

Outcome of Conventional versus Digital Mode of Behaviour Modification with or without Maternal Presence in Paediatric Dental Patients- A Pilot Study

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ABSTRACT

Introduction: In managing paediatric patients most common challenge is to encounter child's fear and anxiety during dental procedures. In modern era smartphone dentist games can be used as a modification of Tell Show Do (TSD) technique.

Aim: To evaluate the effectiveness of different behaviour modification techniques in paediatric patients at first dental visit and to compare conventional techniques: TSD, TSD+maternal presence, Mobile Dental Game (MG) and MG+maternal presence as behaviour modification techniques in preschool children.

Materials and Methods: The present pilot study (a randomised parallel group clinical trial) was conducted in the Department of Paediatric and Preventive Dentistry of Faculty of Dental Sciences, SGT University, Gurugram, Haryana from July 2021 to December 2021 over a period of 6 months in 80 children between the age group of 4 to 6 years with deft (d=decayed, e=extracted due to caries, f=filled, t=teeth) <3 and caries in any primary second molar indicated for Glass Ionomer Cement (GIC) filling, visiting the dentist for the first time. Patient with Frankl behaviour rating score of 1 and 2 accompanied by their mothers with positive dental attitude were included. Patients were equally divided into

four groups. Behaviour was assessed using Frankl behaviour rating scale, Raghavendra, Madhuri, Sujata Pictorial scale (RMS-PS) and Face, Leg, Activity, Cry, Consolability (FLACC) scale before and after treatment. Both intergroup and intragroup statistical analysis was done using student t-test, Chi-square test and one-way ANOVA test for the test of significance.

Results: The mean age of patients in this study was 4.99±0.92 years. The difference between pre and post Frankl behaviour rating score and RMS-PS were statistically significant in all the four groups (p<0.01), whereas difference in pre and post FLACC score was significant in group 2 and 4 (p<0.01). On comparing mean RMS-PS between four groups, significant difference was observed in group 1 and 4 (p<0.01). When mean FLACC score was compared, significant difference was observed between mean scores of group 1 compared to group 2 and Group 4.

Conclusion: In the present study all the behaviour modification techniques showed improvement in child's behaviour but use of digital mode of behaviour management along with maternal presence in paediatric dental operatory had displayed significantly better results.

Keywords: Behaviour rating scale, Mobile application, Preschool children, Smartphone

INTRODUCTION

In managing paediatric patients most common challenge is to encounter child's fear and anxiety during dental procedure. These issues can jeopardise the quality and efficacy of dental care in children and if not dealt properly this fear can be transferred into adulthood leading to avoidance and delays in seeking for dental care. Therefore anxiety management in children is one of the most important factors that can help guarantee a successful care. It is always expected by the parents from a paediatric dentist to deliver quality services in child patients, as compared to a general dentist [1,2].

Effective and efficiently done dental treatment results in favorable outcome even on follow-up visits if behaviour management techniques are used for managing anxious and fearful child. Behaviour guidance techniques are used to alleviate anxiety, nurture a positive dental attitude, and to help provide a high quality oral health care safely and efficiently as suggested by American Academy of Paediatric Dentistry (AAPD) [3]. Today less aggressive behaviour management techniques such as tell-show-do, modelling, distraction etc. are preferred [4]. The TSD is a conventional approach used since years in children as a behaviour management technique in paediatric dentistry. The TSD technique, introduced by Adelman, which is based on the principles of learning theory and is being performed by dentists themselves in the operatory [5,6].

Since smartphones are being very commonly used and technologically advanced, they can be equipped with proper simulation games to act as a new, convenient, and economical way to reduce dental anxiety in children needing dental treatments. Smartphone dentist games can be used as a modification of TSD by demonstrating animated pictures of the use of common dental equipment like airtor, ultrasonic scalers, suction tip, etc. with visual and sound effects, giving the child a first hand experience of their usage, sounds produced, and clinical effects obtained. It acts as an interactive modelling and desensitisation technique as well as active distraction with patient participation. It helps the dentist to easily communicate with the child patient using animated figures in the game [7,8,9].

