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Effect of Aromatherapy Versus Audiovisual Distraction on Pain and Anxiety of Children Undergoing Dental Extraction

Arafa Mohamed Khattab[1], Basma Mahmoud Abd Elhamid Dawood [2], Eslam Mohammed Ahmed Gado[3] & Sabah Mohammed Elsayed Sharshor [4]

[1]Assistant Professor of Pediatric Dentistry, Faculty of Dentistry, Tanta University

[2]Lecturer of Pediatric Nursing, Faculty of Nursing, Tanta University

[3]Lecturer of Psychiatric and Mental Health Nursing, Faculty of Nursing, Tanta University

[4]Assistant Professor of Pediatric Nursing, Faculty of Nursing, Tanta University

ABSTRACT

Background: Dental pain and anxiety have a negative influence on children undergoing dental extraction. Applying pain management techniques such as aromatherapy and audiovisual distraction can lead to an improvement in their quality of life. **The aim** of the current study was to investigate the effect of aromatherapy versus audiovisual distraction on pain and anxiety of children undergoing dental extraction. **The design** of this study was a quasi-experimental research design. **Setting**: The study was conducted at dental care unit in the dental care unit at the faculty of dentistry of Tanta University. **The sample** of the current study comprised of 60 children (20 control group, 20 for aromatherapy, and 20 for audiovisual therapy) and was chosen randomly using a simple random sampling technique. **Tools** that were used in the study were a structured interview schedule, Frank l Behavior Rating Scale, RMS Pictorial Scale, and FLACC. **Results:** the scores of participating children's Frank l Behavior Rating Scale, RMS Pictorial Anxiety Scale and FLACC Pain Scale were lowered during tooth extraction in a lavender group than audiovisual and control group. The study **concluded** that both interventions either lavender oil inhalation or audiovisual distraction resulted in a reduction in the level of pain and anxiety of children undergoing dental extraction, but lavender oil inhalation was more effective. The study **recommended** that educational training programs should be conducted for dental team, about the application of aromatherapy and audiovisual distraction during dental extraction.

Keywords: Aromatherapy, Audiovisual, Anxiety, Children, Dental Extraction, Distraction, Pain

Introduction

Tooth extraction is one of the most common pediatric dentistry procedures for children that include surgical removal of the primary tooth. It is opted for after a child's tooth become damaged owing to an injury, disease or severe tooth decay and often results in pain and anxiety for children**(Mukhopadhyay, S 2015).** The experience of pain, normally conceived because of disorders of the human body organs or systems, is considered a major health problem from an oral health perspective and from dental management procedures, especially dental extraction which usually causes a certain type of pain, which is called dental pain**(Al-Kabateeb, T. 2008)**

Dental anxiety refers to a child's specific reaction toward stress associated with dental management in which the stimulus is unknown, obscure or not present at the moment. The etiology of such cases in children is multifactorial, because increased dental anxiety has been related to prior painful dental experiences, increased general fears and the negative influence of the parents' dental fear. Pain-related anxiety and fear of pain during tooth extraction result in avoidance behavior, which contributes to perpetuating fear and anxiety of dental treatment **(Seligman, L.,2017, Soares, F.,2017).**Pain-related anxiety and fear in children during tooth extraction will affect their central nervous system work, lead to an increase in their blood pressure and heart rate. In addition to negative reflections and co-operation problems in children **(American Academy on Pediatric Dentistry Council on Clinical Affairs (2015)**

Understanding dental fear and anxiety in young children is an intrinsic part of dental team for reducing children's fear and anxiety before and during tooth extraction, as well as in controlling child patient's behavior. Children who seemed to be relaxed and unafraid may exhibit positive behavior, such as smiling and chatting. On the contrary, frightened children may behave hesitantly or cautiously, while others may defend themselves physically and disrupt treatment procedures in extreme cases **(Yon, M., 2020)**

In 2019, the American Academy of Pediatric Dentistry (AAPD) stated that, the purpose of managing children in the dental visit is not only to handle their anxiety, but also to offer a friendly environment for the child and help the dental team to perform their work without any sort of interruptions and ease the dental management. It also motivates the child for future dental visits; thus, improving his/ her oral health care. Behavior management techniques are mainly divided into two categories: pharmacological and non-pharmacological interventions **(AAPD 2019)**

Pharmacological interventions include; the using of medications, general anesthesia, and other agents. Although they are frequently used methods for children with dental pain and anxiety, they can cause many side effects such as nausea, vomiting, respiratory depression, decreased heart rate and blood pressure, and sometimes child may refuse to take them. On the other side, Non-pharmacological interventions contain methods such as: virtual reality, audiovisual distraction, musical distraction, reinforcement, modeling, and aromatherapy.

Nevertheless, non-pharmacological interventions can overcome side effects of pharmacological interventions and produce a positive impact on reducing dental pain and anxiety in children undergoing dental treatment, posing as effective as pharmacological treatments, and may gain more acceptance from parents, children, and the dental team **(Appukuttan, D. (2016, Cianetti, S., 2017, Goettems, M.,2017, Chow, C., 2016).**

Distraction is a non-pharmacological intervention technique, which can divert a child's attention away from noxious or unpleasant stimuli. Audio-visual aid is a new approach that has gained popularity to help in relieving anxiety related to dental treatment that incorporates a visual as well as an audio part before and during tackling dental procedures. The ideal distractor should own multiple sensory modalities such as: visual, auditory, kinesthetic, and active emotional involvement. These various abilities can hold the full attention of children and reduce the activity of children's neuroendocrine and sympathetic nervous systems and subsequently minimize their dental anxiety. Examples of audio-visual aids are background music, television sets, mobile cartoons videos, computer games, two-dimensional, and three-dimensional video glasses for watching movies **(Navidian, A., 2018, Wismeijer, A,2006, Al-Namankany, A., 2014, Al-Khotani, A.,2016).**

