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Effectiveness of Kaleidoscope Distraction Therapy in Reducing Dental Anxiety among Pediatric Patients: A Clinical Study

(A Spectrum of Smiles: Kaleidoscope Therapy for Childhood Dental Anxiety)

Dr.C.Chrishantha Joybell M.D.S [1 *]

[1] Reader and Head, Department of Pedodontics and Preventive dentistry, Rajas Dental college and hospital, Tamil Nadu Dr.M.G.R Medical university

CORRESPONDING AUTHOR

Dr.C.Chrishantha Joybell [1*]M.D.S.,4/8 Dhanasekaran nagar 2nd street, Tuticorin 628002

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KEYWORDS

Dental anxiety; Pediatric dentistry; Kaleidoscope Distraction Therapy; Visual distraction; Non-pharmacological behaviour management.

ABSTRACT:

Background: Dental anxiety is a common behavioural challenge encountered in pediatric dentistry and often results in poor cooperation and compromised oral health. Non-pharmacological behaviour management techniques play a vital role in alleviating anxiety. Visual distraction methods have been shown to effectively reduce stress in children during dental procedures1-4.

Aim and Objectives: To evaluate anxiety levels in pediatric patients visiting the dental outpatient department of a dental college and hospital, Chennai, and to assess the effectiveness of a novel non-pharmacological intervention—Kaleidoscope Distraction Therapy—in reducing dental anxiety.

Results: Children exposed to Kaleidoscope Distraction Therapy demonstrated a statistically significant reduction in anxiety levels as assessed by Modified Corah's Dental Anxiety Scale (MCDAS), RMS pictorial scale, and heart rate measurements.

Conclusion: Kaleidoscope Distraction Therapy appears to be a simple, cost-effective, and promising behaviour management technique for reducing dental anxiety in pediatric patients.

INTRODUCTION

Children exhibit immature emotional responses that influence their behaviour during dental visits. Dental anxiety refers to fear associated with dental treatment and is a major obstacle in achieving successful pediatric dental care. Anxiety often manifests as crying, withdrawal, or refusal of treatment, leading to delayed management of dental caries and subsequent complications.

Behaviour guidance techniques such as Tell-Show-Do, modelling, and communication are commonly used. When these methods fail, pharmacological management may be required. However, parental concerns regarding sedation and general anaesthesia frequently delay treatment[1-6].

Creating a child-friendly dental environment using visual and auditory distractions has been shown to alleviate anxiety. Distraction techniques divert the child's attention away from unpleasant stimuli and toward engaging sensory experiences.

A kaleidoscope is a visual device producing colourful symmetrical patterns that continuously change with movement. These dynamic visuals capture attention, stimulate curiosity, and provide cognitive distraction. Visual distraction using kaleidoscopes has been reported to reduce anxiety and improve cooperation in pediatric medical settings[7-10].

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This study introduces **Kaleidoscope Distraction Therapy** as a novel visual distraction technique to assess its effectiveness in reducing dental anxiety in children.

AIM AND OBJECTIVES

To evaluate the effectiveness of Kaleidoscope Distraction Therapy in reducing dental anxiety among children aged 5–10 years during dental visits using subjective (MCDAS, RMS pictorial scale) and objective (heart rate) measures.

MATERIALS AND METHODS

Fifty healthy children aged 5–10 years attending the Department of Pedodontics for preventive and restorative procedures such as fluoride application, pit and fissure sealants, oral prophylaxis, and fillings were included. All children were first-time dental visitors.

The sample consisted of 25 males and 25 females. Children who were anxious or fearful during dental visits were included. Children with visual impairment, special healthcare needs, or medical compromise were excluded. Written informed consent was obtained from parents or guardians. Ethical clearance was secured prior to study initiation.

KALEIDOSCOPE DISTRACTION THERAPY

Each child was provided with a handheld kaleidoscope displaying multicoloured symmetrical patterns. The kaleidoscope was introduced before seating the child, during the dental procedure, and until completion of treatment. Children were encouraged to observe the changing patterns throughout the procedure.

ANXIETY ASSESSMENT TOOLS

MODIFIED CORAH'S DENTAL ANXIETY SCALE (MCDAS)

MCDAS was recorded before and after the dental procedure. Scores above 19 indicated anxiety. Scores higher than 31, indicates severe phobic disorder. MCDAS scores were obtained before starting the dental procedure and after the completion of the dental procedure. During the dental procedure it is not possible to evaluate the MCDAS score by putting forth questions to the child.

