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Research Article

Effectiveness of Different Distraction Techniques in The Management of Anxiety in Differently Abled Pediatric Dental Patients - A Randomized Comparative Clinical Study.

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Abstract: Anxiety and fear have become the most significant problem for normal children and differently-abled children at the dental operatory. Various techniques in distraction such as audio, and visual are employed for the behavior management of children. The study aimed to evaluate the effectiveness of four different techniques in anxiety management in differently abled dental pediatric patients. The study included 120 children, randomly assorted into four groups i.e consisting of 30 children in each. Each of these groups was subjected to different distraction techniques, like audio distraction, audio-visual distraction, video distraction and tell-show-do techniques. The parameters assessed were systolic and diastolic blood pressure (SBP and DBP), pulse rate (PR) and oxygen saturation (SPO2) levels. Variables were compared before, during and after the dental procedure using Kruskal-Wallis test. Post-hoc analysis and Bonferroni tests were used to determine the statistical significance in inter-group comparison. SBP was insignificant statistically intra-group at before-after time points. However, SBP during-after treatment showed statistical significance in intergroup ($p=0.02$). SBP in audio-visual distraction was statistically significant when compared with video distraction group. There was no statistically significant difference observed in the DBP and PR for intra and intergroup, however, SPO2 levels at all-time points in intergroup were statistically significant ($p<0.001$). Audio-visual distraction proved to be effective as a part of the behavior management technique followed by audio distraction. These non-pharmacological behavior management techniques provided a peaceful dental environment for differently abled children, who have anxiety and fear.

Keywords: Audio-Visual Distraction, Behavior Management, Differently Abled Children, Dental Fear, Dental Anxiety, Pediatric Dental Practice.

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1. INTRODUCTION

Anxiety is related to the mental and emotional state characterized by various emotional, perceptional, and behavioral changes. Fear or emotional state of mind to unknown and being anxious has been a major concern for dentists since long time. Pediatric dentists and researchers are concerned about a young child's emotional and behavioural reaction to dental treatment. Fearful or uncooperative behaviour on the part of the child may hinder the efficient delivery of dental care and jeopardise the quality of treatment provided. If not addressed properly, a persistent negative response may develop, posing a hindrance to carry out the necessary dental care. [1] One in every six children reporting to dentist has anxiety issues and management is an intricate balancing act involving the triad of child, parent/caregiver, and the dentist.[2] Dental anxiety is associated with increased levels of dental caries and behavioral management problems in children.[3] Major amount of stress professionally is reported on the dentists while dealing with anxious patients leading to increased chair time and frequently missed appointments. Patients associate the dental office as an unfriendly and anxiety-provoking environment, characterized by loud noises, distinctive odors, invasive contact in the mouth, and the probability of pain. Various research conducted have shown that procedures in restorative dentistry like sight, sound and vibrational sensation of rotary dental drills provide the most powerful trigger for dental anxiety. The American Academy of Pediatric Dentistry (AAPD) endorsed ten behavior management methods in their guidelines for behavior management. Communicative management techniques include voice control, tell-show-do, positive reinforcement, distraction, and nonverbal communication. Also listed are the hand-over-mouth technique and physical restraints. Pharmacological interventions include conscious sedation, nitrous oxide and general anesthesia.[4] Distraction is the technique that divert the attention of patients from what was perceived as an unlikable procedure. Distraction, which incorporates deviating children's mind away from painful stimuli all through invasive dental procedures, aids in reducing fear and anxiety in the child and is the most efficacious when customised to the child's developmental level. Distraction appears to be safe and inexpensive, and it has the potential to shorten the duration of the procedure. Furthermore, non-invasive techniques are preferred over general anaesthesia and sedation. Different studies reported on distraction methods like the presentation of pictures, audio or music,[5] videotaped material, [1,2] audio-visual distraction with eyeglasses [6,7] to be successful means of reducing anxiety and providing better compliance. However, these distraction techniques were not routinely cited in the literature in the case of the differently abled children, who exhibit limitations in the dental operatory with positive behavior. The aim of the current study is to compare the efficacy of audio distraction, audio-visual distraction, video distraction and tell-show-do techniques in the management of differently abled pediatric dental patients in the dental operatory.