Lavender is a commonly adopted agent in aromatherapy. Lavender essential oil is considered to be steam distilled from the flower of the lavender plant. It is assigned to be non-toxic, non-irritating and non-sensitizing oil. According to an international expert on essential oil safety, there are no known or suspected drug interactions and no contraindications for the use of lavender. It is listed in the United States Food and Drug Administration (FDA) that generally regarded it as some kind of safe oil. It has many therapeutic actions, such as reducing anxiety, pain reliever, anti-spasmodic, antifungal, antimicrobial and wound healing properties. After inhalation of lavender, it begins by sending a signal to the olfactory bulb which has close anatomical ties to the emotional center of the brain in which all major emotional expressions are generated. It also impacts the endocrine and the autonomic nervous system which ultimately lead to a reduction of anxiety and pain in children during the procedure of tooth extraction **(Nasiri, A,2018, Dhifi, W., 2016).**

Significance of the study:

Pain-related anxiety and fear of pain in children undergoing tooth extraction of ten make them uncooperative during dental visits; thus, make treatment difficult or impossible. This behavior of children compromises the treatment outcome, creates occupational stress among dental staff, and is often a cause of discord between dental professionals and patients or their parents. Anxious children may try every possible means to avoid or delay treatment, resulting in more teeth decay, gingivitis and more deterioration of their oral health. Beyond its impacts on dental care, dental anxiety may also cause sleep disorders, affect children’s daily life, and have a negative

influence on their psycho-social functioning (Armfield,J.,2009).

The prevalence of pain-related anxiety and fear of pain in children undergoing tooth extraction ranges from 5 to 20% in various countries, with some cases being known to be dental phobia **(Rajwar, A ,2017).**Dental anxiety acquired in childhood may persist to adulthood and is assigned to be a significant predictor of the avoidance of dental visits in adulthood. Applying pain management techniques can lead to the acceptance of dental treatment and improve their quality of life **(Crocombe,L.2011).** So the dental team should be encouraged to promote pain-related anxiety management as a basic dental care for those pediatric patients during dental extraction. This study was aimed to evaluate the effect of effect of aromatherapy versus audiovisual distraction on pain and anxiety of children undergoing dental extraction.

Aim of the study:

The aim of this study was to investigate the effect of aromatherapy versus audiovisual distraction on pain and anxiety of children undergoing dental extraction.

The research hypothesis:

The application of aroma-therapy and audiovisual distraction is expected to reduce the pain and anxiety of children undergoing dental extraction.

Subjects and Method

Design: A quasi experimental research design was used in this study.

Setting:

The study was conducted in the dental care unit at faculty of dentistry of Tanta University.

Subjects:

The total study sample consisted of 60 children (20 control group, 20 for aromatherapy, and 20 for audiovisual distraction). The sample of the current study was chosen randomly using simple random sampling technique from the previously mentioned setting.

Inclusion Criteria:- Toddler to school age period**,** Both sex**,** Free from any physical problems as visual impairment, auditory and respiratory problems and Welling to participate in the study.

Tools of the study:

Four tools were used for data collection which was developed by the researchers based on literatures review [14-17].

Tool I: A structured interview schedule:

It was developed by the researchers based on literatures review and was composed of two main parts:

Part (1): Socio-demographic data of the participated children such as; age, sex, level of education, and residence.

Part (2): Physiological measurements which included the: measurement of heart rate, and respiratory rate. It was performed three times before, during and after tooth extraction.

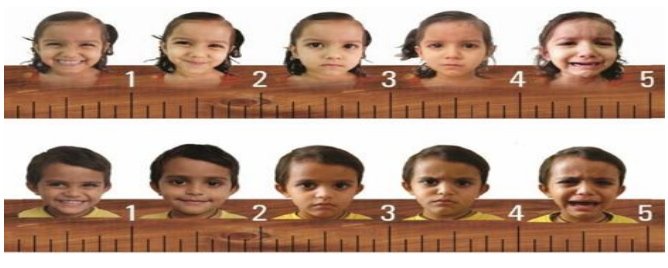
Tool II: Frank l Behavior Rating Scale

(American Academy on Pediatric Dentistry Council on Clinical Affairs (2015))

It was used to measure their behavior through categories. The first category **(definitely negative)** means refusal of any treatment, distrustful, fearful, and cries. The second category **(Negative)** means reluctant to accept treatment but not tetchy. The third category **(Positive)** r Doubtful but followed dentist's directions cooperatively. The fourth category **(Definitely positive)** means cooperative &interested in dental procedure. It was performed three before, during and after tooth extraction.

Tool III: RMS Pictorial Scale for assessment of child's dental anxiety (Yon, M., 2020)

It is a new anxiety scale. It consists of original photographs of both male and female child. It comprises a row of five faces ranging from very happy to very unhappy. Child was asked to choose the face they feel like about themselves at that moment of treatment. It was scored by giving a value of one to the very happy and five to the very unhappy. It measured three times as previously mentioned tools.



Tool IV: FLACC Scale for Assessing Children's Pain(AAPD 2019)

This tool is a checklist that guides the health-care professional in examining the child's behavior in response to pain. This checklist was developed for children aged from two to seven years or longer who's unable to self-report of pain. It includes assessment for faces, legs, activity, cry and consolation.

Face		
0 - No particular expression or smile	1 - Occasional grimace or frown, withdrawn, disinterested	2 - Frequent to constant frown, clenched jaw, quivering chin
Legs		
0 - Normal position or relaxed	1 - Uneasy, restless, tense	2 - Kicking or legs drawn up
Activity		
0 - Lying quietly, normal position, moves easily	1 - Squirming, shifting back/forth, tense	2 - Arched, rigid, or jerking
Cry		
0 - No cry, awake or asleep	1 - Moans or whimpers, occasional complaint	2 - Crying steadily, screams or sobs, frequent complaints
Consolation		
0 - Content, relaxed	1 - Reassured by occasional touching, hugging, or "talking to," distractible	2 - Difficult to console or comfort

- Rate child on each of the five categories (face, legs, arms, crying, consolation). Each category is scored on the 0 to 2 scale and adds the scores together (for a total possible score of 0 to 10).