The MCDAS$_{(f)}$ Scale

How do you feel about:	😀	🙂	😐	☹	😢
Q1: Going to the dentist generally	1	2	3	4	5
Q2: Having your teeth looked at	1	2	3	4	5
Q3: Having your teeth scraped or polished	1	2	3	4	5
Q4: Having an injection in gums	1	2	3	4	5
Q5: Having a filling	1	2	3	4	5
Q6: Having teeth taken out	1	2	3	4	5

Likert scale:

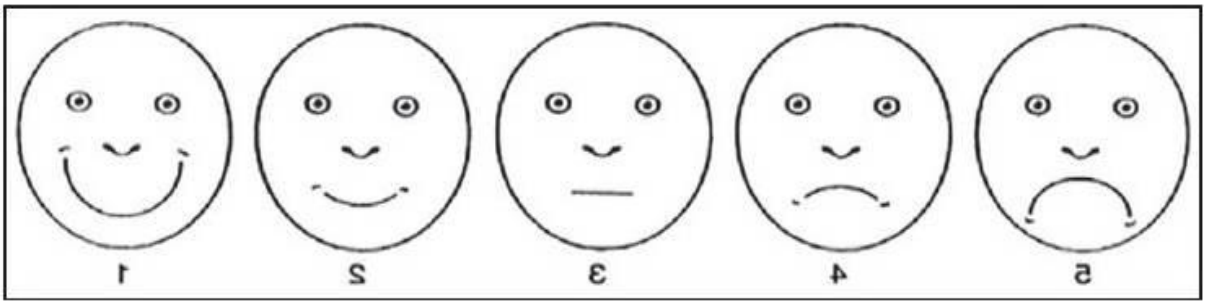
1. would mean: relaxed/not worried
2. would mean: very slightly worried
3. would mean: fairly worried
4. would mean: worried a lot
5. would mean: very worried

RMS PICTORIAL SCALE

RMS scale was recorded at three time points:

- On entering the operatory
- During the procedure with kaleidoscope distraction
- After completion

Scores ranged from 1 (very happy) to 5 (very unhappy).



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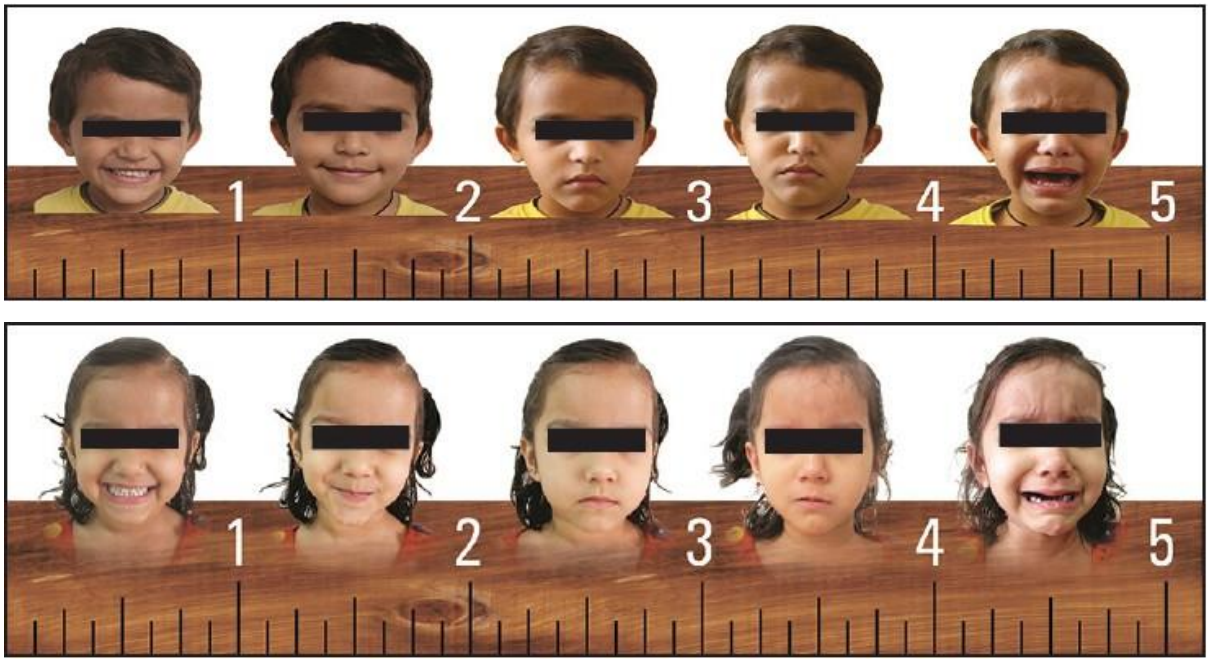

