Assessment of Dental Anxiety Reduction Through an Interactive Game App for Children: A Randomized Controlled Trial

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ABSTRACT

BACKGROUND: Children are very anxious awaiting a dental appointment because of the inborn fear in them or the fear evoked by their peer group. In today's world cognitive development is much improved in young children as they are more used to mobile gadgets at a very younger age. As a result, child behaviour can be guided by the use of dental applications prior to the dental treatment as part of behaviour guidance by distraction.

AIM: To evaluate the effect of anticipatory guidance on dental anxiety in a dental clinic through a dental treatment game app.

MATERIALS ANDS METHODS: A randomized control trial was done among 100 children in the age group 6 to 9 years who underwent dental restoration were included for this study. Children were randomly divided into two groups i.e.; group I- Study group and group II – Control group. Dental anxiety was evaluated using venham pictorial scale and faces anxiety rating scale and children behaviour was assessed using wright behaviour rating scale in both the groups. Chi square test was used to evaluate the differences in mean pain scores between the groups.

RESULTS: Statistical analysis of the measurements were made using chi square test showed that children who were exposed to the dentist treatment showed significantly less dental anxiety ($p < 0.05$) in comparison with control group.

CONCLUSION: Educating the child prior to a dental procedure using a smartphone application using the mobile dental app was an innovative technique to reduce the anticipatory dental anxiety in pediatric patients. Within the limitations of the study, it can be concluded that mobile dental apps can be used for providing anticipatory guidance to parents and children before treatment.

KEYWORDS: *Anticipatory guidance; First dental visit; Dental anxiety.*

INTRODUCTION

Children's dental anxiety is a natural developing emotion expected duo to meeting unfamiliar adults, strange sounds, and tastes, having to lie down and even pain. After the age 6, children acquire abilities in adjustments, independence and self-control. Some children have severe dental anxiety resulting in interruption of the dental treatment process which possibly continues to adulthood. As mentioned in the previous literature even if the operative dentistry may be perfect, the appointment is a failure if a child departs in tears. This was the first scenario where it was mentioned in literature where behavior guidance of a child was given utmost importance rather than technical excellence with the view of the emotional and cognitive involvement of the child during treatment.[1] Dental treatment for children and adolescents is openly viewed as an unpleasant experience in our society. Dental fear and anxiety associated with dental treatment are well recognized factors and have a negative impact on a patient's willingness to get dental treatment.[2] The pediatric patient with his/her first visit to the dentist are usually anxious and apprehensive because of dental equipment and the newness of the experience. Fear of pain and especially the fear of dental and other injections are a common concern amongst dental phobias. Majority of the children with high anticipatory anxiety and expectation of significant pain have been found to over-predict the degree of pain and anxiety they will suffer. If the discrepancy between anticipated and actual discomfort is reduced then the patient's confidence has been shown to increase.[3] Audiovisual distraction combines both the visual and auditory components, which are placed in front of the children's eyes and aimed at reducing visual and auditory interference from the sound and sight of the dental operating environment. During the course of dental treatment, children are exposed to a two- or three-dimensional environment. Dental app has playful anticipation situation video, embedded on an application-type digital platform, which will reduce children's anxiety before dental restorative procedures. By using a dental application which is superior to traditional distraction methods, as it is not only more engaging due to the visual effect of the project images directly in front of the user's eyes, but it also has the capability to block real-world visual and auditory stimuli.[4] So, the aim of my study is to evaluate the child's behavior in dental clinic with anticipatory guidance through dental game app.

MATERIALS AND METHODS

The randomized control parallel-arm design study with a uniform allocation ratio of 1:1. Was started after clearance for the trial given by the Institutional Ethical Review Committee (SDC/IECC/PEDO/12-18/13) and study was conducted on 100 children of age group 6 to 9 years who attended Dept of Pedodontics & Preventive Dentistry, Saveetha Dental College & Hospital, Chennai on their first dental visit, who were well oriented to time and place were selected for the study. After getting approval from the institutional ethical committee of Saveetha Dental College & Hospital, Chennai, India and an informed consent was obtained from the patient's parents along with a brief dental and medical history of the patient. This study was conducted following the consort guidelines for the randomized control trials.

SELECTION CRITERIA

100 hundred children who visited the clinic of the Department of Pedodontics and Preventive Dentistry were selected randomly on the basis of block randomization for the study. The children included in this trial were not aware of the type of educational intervention they were going to receive. To prevent selection bias, the size and order of the blocks were also blinded.

