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Original Research

Effect of an innovative relaxation technique on dental anxiety among 8- to 11-year-olds during infiltrative anesthetic procedures: a randomized control trial

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ABSTRACT

BACKGROUND: Dental procedures especially involving local anesthesia have ranked highest in anxiety as the anaesthetic needle's appearance and feel are the most fear-eliciting stimuli in children.

AIM: To evaluate the efficacy of an innovative reframing behaviour management technique by the combination of breathing and foot rotation in reducing dental fear.

METHOD: In this randomized control trial, 50 children aged 8- 11 years of age, requiring local anesthesia in the maxillary arch and also based on inclusion criteria were selected. Subjects were divided by using the flip of the coin method of randomization. Children in the test group were taught to carry out deep breathing and simultaneous foot rotation in which the right foot was rotated clockwise and the left foot in an anticlockwise direction. The exercises were asked to be performed while the local anesthesia was injected. No exercises were performed in the control group. CFSS-DS scale was used as a tool and children fearful of injection were included. Pulse rate and SPO2 were used as physiologic parameters while the FLACC scale was used to analyze fear.

RESULT: In our study which included both subjective and objective recordings of anxiety during anesthesia statistically significant variation between the two groups was observed. The FLACC score and pulse rate showed a statistically significant difference (p-value <0.05) in the intervention group. There was a marked reduction in fear of injections after the treatment in the case group.

CONCLUSION: Within the limitations of the study, the innovative exercise reduced anxiety in children during anesthetic procedures and can be used as an alternative behaviour management strategy.

***Keywords:** Behavior management, Dental anxiety, Distraction technique, Reframing.*

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INTRODUCTION

Children often envision dental office as an anxiety triggering environment, it is combined by subjective, objective fear, invasive contact in mouth and thus related to a probability of pain.[1] Anxiety associated nearly every child has the habit of thinking about going to the dentist. For children, dental treatments that require the injection of local anaesthetic are a major source of anxiety. The main fear-inducing cues for children undergoing dental treatment have been reported to be the sight and feel of the anaesthetic needle.[2] As paediatric dentist it becomes mandatory to understand that higher levels of anxiety are associated with increased pain perception as a result of the innate propensity to concentrate on the discomfort; hence, behaviour management strategies must address the significant and enduring effects of dental anxiety. Nevertheless, if patients are not managed appropriately, it is quite possible that a vicious cycle of dental fear comes into play.[3] Hence, a successful paediatric practice is fundamentally mastering child's fear and anxiety so as to deliver flawless treatment and instilling a positive attitude towards future dental care. In order to manage fear of injection we need to understand extortionate anxiety happen if the child has been previously sensitized with the pairing of fear and pain during previous injection procedures due to classical conditioning. So unpairing strategies to undo previous stimuli can be a great behaviour management move. Procedural pain and anxiety reduction has been managed by cognitive behavioural techniques such as distraction, relaxation strategies, and coping mechanisms.

MATERIALS AND METHODS

The study was initiated after obtaining clearance from the institutional ethical committee of KVG Dental College, Sullia, Karnataka, India. Samples were collected according to inclusion criteria from the outpatient Department of Pedodontics and Preventive Dentistry. A simple random method of sampling was considered for the present study. Parents were informed about the study and written consent was obtained from them. A questionnaire form of Children's Fear Survey Schedule dental subscale (CFSS ‑ DS) was given to the patients and accordingly, children who were most fearful of injections (with a score of 4 or 5) were included in the study. The pulse rate and oxygen saturation of the child were noted as a physiologic parameter before any intervention. The respiratory rate of the child was not considered as deep breathing is known to cause a spike in the heart rate.2 Children were divided into two groups according to flip of the coin method. A double-blinded study was conducted. The patients were allocated by an observer in the respective groups without the knowledge of the dentist and the child. Flip of coins with heads were included in the Case group and tails in the control group. Children in the test group were taught an innovative relaxation technique. All the children were taught the exercise for 10 minutes before the procedure was carried out. In this technique, patients were taught to carry out deep breathing and simultaneous feet rotation movement in which the right foot was rotated clockwise and the left foot was rotated in an anticlockwise direction. This technique worked on the principle of distraction and relaxation. Nonetheless, the deep breathing practice was given through play. To ensure a precise replication of the activity, active parent engagement was also urged. The exercises were asked to be performed while the local anesthesia was injected. 0.8 ml of local infiltration anesthesia was injected in the mesiobuccal fold of the maxillary arch.

