

Evaluation of Anxiety Level of Children Aged 6 - 9 Years During Sequential Dental Visits Using Objective and Subjective Measures

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Abstract

Aim: The study was conducted to evaluate anxiety level of children aged 6 - 9 years during sequential dental visits using objective and subjective measures.

Materials and Method: Two hundred children, between 6 to 9 years of age were selected from O.P.D of Pedodontics and Preventive Dentistry, Government Dental College and Hospital, Patiala. The children were divided into four groups (n=50) based on the dental procedures performed during sequential dental visits. Children blood pressure, heart rate and oxygen saturation (objective measures) and Facial Image Scale (FIS) and Venham Picture Scale (VPS) (subjective measures) were recorded before and after four standard dental procedures (cavity preparation, extraction, oral prophylaxis and root canal treatment).

Results: The mean of the Systolic Blood Pressure, Diastolic Blood Pressure, Pulse Rate and Oxygen Saturation, Facial Image Scale and Venham Picture Test before and after the extraction was 99.00 ± 4.38 , 68.40 ± 4.05 , 105.88 ± 5.39 , 99.4 ± 1.7 and 92.84 ± 4.59 , 64.16 ± 3.79 , 94.48 ± 4.84 , 99.3 ± 1.4 , 2.86 ± 0.346 , 2.80 ± 0.88 and 1.58 ± 0.49 , 1.36 ± 0.525 respectively. The mean of the Systolic Blood Pressure, Diastolic Blood Pressure, Pulse Rate and Oxygen Saturation, Facial Image Scale and Venham Picture Test before and after oral prophylaxis was 91.20 ± 4.15 , 62.96 ± 2.77 , 89.64 ± 5.21 , 99.4 ± 1.70 and 90.60 ± 3.15 , 61.92 ± 2.11 , 88.64 ± 5.43 , 99.3 ± 1.40 , 2.06 ± 0.544 , 1.74 ± 0.482 and 1.98 ± 0.509 , 1.70 ± 0.538 respectively. The results showed that there was a statistically highly significant difference in Systolic Blood Pressure, Diastolic Blood Pressure, Pulse Rate, Facial Image Scale and Venham Picture Test except oxygen saturation before and after the extraction and statistically non-significant difference before and after oral prophylaxis.

Conclusion: In this study, based on results, the most anxiety provoking dental procedure was found in the following sequence: Extraction > root canal treatment > cavity preparation > oral prophylaxis.

Keywords: Anxiety; Sequential Dental; Root Canal Treatment; Cavity Preparation; Oral Prophylaxis

Introduction

Dental anxiety in children has been recognized as a problem in patient management for many years. It is often reported as a cause of irregular dental attendance, delay in seeking dental care or even avoidance of dental care [1,2]. It has been reported that those experiencing high levels of dental anxiety are among those with the poorest oral health related quality of life. Furthermore, the effects of anxiety have been shown to persist into adulthood, which can often lead to subsequent deterioration of oral health. If a dentist is aware of the level of anxiety of his patients, he is not only able to guide about the patient's behaviour, but can also take measures to alleviate the anxiety during operatory procedures [3].

Dental anxiety refers to patient’s specific response towards dental situation-associated stress. Many studies have described dental anxiety as an adaptative process, which could be initiated during childhood and would decrease over time [4]. It produces some physiological reactions due to the activation of two stress response systems: the sympathetic system and the hypothalamus-pituitary adrenal axis. The psychophysiological responses produced by anxiety are associated in general with an increase in the activity of the sympathetic branch of the autonomic nervous system which results in changes occurring in the cardiovascular system (increased Blood Pressure and Pulse Rate). It causes an increase in the activity of the hypothalamus-pituitary-adrenal axis which is manifested by vasoconstriction and dilatation as well as the release of more epinephrine and norepinephrine [5-7]. Even in simple and painless dental procedure, such as restorative treatment, anticipating pain can increase anxiety and create a stressful situation with possible cardiovascular alterations.

