Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 30s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Effect Of White Noise, Binaural Beats And Instrumental Music In Pain Perception During Dental Treatment In Children Aged 6-12 Years

Dr. M. Nawin Subhaganesh[1*], Dr. M. Sunil Kumar M.D.S.[2], Dr. Vignesh Guptha M.D.S.[3], Dr. Agisha Raaje M.D.S.[4], Dr. Narendra Prassath M.D.S.[5], Dr. Sudhakar M.D.S.[6]

[*1]Postgraduate, Department of Paediatric and Preventive Dentistry, Karpaga Vinayaga Institute of Dental Sciences, Madhuranthagam, Tamil Nadu, India

[2]Professor, Department of Paediatric and Preventive Dentistry, Karpaga Vinayaga Institute of Dental Sciences, Madhuranthagam, Tamil Nadu, India

[3]Professor, Department of Paediatric and Preventive Dentistry, Karpaga Vinayaga Institute of Dental Sciences, Madhuranthagam, Tamil Nadu, India

[4]Senior lecturer, Department of Paediatric and Preventive Dentistry, Karpaga Vinayaga Institute of Dental Sciences, Madhuranthagam, Tamil Nadu, India

[5]Senior lecturer, Department of paediatric and preventive dentistry,Karpaga Vinayaga Institute of Dental Sciences, Madhuranthagam, Tamil Nadu, India

[6]Senior lecturer, Department of paediatric and preventive dentistry,Karpaga Vinayaga Institute of Dental Sciences, Madhuranthagam, Tamil Nadu, India

[*]**Corresponding author:**
Dr. M. Nawin Subhaganesh

Cite this paper as: Dr. M. Nawin Subhaganesh, Dr. M. Sunil Kumar M.D.S., Dr. Vignesh Guptha M.D.S., Dr. Agisha Raaje M.D.S., Dr. Narendra Prassath M.D.S., Dr. Sudhakar M.D.S., Dr. K Gangadhara Rao, (2025) Effect Of White Noise, Binaural Beats And Instrumental Music In Pain Perception During Dental Treatment In Children Aged 6-12 Years. *Journal of Neonatal Surgery*, 14 (30s), 988-993.

ABSTRACT

Background: Pedodontists approach a child in a dental chair via multiple strategies, and they often use a combination of strategies to address the child's age, personality and level of dental anxiety. Creating a welcoming and calming musical environment can significantly ease anxiety and improve the overall experience for children during dental treatment. The aim of the study is to measure and compare the influence of white noise, binaural beats and instrumental music on anxiety levels in children undergoing dental treatments.

Materials & Methods: The children aged between 6-12 years were chosen and were divided evenly into four groups, each consisting of 20 samples, using a basic random sampling procedure. These are the groupings: Group 1: White noise Group 2: Binaural beats, Group 3: Instrumental music, Group 4: No Audio (control group). Patient anxiety level was evaluated by measuring Wong Baker's pain scale and pulse rate at intervals before, during & after 10 minutes of dental treatment.

Results: White noise exposure to children during dental treatment exhibited better results compared to other groups. The Wong baker scale was restricted to <6 whereas in binaural beats with <8 and instrumental music & control group with a maximum score of 10. There was a significant reduction in the average pulse rate before and after 10 minutes of treatment who were exposed to white noise which was 85.85 ± 2.498 and 82.05 ± 3.220. There were no other groups which exhibited promising results as much as white noise.

Conclusion: We found that the effect of white noise was effective in reducing the anxiety of a child in a dental chair during treatment when compared to binaural beats and instrumental music. This proves that the effect of white noise is better and hence can be utilized as one reliable non-pharmacological method to calm a child during dental treatment.

Keywords: *White noise; Binaural beats; Instrumental music; Dental anxiety; Children*