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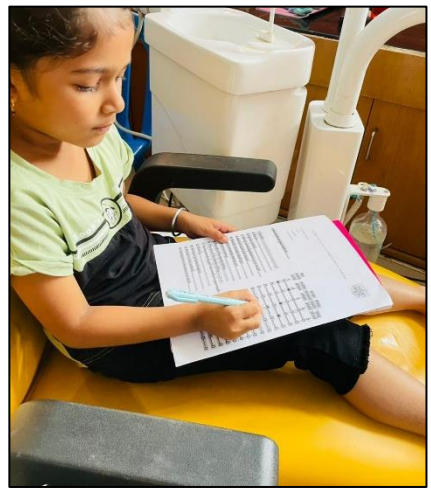

Figure 1: Patient interpretation of the anxiety - case group

For children who were in the control group (Group B) no exercise was asked to perform. In the control group, 0.8 ml of local infiltration anesthesia was injected in the muccobuccal fold of the maxillary arch. While the local anesthesia was injected FLACC scale was used to assess the change in expression of the face, jerking of legs or normally placed legs, movement of the child, and if the child cried or was awake or silent in both the intervention as well as a control group. During the procedure again the pulse rate and oxygen saturation of the child were recorded using a pulse oximeter. After the administration of local anesthesia, the pulse rate and oxygen saturation were noted. The children were again given the CFSS-DS forms to fill out to assess the post-fear level in both groups. The readings were noted and entered in the Excel spreadsheet. The data was statistically analyzed.

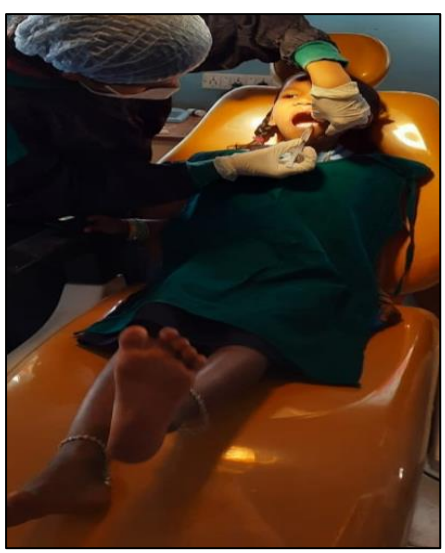

Figure 2: Subject performing the Exercise during the administration of local anesthesia in the case group