Scoring system:

0 =	Relaxed and comfortable
1–3 =	Mild pain
4–6 =	Moderate pain
7–10 =	Severe pain

Method

The study was conducted through the following steps:

Administration process:

An official permission was obtained on March 2021 to carry out the study from the responsible authorities of dental care unit at faculty of dentistry of Tanta University to obtain their approval and cooperation to conduct the study.

Ethical and legal consideration:

The nature of the study wasn't causing any harm or pain to the entire subjects. Oral consents were taken from parents and their children to participate in the study after illustrating the aim of the study. They had the right to withdraw from the study at any time. Children and their parents were informed about the confidentiality of their information and it was used only for the purpose of the study**.**

Tools development:

Study tools were developed and modified based on the review of related literatures. Tools used for data collection were four; Tool I: structured interview schedule, It included; Socio-demographic data of the participated children and physiological measurements which included the: measurement of heart rate, and respiratory rate. The researchers conducted an individualized interview with each child; the questionnaire took 20 minutes to complete. Tool II: Frank l Behavior Rating Scale that was used to measure children's behavior through four categories. The first category **(Definitely negative)**. The second category (**Negative)**, the third category **(Positive)** and the fourth category **(Definitely positive)**. Tool III: RMS Pictorial Scale for assessment of child's dental anxiety, It is a new anxiety scale and consisted of original photographs of both male and female child. It comprises a row of five faces ranging from very happy to very unhappy. Tool IV: FLACC Scale for Assessing Children's Pain ,This tool is a checklist that guides the health-care professional in examining the child's behavior in response to pain.

Content validity:

The tools of the study were presented to a jury of five experts in the field of pediatric nursing, psychiatric nursing and pediatric dentistry to check content validity and clarity of the questionnaire. Modifications were carried out accordingly. The index of content validity was 99%.

Content reliability:

Reliability of developed tools was tested through internal consistency. The value of Cronbach's alpha coefficient was 0.949.

A pilot study:

A pilot study was performed on 6 children (10%) of the sample to test the clarity, visibility and applicability of the study tools and the needed changes were made. Those children were excluded from the total sample of the study.

The study phases:

The study was carried out through three phases:

1. **Assessment phase:** It was done by the researchers for entire studied subjects to collect baseline data and to assess children who met inclusive criteria. The researchers met the nurses and doctors who were working in the previously mentioned setting to explain the study's purpose to them. Also, the children and their parents were interviewed by the researchers after obtaining oral consent from them.
2. **Implementation phase:**

   The researchers were available three days a week attended from 9:00 am until 12:30 pm to collect the data. The parents or their children in the three groups were asked about their socio-demographic data. This step took about 20minutes,

and then the researchers explained RMS Pictorial Scale for children and taught them and their parents how to apply this scale by using printed colored paper.

Control group

The researchers measured the children's physiological measurements (Tool I), observed the behavior of participated children by using Frank l Behavior Rating Scale (Tool II) , asked children to choose the face they feel like about themselves at the moment of treatment by using the RMS pictorial scale (Tool III) , and assessing the participated children's behavior in response to pain by using FLACC scale checklist . All these measurements performed before, during and after tooth extraction without applying any intervention on the participated children.

Lavender group

The lavender inhalation application was explained to the children and their parents .Two drops of 100% pure organic lavender oil were poured on a cotton. The cotton fixed by the child at 5 cm distance from his or her nose and asked to breathe slowly with eyes closed for 15 minutes before tooth extraction procedure. Then child's physiological measurements, child's behavior, dental anxiety and their response to pain were measured before tooth extraction. Also these previous measurements reassessed and recorded by researchers during and after tooth extraction.

Audiovisual distraction group:

The audiovisual distraction technique was explained to the children and their parents. The child lay on the bed watched and heard kids cartoons , songs , and videos to distract his/ her attention during dental extraction .The video was displayed through a smart phone which was fixed on a mobile phone stick from 5-10 minutes before tooth extraction. Then children's physiological measurements, behavior, dental anxiety and response to pain were recorded before tooth extraction. The same assessment and measurements were reassessed and recorded by the researchers during and after tooth extraction.

3. Evaluation phase:

The evaluation was done for control, lavender, audiovisual groups three times before, during and after tooth extraction by using the same assessment tools (part 2 in Tool I, II, III & IV).Data was collected over a period of 6 months starting from March to august 2021

Table (1): Percentage distribution of the studied children according to their socio-demographic characteristics.

Socio-demographic characteristics		Groups					
		Control Group (n=20)		Audiovisual Group (n=20)		Lavender Group (n=20)	
		No	%	No	%	No	%
Age (Years)	3- 6- 9- ≥12	4 12 4	20.0 60.0 20.0	7 7 6	35.0 35.0 30.0	7 4 9	35.0 20.0 45.0
Range Mean ±SD		3-11 6.850±1.694		3-10 6.550±2.064		4-9 6.700±1.720	
Sex	Male	6	30.0	14	70.0	6	30.0
	Female	14	70.0	6	30.0	14	70.0
Residence	Urban	11	55.0	9	45.0	7	35.0
	Rural	9	45.0	11	55.0	13	65.0
Educational level	Nursery school	4	20.0	7	35.0	7	35.0
	Primary school	16	80.0	13	65.0	13	65.0

Table (1) shows socio-demographic characteristics of the participated children. With regard to their age, it was found that the mean ages of the participated children were (6.850±1.694,6.550 ±2.064 and 6.700±1.720) years respectively in control, audiovisual and lavender groups. Regarding their sex, it was observed that 70% of the children was females in control and lavender groups, while 70% of them was males in audiovisual group. With reference to their residence, it was observed that 45%, 55% and 65% of those children were from rural areas in control, audiovisual and lavender groups respectively. In relation to their educational level, it was found that 80%, 65% and 65% of them were respectively in primary school within control, audiovisual and lavender groups. As illustrated in figure 1and 2.