HEART RATE MEASUREMENT

Heart rate was measured using a pulse oximeter before, during, and after the procedure.

RESULTS

TABLE 1: DISTRIBUTION OF SAMPLES ACCORDING TO SEX (Frequency Tables)

Sex	N	%
Male	25	50.0%
Female	25	50.0%
Total	50	100.0%

TABLE 2: DISTRIBUTION OF SAMPLES ACCORDING TO AGE

Age group	N	%
5.0 - 7.0 yrs	15	30.0%
7.1 - 9.0 yrs	22	44.0%
9.1 - 10.0 yrs	13	26.0%
Total	50	100.0%

TABLE 3: DISTRIBUTION OF SAMPLES ACCORDING TO AGE & SEX

Age group	Sex					
	Male		Female		Total	
	N	%	N	%	N	%
5.0 - 7.0 yrs	9	36.0 %	6	24.0 %	15	30.0 %
7.1 - 9.0 yrs	9	36.0 %	13	52.0 %	22	44.0 %
9.1 - 10.0 yrs	7	28.0 %	6	24.0 %	13	26.0 %
Total	25	100.0 %	25	100.0 %	50	100.0 %

GRAPH 1: GRAPH DEPICTING GENDER WISE AGE GROUP DISTRIBUTION

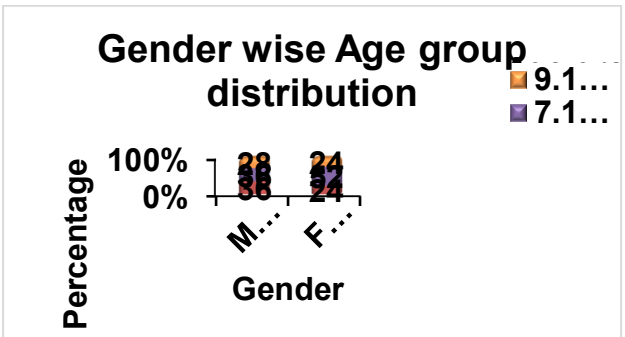

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TABLE 4: COMPARISON OF TOTAL MCDAS SCALE

Total MCDAS Scale		Before	After	p-value*
Overall	N	50	50	<0.001
	Median	22.0	12.0	
	1st Quartile	15.0	9.0	
	3rd Quartile	33.0	17.0	
	Mean	22.7	12.9	
	Std Dev	9.9	5.2	

* Related-Samples Wilcoxon Signed Rank Test

TABLE 5: GENDER WISE COMPARISON OF TOTAL MCDAS SCALE

Total MCDAS Scale		Before	After	p-value*
Male	N	25	25	<0.001
	Median	22.0	13.0	
	1st Quartile	15.0	9.0	
	3rd Quartile	34.0	17.0	
	Mean	23.1	13.4	
	Std Dev	10.0	5.7	
Female	N	25	25	<0.001
	Median	22.0	11.0	
	1st Quartile	13.0	9.0	
	3rd Quartile	29.0	14.0	
	Mean	22.4	12.4	
	Std Dev	10.1	4.8	
p-value[@]		0.838	0.559	