There is extensive documentation in the literature for the role of parental presence or absence as a behaviour modification technique in managing child patients [10]. One parenting factor consistently found to be associated with child anxiety that plausibly contributes to shaping children's negative behaviour is maternal acceptance. Mother's warm and accepting responses to their child's feelings and behaviours provides an environment that allows children to feel safe and secure, enables children to better tolerate the experience of fear and thus show less avoidance of feared stimuli and situations. Hence, maternal presence in the operatory at child's first dental visit can be used as an effective behaviour modification technique for fearful and anxious child [11,12,13].

For any treatment, whether requiring a single or multiple visit, invasive or non invasive, there is a need to alleviate fear and anxiety at first dental visit to gain child's confidence, so that he/she does not possess a barrier while providing dental services. This was one of its kind study regarding digital motivation in children. Therefore this pilot study aimed to evaluate the effectiveness of four different behavioural modification techniques; TSD as control, TSD with maternal presence, modified TSD i.e. smartphone dental game and modified TSD with maternal presence.

MATERIALS AND METHODS

The present pilot study (a randomised parallel group clinical trial) was conducted in the Department of Paediatric and Preventive Dentistry of Faculty of Dental Sciences, SGT University, Gurugram, Haryana, India, from July 2021 to December 2021 over a period of six months. An informed consent was obtained from the parents of the children participating in the study as per following inclusion and exclusion criteria:-

Inclusion criteria:

- Age group between 4 to 6 years.
- Children with no previous dental experience.
- Children with deft score <3.
- Caries in any primary second molar indicated for GIC restoration.
- No learning disability.
- Patients accompanying their mother.
- Frankl's behaviour rating score of 1 or 2 [14].

Exclusion criteria:

- Children with physical and mental disabilities.
- Children presenting with dental emergencies.
- Parents refusing to provide consent for participation.

Study Procedure

As per inclusion and exclusion criteria, a total of 223 patients were screened, out of which 92 fulfilled the inclusion criteria in this study but 12 parents of children refused to give consent for participation. Therefore, total 80 patients (whose parents consented to participate in the study) were enrolled into four different groups using chit method:

Group 1 (control group): TSD [Table/Fig-1a]

Group 2: TSD with maternal presence [Table/Fig-1b]

Group 3: Mobile MG [Table/Fig-1c]

Group 4: MG with maternal presence [Table/Fig-1d].

A single operator performed the behaviour management technique and dental procedure, while a second investigator monitored and recorded child's behaviour before and after treatment to minimise bias.

Preintervention assessment: An independent investigator observed child's behaviour before intervention using Frankl's behaviour rating scale, Raghavendra, Madhuri, Sujata Pictorial Scale (RMS-PS) and Face, Leg, Activity, Cry, Consolability (FLACC) scale [14-16].

Frankl's behaviour rating scale separates observed behaviours into four categories: definitely negative (1) to definitely positive (4) [14]. RMS-PS comprises a row of five faces ranging from very happy to very unhappy (1 to 5) [15]. FLACC consists of five behavioural categories, facial expression, leg movement, bodily activity, cry, and consolability, each rated on a scale of 0 to 2 to provide a maximum overall pain score of 10. In this study, grading was used as 1- relaxed (0), 2- mild (1-3), 3- moderate (4-6) and 4- severe discomfort (7-10) [16].

Scoring was done for each patient individually by the same investigator before and after the treatment using these three scales. Scoring of Frankl's behaviour rating scale and FLACC scale were based on investigator's assessment of child's behaviour, whereas, for RMS-PS, children were asked to choose the face they feel like



[Table/Fig-1]: a) Group 1-TSD; b) Group 2-TSD with maternal presence; c) Group 3-Mobile Dental Game (MG); d) Group 4-MG with maternal presence.

about themselves at the end of treatment. Treatment was done in his/her first clinical dental procedure.

