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Anxiety Rating Scales in Pediatric Dentistry

Dr. Souvik Kar[1], Dr. P V Samir[2], Dr. Anwesha Pattanaik[3]

Abstract: ***In the world of pediatric dentistry, it is very crucial to treat children positively throughout their dental experience and encourage positive dental attitude in order to improve their dental wellness. Child dental anxiety is more complicated in comparison to other age groups who are associated with dental challenges because children are more vulnerable and unable to express their feelings appropriately. Henceforth, it is very crucial to identify the distress or anxiety related behavior among the children in the earliest duration. The review comprehensively explores the anxiety and related symptoms previously felt by the children before visiting the dental clinic. These prior identifying measures are "subjective and objective measures". Subjective measures are also known as self - reporting rating scale which by using pictorial and language assistance determines the prior dental anxiety. Some of the measures that come under subjective domains are pediatric "Corah's Dental Anxiety scale, Modified Dental Anxiety scale, Venham Picture scale, Children's Fear Survey Schedule - Dental Subscale and others. On the other hand, objective measures are the indicator that identify the fear, uneasiness through pulse rate and other techniques such as "Heart rate, Blood Pressure (systolic and diastolic), Oxygen saturation (SpO2) ". These are the physiological measures which are identified separately for every child. The review provides a keen and comparative analysis of various self - reported scales applied to investigate prior DA. Moreover, the study also suggests some measures needed to assure hassle free dentistry therapy acquired by the children without having fear or distress such as enhancing awareness by motivational and educational campaigns, and proper behavior management.***

Keywords: Pediatric dental anxiety, Subjective and Objective measures, Anxiety rating scales in Pediatric dentistry

1. Introduction

Dental Anxiety (DA) is a complicated psychological phenomena comprising physiological, psychological and social aspects associated with the patient who is visiting the dentist. Patients who are associated with extreme range of dental anxiety undergo distress and deny or postpone the needed medication responsible for decline in quality of dental wellness and deterioration of disorder [1]. DA illustrates excessive and uncertain adverse emotion expressed by vulnerable patients, specifically children. Unsurprisingly, anxiety is related to the behavior that can be identified as the most significant factor in dental treatment. Thus, evaluation of dental anxiety has received enormous attention and significance utilized in pediatric dental practice. The practice is used as a guideline for treating individual children to deal with dental abnormalities effectively [2].

In order to identify present circumstances of dental anxiety in children a dental health survey was conducted in 2013. It reveals that children cited anxiety to their parents and visited the dentist around 21% of five year old children and 17% of eight year old children. DA level was increased in higher age groups of children in comparison with lower age group children. As data shows that about 76% of the 12 year old children and 64% of fifteen year old children indicate moderate to severe DA [3].

Several studies [4] illustrated that before obtaining therapeutic assistance it is very significant to identify dental anxiety so that a behavior management approach can be utilized that is medicinal and non - pharmacological practice in order to obtain successful oral therapy. DA can be started from various duration and various measuring tools are utilized to analyze dental fear and anxiety among the children. These assessment or rating scales can be classified as behavioral measure physiological or objective measure and psychometric tools.

Objective measure and Subjective measure

Several time assessment is only accomplished by observation and rating scale so evaluation of dental anxiety can be based on multifold measures. The behavior rating comes under the subjective category of scaling tool. One of the most prominent behavior rating techniques is Frankl's Behavior Rating Scale (FBRS) [5].

Arise in anxiety responsible to release catecholamine, which subsequently lift the "blood pressure (BP), heart rate (HR) " and decline the galvanic skin resistance [6]. Other usual symptoms that are responsible for anxiety related changes like increment in sweat production, uncontrollable breathing, enhanced muscular tone, spastic movement, dry mouth and constipation [7]. The objective measuring technique is used to interpret the anticipatory anxiety level in children by "blood pressure (BP), heart rate (HR), oxygen saturation (SpO2) " and muscle tension.

The psychometric mechanism is based on questionnaires that assist to identify the anxiety level of the children and effectively utilized by the dentist to provide effective medication to the children. Some of the most widely used scales are "Children's Fear Survey Schedule–Dental Subscale (CFSS-DS) " which relies on 15 ingredients. Another one was "Modified Child Dental Anxiety Scale (MCDAS) " which is formulated by 8 elements.

1.1 Background

Child dental anxiety is a usual and capable distressing challenge from a child and dental care perspective. Henceforth, to determine and quantify anxiety trade can be based on scale which embraces certain features like -

- Short length procedures will maximize response from the child and minimize duration for diagnosis and medication.
- Predominant ingredients which are most relevant with pediatric dental experience.
- Convenient approach to obtain the attention of the children

- The mechanism should be shot and simple, conveniently scored and interpretable.

2. Discussion

Anxiety in a dental clinic is usually recorded based on "subjective and objective measures". Subjective measures of DA in pediatrics involve "Corah's Dental Anxiety scale, Modified Dental Anxiety scale, Venham Picture scale, Children's Fear Survey Schedule - Dental Subscale and others. On the other hand, objective measures involve "Heart rate, Blood Pressure (systolic and diastolic), Oxygen saturation (SpO2) ". These are the physiological measures which are identified separately for every child.

There are different Anxiety rating scales in Pediatric dentistry that can be classified into objective and subjective measures. Both the tools are comprehensively explored in the below section along with their scaling figures.

