

Comparison and evaluation of two play therapy breathing exercises to reduce anxiety in children receiving local anaesthesia: A randomized clinical study

Sanika U Karmarkar¹, *Chandrashekhar Badakar², Shivayogi M Hugar³, Bhuvanesh N Bhusari¹, Krishna S Kadam¹, Neha Kohli¹

Sri Lanka Journal of Child Health, 2024; 53(2): 115-120

DOI: <https://doi.org/10.4038/sljch.v53i2.10774>

Abstract

Background: Children are anxious about dental procedures and the anaesthetic needle's sight and feeling have been identified as the most fear-eliciting stimuli. Psychologists have used 'play therapy' to modify child behaviour to alleviate pain and anxiety during elective surgery in children. The pinwheel and bubble blower have been used in play therapy for children to bring about deep breathing which in turn brings about relaxation and anxiety reduction.

Objectives: To evaluate and compare the use of two relaxation breathing exercises for anxiety reduction before and after administration of local anaesthesia for 6–12-year-old children undergoing dental treatment.

Method: Forty-five children were divided into 3 groups as control, pinwheel breathing exercise and bubble blowing breathing exercise. The children were given a demonstration of the breathing exercise before local anaesthesia administration and asked to perform the exercise for 3 to 5 minutes. Anxiety was measured before and after administration of local anaesthesia with pulse rate and Venham's picture scale score.

Results: Post-operative rise in pulse rate was seen in all groups but was statistically significant in the control group and the bubble blowing breathing exercise group ($p < 0.05$). The least rise was seen in the pinwheel breathing exercise group. The post-injection Venham's picture test score was the same as the pre-injection score in the pinwheel exercise group but had increased for the other two groups which was statistically not significant.

Conclusions: The play therapy relaxation breathing exercises can be successfully used for anxiety reduction in children receiving local anaesthesia.

¹Post Graduate Student, ²Professor, ³Professor and Head, Department of Paediatrics and Preventive Dentistry, Kaher KLE VK Institute of Dental Sciences, Belagavi, Karnataka, India

*Correspondent: badakar@gmail.com



<https://orcid.org/0000-0002-5590-6534>

(Received on 03 October 2023; Accepted after revision on 17 November 2023)

The authors declare that there are no conflicts of interest. Personal funding was used for the project.

Open Access Article published under the Creative Commons



Attribution CC-BY License

(Key words: Anaesthesia, Anxiety, Breathing exercises, Bubble blowing exercise, Pinwheel exercise, Play therapy)

Introduction

The most essential components of paediatric dental care are pain and anxiety control. Increased sensitivity and responsiveness to painful stimuli can be seen with high levels of anxiety and fear¹. Children display anxiety about dental procedures and particularly about local anaesthesia administration. In children undergoing dental treatment, the anaesthetic needle's sight as well as feeling have been identified as a stimulus that elicits the most fear. Therefore, paediatric dental practice largely depends on behaviour guidance². In order to reduce procedural pain and anxiety, cognitive behavioural techniques like distraction, relaxation strategies and coping mechanisms have been widely studied and used. Another method that has been used by therapists is 'play therapy' used to communicate with and manage child behaviour. It establishes communication and relaxation of the child by providing objects or situations in the form of games. It has also been used to alleviate pain and anxiety during elective surgery in children.

The pinwheel breathing exercise incorporates deep breathing to relieve anxiety in young children. It is a form of play therapy used to bring about relaxation for the child. Concentration is enhanced by the pinwheel which acts as a focal point and can produce composure and coordination in tasks that require it¹. The bubble blowing exercise, which is also a form of deep breathing exercise and a type of play therapy, is designed to teach children controlled breathing with the aid of a reinforcer which is the bubble blower³. Blowing soap bubbles can be powerfully calming and evolve into a relaxation technique with slow rhythmic breathing⁴. Hence, both these exercises may find application in a child patient undergoing dental treatment for anxiety reduction. There is a lack of literature that studies the use of play therapy relaxation breathing exercises for anxiety reduction in children undergoing dental treatment.

Objectives

To evaluate and compare the anxiety reduction in children after the bubble blowing and pinwheel breathing exercise during local anaesthesia administration.

Method

This is an *in vivo*, randomized control, parallel group study that was conducted over a period of 3 months on the patients who reported to the Department of Paediatric and Preventive Dentistry's outpatient department at KAHER's KLE Vishwanath Katti Institute of Dental Sciences, Belagavi, India.