Figure 3: administration of local anesthesia in the control group

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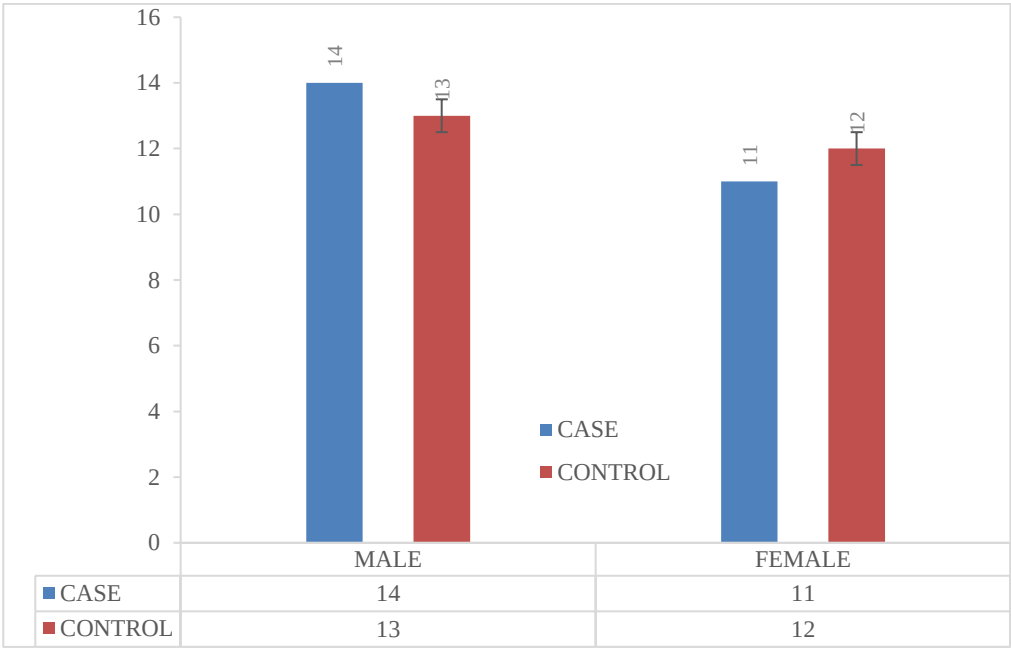
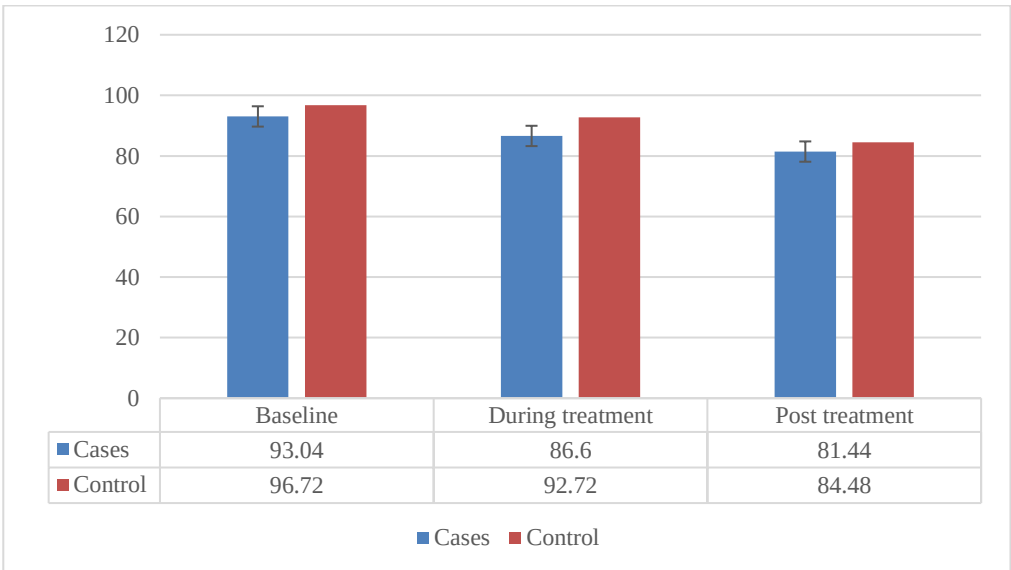
RESULTS

This study was a randomised control trial that evaluated the effectiveness of an innovative relaxation technique during infiltrative anesthetic technique in the maxillary arch. Data were collected and processed using Excel. The statistical analysis was done using a t-test to compare the effectiveness of innovative exercise in both the case and control groups. Group comparison was done using ANOVA and verified using Tukey HSD tests.



	MALE	FEMALE
CASE	14	11
CONTROL	13	12

Graph 1: Gender distribution



	Baseline	During treatment	Post treatment
Cases	93.04	86.6	81.44
Control	96.72	92.72	84.48

Graph 2: Comparison of pulse rate in cases and controls

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	GROUP	N	Mean	Std. Deviation	Std. Error Mean
Age	Case	25	9.480	1.1225	0.2245
	Controls	25	9.480	1.1225	0.2245
Pulse rate pre	Case	25	93.04	14.220	2.844
	Controls	25	96.72	12.074	2.415
FLACC pre	Case	25	1.32	0.476	0.095
	Controls	25	1.36	0.490	0.098
Oxygen saturation	Case	25	97.96	0.978	0.196
	Controls	25	97.88	1.054	0.211
CBFSS-DS	Case	25	28.60	2.236	0.447
	Controls	25	29.40	2.236	0.447

Table 1: shows the comparison of parameters at the base. The mean age of both cases and controls was 9.480 +\- 1.1225. The mean pulse rate in cases is 93.04 +/- 14.220 and controls is 96.72 +/-12.074. The mean FLACC scale score in cases is 1.32 +/- 0.476 and in controls is 1.36 +/- .490. Mean oxygen saturation in cases is 97.96 +/- 0.978 and controls is 97.88 +/- 1.054. The mean p-value is 0.02

Group Statistics					
	Group	**n**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Pulse rate	Case	25	86.60	8.302	1.660
	Controls	25	92.72	14.108	2.822
FLACC score	Case	25	.12	.332	.066
	Controls	25	.68	.627	.125
Oxygen_saturation_during	Case	25	98.28	.737	.147
	Controls	25	97.64	.907	.181