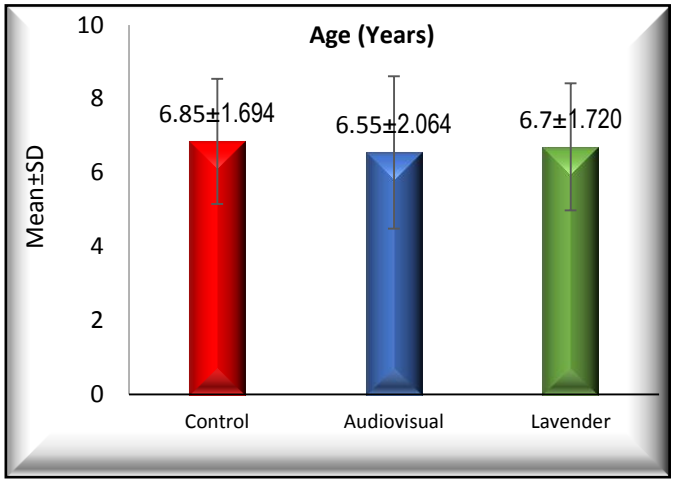


Figure (1): Mean of the participated children of control, audiovisual and lavender groups according to their age

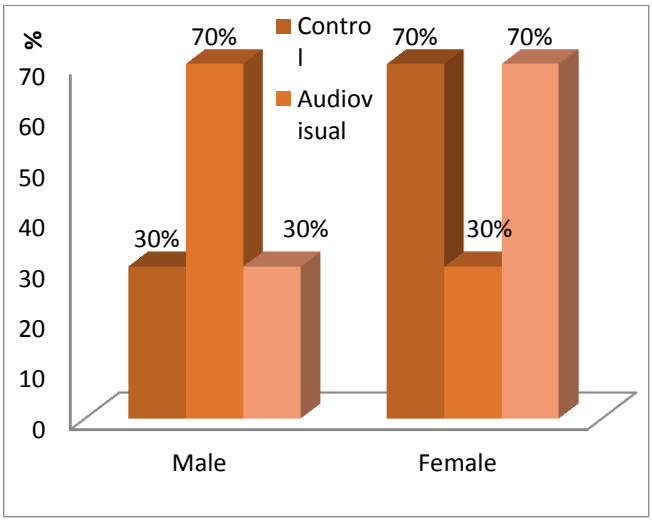


Figure (2): Percentage distribution of the studied children of control, audiovisual and lavender groups according to their sex

Table (2): Mean of pulse rate among the studied children of control, audiovisual and lavender groups before, during and after tooth extraction.

Pulse		Groups			ANOVA		TUKEY'S Test		
		Control Group (n=20)	Audiovisual Group (n=20)	Lavender Group (n=20)	F	P-value	C&A	C&L	A&L
Before (B)	Range	78 - 100	78 - 102	78 - 100	0.991	0.377			
	Mean ±SD	88.850 ± 7.492	89.900 ± 7.656	86.600 ± 7.570					
During (D)	Range	80 - 100	80 - 97	75 - 92	8.680	0.001*	0.783	0.001*	0.006*
	Mean ±SD	89.200 ± 6.646	88.000 ± 5.301	82.200 ± 4.959					
After (A)	Range	76 - 91	76 - 92	75 - 91	0.742	0.481			
	Mean ±SD	82.050 ± 5.042	82.600 ± 5.051	80.700 ± 5.131					
B-D	Differences	-0.350 ± 2.925	1.900 ± 4.038	4.400 ± 4.083					
	Paired Test	0.599	0.049*	<0.001*					
B-A	Differences	6.800 ± 5.268	7.300 ± 5.411	5.900 ± 4.051					
	Paired Test	<0.001*	<0.001*	<0.001*					
D-A	Differences	7.150 ± 4.095	5.400 ± 3.789	1.500 ± 1.987					
	Paired Test	<0.001*	<0.001*	0.003*					

***Statistically significant difference at (P >0.05)**

Table (2) presents the mean of pulse rate among participated children within control, audiovisual and lave groups before, during and after tooth extraction. It indicated that between before and during tooth extrac there were statistically significant differences in audiovi and lavender groups, where (P= 0.049 and P=<0. respectively. Regarding before and after tooth extrac there were statistically significant differences in all groups in which (P<0.001). It was found that between during and after tooth extraction, there were statistically significant differences in control, audiovisual and lavender groups, where (P<0.001,P<0.001 and P= 0.003) respectively. As illustrated in figure 3.

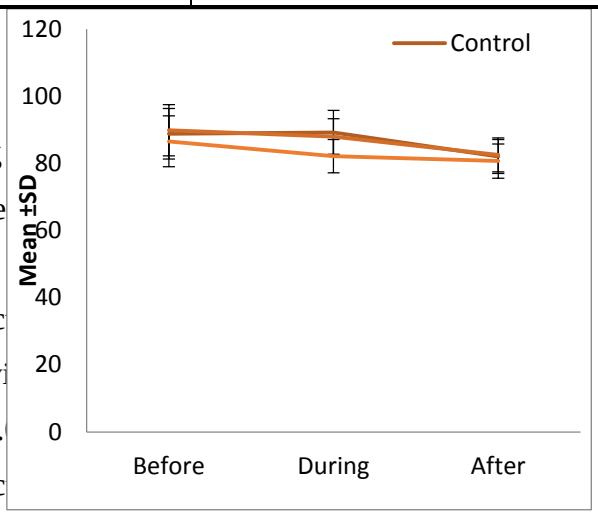


Figure (3): Mean of pulse rate among the studied children of control, audiovisual and lavender groups before, during and after tooth extraction.