Sample size: With the alpha error as 5%, effect size of 0.96, p value set at 0.05 and power of 80%, a sample size (n) of 15 in each group was calculated using the following formula:

$$n = \frac{2S^2(z_{1-\alpha} + z_{1-\beta})^2}{d^2}$$

Inclusion and exclusion criteria: Children between the ages of 6 to 12 years who required dental treatment under local anaesthesia in their 1st appointment except those with special healthcare needs, with medical conditions contraindicating use of local anaesthetics containing adrenaline, respiratory conditions and history of allergy to anaesthetic drugs were included in the study.

Ethical issues: Ethical approval to conduct the study was obtained from the Institutional Review Board of KAHER's KLE Vishwanath Katti Institute of Dental Sciences, Belagavi, India [No: IEC/KLE VKIDS/ 2022/ 37]. The study was registered at the Clinical Trial Registry India (CTRI/2023/01/048689). Written informed consent was obtained from the parents of the children participating in the study and assent from the children.

The children were randomly allotted into three groups using the lottery method: Group A (Control group), Group B (Pinwheel breathing exercise group) and Group C (Bubble blowing exercise group). The randomization was performed by the primary investigator (Figure 1).

The child's pre-operative anxiety measurement was done using the Venham's picture test score and the pulse rate. (Figure 2 a and b)

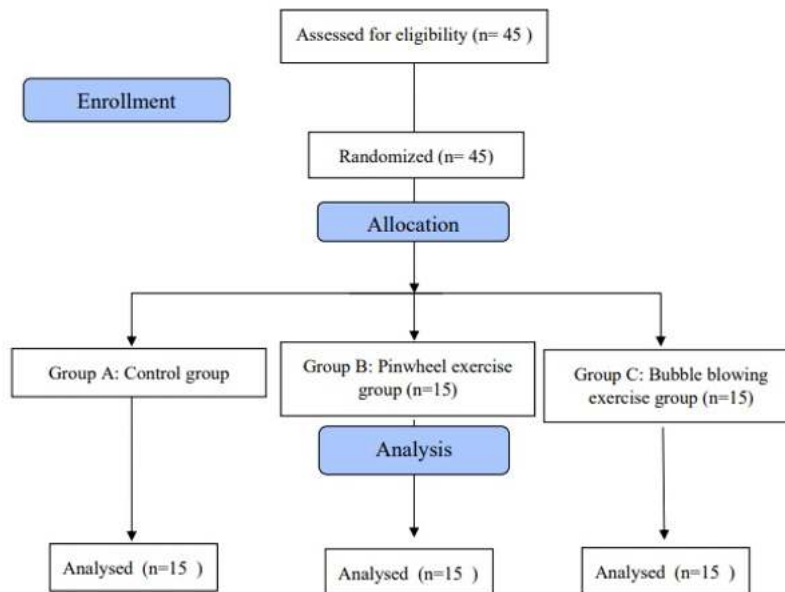


Figure 1: CONSORT (2010) flow diagram



Figure 2: Measurement of anxiety (a) Pulse rate (b) Venham's picture scale

*Permission given by parents to publish photograph

The participants belonging to Groups B and C were then given a demonstration and asked to perform the breathing exercise while participants in Group A did not perform any breathing exercise. In Group B (Pinwheel breathing exercise group), the child was asked to take a deep breath in and breathe out in such a way that the pinwheel rotated for as long as possible. (Figure 3 a) In Group C (Bubble

blowing exercise group), the child was asked to take a deep breath in and breathe out to make the largest soap bubble possible. In both groups, the child was asked to perform the exercise till he learnt the deep breathing pattern and then continue the exercise for 3 to 5 minutes. (Figure 3 b).



Figure 3: Breathing exercises (a) Pinwheel breathing exercise (b) Bubble blowing breathing exercise
*Permission given by parents to publish photograph

Topical anaesthetic gel containing 2% lignocaine (LOX* 2% Jelly, Neon Laboratories Ltd, Mumbai, Maharashtra, India) was applied to the injection site with a sterile cotton swab after drying the area with gauze. To increase the depth of penetration, the gel was rubbed on the mucosa for 30 seconds. After 3 minutes, the excess gel was wiped off with cotton¹. A 2cc disposable syringe with 26-gauge, 1.5-inch needle (UNOLOK Single use hypodermic syringe with needle, Luer lock 3 ml (3 ml), Hindustan syringes and medical devices, Faridabad, Haryana, India) was used for administration of local infiltration with 2% lignocaine with 1:80,000 adrenaline (Lidayn, Lignocaine & Adrenaline Injection IP 2% Adrenaline 1:80,000 30 ml, Global Dent Aids Pvt Ltd, Noida, Uttar Pradesh, India). The mucosa was made taut, and the needle was inserted 2 to 3 mm at the height of the muco-buccal fold adjacent to the tooth concerned. 1 ml of anaesthetic solution was injected at the standard rate of 0.8 ml/min to minimize pain³. The post-operative anxiety measurement was immediately carried out with pulse rate measurement and

Venham's picture test score. The pre-operative and post-operative data were tabulated in Excel and entered using the IBM SPSS software (version 22.0 Chicago IL, USA) and subjected to statistical analysis (Figure 1).