* Related-Samples Wilcoxon Signed Rank Test

[@]Independent-Samples Mann-Whitney U Test

TABLE 6: AGE GROUP WISE COMPARISON OF TOTAL MCDAS SCALE

Total MCDAS Scale		Before	After	p-value*
5.0 - 7.0 yrs	N	15	15	<0.001
	Median	33.0	17.0	
	1st Quartile	21.0	12.0	
	3rd Quartile	39.0	20.0	
	Mean	29.5	16.4	
	Std Dev	9.9	4.7	
7.1 - 9.0 yrs	N	22	22	0.001
	Median	23.0	12.0	
	1st Quartile	20.0	11.0	
	3rd Quartile	29.0	15.0	
	Mean	24.0	13.5	
	Std Dev	7.8	4.8	
9.1 - 10.0 yrs	N	13	13	1.000
	Median	12.0	7.0	
	1st Quartile	11.0	6.0	
	3rd Quartile	15.0	9.0	
	Mean	12.8	7.9	
	Std Dev	4.0	2.0	
p-value[#]		<0.001	<0.001	

*Related-Samples Wilcoxon Signed Rank Test

[#]Independent-Samples Kruskal-Wallis Test

TABLE 7: BONFERRONI CORRECTED PAIRWISE COMPARISONS OF TOTAL MCDAS SCALE

Pairs (Age group)	Before	After
9.1 - 10.0 yrs vs 7.1 - 9.0 yrs	0.001	0.001
9.1 - 10.0 yrs vs 5.0 - 7.0 yrs	<0.001	<0.001

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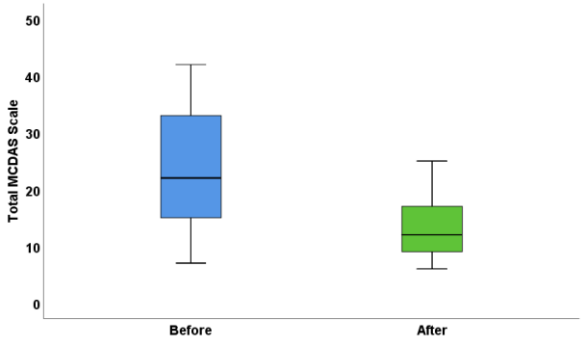
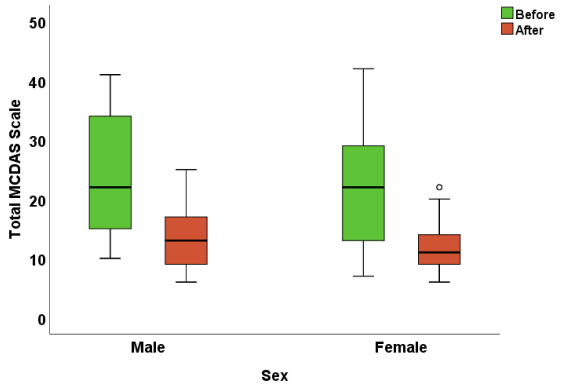
7.1 - 9.0 yrs vs 5.0 - 7.0 yrs	0.511	0.382

GRAPH 2: COMPARISON OF TOTAL MCDAS SCALE



GRAPH 3: GENDER WISE COMPARISON OF TOTAL MCDAS SCALE



GRAPH 4: AGE GROUP WISE COMPARISON OF TOTAL MCDAS SCALE

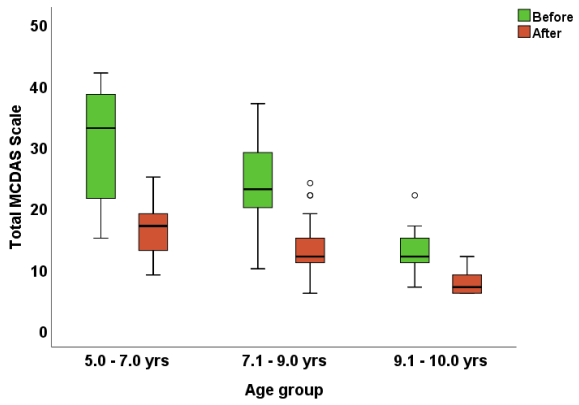


TABLE 8: COMPARISON OF TOTAL RMS SCALE

RMS Scale		Before	During	After	p-value[$]
Overall	N	50	50	50	<0.001
	Median	1.0	1.0	1.0	
	1st Quartile	1.0	1.0	1.0	
	3rd Quartile	2.0	1.0	1.0	
	Mean	1.8	1.2	1.0	
	Std Dev	.9	.5	.0	

[$]Related-Samples Friedman's Two-Way Analysis of Variance

TABLE 9: BONFERRONI CORRECTED PAIRWISE COMPARISONS OF RMS SCALE

Pairs (Time points)	p-value
After vs During	0.750
After vs Before	<0.001
During vs Before	0.024