Table (3): Mean of respiratory rate among studied children before, during and after tooth extraction

Respiratory rate		Groups			ANOVA		TUKEY'S Test		
		Control Group (n=20)	Audiovisual Group (n=20)	Lavender Group (n=20)	F	P-value	C&A	C&L	A&L
Before	Range	18 - 26	18 - 26	18 - 26	0.168	0.846			
	Mean ±SD	21.200 ± 2.462	21.400 ± 2.393	20.950 ± 2.523					
During	Range	20 - 27	18 - 27	18 - 21	12.596	<0.001*	0.455	<0.001*	0.002*
	Mean ±SD	22.300 ± 2.273	21.500 ± 2.646	19.100 ± 1.021					
After	Range	18 - 23	18 - 24	18 - 20	4.070	0.022*	0.943	0.065	0.030*
	Mean ±SD	19.750 ± 1.410	19.900 ± 1.832	18.700 ± 0.979					
B-D	Differences	-1.100 ± 0.912	-0.100 ± 1.832	1.850 ± 2.277					
	Paired Test	<0.001*	0.810	0.002*					
B-A	Differences	1.450 ± 1.932	1.500 ± 2.236	2.250 ± 2.314					
	Paired Test	0.003*	0.007*	<0.001*					
D-A	Differences	2.550 ± 1.791	1.600 ± 2.037	0.400 ± 1.231					
	Paired Test	<0.001*	0.002*	0.163					

***Statistically significant difference at (P >0.05)**

Table (3) illustrates the mean of respiratory rate among studied children of control, audiovisual and lavender gro before, during and after tooth extraction. It was obvious between before and during tooth extraction, there w statistically significant differences in control and laver groups where (P=<0.001 and P=0.002) respectively.

Regarding before and after tooth extraction, there were statistically significant differences in control, audiovisual and lavender groups in which (P=0.003, P=0.007 and P<0.001) respectively. It was indicated that between during and after tooth extraction, there were statistically significant differences in control and audiovisual groups where (P<0.001 and P= 0.002) respectively. As illustrated in figure figure.4.

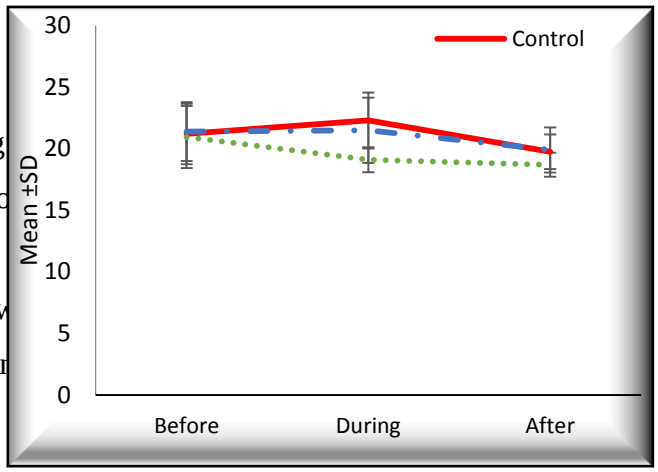


Figure (4): Mean of respiratory rate among studied children before, during and after tooth extraction

Table (4): Percentage distribution of the studied children according to their Frank l behavior rating scale before, during and after tooth extraction

Category		Groups						Chi-Square	
		Control Group (n=20)		Audiovisual Group (n=20)		Lavender Group (n=20)			
		No	%	No	%	No	%	X^2	P-value
Before tooth extraction	Definitely negative	17	85.0	6	30.0	10	50.0	15.836	0.015*
	Negative	1	5.0	4	20.0	5	25.0		
	Positive	2	10.0	8	40.0	5	25.0		
	Definitely positive	0	0.0	2	10.0	0	0.0		
During tooth extraction	Definitely negative	3	15.0	2	10.0	0	0.0	12.900	0.045*
	Negative	6	30.0	2	10.0	4	20.0		
	Positive	11	55.0	9	45.0	8	40.0		
	Definitely positive	0	0.0	7	35.0	8	40.0		
After tooth extraction	Definitely negative	1	5.0	0	0.0	0	0.0	17.775	0.007*
	Negative	2	10.0	0	0.0	0	0.0		
	Positive	8	40.0	1	5.0	2	10.0		
	Definitely positive	9	45.0	19	95.0	18	90.0		
Chi-Square	Before-During	<0.001*		0.138		<0.001*			
	Before-After	<0.001*		<0.001*		<0.001*			
	During-After	0.006*		0.001*		0.003*			

***Statistically significant difference at (P >0.05)**

Table (4) shows percentage of distribution of the participated children according to their Frank l behavior rating scale before, during and after tooth extraction. It was clear that there were statistically significant differences among children of their Frank l behavior rating scale in all groups before, during and after tooth extraction in which (P=0.015,P=0.045 and P=0.007) respectively. As illustrated in figure 5.