Results

The participants were divided into 3 equal groups of 15 each. There were no dropouts or exclusions. The mean age of the participants in this study was 8.96 years; 62.2% of them were males while 37.8% were females. The pre-operative and post-operative Venham's picture test scores in all the three groups do not follow a normal distribution. Therefore, the non-parametric tests were applied. Parametric tests were applied for pre-operative and post-operative pulse rate scores as they follow a normal distribution. For the Venham's picture test, the pre-operative and post-operative scores of all 3 groups were compared with Kruskal Wallis ANOVA while pairwise comparison of the groups was done using the Mann-Whitney U test (Table 1). No significant difference was observed in these scores.

Table 1: Pre-operative and post-operative Venham's picture scale scores of groups A, B, and C compared pairwise by Mann-Whitney U test

Groups	Group A vs Group B	Group A vs Group C	Group B vs Group C
Pre-operative	p=0.3050	p=0.7750	p=0.2500
Post-operative	p=0.1370	p=0.9670	p=0.2670
Difference	p=0.6240	p=0.8060	p=0.5670

Intra-group comparison of pre-operative and post-operative Venham's picture test scores was done using the Wilcoxon-matched pair test. Though not statistically significant, it revealed that while the Venham's picture

test score had increased in Groups A (Control) and C (Bubble blowing breathing exercise) post-operatively it remained unchanged for Group B (pinwheel breathing exercise) (Table 2).

Table 2: Comparison of pre-operative and post-operative Venham's picture scale scores in Group A (Control group), Group B (Pinwheel breathing exercise group), and Group C (Bubble blowing breathing exercise group) by Wilcoxon matched pairs test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	% of change	Z-value	p-value
Group A	Pre-operative	1.13	1.46	-0.13	0.83	-11.76	0.5916	0.5541
	Post-operative	1.27	1.62					
Group B	Pre-operative	0.60	0.83	0.00	1.07	0.00	0.1348	0.8927
	Post-operative	0.60	1.12					
Group C	Pre-operative	1.47	1.88	-0.40	1.24	-27.27	1.3522	0.1763
	Post-operative	1.87	2.53					

Pre-operative and post-operative comparison of pulse rates between the three groups was done by one way

ANOVA test while the pairwise comparison was done by Tukey's multiple post-hoc test (Table 3).

Table 3: Pulse rate scores of Group A, B and C compared pairwise pre- and post-operatively by Tukey's multiple post-hoc procedures

Groups		Group A	Group B	Group C
Pre-operative	Mean	96.53	88.73	87.00
	SD	24.97	14.97	16.86
	Group A	-		
	Group B	p=0.5196	-	
	Group C	p=0.3792	p=0.9677	-
Post-operative	Mean	106.80	92.33	94.20
	SD	21.08	19.38	10.52
	Group A	-		
	Group B	p=0.0746	-	
	Group C	p=0.1352	p=0.9548	-
Difference	Mean	10.27	3.60	7.20
	SD	12.60	16.89	13.32
	Group A	-		
	Group B	p=0.4206	-	
	Group C	p=0.8297	p=0.7735	-

The intragroup pre-operative and post-operative pulse rate comparison was done using the dependent t-test. The rise in the pulse rates was seen in all groups post-operatively

and was statistically significant in Group A (p=0.0070) and Group C (p=0.0500). The least rise in the pulse rate was seen in Group B. (Table 4).

Table 4: Pre- and post-operative pulse rate scores in Group A, B and C compared using dependent t-test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	% of change	t-value	p-value
Group A	Pre-operative	96.53	24.97	-10.27	12.60	-10.64	-3.1556	0.0070*
	Post-operative	106.80	21.08					
Group B	Pre-operative	88.73	14.97	-3.60	16.89	-4.06	-0.8257	0.4228
	Post-operative	92.33	19.38					
Group C	Pre-operative	87.00	16.86	-7.20	13.32	-8.28	-2.0933	0.0500*
	Post-operative	94.20	10.52					

*p≤0.05

Discussion

Dental anxiety is a global phenomenon that impacts people of all age groups and impacts their oral-health related quality of life. It is a state of apprehension where a patient feels something dreadful might happen during dental treatment and is observed commonly in 3-18-year-olds worldwide⁶. In paediatric patients, local anaesthetic needles produce the greatest negative responses. Children become sensitized with repeated exposure to the injection procedures causing increasing negative responses⁷.