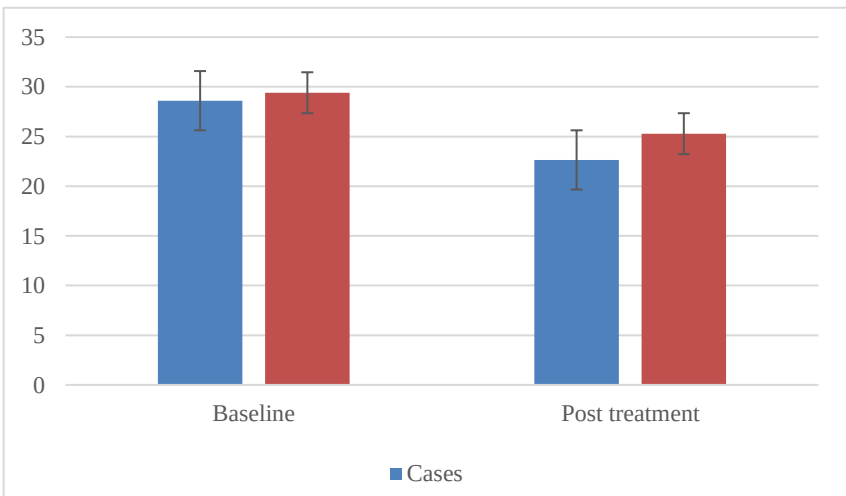
Table 2: shows the comparison of parameters during treatment. Mean pulse rate in cases is 86.60 +/- 8.302 and controls is 92.72 +/- 14.108. Mean FLACC scores in cases is 0.12 +/- 0.332 and controls is 0.68 +/- .627. Mean oxygen saturation in cases is 98.28 +/- 0.737 and controls is 97.64 +/- 0.907. The mean p-value is 0.015.

Group Statistics					
	GROUP	N	Mean	Std. Deviation	Std. Error Mean
PR_post	Case	25	81.44	9.527	1.905
	Controls	25	84.48	12.080	2.416
FLACC_post	Case	25	.00	.000	.000
	Controls	25	.16	.374	.075
Oxygen saturation_post	Case	25	98.48	.653	.131
	Controls	25	98.36	.810	.162
CFSS-DS	Case	25	28.60	2.236	.447
	Controls	25	29.40	2.236	.447

Table 3: shows the comparison of parameters post-treatment. There is a statistically significant difference in PR before, during, and after treatment among cases. There is a statistically significant difference in FLACC scores before, during, and after treatment among cases. There is no statistically significant difference in Oxygen saturation before, during, and after treatment among cases. The mean p value is 0.001.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
PR_Cases	Between Groups	1688.827	2	844.413	7.000	.002
	Within Groups	8685.120	72	120.627		
	Total	10373.947	74			
FLACC_cases	Between Groups	26.640	2	13.320	118.693	.000
	Within Groups	8.080	72	.112		
	Total	34.720	74			
Saturation cases	Between Groups	3.440	2	1.720	2.678	.076
	Within Groups	46.240	72	.642		
	Total	49.680	74			

Table 4: Comparison of parameters among cases. There is a statistically significant difference in PR before, during and after treatment among cases. There is a statistically significant difference in FLACC scores before, during and after treatment among cases. There is no statistically significant difference in Oxygen saturation before, during and after treatment among cases. Mean p value is 0.001



GRAPH 3: Comparison of CFFS-DS in cases and controls

DISCUSSION

Child dental anxiety has the potential to play an important and detrimental role in a child's dental and general health.[4] So, pediatric dentistry should minimize behavioral problems and maintain a positive connection with nervous children using nonpharmacological behaviour management strategies and be able to recognize and address their anxiety. About the enormous benefits of non-pharmacological behaviour management techniques, many techniques involving biofeedback and modifications to physiological processes like breathing have been very beneficial to patients due to cognitive processing and continuous attention. It is important to understand a child's dental anxiety to make sure there is no acute fear so that, any approach to behavioural management for dental child patients must be rooted in empathy and concern for each child's welfare.