1. INTRODUCTION

It is always a challenge for dental professionals to manage a child's behavior during a dental treatment. It is believed that the most difficult aspects of working in pediatric dentistry are dealing with anxieties and fear, this causes induviduals to postpone receiving dentalcare, ultimately leading to poor oral health(1). Evidence suggests that children with a history of dental trauma exhibit heightened anxiety levels, as indicated by a study where only 12.2% of trauma-free children reported no fear of dental injections, contrasted with 51.7% of those with repeated trauma (2). Depending on the level of cooperation and fear in the child, pharmacological techniques like medications, sedation, or general anesthesia whereas the non-pharmacological method deals with different behavioral management strategies (3). Numerous non-pharmacological techniques such as voice control, modeling, positive reinforcement, Tell-Show-Do, parental involvement, desensitization and distraction techniques were employed in conjunction with dental treatment to foster a strong patient-dentist bond and enhance the patient's long-term oral health (4). The non-pharmacological techniques are preferred much to avoid the adverse reactions in children. In addition to the methods indicated above, pedodontists nowadays approach children in a variety of other ways. Giving the child access to the digital world is a common method of distraction. Gadget addiction has been relatively increased in children after the covid pandemic era (5). There is a lot to be concerned about the quick rise of children accessing digital media, especially addiction to digital noises. Children tend to respond well to digital noises rather than human noises. Hence this can be utilized positively as one non-pharmacological technique to reduce the fear and anxiety in children during the dental treatment.(6).Previous literature confirmed that audio distraction techniques effectively decreased anxiety in pediatric patients, highlighting a substantial reduction in anxiety (7,8)

2. MATERIALS & METHODS

This double blinded randomized clinical study was conducted in the Department of Pediatrics and Preventive Dentistry at Karpaga Vinayaga Institute of Dental Sciences. Informed consent was taken before enrolling any subject in the study. Only a single operator handled all of the children. Another observer who was blinded to the kind of noise being employed assessed the subjective parameters.

The child was included in the study if -

1.) Aged between 6 and 12 years

2.) No prior dental experience

3.) Children requiring any treatment under Local Anesthesia

The child was excluded if -

1.) Treatment can be done without local anesthesia

2.) Medically and developmentally compromising conditions

Groups: Using simple random sampling technique, the selected children were equally distributed into four groups with 20 samples in each group. The groupings are as follows:

Group 1: White noise

Group 2: Binaural beats,

Group 3: Instrumental music,

Group 4: No Audio (control group).

Parameters: Child's overall experience of the dental visit was recorded using Wong baker's faces pain rating scale (Figure 1) along with it the pulse rate was evaluated 10 mins before treatment, during treatment & 10 mins after treatment.

Figure 1: Wong Baker's Faces pain rating scale

Statistical analysis: All the data collected and entered in MS excel and analyzed using SPSS

16.0 for windows (SPSS Inc, Chicago, IL, USA, 2001). Descriptive statistics, frequency distribution, including the mean, median and standard deviation were calculated for all measurements. The significance of difference of means between two groups, i.e. inter group comparison for normal data was tested by ANOVA one way test, and intra group comparison was tested by paired student t test (parametric test). The level of significance and confidence interval were 5% and 95 % respectively. The p value <0.05 was considered significant.

3. RESULTS

According to the assessment to measure and compare the influence of white noise, binaural beats and instrumental music on anxiety levels in children aged between 6-12 years via Wong Baker scale, we found that white noise showed much better results than binaural beats and instrumental music (Figure 2).

Upon utilization of white noise during dental treatment, Wong baker's pain scale restricted to score < 6, indicating a significant reduction in anxiety. Of the study population, only 3.75% were identified to have a score of 6, 12.5% had a score of 4, and 8.75% had a score of 2 for those who were exposed to white noise. On comparing between the groups, 10 mins before & after treatment, Student paired T-test showed a p value of 0.00 (p value <0.05 statistically significant). Binaural beats were identified to have comparable results to that of white noise. A small study population of 2.5% exclaimed to have score 8, 8.75% of the study population had a score of 6 & 4 each followed by which 5% had a score of 2. Student paired T-test showed a p value of 0.01 (p value <0.05 statistically significant).

Instrumental music was found to have better results only for a few children because 2.5% of children had a score of 10 which is the highest score of Wong baker's pain scale. 8.75% of the study population had a score of 8 followed by 6.25% with a score of 6; 2.5% with a score of 4 & 5% with a score of 2. Student paired T-test showed a p value of 0.01 (p value <0.05 statistically significant).

In comparison with the control group with no music exposure, others who received music during treatment showed better Wong baker pain scoring. 3.75% of children scored 10. 12.5% of the study population had a score of 8 followed by 6.25% with a score of 6 & 2.5% with a score of 4.

None of the children experienced less pain during the treatment. Student paired T-test showed a p value of 0.954 (p value <0.05 statistically not significant).

On statistically comparing between the groups, white noise, binaural beats, instrumental music and no music groups via One-way anova, we found a statistical significance with a p value 0.00 (p value <0.05 statistically significant). All the P values of the statistical analysis performed according to the study groups are listed below in table 1.