2. MATERIALS AND METHODS

2.1 Study design

The present comparative study was conducted at the St. John special higher secondary school for handicapped, located at Mandakarai, near Villupuram district, Tamil Nadu, India. The duration was for one year. A sample of 120 children were selected on the basis of convenient sampling method. The study was approved by the Institutional Ethical Committee & Internal Review Board (IRB Ref. No. IGIDSIRB2014PEDO01PGCADP). A written informed consent in the vernacular language was obtained from the coordinator and the guardian for all the participants prior to the study. Physically disabled children between the age group of 6-12 years with large multiple carious lesions were included for the study. Differently abled children with mental, auditory-visual disability were excluded.

2.2 Interventions

The participants (n = 120) were assorted randomly into four groups of 30 each. The groups were divided as follows:

2.3 In Group A (Audio Distraction)

Distraction was using rag Chandrakauns or patient's favorite music which was provided through the earphones/headphones.

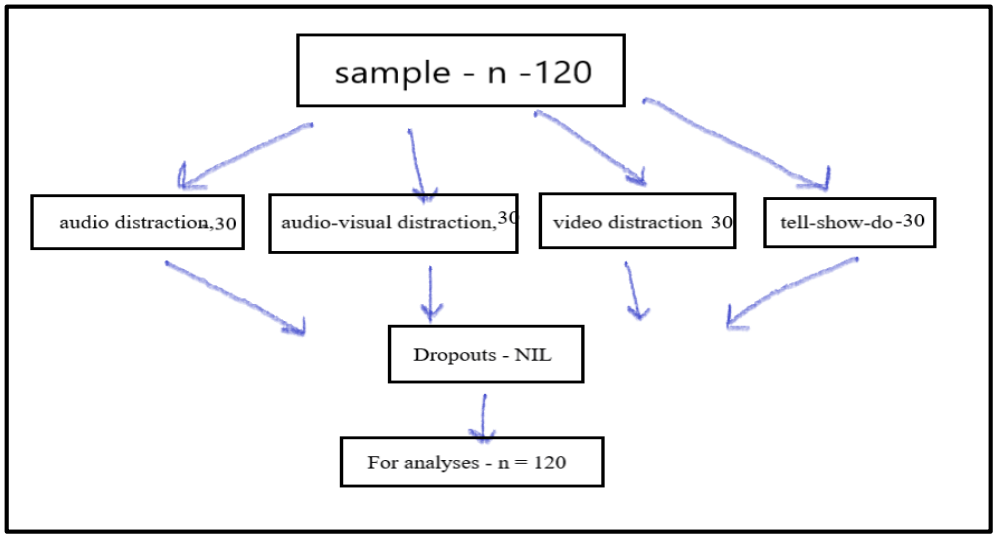
2.4 In Group B (Audiovisual Distraction)

This distraction technique is a combination of both audio and video compiled in an eyeglass gear. It consists of a virtual reality screen or virtual private theatre system which projects the favorite programs of the child, for instance, a popular cartoon program in a 70 mm screen and the source of the audio comes from the attached earplugs to the frame of the eyeglass. In Group C (Video Distraction): The technique consists of the projection of the favorite cartoon of the child using the TV monitor or any display. This monitor projects the cartoons and was placed exactly opposite to the chair in which the child is seated. In Group D (Tell-Show-Do technique): A conventional method without any distraction. In this technique, the exact treatment procedure was explained to the child. Before starting the procedure, the child has been given a spoon excavator in hand so that he/she feels it and how the demonstrated spoon excavator is going to be used inside the mouth without any deviation from the explanation, the treatment was performed in the mouth of the child. During all these distraction techniques, a sharp spoon excavator was employed for the excavation of large cavitated caries and restored using the Glass Ionomer Cement. Before starting the procedure, the study parameters were recorded at the time and after the restorative material was placed.