Intervention: In group 1, TSD technique was used for managing anxious and fearful patients [17]. Patients were told about the procedure to be performed and got familiarised with dental equipment to be used. Then the operator performed restoration exactly as explained and demonstrated to the patients.

In group 2, TSD technique was used along with the passive presence of mother in the operatory during the whole procedure.

In group 3, patients were made to play mobile dental game named Dentist (developed by YovoGames for age 4+) while the operator explained the procedure alongside.

In group 4, mother was allowed to sit in the operatory and behaviour modification was done using mobile dental game.

Favorable outcome meant that the patient was positive or definitely positive, i.e., score 3 or 4 according to Frankl's scale. In RMS-PS happy to normal i.e. 1 to 3 was favorable outcome and in FLACC relaxed to mild discomfort was taken as favorable outcome.

STATISTICAL ANALYSIS

The data collected was entered into Microsoft Excel and then transferred to Statistical Analysis for the Social Sciences (SPSS) version 20.0. Categorical data was presented in the form of proportion. Both intergroup and intragroup statistical analysis was done using student t-test, Chi-square test and one-way Analysis of Variance (ANOVA) test for the test of significance. All the statistical tests were performed at 5% significance level.

RESULTS

A total of 80 patients, meeting the inclusion criteria, were evaluated in this study with a mean age of 4.99 ± 0.92 years. Demographic details of the sample is given in [Table/Fig-2]. No significant difference was found between the four groups in terms of mean age, mean deft score and gender distribution (p -value >0.05). The mean operating time in ascending order was, group 4 (14 minutes) < group 3 (15 minutes) = group 2 (15 minutes) < group 1 (18 minutes). Group 1 was most difficult to manage.

Demographic characteristics	Group 1	Group 2	Group 3	Group 4	p-value
Mean age (years)	4.7±0.65	4.9±0.71	5±0.79	4.8±0.76	0.607
Mean deft	2.2±0.61	2.3±0.65	2±0.65	2.2±0.76	0.557
Gender					
Male (n=50)	12	13	13	12	0.99
Females (n=30)	8	7	7	8	

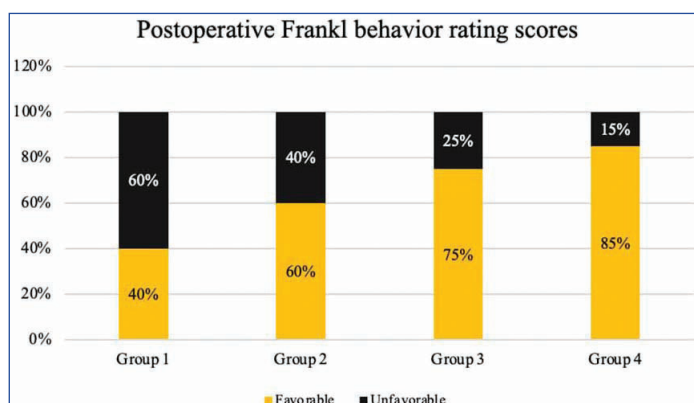
[Table/Fig-2]: Demographic data distribution of mean age, deft and gender distribution. p-value for mean age and mean deft: one-way ANOVA p-value for gender distribution: Chi-square test

Intragroup comparison of pre and post mean values of Frankl score, RMS-PS and FLACC score in group 1, 2, 3 and 4:

a. Analysis of mean Frankl behaviour rating score: On intragroup comparison of mean Frankl behaviour rating score, significant improvement was observed in behaviour of patients in all four groups (p<0.001) after treatment completion according to student's paired t-test [Table/Fig-3,4].