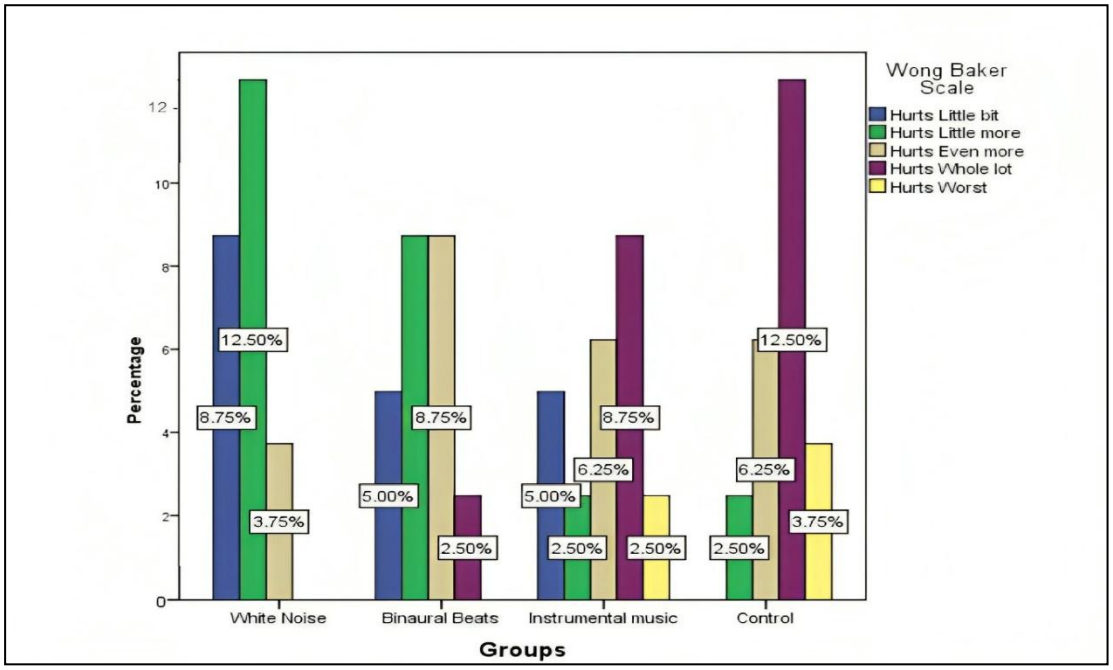

Figure 2: The percentage distribution of the study population according to study groups based on the Wong Baker's pain scale is depicted in this clustered graph. Blue denotes score 2 (Hurts Little bit); Green depicts score 4 (Hurts little more); Beige displays score 6 (Hurts even more); Purple depicts score 8 (Hurts whole lot) and Yellow exhibits score 10 (Hurts worst).

Table 1: The P values of the statistical analysis according to the study groups & study parameters are listed.

STATISTICAL ANALYSIS – P VALUE	
ONE WAY ANOVA	
WONG BAKER SCALE	.000*
PAIRED T-TEST	
WHITE NOISE	.000*
BINAURAL BEATS	.001*
INSTRUMENTAL MUSIC	.001*
CONTROL (NO NOISE)	.954

According to the pulse rate evaluated before, during and after 10 minutes of the treatment, we found that white noise was far superior than the other 3 groups evaluated in this study. The average pulse rate for all 4 groups before treatment was between 88.05 ± 1.000 - 89.00 ± 2.000. But the pulse rate greatly declined in children who were exposed to white noise during treatment with an average of 85.85 ± 2.498 and furthermore reduced after treatment with an average of

82.05 ± 3.220. Similarly, binaural beats exhibited a comparable decline in the pulse rate during and after treatment with 86.85 ± 3.297 and 84.55 ± 3.187 respectively. Instrumental music was found to be beneficial for few children to reduce anxiety. The average pulse rate was not much reduced when compared to white noise & binaural beats. The average pulse rate during & after treatment was 87.55 ± 2.064 & 86.10 ± 1.917 respectively. There was no decline or procline in the pulse rate for the control group population.

Table 2: The mean & standard deviation of the pulse rate evaluated before; during & after treatment according to the study groups are listed.