The aetiology of dental anxiety is still not completely understood. The literature has shown that the aetiology of dental anxiety is a multidimensional phenomenon, and stimuli (real or imaginative) can contribute to the development of dental anxiety. The stimulus can be acquired from role models e.g. family, peers and society, unpleasant previous dental experience, environmental factors such as examination room, appearance and noise of equipment, unpleasant odour, fear of injections and high-speed instruments [4,8,9].

It is important that dentist should be able to assess dental anxiety in child patient as early as possible, so that they may identify patients who are in special need with regard to their anxiety. For this purpose, formal assessment measures are essential. Numerous measures for evaluating the degree of anxiety in a patient have been reported in the literature. In children, the choice is based on age and intellectual development. These measures can be objective or subjective, depending on the method used to quantify the degree of anxiety [1,5]. However, study of a single-parameter does not adequately evaluate dental anxiety level in children. So, in the present study we simultaneously recorded three autonomic measures (Pulse Rate, Blood Pressure and Oxygen Saturation) and two pictures scales (FIS and VPT) in children and evaluated patterns of their response to four well- defined dental procedures.

Considering the fact that proper selection of behaviour modulation techniques and applying the same on children is necessary in order to detect anxious patients at an early stage and help them through their dental experience [3], the purpose of conducting this study is to evaluate anxiety level of children aged 6 - 9 years during sequential dental visits using objective and subjective measures.

Materials and Method

The present study was carried out to evaluate the anxiety level of children aged 6-9 years during sequential dental visits using objective and subjective measures in the Department of Pedodontics and Preventive Dentistry, Government Dental College and Hospital, Patiala.

Materials

1. Pulse Oximeter (Figure 1)



Figure 1: Pulse Oximeter.

2. Sphygmomanometer
3. Stethoscope
4. Facial Image Scale (Figure 2)

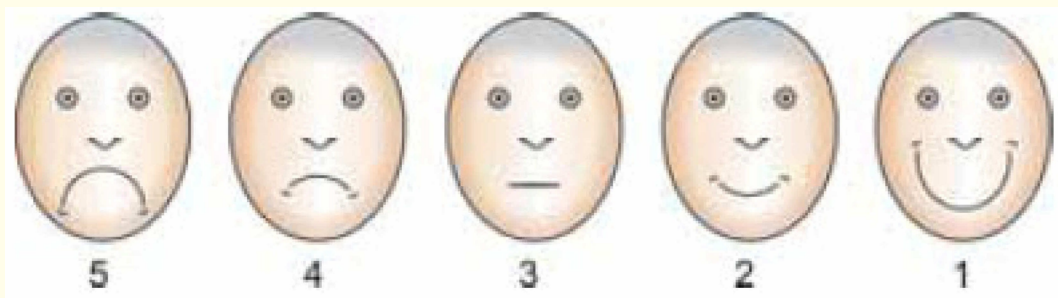


Figure 2: Facial image scale.