TABLE 10: GENDER WISE COMPARISON OF TOTAL RMS SCALE

RMS Scale		Before	During	After	p-value[$]
Male	N	25	25	25	<0.001
	Median	2.0	1.0	1.0	
	1st Quartile	1.0	1.0	1.0	
	3rd Quartile	2.0	1.0	1.0	
	Mean	1.8	1.2	1.0	
	Std Dev	.9	.4	.0	
Female	N	25	25	25	<0.001
	Median	1.0	1.0	1.0	
	1st Quartile	1.0	1.0	1.0	

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	3rd Quartile	2.0	1.0	1.0	
	Mean	1.7	1.2	1.0	
	Std Dev	.9	.5	.0	
p-value[@]		0.687	0.771	1.000	

[$]Related-Samples Friedman's Two-Way Analysis of Variance

[@]Independent-Samples Mann-Whitney U Test

TABLE 11: BONFERRONI CORRECTED PAIRWISE COMPARISONS OF RMS SCALE

Pairs (Time points)	p-value	
	Male	Female
After vs During	1.000	1.000
After vs Before	0.011	0.040
During vs Before	0.143	0.231

TABLE 12: AGE GROUP WISE COMPARISON OF TOTAL RMS SCALE

RMS Scale		Before	During	After	p-value[$]
5.0 - 7.0 yrs	N	15	15	15	<0.001
	Median	3.0	1.0	1.0	
	1st Quartile	3.0	1.0	1.0	
	3rd Quartile	3.0	2.0	1.0	
	Mean	2.9	1.4	1.0	
	Std Dev	.6	.6	.0	
7.1 - 9.0 yrs	N	22	22	22	0.051
	Median	1.0	1.0	1.0	
	1st Quartile	1.0	1.0	1.0	
	3rd Quartile	2.0	1.0	1.0	
	Mean	1.4	1.2	1.0	
	Std Dev	.5	.4	.0	
9.1 - 10.0 yrs	N	13	13	13	1.000
	Median	1.0	1.0	1.0	
	1st Quartile	1.0	1.0	1.0	
	3rd Quartile	1.0	1.0	1.0	
	Mean	1.0	1.0	1.0	
	Std Dev	.0	.0	.0	
p-value[#]		<0.001	0.071	1.000	

[$]Related-Samples Friedman's Two-Way Analysis of Variance

[#]Independent-Samples Kruskal-Wallis Test

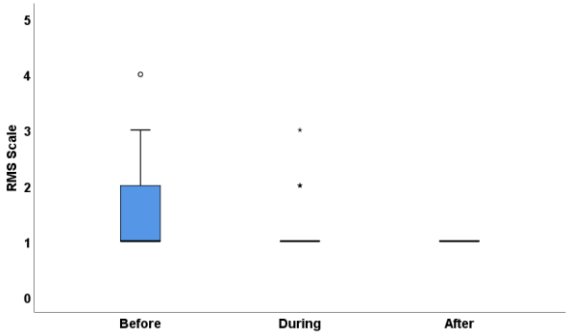
TABLE 13: BONFERRONI CORRECTED PAIRWISE COMPARISONS OF AGE GROUP

Pairs (Age group)	Before
9.1 - 10.0 yrs vs 7.1 - 9.0 yrs	0.288
9.1 - 10.0 yrs vs 5.0 - 7.0 yrs	<0.001
7.1 - 9.0 yrs vs 5.0 - 7.0 yrs	<0.001

TABLE 14: BONFERRONI CORRECTED PAIRWISE COMPARISONS OF RMS SCALE

Pairs (Time points)	p-value
	5.0 - 7.0 yrs
After vs During	0.946
After vs Before	<0.001
During vs Before	0.002

GRAPH 5: COMPARISON OF RMS SCALE



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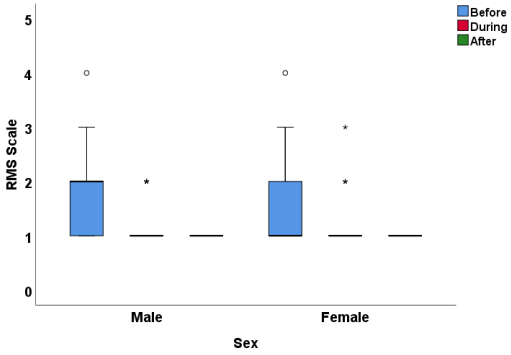
GRAPH 6: GENDER GROUP WISE COMPARISON OF TOTAL RMS SCALE