Groups	Mean Frankl behaviour rating score		p-value
	Pretreatment	Post-treatment	
Group 1	1.8±0.04	2.4±0.50	0.0002
Group 2	1.8±0.01	2.6±0.50	<0.0001
Group 3	1.9±0.01	3±0.65	<0.0001
Group 4	1.6±0.50	3.2±0.41	<0.01

[Table/Fig-3]: Intragroup comparison of mean Frankl behaviour rating scores. Student's paired t-test p-value <0.05 considered significant



[Table/Fig-4]: Bar diagram representing percentage of patients showing favorable and unfavorable postoperative Frankl behaviour rating scores.

No significant difference was found between percentages of males and females showing post-treatment positive behaviour (p-value: group 1-0.66, group 2-0.56, group 3-0.65, group 4-0.42) [Table/Fig-5].

Groups	Frankl's behaviour rating scale		p-value
	Male (%)	Female (%)	
Group 1	41%	37.5%	0.66
Group 2	61%	57%	0.56
Group 3	69%	66%	0.65
Group 4	83%	87%	0.42

[Table/Fig-5]: Percentage of males and females showing favorable postoperative Frankl's behaviour rating scores using Chi-square test.

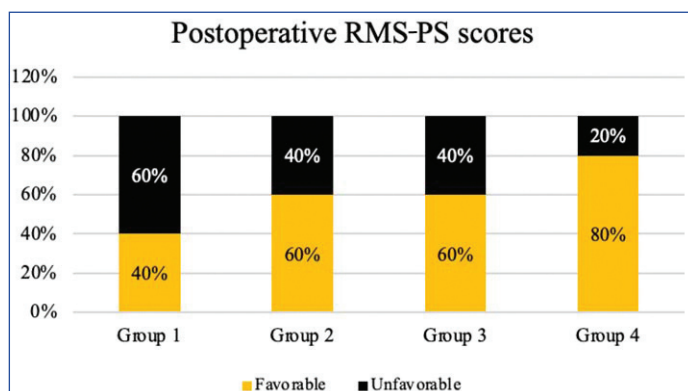
b. Analysis of mean RMS-PS: Comparison of pre and post-treatment mean RMS-PS scores of the four groups is shown in [Table/Fig-6]. Significant difference was observed in pre and post-treatment mean RMS-PS scores in all the four groups [Table/Fig-6,7].

c. Analysis of mean FLACC scores: Statistically significant difference was observed in pre and post-treatment scores

of group 2 and group 4 according to paired student's t-test [Table/Fig-8,9].

Groups	Mean RMS-PS values		p-value
	Pretreatment	Post-treatment	
Group 1	4.4±0.50	3.6 ±1.046	0.01
Group 2	4.2±0.41	3±0.917	<0.01
Group 3	4±0.65	3±1.00	<0.01
Group 4	4.4±0.50	2.8±0.77	<0.01

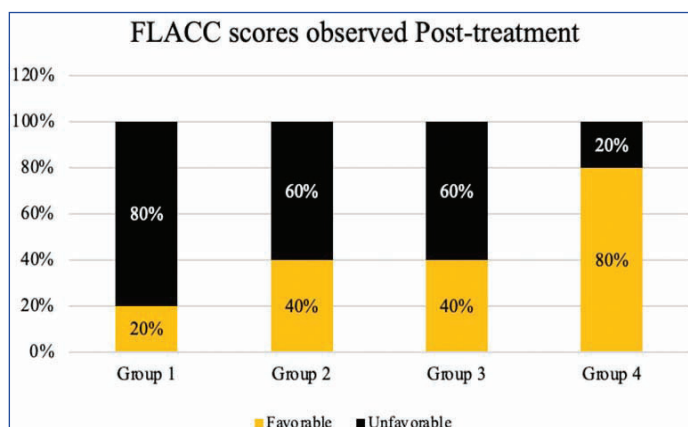
[Table/Fig-6]: Intragroup comparison of mean RMS-PS scores. Student's paired t-test; p-value <0.05 considered significant



[Table/Fig-7]: Bar diagram representing percentage of people showing favorable and unfavorable postoperative RMS PS scores.