SAMPLE SIZE CALCULATION

The sample size was calculated according to the formula
$n = (4 \times 2S^2) \div d^2$.
The confidence was 0.95, the probability was 0.05, and a sample size of 100 was obtained.

INCLUSION CRITERIA

- All subjects attending their first dental visit.
- Children aged between 6-9 years who require dental prophylaxis and one restoration for a carious tooth in mandibular arch which require cavity preparation.
- Children accompanied by parents only and willing for informed consent.
- Parents from all sociodemographic status.

EXCLUSION CRITERIA

- Children who had previous dental treatment
- Children who had significant behavioural management problems.
- Children who suffered any debilitating or systemic disease.
- Children who had previous negative dental experience and
- Medically, mentally and physically compromised children.
- Children not accompanied by parents and not willing for a informed consent form.

The children of both age groups were randomly divided into two subgroups, with 50 patients in each age group, as follows:
Gp1: Study group (n=50)
Gp2: Control group (n=50)
The children in the study group listened, viewed and played the dentist bling app before the treatment procedures during all the visits respectively. “Dentist bling app” is an application developed by Crazy labs Ltd. available on the Google Play Store and App Store, respectively. It can be used for playfully educating children about treatment dental procedures such as prophylactic cleanings, pit and fissure sealants, restorations, and extractions. It also explains the importance of oral hygiene maintenance through emphasize on tooth brushing.
The children in the control group no dentist app was showed them just routine screening checkup was done. Every child in the study and control groups was assessed in the first dental visits for following dental procedures; Screening or diagnosis was done, Cavity preparation without the need of administration of local anesthesia. Child anxiety level in each visit was assessed by using behavior means of anxiety measuring parameters before and after treatment in both study and control groups comprised of:

1. Clinical anxiety rating scale (VPT and Faces anxiety rating scale)
2. Wright behavioral rating scale.

During the procedure, the child's behaviour was assessed by single examiner other than operator who was trained in the use of wright behaviour assessment scale. To access the behavioral means each child patient was video captured on every visit. The video was made after making the child sit on the dental chair either for diagnosis or treatment till the completion of the procedure. Ratings of these parameters were assessed by an independent investigator after reviewing the videotapes recorded of the visits by using five-point rating scales, the scores ranged from 0 to 4 and the investigator was blinded to the distraction dental app used, the dentist bling app. For all dental procedures, proper aseptic protocol was followed for

prophylactic and restorative procedure. If the tooth was indicated for restorative procedure proper isolation was done by rubber dam or cotton rolls depending on the cooperation of the patient.

RESULTS:

This prospective controlled randomized experimental study organized in two groups. The aim was to show playful anticipation treatment situation videos to children, embedded on an application-type digital platform (app), to reduce children's anticipatory dental anxiety. The study explored the effect of anticipatory guidance through dental treatment app and its influence on between children's dental fear and anxiety and a variety of related factors. The results showed that DFA was quite common an issue reported by around one third (73%) of children. The mobile dental app was found to be very useful in the dental setup to reduce the fear and anxiety of the pediatric dental patients. On comparing the patient who weren't exposed to the dental app the patients who used dental app showed more enthusiasm and co-operation. The difference between the control group and test group where the patients who used dental app by using the venham pictorial test and faces scale were statistically significant.

Paired Samples Statistics

Group	Scales	Mean ±SD
Test group	VPT before	2.42±0.071
	VPT after	1.62±0.725
	FACES before	4.32±0.471
	FACES after	1.44±0.501
Control group	VPT before	2.64±0.485
	VPT after	2.46±0.503
	FACES before	4.42±0.499
	FACES after	4.00±0.857

Table 1

Table 1 shows the paired samples Pair 1 Test group before and after venham pictorial test; Pair 2 Test group before and after Faces anxiety rating scale; Pair 3 Control group before and after venham pictorial test; Pair 4 Control group before and after Faces anxiety rating scale The paired sample mean for test group in venham pictorial test before is 2.42 and after is 1.62; in faces anxiety rating scale in test group before is 4.32 and after is 1.44 and for control group in venham pictorial test before is 2.62 and after is 2.46; in faces anxiety rating scale in test group before is 4.42 and after is 4.00. The standard deviation of test group Venham pictorial test before is 0.499 and after is 0.725, Faces anxiety rating scale before is 0.471 and after is 0.501; control group Venham pictorial test before is 0.485 and after is 0.503, Faces anxiety rating scale before is 0.499 and after is 0.857. The standard error of mean of test group Venham pictorial test before is 0.071 and after is 0.103, Faces anxiety rating scale before is 0.067 and after is 0.071; control group venham pictorial test before is 0.069 and after is 0.071, Faces anxiety rating scale before is 0.071 and after is 0.121.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Test Group VPT BEFORE & AFTER	50	-.001	.994
Pair 2	Test Group FACES BEFORE & AFTER	50	.169	.240
Pair 3	Control Group VPT BEFORE & AFTER	50	-.060	.678
Pair 4	Control Group FACES BEFORE & AFTER	50	.096	.509