The American Academy of Paediatric Dentistry (AAPD) recommended concentrating more on non-pharmacologic intervention in future studies.[5] The relationship between fear and pain is highly relevant to dental procedures as children with dental anxiety may experience both heightened pain expectations as alteration and perception are focused on the site of pain.[3] In the present study, a video showing the

exercise was previously recorded and shown to the participants to avoid bias and this allows them to be more autonomous, more self-directed, and more motivated. As all the participants belonged to the age group of 8 to 11 years, the children inherently seemed to be capable of coping with the dental treatments and were made to understand the treatment process as explained hence could carry out the innovative relaxation procedure. In our study, care was taken to conduct the intervention with standardized procedures by a trained single operator, and the observer outcomes were measured with the physiologic parameters.

The current study aimed at children aged 8 to 11 years. Because, according to Jean Piaget's theory, dental phobia (84.5%) in children of this age group includes those belonging to the concrete operational stage of cognitive theory. It represents an important turning point in a child's cognitive development as it marks the beginning of logical or operational thinking. This means the child can assimilate with the newer environment and accommodate the technique of distraction, According to Stone and Church's classification, this age range is known as middle-year children.[6] We found that the children in this age group could cope with the exercise as instructed. These children comprehend what they observe and discover how to calm their fears in healthy ways. This age range was chosen since the intervention required that the youngsters understand the concept and make a voluntary effort. The age in the current study is by the age group of a study by Kumar et al. that evaluated dental anxiety among 6- to 12-year-old children in the South Indian population.[7]

The present study compared the difference in anxiety in both genders which showed no significant difference between the gender distribution as both boys and girls were equally anxious for injections (p value<0.05). these can be justified by the fact that children in this age group are anxious for the sight of injection regardless of their gender. There was an increased anxiety in children aged 8-9 years than those in 10-11 years of age. This is justified by the fact that with the increase in age reduction in anxiety was noted. These study results are in accordance with the findings by Khalil et al that showed there was no relationship between the perceived pain during injection and the gender of the child. [6,7] In contrast to the present study, findings by Bahrololoomi et al, Shindova et al found girls tend to have increased anxiety than boys.[8] Anjum et al showed females scored considerably higher than males. The gender difference is related to the fact that females are more likely to feel comfortable expressing their feelings and admitting their fears than males, girls reported frequent uncooperative behaviours as compared to boys.[9]

In the present study, a CFSS-DS scale was used to subjectively assess dental anxiety for the anaesthetic needle as it is a highly ranked fearful thing in children. The scale has strong validity and reliability for determining anxiety levels. The reliability of the CFSS-DS was found to be 0.92 in India, which is quite similar to the results published by Cuthbert and Melamed, Arapostathis et al., and Yamada et al. The scale was therefore shown to be accurate at measuring fear.10 In the present study, the difficulty of filling out the questionnaire was seen in some cases, therefore to get around it, parents constantly supervised their children as they answered the questions. The assessment of dental anxiety and fear in children has been done using a variety of instruments. The CFSS-DS is popular throughout the world and is easy to use with pediatric patients. The CFSS-DS, a widely adopted international scale to assess children's anxiety, covers all facets of young patients' anxiety during dental care (Arapostathis et al., 2008). 41 The 15-item CFSS-DS features three questions with the highest scores: fear of injections, fear of dentist drilling, and fear of choking, according to a study by Dahlander et al, Wogelius et al. (2009), Rath et al., Alsadat et al. In dental offices, child behavior ratings are frequently reviewed, but anxiety levels are not. Additionally, it has been noticed that several psychometric scales are used to measure anxiety, but the trigger has not yet been thoroughly documented. In most studies, kids ranked "injections" as their top fear, with only slight

variances in how they prioritized other things. This is supported by the fact that kids typically have similar concerns about oral care.

Pulse rate was used as a physiologic parameter to assess the anxiety in children in the present study as there is a direct correlation between heart rate and anxious dental situations. The study found a statistically significant reduction in pulse rate in children performing the innovative exercise when compared to the subjects in control group (p value-0.002) which is based on the biofeedback mechanism that is the reflection of a calming effect while the subjects in the control group had increased heart rate during the entire procedure. At baseline, there was no statistically significant difference in pulse rate between the intervention and control groups p value 0.329 This is justified by the fact that heart rate is a valid physiological measure of anxiety. This investigation focused on pulse rate because it is the simplest biological parameter to measure and also because an increase in heart rate is the most common physiological indicator for anxiety and fear. It has been demonstrated that pulse rate is more in line with the anxiety experienced in dental visits than other physiological parameters. Large inspirations cause arterial dilation and a decrease in heart rate as they can cause lung expansion and activation of pulmonary stretch receptors, stimulation of vagal activity and baroreceptor reflex, and suppressed sympathetic activity, which is consistent with the findings of Bahrololoomi et al. Khattab et al evaluated physiological measurements among the kids who participated in the study, breathing lavender oil caused the mean scores of pulse and respiratory rate to drop compared to before and during tooth extraction. In contrast to the present results, Sridhar et al. found during the injection of local anesthesia, mean pulse rates increased in case and control groups, with the relaxation exercise group experiencing a greater rise than the control group. The endogenous adrenaline release brought on by emotional stress is partly to blame for this.