Kumar V, *et al*⁸, reported high level dental anxiety prevalence (84.5%) among 6-12-year-old children of South India; 6-12-year-old children were hence recruited for the present study. Additionally, children younger than 5 years of age do not have sufficient cognitive development to rate pain or anxiety with self-reporting scales such as the Venham's picture test used in this study². The anxiety was reported using subjective and objective measurements using the Venham's picture test and pulse rate respectively. Rise in anxiety leads to sympathetic stimulation and increases the heart rate and

hence, the pulse rate⁹. The Venham's picture test is a self-measure test which is projective as well as psychometric, the reliability of which has been previously tested¹⁰.

An anxious child might perceive pain to be of a more severe, or longer lasting kind as compared to the pain perceived by a less anxious child¹¹. Meditation, relaxation, and breathing techniques have been shown to counteract the detrimental effects of stress, anxiety, and the autonomic nervous system's sympathetic dominance. Breathing techniques could be used as first-line as well as supplemental treatment for stress and anxiety¹². A study by Busch V, *et al*¹³ showed that modulation of sympathetic arousal and pain reduction can be brought about by deep and slow breathing. Relaxation breathing exercises cause an active distraction inducing stimulation of the vagus nerve, cortisol reduction and secretion of antidepressant neurotransmitters such as serotonin².

'Play therapy' is a newer technique successfully used by therapists to help engage with and manage intensely anxious kids¹. The pinwheel breathing exercise and the bubble blowing exercise incorporate relaxation deep breathing along with the play therapy, where the pinwheel and the bubble blower are the reinforcers^{1,2}. They are easy to learn and perform and enjoyable to children.

The results of this study revealed a spike in post-operative pulse rates in all 3 groups, the maximum rise being in the control group (statistically significant with $p=0.0070$), followed by the bubble blowing exercise group (statistically significant with $p=0.0500$) and the least rise being in the pinwheel breathing exercise group. This rise in the pulse rates can be due to the endogenous epinephrine release caused because of emotional stress¹⁴. The pain experienced is however, not just dependent on the dental anxiety but also modulated by psychological factors or the coping mechanisms of the individual¹⁵. Similar findings of post-operative rise in the pulse rate and the rise in Venham's picture test scores of the present study in the control and bubble blowing exercise group have been reported in existing literature^{1,2,5}.

Even though the dental anxiety among all 3 groups seems to be comparable in this study, it can be said that the pinwheel exercise was slightly efficacious in terms of the least rise in the post-injection pulse rate and an almost unchanged Venham's picture test score. The findings of a study by Kohli N, *et al*¹⁶ that evaluated anxiety and pain perception during local anaesthesia administration using insulin syringes and deception syringes showed a statistically significant anxiety reduction implying that hiding or camouflaging of threatening stimuli is of core importance to manage an anxious patient. Hence, the occasional circumstantial and inevitable sight of the needle in the present study could have resulted in a bias.

This study has scope to be carried out with a larger sample size, in a wider age group while using more methods of anxiety assessments at varying time intervals throughout the process of local anaesthesia administration. These methods of relaxation could also be implemented for anxiety reduction in children undergoing other dental treatments.

Conclusions

The study revealed that post-injection rise in the pulse rate in the pinwheel group and the bubble blowing exercise group was less than that seen in the control group. The Venham's picture test scores also remained the same post-injection in the pinwheel breathing exercise group. Hence, it can be concluded that these relaxation breathing exercises can be successfully used for anxiety reduction in children receiving local anaesthesia.