GRAPH 7: AGE GROUP WISE COMPARISON OF TOTAL RMS SCALE

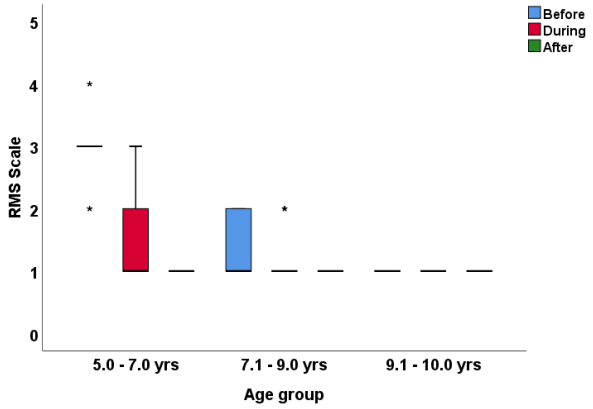


TABLE 15: CHI-SQUARE TEST TO COMPARE PROPORTIONS OF HEART RATE BETWEEN GENDERS

Heart Rate		Sex						p-value
		Male		Female		Total		
		N	%	N	%	N	%	
Before	Normal	11	44.0%	12	48.0%	23	46.0%	
	High	14	56.0%	13	52.0%	27	54.0%	0.777
	Total	25	100.0%	25	100.0%	50	100.0%	
During	Normal	22	88.0%	20	80.0%	42	84.0%	
	High	3	12.0%	5	20.0%	8	16.0%	0.702*
	Total	25	100.0%	25	100.0%	50	100.0%	
After	Normal	23	92.0%	24	96.0%	47	94.0%	
	High	2	8.0%	1	4.0%	3	6.0%	1.000*
	Total	25	100.0%	25	100.0%	50	100.0%	

* Fisher's exact test p-value

TABLE 16: CHI-SQUARE TEST TO COMPARE PROPORTIONS OF HEART RATE BETWEEN AGE GROUPS

Heart Rate		Age group								p-value
		5.0 - 7.0 yrs		7.1 - 9.0 yrs		9.1 - 10.0 yrs		Total		
		N		N		N		N		
Before	Normal	3	20.0	10	45.5	10	76.9	23	46.0	
	High	12	80.0	12	54.5	3	23.1	27	54.0	0.011
	Total	15	100.0	22	100.0	13	100.0	50	100.0	
During	Normal	11	73.3	18	81.8	13	100.0	42	84.0	
	High	4	26.7	4	18.2	0	0.0	8	16.0	0.172*

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	Total	15	100.0	22	100.0	13	100.0	50	100.0	
After	Normal	14	93.3	20	90.9	13	100.0	47	94.0	
	High	1	6.7	2	9.1	0	0.0	3	6.0	0.781*
	Total	15	100.0	22	100.0	13	100.0	50	100.0	

* Fisher's exact test p-value

TABLE 17: MCNEMAR'S CHI-SQUARE TEST TO COMPARE HEART RATE BETWEEN TIME POINTS

Heart Rate		Heart Rate: Before						p-value
		Normal		High		Total		
		N	%	N	%	N	%	
During	Normal	22	95.7%	20	74.1%	42	84.0%	
	High	1	4.3%	7	25.9%	8	16.0%	<0.001
	Total	23	100.0%	27	100.0%	50	100.0%	
After	Normal	23	100.0%	24	88.9%	47	94.0%	
	High	0	0.0%	3	11.1%	3	6.0%	<0.001
	Total	23	100.0%	27	100.0%	50	100.0%	
Heart Rate		Heart Rate: After						p-value
		Normal		High		Total		
		N	%	N	%	N	%	
During	Normal	42	89.4%	0	0.0%	42	84.0%	
	High	5	10.6%	3	100.0%	8	16.0%	0.063
	Total	47	100.0%	3	100.0%	50	100.0%	