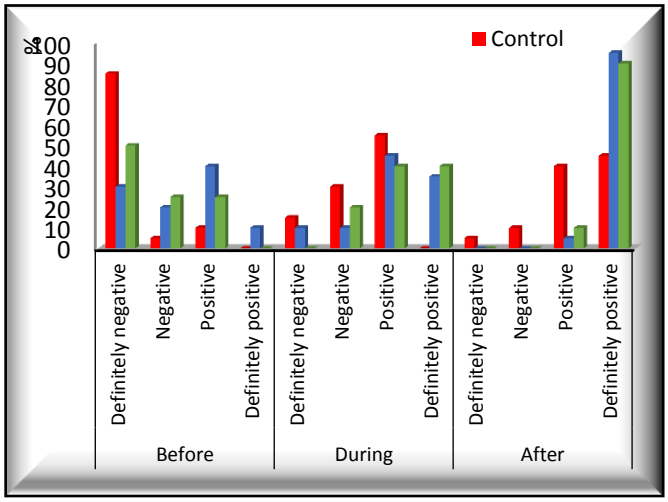


Figure (5): Percentage distribution of the studied children according to their Frank l behavior rating scale before, during and after tooth extraction

Table (5): Percentage distribution of the studied children according to their RMS pictorial anxiety scale before, during and after tooth extraction

RMS pictorial anxiety scale		Groups						Chi-Square	
		Control Group (n=20)		Audiovisual Group (n=20)		Lavender Group (n=20)			
		No	%	No	%	No	%	X^2	P-value
Before tooth extraction	Anxiety free	1	5.0	5	25.0	0	0.0	11.582	0.072
	Low anxiety	5	25.0	9	45.0	8	40.0		
	Moderate anxiety	5	25.0	2	10.0	5	25.0		
	High anxiety	9	45.0	4	20.0	7	35.0		
During tooth extraction	Anxiety free	2	10.0	12	60.0	16	80.0	29.775	<0.001*
	Low anxiety	7	35.0	8	40.0	1	5.0		
	Moderate anxiety	6	30.0	0	0.0	2	10.0		
	High anxiety	5	25.0	0	0.0	1	5.0		
After tooth extraction	Anxiety free	4	20.0	18	90.0	20	100.0	37.257	<0.001*
	Low anxiety	8	40.0	2	10.0	0	0.0		
	Moderate anxiety	6	30.0	0	0.0	0	0.0		
	High anxiety	2	10.0	0	0.0	0	0.0		
Chi-Square	Before-During	0.593		0.030*		<0.001*			
	Before-After	0.071		0.001*		<0.001*			
	During-After	0.569		0.068		0.217			

***Statistically significant difference at (P >0.05)**

Table (5) exhibits the percentage of distribution of the participated children according to their RMS Pictorial Anxiety Scale before, during and after tooth extraction. It was showed that there were no statistically significant differences among children regarding their RMS Pictorial Anxiety Scale in all groups before tooth extraction where (P=0.072). On the other hand, there were statistically significant differences among children regarding their RMS Pictorial Anxiety Scale in all groups during and after tooth extraction where (P<0.001).As illustrated in figure 6.

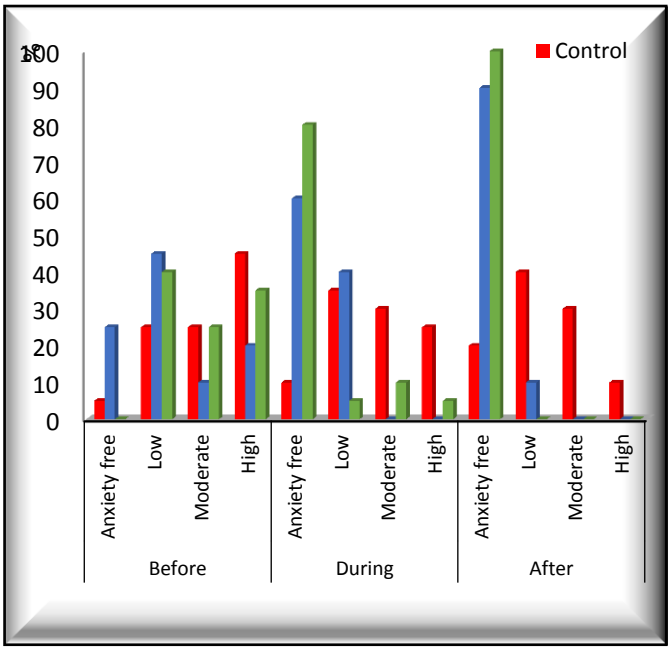


Figure (6): Percentage distribution of the studied children according to their RMS pictorial anxiety scale before, during and after tooth extraction

Table (6): Percentage distribution of the studied children according to their FLACC pain scale before, during and after tooth extraction

FLACC pain scale		Groups						Chi-Square	
		Control Group (n=20)		Audiovisual Group (n=20)		Lavender Group (n=20)			
		No	%	No	%	No	%	X^2	P-value
Before tooth extraction	Mild pain	5	25.0	10	50.0	7	35.0	3.784	0.436
	Moderate pain	8	40.0	5	25.0	9	45.0		
	Severe pain	7	35.0	5	25.0	4	20.0		
During tooth extraction	Mild pain	6	30.0	15	75.0	16	80.0	15.796	0.003*
	Moderate pain	6	30.0	4	20.0	3	15.0		
	Severe pain	8	40.0	1	5.0	1	5.0		
After tooth extraction	Mild pain	12	60.0	18	90.0	19	95.0	10.422	0.034*
	Moderate pain	6	30.0	2	10.0	1	5.0		
	Severe pain	2	10.0	0	0.0	0	0.0		
Chi-Square	Before-During	0.801		0.151		0.016*			
	Before-After	0.051*		0.014*		<0.001*			
	During-After	0.061		0.379		0.324			