5. Venham Picture Test (Figure 3)

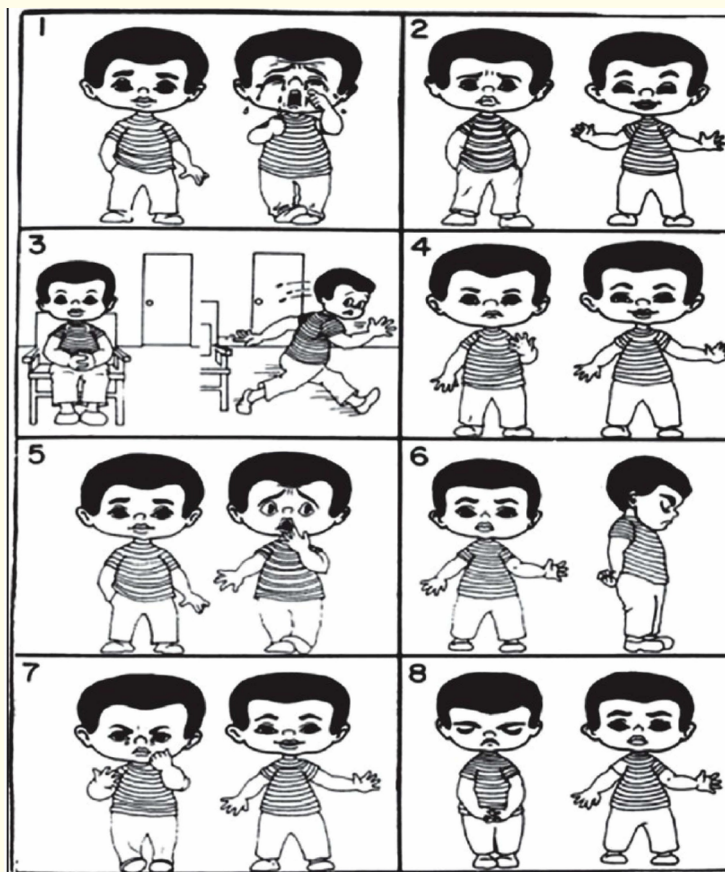


Figure 3: Venham Picture Test.

6. Proforma

Methodology

Two hundred children, between six to nine years of age who reported for the dental treatment were selected for the study from O.P.D of Pedodontics and Preventive Dentistry, Government Dental College and Hospital, Patiala. Of these 200 children, 80 were girls and 120 were boys. The children were divided into four groups based on the procedures performed during sequential dental visits.

1. Group 1 - 50 children for cavity preparation.
2. Group 2 - 50 children for extraction.
3. Group 3 - 50 children for oral prophylaxis.
4. Group 4 - 50 children for root canal treatment.

The subjects were selected on the basis of the following criteria

1. Children with definite indications of oral prophylaxis, restorations, extraction and root canal treatment.
2. Absence of past and/or present mental and physical disorders.
3. No history of current episodes of medications.

Children with accompanying parents/guardian were included in the study because a brief history about the child and social background was elicited during the first visit. It included age, sex and birth order of the child. Details of procedure were explained to parents and informed consent was obtained.

Pulse Rate, Blood Pressure (systolic and diastolic) and Oxygen Saturation were objective measures while Facial Image Scale and Venham Picture Test were subjective measures to evaluate the dental anxiety.

Objective measures

Technique of measuring Pulse Rate and Oxygen Saturation

The reading for Pulse Rate and Oxygen Saturation appeared on the display of fingertip Pulse Oximeter [10] (Figure 1).

Method of recording Blood Pressure

Blood Pressure was measured manually using a stethoscope and a sphygmomanometer. The appropriate size of the cuff which should cover two-third of upper arm (or should be 20% wider than the diameter of the upper arm) was used. The recommended cuff size in children aged 5 - 9 years was 9 cm.

Subjective measures

The Facial Image Scale comprises a row of five faces ranging from very happy to very unhappy. The children were asked to point at which face they felt most like at that moment. The scale was scored by giving a value of one to the most positive affect face and five to the most negative affect face [11] (Figure 2).

The Venham Picture Test comprises eight cards, with two figures on each card, one 'anxious' figure and one 'nonanxious' figure. The children were asked to point at the figure they felt most like at that moment. All cards were shown in their numbered order. If the child pointed at the 'anxious' figure a score of one was recorded, if the child pointed at the 'nonanxious' figure a score of zero was recorded. The number of times the 'anxious' figure was chosen was totalled to give a final score (minimum score, zero; maximum score, eight) [12,13] (Figure 3).

During the visit, the child was made to sit comfortably in the dental chair and the initial values of Pulse Rate, Blood Pressure and Oxygen Saturation were recorded. After the recording of physiological parameters, Facial Image Scale and Venham Picture Test were performed to obtain their scores. Once the initial data was collected, the clinician performed the desired treatment procedure, after which all the parameters were recorded again.

These physiological variables and picture scales were recorded for the dental procedures as:

1. Before and after cavity preparation
2. Before and after extraction.
3. Before and after oral prophylaxis
4. Before and after root canal treatment.

The values obtained before and after the procedures were compared with each other. Data was tabulated and put to statistical analysis.