Groups	Mean FLACC values		p-value
	Pretreatment	Post-treatment	
Group 1	3±0.40	2.4±0.82	0.34
Group 2	3±0.51	1.9±0.77	<0.01
Group 3	3±0.61	2±0.917	0.11
Group 4	3±0.01	1.4±1.046	<0.01

[Table/Fig-8]: Intragroup comparison of mean FLACC scores. Student's paired t-test; p-value <0.05 considered significant



[Table/Fig-9]: Bar diagram representing percentage of patients showing favorable and unfavorable FLACC scores post-treatment.

Intergroup comparison of postoperative mean Frankl score, RMS-PS and FLACC score: One-way ANOVA was used for intergroup comparison [Table/Fig-10]. No significant difference was seen in mean Frankl behaviour rating score when group 1 and group 2 were compared with group 3 and 4 individually. For mean RMS-PS, significant difference was only seen between group 1 and group 4. When mean FLACC score was compared, significant difference was observed between mean scores of group 1 compared to group 2 and group 4.

DISCUSSION

The behaviour management of an anxious child patients is an integral part of paediatric dental practice. Various behaviour modification

Groups	Frankl's behaviour rating score (p-value)	RMS-PS score (p-value)	FLACC score (p-value)
Group 1:2	0.21	0.06	0.05
Group 1:3	<0.01	0.07	0.15
Group 1:4	<0.01	<0.01	<0.01
Group 2:3	0.03	0.97	0.46
Group 2:4	<0.01	0.45	0.17
Group 3:4	0.25	0.48	0.06

[Table/Fig-10]: The p-value for intergroup comparison of Frankl's behaviour rating score, RMS-PS score and FLACC score using. One-way ANOVA test; p-value <0.05 considered significant

techniques are used to establish communication, alleviate fear and anxiety, build a trusting relationship between dentist, child, and parent, and promote the child's positive attitude towards oral healthcare to facilitate delivery of quality dental care [18].

The dentist must have a basic understanding of the cognitive development of the child. Establishment of communication and implementation of proper behaviour guidance technique, according to patient's developmental status, are important to obtain desired behaviour outcome. Children in the age group of 4-6 years are ideal for testing behaviour modification techniques, as they are in the stage of developing vocabulary, attention and concentration. They tend to understand the verbal commands and respond to the behaviour modification techniques in an accurate manner [19].

Also, for a preschool aged child, attachment and separation anxiety often play an important role [20]. According to Olsen NH, one should avoid separation of the child from parents during their initial visits as their presence may help in the prediction of future child's behaviour [20]. On the other hand, according to Feigal RJ, parent may exhibit anxiety and their presence may complicate communication with the child [21]. According to a theoretical model warm and accepting responses to a child's negative internal experiences, on the part of the mother, reduce the behavioural impact of negative experiences and hence leading to less avoidance behaviour by the child [11]. Hence, in the present study presence of mothers with positive dental attitude in the operatory was used as one of the behaviour management technique in children with age of 4-6 years.

Again, concept of developing intelligence is applicable to this learning stage of 4-6 years, where child's cooperative behaviour can be achieved by making them understand about new dental equipment and procedure. TSD approach is widely used by dentists to alleviate fear and anxiety in children related to new dental instruments and procedures. It is a behaviour guidance technique that involves communication and education, which ultimately builds trust and alleviates fear and anxiety. Closely aligned with desensitisation, this is a method of introducing child patients to a procedure in a stepwise fashion [5,6,22].

In recent scenario of Coronavirus disease-2019 (COVID-19), where most of the activities of children are on an online platform, mobile dental games can be used to increase patient's acceptability towards dental procedures. Mobile dental games serve as a versatile behaviour modification technique as it acts as a modification of TSD technique and helps in desensitisation and distraction of child patients [23]. It also gives a sense of authority, as patient himself perform dental procedures on animated characters in the game, building confidence and decreasing the feeling of fear and anxiety [24]. According to Radhakrishna S et al., effective handling of patients during the procedure was observed when mobile dental game was used as a behaviour modification technique [25]. In a study conducted by Elicherla SR et al., a significant reduction in heart rate was observed in children with dental application group when compared to TSD group indicating reduced anxiety [26].