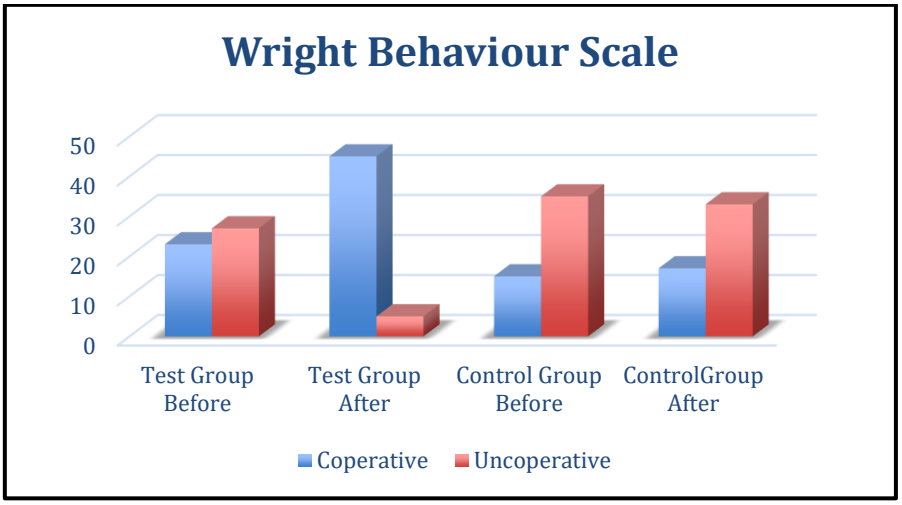
Table 2

Table 2 shows the correlation of the venham pictorial test before and after the in the test and control group show a negative correlation compared to the control group and in the faces anxiety rating scale before and after the in the test and control group show a mild correlation compared to the control group.

Group	Scales	Mean ±SD	P Value (0.05)
Test group	VPT before & after	0.800±0.881	0.00
	FACES before & after	2.880±0.627	0.00
Control group	VPT before & after	0.180±0.720	0.083
	FACES before & after	0.420±0.950	0.003

Table 3

Table 3 shows the statistically significance of the results of the venham pictorial test before and after use of the dental treatment app in the test group compared to the control group and in the faces anxiety rating scale shows a statistically significant result in the test group compared to the control group.



Graph 1

Graph 1 shows the wright behaviour scale in the test and control group before and after the use of the dental bling app.

OUTCOMES MEASURED:

The primary outcome assessed the influence of the Dentist Bling app on anticipatory dental anxiety using the Venham Pictorial Scale and the Faces Anxiety Rating Scale, while the secondary outcome evaluated the effect of the app on children's behavior using the Wright Behavior Rating Scale.

DISCUSSION:

Anticipatory guidance is a proactive counselling technique of delivering the information of what is to be expected and brace for the same. Children who are visiting a dentist for the first time often exhibit poor behavior at their appointment. Anxiety during dental treatment can hamper the effective delivery of oral care since it can manifest in diverse ways, often as disruptive or interruptive behaviors. The emotional quality of the first dental visit can have more effect on anxiety than the number of previous visits, since positive dental experiences may lead to less apprehension at future visits.[5] In the world of booming Smartphone market, India is the third largest in end users. Research has shown that, in India, the frequency of mobile phone use was 68.6% and the rate of use by children was 56.6%. Rates also show that around 40% of children aged 10 years use a smartphone and this number increases gradually with age. The World Health Organization has proposed the new term mobile Health, which is a component of Health, and defined as “medical and public health practice strengthened by mobile devices, such as mobile phones, patient monitoring devices and personal digital assistants”. Therefore, healthcare professionals have been discovering novel ways of providing services and teaching patients using mobile applications designed for use in dental fields. These applications can be used to reduce patients’ anxiety by educating patients about dental treatment and encouraging them to appropriately cope with the treatment.[6]

In the present study dental bling treatment app demonstrated the effectiveness of an app in decreasing dental anxiety in dental environments. In this sense, similar studies which has

shown that the follow-up and feedback features of the apps for dental health can facilitate dental care to users from different ages and, especially, patients with special needs.