2.5 Data collection

Blood Pressure (BP), PR and SPO2 levels were recorded using Pulse Oximetry before the introduction of the distraction technique, during the procedure and after completion of the procedure. The Pulse Oximeter was clipped on the index finger for recording the arterial oxygen saturation. The demographic data was collected in the form of case sheets which consist of personal information, diagnosis and a treatment plan was observed by an independent observer.

Consort flow diagram



3. STATISTICAL ANALYSIS

Data pooled were coded in the Microsoft Excel spreadsheet. R statistical software (version 3.6.1) was used to analyze the data. The data represented categorically were in the form of frequencies and compared using the chi-square test. Data represented as continuous were in the form of mean ± standard deviation and the mean difference was compared with Kruskal-Wallis test. Further post-hoc analysis tests and Bonferroni tests were employed to determine the statistical significance between the groups.

4. RESULTS

The age, gender and physiologic parameters of the participants in the study are depicted in Table 1.

Table 1: Demographic characteristics and physiologic parameters of participants

Parameters	Groups				p-value
	A	B	C	D	
Age in years (mean ± SD)	8.50±1.28	8.40±0.97	8.37±0.93	8.20±1.13	0.75
Male (%)	15 (50%)	15(50%)	14 (46.7%)	14 (46.7%)	-
Female (%)	15(50%)	15(50%)	16 (53.3%)	16 (53.3%)	-
Physiological parameters					
Systolic blood pressure (mmHg)					
Before	108.73 ± 14.0	106.87 ±5.66	112.67 ±7.7	109.20 ±6.12	0.027*
During	103.8 ±13.84	98.43±5.62	105.0±6.82	102.0 ±4.47	0.004*
After	104.77 ±23.30	107.20±4.93	113.57±6.39	108.43 ±6.23	0.002*
Diastolic blood pressure (mmHg)					
Before	73.17±11.76	76.5±7.37	76.53±6.63	75.9±6.43	0.484
During	71.8±10.71	69.77±6.03	68.67±4.9	68.83±5.03	0.423
After	70.83±10.85	74.47±6.45	71.0±5.78	71.17±5.03	0.140
Pulse rate (per minute)					
Before	83.53 ±10.58	84.70±4.85	82.13±7.01	82.80 ±6.22	0.488
During	81.63±16.97	79.70 ±4.15	77.53 ± 5.42	78.67 ± 5	0.068
After	81.70 ±9.97	84.97 ±4.37	105.17 ±121.54	83.77 ±5.51	0.248
Pulse oxygen saturation (%)					
Before	97.67 ±2.644	99.1±1.71	98.77 ±1.04	98.87 ±1.10	0.0384*
During	95.67 ±2.37	96.67 ±1.95	97.33±1.35	97.63±1.40	0.0008*
After	96.53 ±2.29	99.13 ±1.04	98.30 ±0.95	98.33 ±0.88	<0.0001*

A: Audio distraction, B: Audio-visual distraction, C: Visual distraction, D: Tell-show-do technique

The difference in age between 120 children was statistically insignificant (p = 0.75). Among all the groups, regards to gender, the number of females (51.7%) were predominant compared to the number of males (48.3%). The main physiologic parameters assessed were SBP, DBP, PR, and SPO2 before (B), during (D) and after (A) treatment. Mean SBP and SPO2 were statistically significant in all the four groups before, after and during treatment. An intra-group

comparison of physiologic parameters demonstrated a statistically significant difference for DBP during-after treatment in group B ($p<0.0001$), C ($p = 0.00249$) and D ($p = 0.00249$). Also, there was a statistically significant difference ($p<0.0001$) observed for SBP and PR in groups B, C and D at during-after-treatment. Also, SPO2 values demonstrated a statistically significant difference during-after-treatment with $p = 0.003$ for Group A and $p<0.0001$ for Groups B and C respectively as shown in Table 2.