TABLE 18: MCNEMAR'S CHI-SQUARE TEST TO COMPARE HEART RATE BETWEEN TIME POINTS: GENDER WISE

Sex	Heart Rate		Heart Rate: Before						p-value
			Normal		High		Total		
			N	%	N	%	N	%	
Male	During	Normal	11	100.0%	11	78.6%	22	88.0%	
		High	0	0.0%	3	21.4%	3	12.0%	0.001
		Total	11	100.0%	14	100.0%	25	100.0%	
	After	Normal	11	100.0%	12	85.7%	23	92.0%	
		High	0	0.0%	2	14.3%	2	8.0%	<0.001
		Total	11	100.0%	14	100.0%	25	100.0%	
Female	During	Normal	11	91.7%	9	69.2%	20	80.0%	
		High	1	8.3%	4	30.8%	5	20.0%	0.021

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		Total	12	100.0%	13	100.0%	25	100.0%	
	After	Normal	12	100.0%	12	92.3%	24	96.0%	
		High	0	0.0%	1	7.7%	1	4.0%	<0.001
		Total	12	100.0%	13	100.0%	25	100.0%	
Sex	Heart Rate		Heart Rate: After						p-value
			Normal		High		Total		
			N	%	N	%	N	%	
Male	During	Normal	22	95.7%	0	0.0%	22	88.0%	
		High	1	4.3%	2	100.0%	3	12.0%	0.999
		Total	23	100.0%	2	100.0%	25	100.0%	
Female	During	Normal	20	83.3%	0	0.0%	20	80.0%	
		High	4	16.7%	1	100.0%	5	20.0%	0.125
		Total	24	100.0%	1	100.0%	25	100.0%	

TABLE 19: MCNEMAR'S CHI-SQUARE TEST TO COMPARE HEART RATE BETWEEN TIME POINTS: AGE GROUP WISE

Age group	Heart Rate		Heart Rate: Before						p-value
			Normal		High		Total		
			N	%	N	%	N	%	
5.0 - 7.0 yrs	During	Normal	2	66.7%	9	75.0%	11	73.3%	
		High	1	33.3%	3	25.0%	4	26.7%	0.021
		Total	3	100.0%	12	100.0%	15	100.0%	
	After	Normal	3	100.0%	11	91.7%	14	93.3%	
		High	0	0.0%	1	8.3%	1	6.7%	0.001
		Total	3	100.0%	12	100.0%	15	100.0%	
7.1 - 9.0 yrs	During	Normal	10	100.0%	8	66.7%	18	81.8%	
		High	0	0.0%	4	33.3%	4	18.2%	0.008
		Total	10	100.0%	12	100.0%	22	100.0%	
	After	Normal	10	100.0%	10	83.3%	20	90.9%	
		High	0	0.0%	2	16.7%	2	9.1%	0.002
		Total	10	100.0%	12	100.0%	22	100.0%	
9.1 - 10.0 yrs	During	Normal	10	100.0%	3	100.0%	13	100.0%	
		High	0	0.0%	0	0.0%	0	0.0%	-
		Total	10	100.0%	3	100.0%	13	100.0%	
	After	Normal	10	100.0%	3	100.0%	13	100.0%	-

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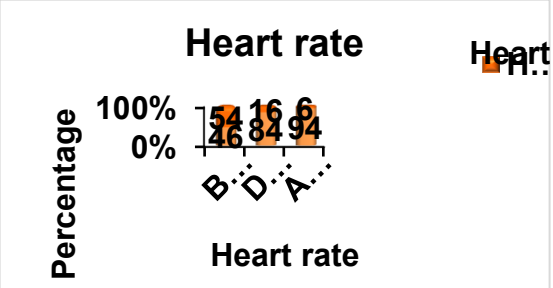
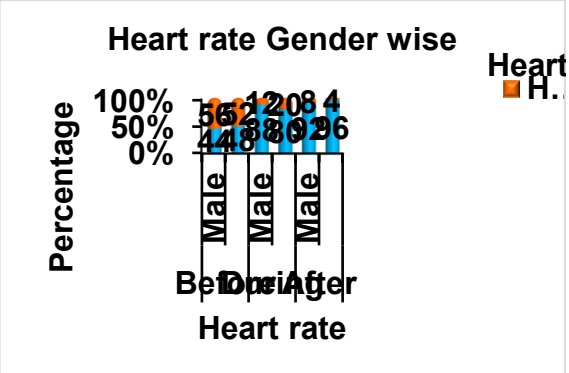
		High	0	0.0%	0	0.0%	0	0.0%	
		Total	10	100.0%	3	100.0%	13	100.0%	
Age group	Heart Rate		Heart Rate: After						p-value
			Normal		High		Total		
			N	%	N	%	N	%	
5.0 - 7.0 yrs	During	Normal	11	78.6%	0	0.0%	11	73.3%	
		High	3	21.4%	1	100.0%	4	26.7%	0.250
		Total	14	100.0%	1	100.0%	15	100.0%	
7.1 - 9.0 yrs	During	Normal	18	90.0%	0	0.0%	18	81.8%	
		High	2	10.0%	2	100.0%	4	18.2%	0.500
		Total	20	100.0%	2	100.0%	22	100.0%	
9.1 - 10.0 yrs	During	Normal	13	100.0%	0	0.0%	13	100.0%	
		High	0	0.0%	0	0.0%	0	0.0%	-
		Total	13	100.0%	0	0.0%	13	100.0%	