The present study results showed a statistically significant increase in oxygen saturation levels during the treatment in the control group (p value- 0.025) but there was no statistically significant difference in oxygen saturation among the subjects in the case group (p value-0.76), indicating more anxiety in the control group during the procedure which was later reversed to normal. This is on par with a study by James et al. in which measurement of oxygen saturation rate was utilized to evaluate anxiety levels.

FLACC scale was used in the present study as an objective method for the analysis of anxiety in children as this scale aids in understanding a child's emotions as they are expressed through crying, leg movements, and facial expressions. The present study found that there was a statistically significant decrease (p-value of 0.00) in FLACC ratings between the case and control groups. The subjects in the control group showed frowning facial expressions, were tensed, uneasy and with tears, and were difficult to console even after the completion of the procedure compared to the case group. When used objectively, the FLACC scale has been demonstrated to have exceptional validity and reliability for assessing pain in young infants. The literature has evaluated the application of the "Face Leg-Activity-Cry-Consolability" (FLACC) pain scale to measure patient discomfort during therapy. Regardless of the degree of their participation, Al-Habibi et al. employed the FLACC scale to assess pain in children older than 3 years of age.[9] In contrast to present study results Peretz et al. reported an insignificant reduction in FLACC scores.[2]

The current study has used an active kind of distraction by involving the motor activity of rotating the feet in the case group by asking the youngster to concentrate on rotating the feet that are located in the distalmost region, distant from the oral cavity as it requires active engagement of their attention while the dentist instructs them. The study results showed a marked reduction in anxiety (p-value 0.00) in the intervention group. There are two sorts of distraction; the active type uses a variety of sensory elements such as virtual reality, guided imagery, and interactive toys to promote child participation. The passive type of distraction, however, involves forcing the youngster to pay attention to a stimulus or activity, such

as watching cartoons or listening to music. In the dental office, distractions like magic tricks, toys, cartoons, or music are frequently used, so this study has focused on employing a newer distraction technique. They may be administered both during dental procedures and in the waiting area (Bentsen 2001; Hoffman 2001).[10] The present study results found the children were highly anxious before the procedure which showed significantly reduced anxiety (p-value - 0.00) in the intervention group during and after the procedure was carried out.

The effectiveness of breathing alone has been demonstrated in the literature, but in this study combined breathing with rotation of feet was proved to be an excellent technique to divert the child's attention from the source of discomfort. Various behaviour management techniques are used but the present technique modifies and helps in behaviour shaping in the child. The method was user-friendly for both patients and clinicians since school-aged children could readily adjust to it. This activity is a low-cost, simple, and uncomplicated cognitive behaviour-guiding tool. The limitations of the study are the child may not perform the exercise if he/she is negative. The study considered only the gender of the children for assessment of anxiety, however, anxiety could be due to several contributing factors. The study was carried out in a smaller population so further studies with a larger sample size were required.

CONCLUSION

Achieving a proper behavior management protocol during dental procedures in anxious children plays an important role in pediatric dentistry. Various behavior management techniques have already been in practice but a child friendly easily applied chairside technique has been used in our study. Our study concluded that: 1. Dental anxiety for anaesthetic needles is more in children of age 8 to 11 years during any of the dental procedures. 2. Dental anxiety during anaesthetic procedures without any behaviour management showed a negative behaviour for dental procedures. 3. In children with the innovative relaxation technique the anaesthetic procedures showed a positive response during and after the treatment. 4. When comparing the children with innovative exercise and no behaviour management techniques, children with the exercise showed a better co-operation and positive impact for future dental procedures. In conclusion, within the limitations of this study, the innovative behavior management technique can be used as an alternative to the prevailing behavior management strategies and is efficient, effective, less time consuming, easily performed chairside technique.

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Nil

CONFLICTS OF INTEREST

There are no conflicts of interest

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