Table 2: Intra-group comparison of physiologic parameters

	Before-During	p-value	During-After	p-value	Before-After	p-value
Systolic blood pressure (mmHg)						
A	4.93±6.77	0.0041[pt]	-0.97±15.48	0.7348[pt]	3.97±16.05	0.1863
B	8.43±3.57	<0.0001	-8.77±3.73	<0.0001	-0.33±2.95	0.4749
C	7.67±3.68	<0.0001[pt]	-8.57±3.55	<0.0001	-0.9±2.99	0.1336
D	7.2±3.42	<0.0001	-6.43±3.84	<0.0001	0.77±4.05	0.3469
Diastolic blood pressure (mmHg)						
A	1.33±4.86	0.1437[pt]	1±5.9	0.361	2.33±6.95	0.07618
B	6.73±4.87	<0.0001[pt]	-4.7±4.08	<0.0001[pt]	2.03±5.2	0.04084[pt]
C	7.87±5.28	<0.0001	-2.33±3.41	0.00249	5.53±6.53	0.00020
D	7.07±2.89	<0.0001	-2.33±3.41	0.00249	4.73±4.02	<0.0001
Pulse rate (per minute)						
A	1.9±15.01	0.4937[pt]	-0.07±14.5	0.9801[pt]	1.83±3.63	0.0097
B	5±1.55	<0.0001[pt]	-5.27±2	<0.0001[pt]	-0.27±1.44	0.3178[pt]
C	4.6±3.67	<0.0001[pt]	-5.66±3.11	<0.0001[pt]	-1.06±4.3	0.1858[pt]
D	4.13±4.11	<0.0001[pt]	-5.1±2.01	<0.0001[pt]	-0.97±4.3	0.2284[pt]
Pulse oxygen saturation (%)						
A	2±1.23	<0.0001	0.87±1.31	0.00358	1.13±1.01	<0.0001
B	2.43±1.19	<0.0001	-2.47±1.76	<0.0001	-0.03±1.43	0.7442
C	1.43±1.14	<0.0001	-0.97±0.96	<0.0001	0.47±0.94	0.01374
D	1.23±1.19	<0.0001	-0.7±1.56	0.1998[pt]	0.53±1.28	0.02992

The comparison of different physiologic parameters between the groups are presented in Table 3. Distribution of during-after SBP in Groups B and C was statistically significant in comparison to Group A during-after treatment. The results were similar with respect to DBP, PR, and SPO2.

pt: paired t-test

Table 3: Inter-group comparison of physiologic parameters

Group	Before-During	p-value	During-After	p-value	Before-After	p-value
Systolic blood pressure (mmHg)						
A	4.93±6.77	0.07158[A]	-0.97±15.48	<0.0001[KW]	3.97±16.05	<0.0001[KW]
B	8.43±3.57		-8.77±3.73		-0.33±2.95	
C	7.67±3.68		-8.57±3.55		-0.9±2.99	
D	7.2±3.42		-6.43±3.84		0.77±4.05	
Diastolic blood pressure (mmHg)						
A	1.33±4.86	<0.0001[KW]	1±5.9	0.00278[KW]	2.33±6.95	0.013688[KW]
B	6.73±4.87		-4.7±4.08		2.03±5.2	
C	7.87±5.28		-2.33±3.41		5.53±6.53	
D	7.07±2.89		-2.33±3.41		4.73±4.02	
Pulse rate (per minute)						
A	1.9±15.01	0.01237[KW]	-0.07±14.5	<0.0001[KW]	1.83±3.63	0.0005184[KW]
B	5±1.55		-5.27±2		-0.27±1.44	
C	4.6±3.67		-5.66±3.11		-1.06±4.3	
D	4.13±4.11		-5.1±2.01		-0.97±4.3	
Pulse oxygen saturation (%)						
A	2±1.23	0.0005225[A#]	0.87±1.31	<0.0001[KW]	1.13±1.01	<0.00092[KW]
B	2.43±1.19		-2.47±1.76		-0.03±1.43	
C	1.43±1.14		-0.97±0.96		0.47±0.94	
D	1.23±1.19		-0.7±1.56		0.53±1.28	

A = ANOVA, Group A: Audio distraction, B: Audio-visual distraction, C: Visual distraction, D: Tell-show-do technique, KW: Kruskal-Wallis test, #: Outliers were not present in the data

Further post-hoc analysis tests and Bonferroni tests were conducted to determine the group that was significantly better. After performing multiple comparisons between the groups, the results revealed that SBP between the groups before the treatment was not statistically significant. Whereas, at during-after-treatment, SBP in Group B was statistically significant in comparison to Group C. With respect to Group D, there was no statistically significant difference observed. Distribution of DBP in between the groups showed that before-during treatment Group B showed statistically significant difference with Group A (p = 0.0018), whereas, there was no statistically significant difference observed with Groups C and D [Table 4**]**.

