
- cost: time spent practising the technique and cost of any materials and equipment used

These principles allowed us to assess the validity of the live modelling technique used in this study, as follows:

- effectiveness: children who were prepared for dental treatment by live modelling had lower heart rates than children who were prepared by means of the tell-show-do method, even though the tell-show-do method is still considered the technique with which dentists and parents are most comfortable^{6,10}
- social validity: all of the parents selected for modelling were willing to participate in the study (the advantage of active participation has been described in several recent studies^{6,8})
- risk: the risks associated with the behaviour-management technique were reduced to almost zero

- cost: the time taken to explain the modelling method to parents allowed their participation to be optimized.^{6,8} The additional cost of cleaning the work area between patients was minimal compared with the advantages offered by the modelling technique.

Conclusions

Live modelling is a technique worth practising in pediatric dentistry. The model used (e.g., mother or father) and the age of the child represent determining factors in the success of this technique.

Multicentre studies are needed to allow more thorough evaluation of the method at a national scale. Continuing to study and perfect nonpharmacologic techniques for behaviour management will help to fill the need for scientific data supporting this approach within pediatric dentistry.^{6-8,29-32} ♦

THE AUTHORS



Dr. Farhat-McHayleh is head of the department of pediatric and community dentistry, faculty of dentistry, Saint Joseph University, Beirut, Lebanon.



Dr. Harfouche maintains a pediatric dental clinic in Brossard, Quebec.

Prof. Souaid is director of the orthodontic and pediatric program, College of Dentistry, Hazmié, Beirut, Lebanon.

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