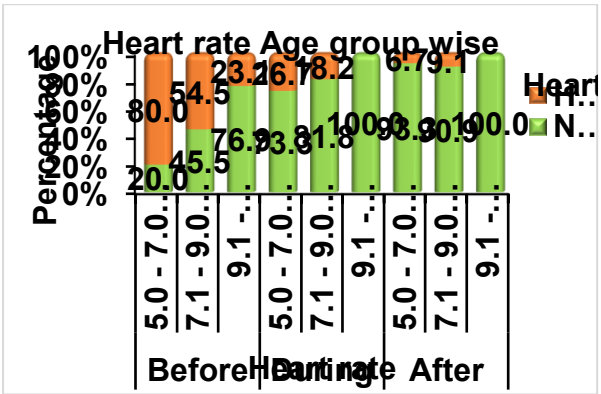
GRAPH 8: COMPARISON OF HEART RATE



GRAPH 9: GENDER GROUP WISE COMPARISON OF HEART RATE



GRAPH 10: AGE GROUP WISE COMPARISON OF HEART RATE



Statistical analysis revealed significant reductions in MCDAS scores following Kaleidoscope Distraction Therapy ($p < 0.001$). RMS pictorial scores demonstrated improvement from anxious facial expressions to happier expressions during and after intervention. Heart rate values showed significant normalization during and after treatment.

Greater anxiety reduction was observed in younger children (5–7 years). No significant gender differences were noted.

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DISCUSSION

Dental anxiety remains a significant challenge in pediatric dentistry. Barlow has delineated anxiety as a unique and coherent cognitive-affective structure embedded within the defensive and motivational systems.[3] Despite significant advancements in dental care, managing anxiety in pediatric patients continues to pose a major challenge for pediatric dentists. Anxious or fearful children may exhibit behaviors such as crying, screaming, trembling, or panic, and may even attempt to leave the dental chair, resulting in uncooperative behavior during treatment.[4] It has also been demonstrated that children tend to cry more upon seeing the dentist holding a needle[11-15].

A wide range of psychological approaches are available to manage dental anxiety and fear in clinical settings, in addition to basic behavior management techniques such as communication, voice control, Tell-Show-Do, and modeling. These approaches vary in complexity, ranging from relatively simple methods to those that require specialized training.[5]

Visual distraction techniques function by redirecting the child's attention from threatening stimuli to engaging visual inputs. The kaleidoscope provides continuous colourful motion patterns that stimulate visual curiosity and cognitive engagement, thereby reducing perception of pain and anxiety[16, 17].

In this study, significant reductions were observed across psychological (MCDAS, RMS) and physiological (heart rate) parameters, demonstrating the effectiveness of Kaleidoscope Distraction Therapy. Previous studies have shown that visual distraction reduces stress hormones and improves cooperation[18- 20]. The present findings support the role of simple visual tools in pediatric behaviour management.

CONCLUSION

Kaleidoscope Distraction Therapy significantly reduced dental anxiety in children aged 5–10 years. It is an inexpensive, non-invasive, and easily implementable behaviour management technique that can be incorporated into routine pediatric dental practice to improve cooperation and treatment outcomes.

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