STATISTICAL ANALYSIS – DESCRIPTIVE STATISTICS			
PULSE RATE - MEAN ± STANDARD DEVIATION			
GROUPS	BEFORE TREATMENT	DURING TREATMENT	AFTER 10 MINUTES
WHITE NOISE	89.00 ± 2.938	85.85 ± 2.498	82.05 ± 3.220
BINAURAL BEATS	88.05 ± 3.220	86.85 ± 3.297	84.55 ± 3.187
INSTRUMENTAL MUSIC	88.25 ± 1.997	87.55 ± 2.064	86.10 ± 1.917
CONTROL (NO NOISE)	89.05 ± 2.685	89.90 ± 2.989	89.00 ± 2.534

4. DISCUSSION

In our study, we utilized white noise, binaural beats and instrumental music in our study to calm the child during the dental treatment. On comparing the different types of noises/music experimented in children aged between 6-12 years with the Wong baker scale, we found that white noise was more effective in distracting & reducing the anxiousness of a child in the dental chair with Wong baker's pain scale restricted to score < 6 than in binaural beats with <8 and instrumental music with a maximum score of 10. The mean pulse rate was also comparatively lower in children exposed to white noise. Our study results were concordant with the previous research, Janvi G et al. discovered that using white noise as an auditory diversion during the nitrous oxide sedation induction process is a viable alternative because of its soothing capacity (14). Singh D et al. found that when the pulse rate was recorded in white noise at various points throughout the process, statistically significant results were seen (11). This could be because a sound with equal proportions of each frequency creates white noise. It is produced by merging all audible frequencies at once to produce a uniform noise (9). White noise can be used as a form of audio camouflage to effectively cover other more distracting sounds in our immediate environment because of its delicate

and steady nature. This organic "sound barrier" lessens abrupt or startling noises that could otherwise be unpleasant to our tranquility. (10)

Binaural beats exhibited comparable results followed by white noise in our study. Isik BK. et al. found that binaural beats significantly decreased the level of anxiety whereas it remained unchanged in the control group and concluded that binaural beats may be useful in reducing preoperative anxiety in dentistry (12). Padmanabhan R. et al. identified that the binaural beat audio has the potential to decrease acute pre-operative anxiety significantly (15). The binaural beats are when two sounds are transmitted independently, one to each ear, at distinct frequencies but with constant intensities (13). The idea behind binaural beats is to play a sound at one ear at a consistent frequency and strength, and another sound at the same intensity, albeit at a marginally distinct frequency from the opposite ear. It has been proposed that tones between 200 and are more successful in evoking binaural beats up to 900 Hz than ones that go above 1000 Hz. The variation in frequency for the beats, there must be fewer than 30 Hz between the two sounds to happen; if not, the two tones are recorded separately, and no discernible beats (8,16).

Our study results showed that instrumental music did not meet up to our expectations. There were patients who experienced extreme pain during dental treatments which was not noticed in patients exposed to white noise and binaural beats. The main drawback of instrumental music is that it blends sounds from several musical instruments that have varying intensities and frequencies. The recommended intensity for children is between 50-60 dB; focus on low to mid-frequency sounds (60-4000 Hz); with slow & consistent tempo (60-80 BPM) and the most favorable instruments are soft piano, acoustic guitar, harp, and lower-register strings and woodwinds (17,18).

5. CONCLUSION

We found that the effect of white noise was effective in reducing the anxiety of a child in a dental chair during treatment when compared to binaural beats and instrumental music. We assessed the

effectiveness of the experimental groups of noise /music via Wong baker scale and pulse rate before, during & after the dental treatment. Of which the rating scale was restricted to <6 for white noise, <8 for binaural beats and < or equal to 10 which proves that the effect of white noise is better and hence can be utilized as one reliable non-pharmacological method to calm a child during dental treatment.

REFERENCES

[1] Gowdham G, Shetty AA, Hegde A, Suresh LR. Impact of Music Distraction on Dental Anxiety in Children Having Intellectual Disability. Int J Clin Pediatr Dent. 2021 Jan-Feb;14(1):170–4. Available from: http://dx.doi.org/10.5005/jp-journals-10005-1902

[2] Negovetić Vranić D, Ivančić Jokić N, Bakarčić D, Carek A, Rotim Ž, Verzak Ž. Dental fear in children with repeated tooth injuries. Acta Clin Croat [Internet]. 2016 Jun 1 [cited 2024 Sep 29];55.(2.):259–64. Available from: https://hrcak.srce.hr/file/243074

[3] Nmk, Arwa & Ghibban, Ahmed & Omar, Ola. (2019). The Effect of Different Non-Pharmacological Methods in the Management of Pediatric Patients' Dental Anxiety and Behaviour. 10.13140/RG.2.2.24343.93602.