In the present study, as discussed above, all these factors were emphasised, i.e. maternal presence, TSD and mobile dental game,

to analyse the best possible way to manage uncooperative children in the age group of 4-6 years, so that, acceptability of these children can be enhanced who otherwise are left untreated by general dentists leading to progression of complications in oral health. In the present study, children with Frankl negative or definitely negative behaviour were included. The Frankl behaviour rating scale is commonly used by researchers to study the child's behaviour toward different variables. According to a study conducted by Asokan S et al., the sensitivity and specificity scores were 93.4% and 62.5% for Frankl's behaviour rating scale [27]. Another scale used in the study was FLACC scale which has shown excellent sensitivity (98%) and good specificity (88%) in a study conducted by Bai J et al., [28]. A new anxiety rating scale was introduced by Shetty RM et al., called the RMS-PS scale [29]. RMS-PS has shown strong correlation with Venham Picture Test (VPT), hence it can be used as a valid scale to assess child's dental anxiety. This scale was chosen as it is easy for the child patients, takes very short time and patients can relate better to the child's facial expressions used in the scale [29].

In the present study, all the four groups showed improvement in child's behaviour according to Frankl behaviour rating scale. Significant number of patients in group 3 (75%) and group 4 (85%) showed positive behaviour when compared to group 1 (40%). Which means, mobile dental game alone and along with maternal presence helped patients to cope up with anxiety and fear related to new dental environment and equipment. Similar results were obtained in a study conducted by Radhakrishna S et al., with 85% of the patients showing positive behaviour after playing smartphone dentist game [25].

According to RMS-PS, significant improvement was observed in post-treatment scores of group 2, and 4. Similarly, the pretreatment and post-treatment mean FLACC scores in group 2 and group 4 showed significant difference. Patients in group 4 (80%) showed significantly better results in relation to group 1 whereas group 3 (40%) showed insignificant improvement.

In the present study mobile dental game showed better results compared to conventional TSD technique. Smartphone dental game simulate various dental procedures to the child patient and are far superior to the TSD technique in reducing anxiety and in managing the child effectively [30]. Patil VH et al., conducted a study on 60 children who were made to use a mobile dental application [30]. The results were found to be highly significant; 1.67% from definitely negative to negative 86.67% of patients turned from a negative to positive behaviour, 11.67% from positive to definitely positive, and according to Frankl's behaviour rating scale.

Another observation in the study was that presence of mother in the operatory significantly improved child's behaviour. In a study conducted by Pani SC et al., parental presence resulted in significantly lower heart rates suggesting that the presence of the parent calms the child and is a form of reassurance [31]. According to another study conducted by Vasiliki B et al., paediatric dentist's rating, children's behaviour was worse when the parent was absent [32].

In this study, patients with TSD along with maternal presence showed better results than TSD alone, similarly, patients with MG along with maternal presence showed better results than MG alone. Patients in control group (group 1 i.e TSD) showed least improvement in their behaviour at the end of treatment.

Limitation(s)

As this study was a pilot study with small sample size, studies with large sample size and age defined dental game applications need to be developed. Level of understanding of the child regarding mobile game application depends upon his daily use of gadgets. This factor was not considered in the present study.

CONCLUSION(S)

Behaviour guidance of fearful and anxious paediatric patients at their first dental visit is a keystone for their future dental appointments and

maintenance of oral health. In the present study all the behaviour modification techniques showed improvement in child's behaviour but use of digital mode of behaviour management along with maternal presence in paediatric dental operatory had shown significantly better results than other techniques. Hence, for preschool children, digital modification of TSD technique i.e. mobile dental game, can be used along with emotional support from mother as a behaviour modification technique.

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