***Statistically significant difference at (P >0.05)**

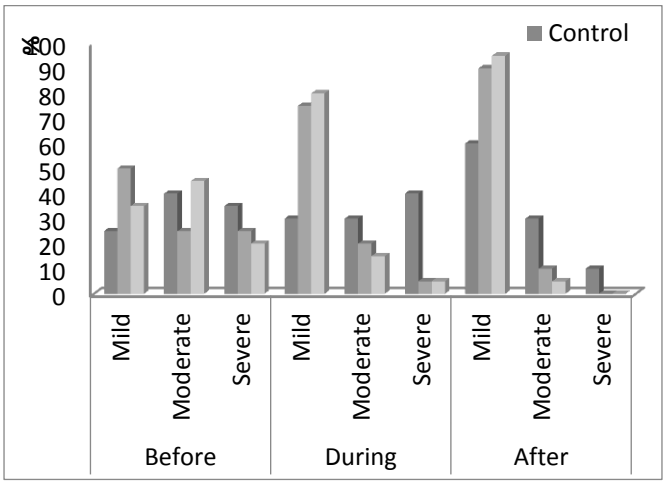


Figure (7): Percentage distribution of the studied children according to their FLACC pain scale before, during and after tooth extraction

Table (6) shows percentage of distribution of the participated children according to their FLACC Pain Scale before, during and after tooth extraction. It was concluded that, there were no statistically significant differences among children concerning their FLACC Pain Scale in all groups before tooth extraction where (P=0.436). On the other hand, there were statistically significant differences among children regarding their FLACC Pain Scale in all groups during and after tooth extraction in which (P=0.003 and P=0.034) respectively. As illustrated in figure 7.

Table (7): Percentage distribution of the studied children according to their Frank l behavior rating, scale RMS pictorial anxiety scale and FLACC pain scale during tooth extraction

Scales		Groups						Chi-Square	
		Control Group (n=20)		Audiovisual Group (n=20)		Lavender Group (n=20)			
		No	%	No	%	No	%	X^2	P-value
Frank l scale	Definitely negative	3	15.0	2	10.0	0	0.0	12.900	0.045*
	Negative	6	30.0	2	10.0	4	20.0		
	Positive	11	55.0	9	45.0	8	40.0		
	Definitely positive	0	0.0	7	35.0	8	40.0		
RMS Scale	Anxiety free	2	10.0	12	60.0	16	80.0	29.775	<0.001*
	Low anxiety	7	35.0	8	40.0	1	5.0		
	Moderate anxiety	6	30.0	0	0.0	2	10.0		
	High anxiety	5	25.0	0	0.0	1	5.0		
FLACC Scale	Mild pain	6	30.0	15	75.0	16	80.0	15.796	0.003*
	Moderate pain	6	30.0	4	20.0	3	15.0		
	Severe pain	8	40.0	1	5.0	1	5.0		

***Statistically significant difference at (P >0.05)**

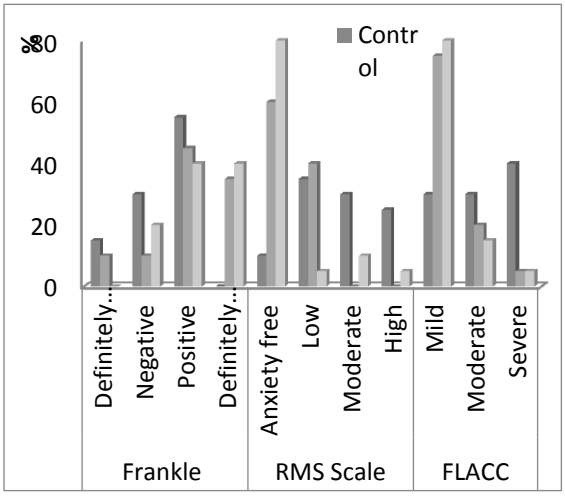


Figure (8): Percentage distribution of the studied children according to their Frankl behavior rating, scale RMS pictorial anxiety scale and FLACC pain scale during tooth extraction

Table (7) illustrates percentage of distribution of the participated children according to their Frankl Behavior Rating Scale, RMS Pictorial Anxiety Scale and FLACC Pain Scale during tooth extraction. It was found that there were statistically significant differences among the participated children in all groups regarding their Frankl Behavior Rating, RMS Pictorial Anxiety and FLACC Pain Scales during tooth extraction in which (P=0.045, P<0.001 and P=0.003) respectively.As illustrated in figure 8.

Table (8): **Relation between audiovisual group and lavender group according to their FLACC pain scale and RMS pictorial anxiety scale during tooth extraction**

Groups	RMS Scale	FLACC Scale						Chi-Square	
		Mild		Moderate		Severe			
		No	%	No	%	No	%	X^2	P-value
Audiovisual Group	Anxiety free	7	46.7	4	100.0	1	100.0	6.193	0.045*
	Low anxiety	8	53.3	0	0.0	0	0.0		
	Moderate anxiety	0	0.0	0	0.0	0	0.0		
	High anxiety	0	0.0	0	0.0	0	0.0		
Lavender Group	Anxiety free	16	100.0	0	0.0	0	0.0	40.000	<0.001*
	Low anxiety	0	0.0	1	33.3	0	0.0		
	Moderate anxiety	0	0.0	2	66.7	0	0.0		
	High anxiety	0	0.0	0	0.0	1	100.0		

***Statistically significant difference at (P >0.05)**

Table (8) indicates relation between audiovisual group and lavender group according to their FLACC Pain Scale and RMS Pictorial Anxiety Scale during tooth extraction. It was concluded that there was statistically significant relation between children's FLACC Pain Scale and RMS Pictorial Anxiety during tooth extraction in audiovisual and lavender groups where(P=0.045 and P<0.001) respectively. As illustrated in figure 9.