The possible negative impact of dental anxiety on children cognitive development, including mental, oral, and general health the utilization of the app "Dentist Bling!" Has a strong potential in the pediatric dentist field for reducing the anticipatory dental anxiety in children. Children usually have anticipation of potentially fear-inducing situations, including dental ones, by showing the child to play with treatment app it will help to decrease anxiety and help build a positive behaviour guidance which paves way for a better oral health in them in future.

In this study, the anticipatory anxiety of potentially fear-inducing situations by waiting in the dental reception with the parent, including noises of procedures influence the children behaviour management technique, which in turn the oral health care outcomes. The use of this dental app virtual tools decreases the levels of dental anxiety in children through anticipation of dental situations were found. This demonstrates the unprecedentedness and relevance of the application "Dentist Bling app." As it creates a fun situation wherein children become enthusiastic to participate and see dental treatment as game rather than feeling anxious. Similar to the studies done by Qari et al where also the influence of dental app.[7]

In this study similar to the scientific literature which has shown that children respond well to anticipation of procedures that cause some level of anxiety dentist bling app reduced the dental anxiety in children undergoing procedure.[8]

Due to the limited availability of information regarding the use of gadgets in the reduction of dental anxiety, this study was conducted to assess the effect of software applications to reduce anxiety during a child's first dental visit as children are more exposed to gadgets at an earlier age itself. All the children who participated in the present study exhibited anxiety since they did not have any prior information to dental treatment for various reasons. One of the significant reasons could have been exposure to another child or a relative who had an unpleasant dental experience.[9]

Health-related apps and wearable technology are revolutionizing health and healthcare for patients with regards to dental anxiety, apps provide patient information combined with psychological techniques prior to the procedure. Apps related to many aspects of general health are already widely available, but the volume of available apps is vastly outgrowing still relevant to dental care with sufficient information for the public with good efficacy are less. A recent systematic analysis of commercially available apps aiming to psychologically prepare patients for medical procedures identified five apps, however none had any evidence to support their efficacy.[10] Only one of these apps targeted children with upcoming medical and dental procedures, aiming to reduce anxiety and improve recovery via a mixture of hypnosis, breathing exercises and guided imagery. Dentist bling app is a dentist app currently available in the India app store.
A significant reduction in dental anxiety was elicited only for the children in the dental app group, which indicates the cognitive influence of software application on the child. This reduction of anticipatory anxiety can be attributed to exposure to the procedure in an interactive, joyful, and playful manner through the dental app called "Dentist bling app." Another important aspect that may have aided in the reduction of anxiety could have been exposure to the procedure process and the noise of the procedure during the virtual cognitive simulation. Similar results were obtained in studies conducted by Elicherla et al.[11,12,13]

Future studies can be focused on developing newer applications in the form of games, puzzles and adventure tasks which helps young children to overcome the dental fear, anticipatory anxiety and provide a joyous environment wherein a better behaviour guidance can be easily achieved.[14,15,16]

Prevention of dental fear and anxiety by pre appointment parental counselling method an excellent method for managing very anxious children[17]. Studies in mice have proven that fear and anxiety can be managed by inducing LPS administration in mice and rats induces an anxiety-like behaviour on EPM.[18] Despite being a reliable and useful test to assess anxiogenic- or anxiolytic-like behaviour induced by drug treatment, due to the difficulties listed above as to assessing the behaviour analysis of ill animals, it is proposed that the fear and anxiety test in animals should be used with other ethological tools.[19]

Within the limitations of the study, the mobile dental app as a distraction was found to be very effective in reducing the anticipatory dental fear and anxiety in children.

1. Audio-visual distraction techniques based on treatment app software platform provided effective distraction perform better than audio distraction aids.[17,18,19]
2. Software app platform based audiovisual distraction aids performed better than audio and audiovisual distraction techniques in reducing dental fear and anxiety in both the groups as depicted by VPT and Faces anxiety rating scale. However, maximum clinical anxiety/fear reduction was found in the dentist bling app group followed by the control group.
3. In the test groups a significant effect of reduction of anticipatory dental anxiety, uncooperative behavior was noted. Moreover, according to our study we found that the cooperation level of patients improved significantly in test group as the type of procedure which has to be carried out was familiar to them rather than the control group where it was unfamiliar to them.

CONCLUSION

From the results of the present study, educating a child using a dental app is an effective method to alleviate the anticipatory anxiety during their first dental visit and is worth utilizing in pediatric dentistry for better behaviour guidance.

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CONFLICT OF INTEREST

The authors declare no conflict of interest regarding this study.

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