References

1. Bargale S, Khandelwal JR, Dave BH, Deshpande AN, Shah SS, Chari DN. Comparative evaluation of effect of two relaxation breathing exercises on anxiety during buccal infiltration anaesthesia in children aged 6-12 years: A randomized clinical study. *Journal of the Indian Society of Pedodontics and Preventive Dentistry* 2021; **39**: 284-90.
2. Bahrololoomi Z, Sadeghiyeh T, Rezaei M, Maghsoudi N. The effect of breathing exercise using bubble blower on anxiety and pain during inferior alveolar nerve block in children aged 7 to 10 years: A Crossover Randomized Clinical Trial. *Pain Research and Management* 2022; **17**: 1-8.
<https://doi.org/10.1155/2022/7817267>
PMid: 35082960 PMCID: PMC8786543
3. Sridhar S, Suprabha BS, Shenoy R, Shwetha KT, Rao A. Effect of a relaxation training exercise on behaviour, anxiety, and pain during buccal infiltration anaesthesia in children: Randomized clinical trial. *International Journal of Paediatric Dentistry* 2019; **29**: 596-602.
<https://doi.org/10.1111/ipd.12497>
PMid: 30887592
4. Eldridge C, Kennedy R. Nonpharmacologic techniques for distress reduction during emergency medical care: A review. *Clinical Pediatric Emergency Medicine* 2010; **11**: 244-50.
<https://doi.org/10.1016/j.cpem.2010.09.001>
5. Omidpanah N, Shahrzad N, Safari R. The effect of topical anaesthetic gel relaxation exercise in controlling the pain of anterior maxillary injection. *Open Dentistry Journal* 2020; **31**: 752-6.
<https://doi.org/10.2174/1874210602014010752>
6. Grisolia BM, dos Santos APP, D'Hyppolito IM, Buchanan H, Hill K, Oliveira BH. Prevalence of dental anxiety in children and adolescents globally: a systematic review with meta-analyses. *International Journal of Paediatric Dentistry* 2021; **31**: 161-83.
<https://doi.org/10.1111/ipd.12712>
PMid: 33245591
7. Kaufman E, Epstein JB, Naveh E, Gorsky M, Gross A, Cohen G. A survey of pain, pressure, and discomfort induced by commonly used oral local anaesthesia injections. *Anesthesia Progress* 2005; **52**: 122-7.
[https://doi.org/10.2344/00033006\(2005\)52\[122:ASP\]2.0.CO;2](https://doi.org/10.2344/00033006(2005)52[122:ASP]2.0.CO;2)
PMid: 16596910
8. Kumar V, Goud EV, Turagam N, Mudrakola DP, Ealla KK, Bhoopathi PH. Prevalence of

- dental anxiety level in 6-12-year-old south Indian children. *Journal of Pharmacy and Bioallied Sciences* 2019; **11**: 321-4.
https://doi.org/10.4103/JPBS.JPBS_22_19
PMid: 31198362 PMCID: PMC6555310
9. Guyton AC. Textbook of Medical Psychology. 8th ed. Bangalore, India: Prism Books; 1991.
10. Venham LL, Gaulin-Kremer E. A self-report measure of situational anxiety for young children. *Pediatric Dentistry* 1979; **1**: 91-6.
11. Orenius T, LicPsych, Säilä H, Mikola K, Ristolainen L. Fear of injections and needle phobia among children and adolescents: an overview of psychological, behavioural and contextual factors. *SAGE Open Nursing* 2014; **4**: 1-8.
<https://doi.org/10.1177/2377960818759442>
PMid: 33415191 PMCID: PMC7774419
12. Jerath R, Crawford MW, Barnes VA, Harden K. Self-regulation of breathing as a primary treatment for anxiety. *Applied Psychophysiology and Biofeedback* 2015; **40**: 107-15.
<https://doi.org/10.1007/s10484-015-9279-8>
PMid:25869930
13. Busch V, Magerl W, Kern U, Haas J, Hajak G, Eichhammer P. The effect of deep and slow breathing on pain perception, autonomic activity, and mood processing--an experimental study. *Pain Medicine* 2012; **13**: 215-28.
<https://doi.org/10.1111/j.15264637.2011.01243.x>
PMid: 21939499
14. Brand HS, Abraham-Inpijn L. Cardiovascular responses induced by dental treatment. *European Journal of Oral Sciences* 1996; **104**: 245-52.
<https://doi.org/10.1111/j.16000722.1996.tb00074.x>
PMid: 8831058
15. Marsac ML, Funk JB. Relationships among psychological functioning, dental anxiety, pain perception, and coping in children and adolescents. *Journal of Dentistry for Children* 2008; **75**: 243-51.
16. Kohli N, Hugar SM, Patil VH, Saxena N, Kadam KS, Karmarkar S. Evaluating anxiety levels and pain perception while administering local anaesthesia using conventional, insulin, and deception syringes in 6-12-year-olds. *Journal of Dental Anesthesia and Pain Medicine* 2022; **22**: 197-204.
<https://doi.org/10.17245/jdpm.2022.22.3.197>
PMid: 35693350 PMCID: PMC9171339