Results

The results of the study are summarized as follows:

1. In group 1, all the parameters (pulse rate, blood pressure, facial image scale and venham picture test) except oxygen saturation are statistically significant before and after the cavity preparation (p = 0.01).
2. In group 2, all the parameters (pulse rate, blood pressure, facial image scale and venham picture test) except oxygen saturation are statistically significant before and after extraction (p = 0.000)
3. In group 3, all the parameters (pulse rate, blood pressure, oxygen saturation, facial image scale and venham picture test) are statistically insignificant before and after oral prophylaxis (p = 0.07)
4. In group 4, all the parameters (pulse rate, blood pressure, facial image scale and venham picture test) except oxygen saturation are statistically significant before and after root canal treatment (p = 0.01).

Variable	Category	Number	Percentage
Sex	Boys	120	60%
	Girls	80	40%
Age group	6 - 7 yrs	80	40%
	7 - 8 yrs	80	40%
	8 - 9 yrs	60	20%
Birth order	First order	112	56%
	Second order	68	34%
	Third order	20	10%
	Fourth order	0	0%
Socioeconomic class	Upper class	16	8%
	Upper middle	35	17.5%
	Middle class	68	34%
	Lower middle	47	23.5%

Table 1: Showing profile of children.

Variables	Before extraction	After extraction	Change	P value
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Systolic B.P	99.00 ± 4.38	92.84 ± 4.59	6.16 ± 5.12	0.000 (HS)
Diastolic B.P	68.40 ± 4.05	64.16 ± 3.79	4.24 ± 3.51	0.000 (HS)
Pulse Rate	105.88 ± 5.39	94.48 ± 4.84	11.40 ± 8.08	0.000 (HS)
Oxygen Saturation	99.4 ± 1.7	99.3 ± 1.4	0.20 ± 0.40	0.48 (NS)
FIS	2.86 ± 0.346	1.58 ± 0.499	1.28 ± 0.454	0.000 (HS)
VPT	2.80 ± 0.871	1.36 ± 0.525	1.44 ± 0.577	0.000 (HS)

Table 2: Mean, Standard deviation and test of significance of mean change before and after extraction
 HS: Highly Significant; NS: Non-significant

Variables	Before CP	After CP	Change	P value
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Systolic B.P	96.00 ± 5.16	91.88 ± 3.40	4.12 ± 4.04	0.01(S)
Diastolic B.P	65.24 ± 2.64	62.32 ± 2.27	2.92 ± 2.23	0.01(S)
Pulse Rate	95.80 ± 6.63	89.64 ± .495	6.16 ± 5.28	0.01(S)
Oxygen Saturation	98.2 ± 1.8	98.4 ± 1.40	0.20 ± 0.40	0.74(NS)
FIS	2.40 ± 0.489	1.24 ± 0.427	1.16 ± 0.370	0.01(NS)
VPT	2.56 ± 0.601	1.34 ± 0.473	1.22 ± 0.418	0.01

Table 3: Mean, Standard deviation and test of significance of mean change before and after cavity preparation (CP).
 S: Significant

Variables	Before OP	After OP	Change	P value
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Systolic B.P	91.20 ± 4.15	90.60 ± 3.15	0.60 ± 1.35	0.07(NS)
Diastolic B.P	62.96 ± 2.77	61.92 ± 2.11	1.02 ± 1.73	0.09(NS)
Pulse Rate	89.64 ± 5.21	88.64 ± 5.43	1.00 ± 1.43	0.07(NS)
Oxygen Saturation	99.4 ± 1.7	99.3 ± 1.4	0.1 ± 0.9	0.56(NS)
FIS	2.06 ± 0.544	1.98 ± 0.509	0.08 ± 0.239	0.08(NS)
VPT	1.74 ± 0.482	1.70 ± 0.538	0.04 ± 0.287	0.07

Table 4: Mean, Standard deviation and test of significance of mean change before and after Oral prophylaxis (OP).