Table 4: Post-hoc analysis of intergroup comparison of systolic and diastolic parameters

Parameters		Groups			
SBP (mmHg)		**A**	**B**	**C**	**D**
During-After	**A**	-	<0.0001	<0.0001	0.0393
	B	<0.0001	-	1.00	0.2391
	C	<0.0001	1.00	-	0.3079
Before- After	**A**	-	0.0013	<0.0001	0.00895
	B	0.0013	-	1.00	1.00
	C	<0.0001	1.00	-	0.32222
DBP (mmHg)		**A**	**B**	**C**	**D**
Before- During	**A**	-	0.00018	<0.0001	<0.0001
	B	0.00018	-	1.000	1.000
	C	<0.0001	1.000	-	1.000
During-After	**A**	-	0.0014	1.000	1.000
	B	0.0014	-	0.1034	1.000
	C	1.000	0.1034	-	1.000
Before-After	**A**	-	1.000	0.0800	0.0184
	B	1.000	-	1.000	0.4589
	C	0.0800	1.000	-	1.000

DBP = diastolic blood pressure, SBP = systolic blood pressure, Group A: Audio distraction, B: Audio-visual distraction, C: Visual distraction, D: Tell-show-do technique

Distribution of during-after-treatment PR showed that Group B, C and D showed statistically significant difference to Group A with p<0.0001 and Group B showed significant statistical difference (p<0.0001) to Group A. Pulse oxygen saturation levels (SPO2) during-after treatment in between the groups revealed that Group B was statistically significant compared to groups A, C and D with p = 0.00078, 0.00435 and 0.00034 respectively [Table 5**]**.

Table 5: Post-hoc analysis of intergroup comparison of pulse rate and pulse oxygen saturation

Parameters		Groups			
PR (per minute)		**A**	**B**	**C**	**D**
Before-During	**A**	-	0.0886	0.0092	0.2104
	B	0.0886	-	0.8497	0.8497
	C	0.0092	0.8497	-	0.6546
During-After	**A**	-	<0.0001	<0.0001	<0.0001
	B	<0.0001	-	1.000	1.000
	C	<0.0001	1.000	-	1.000
Before-After	**A**	-	0.0017	0.0071	0.0044
	B	0.0017	-	1.000	1.000
	C	0.0071	1.000	-	1.000
SPO_2 (%)		**A**	**B**	**C**	**D**
Before-During	**A**	-	0.4950	0.2576	0.06578
	B	0.4950	-	0.00796	0.00089
	C	0.2576	0.00796	-	0.91491
During-After	**A**	-	0.00078	1.000	1.000
	B	0.00078	-	0.00435	0.00034
	C	1.000	0.00435	-	1.000
Before-After	**A**	-	0.00032	0.21816	0.42758
	B	0.00032	-	0.30687	0.15081
	C	0.21816	0.30687	-	1.000

PR = pulse rate, SPO2 = pulse oxygen saturation, Group A: Audio distraction, B: Audio-visual distraction, C: Visual distraction, D: Tell-show-do technique

Overall, Group B (Audiovisual Distraction) proved to be the most effective treatment in differently abled dental pediatric patients. Followed by Group B, Group A (Audio Distraction) proved to be an effective treatment.