[4] Cianetti S, Paglia L, Gatto R, Montedori A, Lupatelli E. Evidence of pharmacological and non-pharmacological interventions for the management of dental fear in paediatric dentistry: a systematic review protocol. BMJ Open. 2017 Aug 18;7(8):e016043. Available from: http://dx.doi.org/10.1136/bmjopen-2017-016043

[5] Gladson SRA, Srinivasan S, Ravi G, et al. Assessment of Gadget Addiction among the South Indian Student Community during the Pandemic: A Survey. World J Dent 2022;13(S-1):S96–S99 https://www.jaypeedigital.com/doi/ WJOUD/pdf/10.5005/jp-journals-10015-2122

[6] Kasuya-Ueba Y, Zhao S, Toichi M. The Effect of Music Intervention on Attention in Children: Experimental Evidence. Front Neurosci [Internet]. 2020 Jul 24 [cited 2024 Sep 19];14:511950.Availablefrom:https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2020.00757/pdf

[7] Ainscough SL, Windsor L, Tahmassebi JF. A review of the effect of music on dental anxiety in children. Eur Arch Paediatr Dent [Internet]. 2019 Feb;20(1):23–6. Available from: http://dx.doi.org/10.1007/s40368-018-0380-6

[8] Aitken JC. Audio Distraction as a Behavior Management Technique in Pediatric Dental Patients.1999.106 Availablefrom:https://books.google.com/books/about/Audio_Distraction_as_a_Behavior_Manageme.html?hl=&id=V9HjtgAACAAJ

[9] O'Callaghan PM. The Efficacy of Noncontingent Escape for Decreasing Disruptive Behavior During Dental Treatment.2005.Availablefrom:https://books.google.com/books/about/The_Efficacy_of_Noncontingent_Escape_for.html?hl=&id=KUD_jwEACAAJ

[10] Lu SY, Huang YH, Lin KY. Spectral Content (colour) of Noise Exposure Affects Work Efficiency. Noise Health. 2020 [cited 2024 Sep 20];22(104):19. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7986458/

[11] Effect of white,brown and pink noises on anxious pediatric dental patients [Internet]. [cited 2024 Sep 20]. Available from: http://dx.doi.org/10.18137/cardiometry.2022.25.12521258

[12] Padawe D, Chettiankandy TJ, Rathi GV, Sachdev SS, Takate VS, Yadav T. Effectivity of binaural beats in reduction of anxiety during dental treatment in pediatric patients. Glob J Med Pharm Biomed Update 2023;18:3 https://gdcmumbai.edu.in/wpcontent/uploads/2024/05/Effectivity-of-Binaural-Beats-in-Reduction-of-Anxiety-during-Dental-Treatment-in-Pediatric-Patients-min.pdf

[13] Isik BK, Esen A, Büyükerkmen B, Kilinç A, Menziletoglu D. Effectiveness of binaural beats in reducing preoperative dental anxiety. Br J Oral Maxillofac Surg [Internet]. 2017 Jul;55(6):571–4. Available from: http://dx.doi.org/ 10.1016/j.bjoms.2017.02.014

[14] Gandhi, Janvi. (2021). Comparative Evaluation of Effect of White Noise, Nursery Rhymes and Movie Songs as Distraction Methods On Behaviour Of Children During Induction Of Nitrous Oxide Sedation In Pediatric Dentistry. International Journal of Dentistry and Oral Science. 4209-4211. 10.19070/2377-8075-21000857.

[15] Padmanabhan R, Hildreth AJ, Laws D. A prospective, randomised, controlled study examining binaural beat audio and pre-operative anxiety in patients undergoing general anaesthesia for day case surgery. Anaesthesia. 2005 Sep;60(9):874–7. Available from: http://dx.doi.org/10.1111/j.1365-2044.2005.04287.x

[16] Wahbeh H, Calabrese C, Zwickey H, Zajdel D. Binaural Beat Technology in Humans: A Pilot Study to Assess Neuropsychologic, Physiologic, And Electroencephalographic Effects. 2007 Mar27[cited2024Oct4]; Available from:https://www.liebertpub.com/doi/10.1089/acm.2006.6201

[17] Viet SM, Dellarco M, Dearborn DG, Neitzel R. Assessment of Noise Exposure to Children: Considerations for the National Children's Study. J Pregnancy Child Health [Internet]. 2014 Oct;1(1). Available from: http://dx.doi. org/10.4172/2376-127X.1000105

[18] Balk SJ, Bochner RE, Ramdhanie MA, Reilly BK, Council on environmental health and climate change, section on otolaryngology–head and neck surgery. Preventing excessive noise exposure in infants, children, and adoloscents. Pediatrics.2023Nov1;152(5).