Variables	Before RCT	After RCT	Change	P value
	Mean ± S.D	Mean ± S.D	Mean ± S.D	
Systolic B.P	98.00 ± 4.99	92.68 ± 4.03	5.32 ± 4.18	0.01(S)
Diastolic B.P	67.36 ± 3.84	63.76 ± 8.77	3.60 ± 3.51	0.01(S)
Pulse Rate	103.90 ± 5.41	93.44 ± 5.65	10.46 ± 7.08	0.000(HS)
Oxygen Saturation	98.6 ± 1.8	98.4 ± 1.40	0.20 ± 0.40	0.48(NS)
FIS	2.58 ± 0.499	1.36 ± 0.485	1.22 ± 0.465	0.01(S)
VPT	2.72 ± 0.895	1.22 ± 0.914	1.50 ± 0.763	0.01(S)

Table 5: Mean, Standard deviation and test of significance of mean change before and after Root Canal Treatment (RCT).

Discussion

Anxiety is a nonspecific feeling of apprehension, worry, uneasiness, the source of which may be vague or unknown or it is a state of unpleasant feeling combined with an associated feeling of impending doom. The most likely responses to dental stimuli in case of children reporting for first dental visit would be anxiety. It is considered a multidimensional construct comprising behavioural, cognitive and physiological components. The production of anxiety can be viewed from two different aspects .One is the psychoanalytical aspect and the other is the physiological aspect. Anxiety does produce some physiological reactions including alteration in Blood Pressure and heart rate.

According to study by Rosenberg and Katcher, *et al.* (1976) [14] the anxiety provoking situations alter the physiological functions like Pulse Rate and Blood Pressure. This increase in Pulse Rate and Blood Pressure can be used to assess dental anxiety in children. Studies by Messer, *et al.* (1977) [15], and Beck, *et al.* (1981) [16] confirmed that the physiological changes occur in the body as a result of the stress suffered by patients during dental procedures and these physiological changes are very useful for measuring anxiety level in a patient before and after the dental treatment. McCarthy, *et al.* (1957) [17] obtained similar results. So in the present study Pulse Rate and Blood Pressure were used as reliable indicators to evaluate anxiety level of children.

In the present study fingertip pulse oximeter was used to measure Pulse Rate and Oxygen Saturation because it is easy to use as it requires no calibration, warm-up time or tissue preparation. It is based on the concept that pulsatile changes in the light transmission through living tissues are due to alteration in the arterial blood volume [18].

A literature search revealed that various scales and questionnaires were used for subjective assessment of anxiety level in children e.g. Venham Picture Test, Children’s Fear Survey Schedule-Dental Subscale, Corah’s Dental Anxiety Scale, Facial Image Scale, Children’s Manifest Anxiety Scale and Interval Scale of Anxiety Response etc. Questionnaire methods suffer from questions reliability and validity due to difficulties in the interpretation and the standardization of scoring and verbal methods employed with young children can have limitations due to comprehension and intellectual ability. Studies conducted by Buchanan, *et al.* (2002) [11] and Jimeno FG, *et al.* (2011) [19] found that for subjective measurement, the ideal measure should be valid, allow for limited cognitive and linguistic skills, and be easy to administer and score in a clinical context.

The results of this study clearly showed a significant change in blood pressure and pulse rate, FIS and VPT in all dental procedure except oral prophylaxis in the dental operatory area. The most anxiety provoking situation was found to be the time before and after the extraction followed by root canal treatment and cavity preparation. Oxygen saturation remained unchanged in all four standard procedures.

The results of this study were supported by Rayen R., *et al.* (2006) [20] who studied Evaluation of physiological and behavioral measures in relation to dental anxiety during sequential dental visits in children. The mean systolic blood pressure, diastolic blood pressure and pulse rate before and after the extraction was 100.40 ± 8.2 , 63.3 ± 5.90 and 104.4 ± 13.0 and 99.4 ± 7.7 , 63.0 ± 5.8 and 101.6 ± 9.9 . In our study mean systolic blood pressure, diastolic blood pressure and pulse rate before and after the extraction was 99.00 ± 4.38 , 68.40 ± 4.05 and 105.88 ± 5.39 and 92.84 ± 4.59 , 64.16 ± 3.79 and 94.48 ± 4.84 . The results when compared showed a very close correlation in all three physiological parameters. In their study and in our study physiological reading were high before the extraction procedure showing a significant correlation with two studies. Similar results were obtained by sowjanya., *et al.* (1995) [6] and sanadhya., *et al.* (2013) [3]. They concluded that there was a statically significant difference in all physiological parameters before and after the extraction procedure. Similar statistically significant results were also obtained for mean systolic blood pressure, diastolic blood pressure and pulse rate in root canal and cavity preparation procedures.