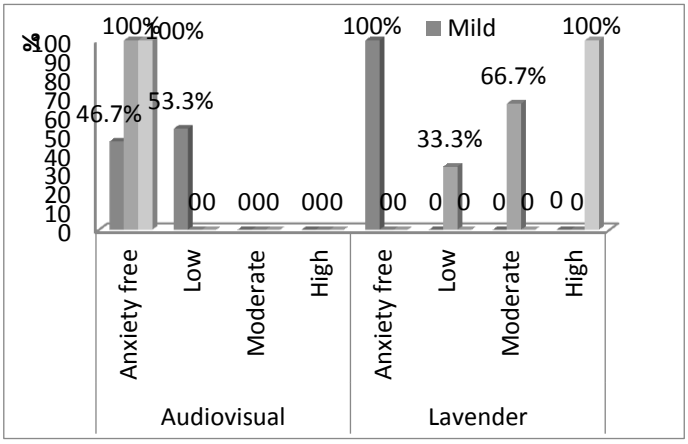


Figure (9): Relation between audiovisual group and lavender group according to their FLACC pain scale and RMS pictorial anxiety scale during tooth extraction

Discussion

Dental anxiety is one of the most well-known obstacles to dental care, especially for children. In addition, pain-related anxiety and fear of pain increase the level of anxiety and result in more painful experiences during dental interventions, and this leads to negative reflections and co-operation problems in children. Consequently, dental anxiety in children should not be underestimated because it prevents them from receiving the proper treatment and causes further oral health problems for them during childhood **(Arslan, I.,2020).**

One of the most significant roles of pediatric dental team members is to treat their children in an anxiety-free environment along with a high quality of the dental care. Thus, they have to implement pharmacological and non-pharmacological interventions to eliminate their children's dental anxiety and promote their good general oral hygiene habits. Non-pharmacological interventions such as audiovisual distraction and aromatherapy with lavender oil inhalation seemed to be safe, own few or no side effects and are greatly accepted by parents, children, and dental team members **(Al-Khotani, A,2016).**

The current study was conducted to evaluate the effect of aromatherapy versus audiovisual distraction on pain and anxiety of children undergoing dental extraction. The results of the present study revealed that less than half ,more than half and nearly two thirds of children were from rural areas in control, audiovisual and lavender groups respectively (table 1). This may due to place of faculty of dentistry at Tanta University near rural areas and lack of public pediatric dental care services in those areas as well as high cost of private clinics visit.

According to the children's educational level, it was concluded that most of the participated children in control group and nearly two-thirds of them in audiovisual and lavender groups were in primary school (table 1). This result may be interpreted on the basis that the period of primary school education is a transitional period between primary and permanent dentition (mixed dentition) for children in addition to dental caries which is common between them and consider the main reason for dental extraction in this age. This result was in line with **(Demiriz & Bodrumlu, 2018)**

Concerning physiological measurements among the participated children of the lavender group, the results of the present study indicated that the mean scores of pulse and respiratory rate were decreased after than before and during tooth extraction (table 2 and 3). These findings have appeared due to the effect of inhaling lavender that stimulates olfactory receptors and send messages to the limbic system which finally help to release endorphins, encephalin, and serotonin that cause a reduction of pain, stress and their associated arousal signs and symptoms [(24)]. This result was in agreement with **Arslan et al., (2020)** who found a

significant pulse rate drop after inhalation in the lavender group(**Arslan et al., 2020**).

Concerning physiological measurements among the participated children of the audiovisual group, the results of the current study indicated that the mean scores of pulse and respiratory rate decreased after than before and during tooth extraction (table 2 and 3). These findings may be due to the positive influence of audiovisual distraction method, which owns auditory and visual impact that diverts children's attention easily away from pain sensation and thus decreasing pulse and respiratory rate.

These findings are in parallel with **Mitrakul et al.,(2015)**and **Agarwal et al., (2017)** who found in their studies that using audiovisual distraction during dental visits significantly reduced pulse rate as compared to the control group(**Mitrakul et al.,(2015)**and **Agarwal et al., (2017)**). On the other hand, these results are incongruent with **Liu et al., (2018)** who did not observe any statistically significant difference between the audiovisual distraction group and control group in relation to vital signs in their studies(**Liu et al., (2018)**).

The level of anxiety that children perceive before or during dental treatment is mainly associated with an increase of pain perception, which consequently may result in their nervousness, fear, noncooperation, in the future appointments(**Al-Khotani,2016).**According to the results of lavender group children, the present study has indicated that the scores of their Frank l Behavior Rating Scale, RMS Pictorial Anxiety Scale and FLACC Pain Scale minimized after tooth extraction than scores before and during tooth extraction.

These findings may be attributed to the

Inhaled lavender oil that entered directly through a large surface area of the nasal mucosa directly to the brain and then exerting its relaxing effects on all body systems and mind. The recent results are in parallel with **Karan (2019)** and **Babaev et al., (2018)** who stated that inhalation of lavender oil significantly reduced dental anxiety and dental pain after tooth extraction in children, compared with the control group(**Karan (2019)** and **Babaev et al., (2018)**).

Regarding audiovisual group children, the recent study concluded that the scores of their Frank l Behavior Rating Scale, RMS Pictorial Anxiety Scale and FLACC Pain Scale minimized after tooth extraction than scores before and during tooth extraction. These findings may be due to the children’s perception of pain that is decreased when distracted them from an unpleasant stimulus. Also, audiovisual group children have become relaxed and satisfied with this alternative method. These findings were in accordance with **A svanund et al.,(2015)** who reported that audiovisual aids significantly reduce pain scores.Besides **Fakhruddin et al.,(2015)** also reported a significant difference in anxiety between control and audiovisual group. On the contrary, **Bugattoni et al., (2018)** were against the current results and reported that using audiovisual

aids during dental treatment didn't significantly affect behavior.

Conclusion:

Both interventions either lavender oil inhalation or audiovisual distraction resulted in a reduction in the level of pain and anxiety of children undergoing dental extraction, but lavender oil inhalation was more effective in reducing pain and anxiety severity.

Recommendations:

- Educational training programs should be conducted for dental team, about the application of aromatherapy and audiovisual distraction during dental extraction.
- Implementation of aromatherapy and audiovisual distraction as a part of routine care for children undergoing dental extraction.

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