5. DISCUSSION

Anxiety is a non-specific unpleasant feeling of discomfort and requires therapeutic interventions usually.[1,8] Dental anxiety in high levels result in higher dental caries in children which will affect the oral health of patients.[9] Avoidance of dental procedure in children ranges between 5.7% to 19.5% and was due to anxiety. Hence, to manage the anxiety and fear, proper assessment of dental anxiety followed by the requirement of treatment in a pleasant setting is essential [9] Music is proved to be a plan of action to manage anxiety. Music medicine is defined as "passive listening to music which are pre-recorded and administered by medical personnel". It is an audio analgesic, sedative which could be used as a supplement along with nonpharmacological techniques. Gerik (2011) has reviewed that, developmental consideration and mind-body therapy especially music therapy proved to be effective in eliciting desired clinical outcomes. He also discussed that music therapy could be an option in pre-operative settings, for painful procedures and emergency departments for reducing anxiety and stress.[10] Patients were exposed to four different distraction techniques: Audio distraction, audiovisual distraction, video distraction and tell-show-do technique in the current study. Study results showed that audiovisual distraction had a major effect on anxiety reduction and pain in differently abled children. A similar comparative study conducted by Prabhakar et al (2007) compared audio distraction and audiovisual distraction techniques among children and reported that audiovisual distraction was more effective in management of pediatric anxiety.[1] Another study conducted by Marwah et al (2005) on efficacy and management of music evaluation in anxious dental patients reported reduction in anxiety levels in pediatric dental patients, however the effect was not much significant.[5] Few other studies also showed similar results which proved that audiovisual distraction was more effective in management of pediatric anxiety.[1,9,11] In a study conducted by Lai and Colleagues on music therapy in patients who underwent root canal therapy, the only method employed in their study as a behavior management was audiovisual distraction and the results demonstrated that PR and SPO2 showed statistically significant difference compared to before values, while we compared four methods wherein decrease in PR and SPO2 were observed though not significant in differently abled children.[12] In a study conducted by Khotani AA (2016), a comparison of audiovisual distraction versus control showed less effectiveness in anxiety reduction due to the design used for the eyeglass system as it could not eliminate the access of vision to the surrounding area.[13] The current study revealed that differences in SBP during-after treatment between the groups were statistically significant. Multiple comparisons conducted between the groups revealed that SBP in between the groups before the treatment was not significant, whereas SBP in the audiovisual distraction group was statistically significant in comparison to visual distraction. SPO2 levels at all timepoints during treatment in between the groups were statistically significant when compared audio distraction group to audiovisual distraction group. In contrast to the results, few other studies reported that audio distraction showed better results. Studies conducted by Singh et al., (2014) and Navit et al (2015) reported a major reduction in anxiety in comparison to the control group which could be attributed to the music presentations and audio stories that were more effective.[14,15] Farhat *et al* compared live modeling and on the basis of heart rates of children during treatment, lower heart rates were achieved during live modeling with the mother in comparison with father and tell-show-do technique.[16] In our study, tell-show-do (group D) proved better only next to audio groups (A) and audio-visual (B) groups. Few other studies conducted by Khandelwal et al (2018) and Alrshah et al (2014) also showed similar results with the use of tell-show-do behavior.[17,18] The uniqueness of the study lies in comparing the audio distraction, audiovisual distraction, video distraction and conventional tell-show-do technique in children who are differently abled dental patients. It can be concluded that audio-visual distraction proved to be the best behavior management technique in the management of fear and anxiety in differently abled pediatric dental patients besides not only recommended for pediatric dental patients but also for the varied groups of age.

5.1 Risk of bias

Randomization and blinding decrease the risk of bias in our design.

5.2 Limitations

Our study has few limitations. Firstly, the audio presentation might affect the interaction capability of patient with dentist. Hence it could act as an adjunct along with other behavioral management techniques. Another limitation was the use of comparatively small sample size. Further studies should be conducted in future with a larger sample size to evaluate the success of behavioral therapy. An analysis of the type of audio distraction with differing ages and their success in these patients may be the work of future research

6. CONCLUSION

The audiovisual distraction technique, which employs a virtual reality private theatre system followed by audio distraction, has proven to be a successful and effective behavioral management technique. This method completely eliminates the discomfort associated with the dental procedure. The behavioral intervention techniques used were non-pharmacological methods that provided a peaceful dental environment for differently abled children with fear and anxiety.

7. AUTHOR CONTRIBUTION

ACH - data collection, concept and design
A JS, data collection and statistics
KG- overall supervision,
R. S – concept and design
S A - manuscript

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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