The mean of Facial Image Scale and Venham Picture Test before the extraction was 2.86 ± 0.346 , 2.80 ± 0.88 . The mean of Facial Image Scale and Venham Picture Test after the extraction was 1.58 ± 0.49 , 1.36 ± 0.525 . The results showed that there was a statistically significant difference in Facial Image Scale and Venham Picture Test before and after the extraction. These findings are in accordance with those of P Lopez-Jornet., *et al.* (2014) [21] who assessed the general pre and post-operative anxiety in patients undergoing tooth extraction. There were significant differences in the Modified Dental Anxiety Scale (MDAS) and The Dental Fear Survey (DFS) between before and immediately after extraction. Similar results were obtained by study of Venham L., *et al.* (1977) and DM De Menezes Abreu., *et al.* (2011) [4]. Schriks and van Amerongen., *et al.* (2003) [22] found a relationship between Venham Picture Test and Pulse Rate during minimal restorative treatment. Another study by Liau., *et al.* (2008) [23] found that the dental anxiety scale was able to predict the impact of anxiety on Pulse Rate during anaesthetic administration for extraction procedure. Similar results were found by Muinelo Lorenzo., *et al.* (2014) [24] suggesting that changes in the Facial Image Scale were consistent with changes in Pulse Rate.

In the present study, Two hundred children, between six to nine years ages were selected. This age group was selected as it corresponds with the concrete operational stage of cognitive development theory by Jean Piaget and the stage of industry versus inferiority, that is, mastery of skills of emotional development by Erik Erikson. This stage thus, shows an improved ability of children to reason. In our study we found that girls were significantly more anxious than boys. This result is in agreement with wright., *et al.* (1980) [25] who concluded that girls had more dental anxiety than boys. Klein knecht., *et al.* [26] also reported that girls rated themselves more fearful than boys. Younger children in the family exhibited significantly greater anxiety than elder children because younger children are believed to be customized to receiving attention and thought to misbehave, if they feel lack of attention [27]. Children of lower middle class had more anxiety as compared to the upper class. This might be due to an indirect affect, as ethnic minorities or people with a low socioeconomic status tend to visit the dentist infrequently and hence have less dental treatment modality awareness [28-30].

Significant changes in the FIS and VPT were consistent with changes in Pulse Rate, Blood Pressure in all dental procedures except oral prophylaxis, thus suggesting that the FIS and VPT could be a helpful method for assessing the influence of anxiety on Pulse Rate and Blood Pressure during invasive (extraction, root canal treatment and restoration) and non-invasive (oral prophylaxis) treatments in children. Further studies with a larger sample should be done in order to better understand the correlation between the objective (Pulse Rate, Blood Pressure) and subjective measures (FIS, VPT).

Summary and Conclusion

The following conclusions were drawn from the present study:

1. In this study, based on results, the most anxiety provoking dental procedure was found in the following sequence:
Extraction > root canal treatment > cavity preparation > oral prophylaxis
2. The study confirmed that there is a direct correlation between the objective measures (blood pressure and pulse rate) and subjective measures (facial image scale and venham picture test) during anxiety producing dental situations.
3. Girls were significantly more anxious than boys.
4. Younger children exhibit significantly more anxiety than elder children in the dental clinic.
5. Children of lower middle class had more anxiety as compared to upper class.

In our study, we found that Pulse Rate, Blood Pressure, FIS and VPT had higher values before all procedures, except oral prophylaxis. It could be attributed to the fact that before the procedure (extraction, root canal treatment, restoration) children had subjective fear of tooth loss, injection and drilling. These fears are based on feelings and attitude that have been communicated to the child mainly by parents. However, after the completion of the procedure as the fear of the child was reduced, lower values were obtained for Pulse Rate, Blood Pressure, FIS and VPT. Within the limitations of the study, more studies are needed to be performed over a larger sample size to evaluate the anxiety level in children before and after the procedures.

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