2.1 Objective Measure

Pulse Oximeter is used to measure "heart rate and Oxygen saturation" (Pulse Oximeter, PO - 15, Delhi, India). In order to identify the blood pressure pre pre - extraction approach was used by an automated blood pressure monitor device (MX3; Omron, Tokyo, Japan). This device's description is mentioned by the researcher Kalra et al., (2021) while using it in their work [8].

Table 1: The physiological parameters [8]

Variable	Ranges	Mean Std
HR	98 - 155	118.4 $\pm$ 12.9
SBP	104 - 144	125 $\pm$ 9.3
DBP	68 - 89	79.7 $\pm$ 5.7
SpO2	90 - 100	98.1 $\pm$ 1.7

Another study [9] evaluated the pulse fluctuation and SpO2 under the physiological parameter to identify oral anxiety among children. The research utilizes fingertip pulse oximeter devices embedded with monitor displays. It is used to display pulse rate and SpO_2 value. The equipment was fitted on the left - hand index finger. The device was put on the finger 15 minutes before the dentist intended to start the treatment to identify and record the "pulse rate and oxygen saturation level". All the fluctuation and the information were recorded and mean calculation was evaluated.

Table 1: The physiological parameters [9]

Variable	Mean Std (before)	Mean Std (after)
Pulse	100 11	106 14
SpO2	98 1	98 1

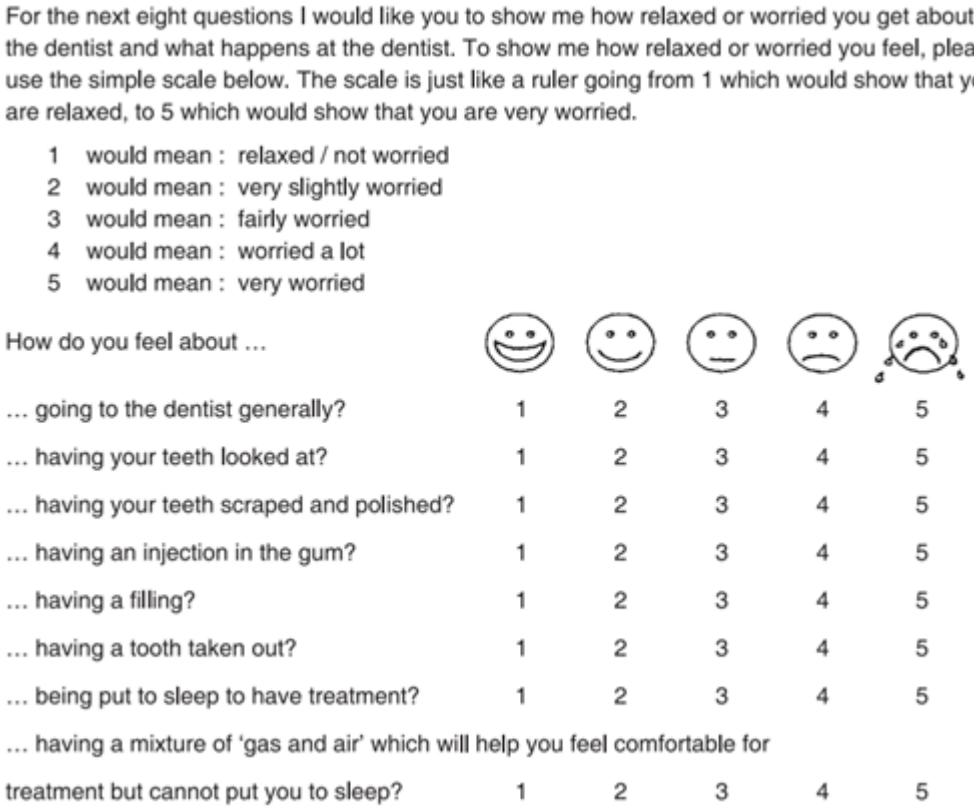
The physiological parameters including pulse rate and oxygen level assist to address the stress and distress level because it depicts the changing heart rate and respiratory rate in the blood. A small fingertip device identified the changes of HR and oxygen level which are significant from dentist insight and make the procedure more convenient from children's insight. Some of the article [10] indicates there is a positive association between subject and objective measures on dental anxiety however, also provide contradictory analysis and mention that positive incorporation amongst negative behavior and increased heart rate and systolic blood pressure in childrens who are suffering with dental anxiety.

Anxiety causes distress that changes hemodynamics because of release of catecholamine by the patients. Arise in anxiety responsible to release catecholamine, which subsequently lifts the "blood pressure (BP), heart rate (HR) " and declines the galvanic skin resistance. The change or fluctuation in HR without change in blood pressure is also a kind of dental anxiety found in children which may occur because of decline in compensatory intro volume or peripheral resistance. The declining range of SpO_2 level for extraction and pulpotomy process among children was also seen in some of the investigations.

2.2 Subjective Measures

The subjective measures come under the category of self - assessment to determine dental anxiety The characteristic of a self assessed tool is convenient to monitor and usually completed in a short duration of time. Out of usual, some of the most frequently used scales was "Corah Dental Anxiety Scale (CDAS) ", it is a famous, reliable and prevailing scale employed to interpret DA among adults. When the tool is utilized to identify the dental stress among pediatricians its methodology is quite complicated. Henceforth, modified versions were prepared by Wong, and named as "Modified Child Dental Anxiety Scale (MCDAS) " [11].

The **Modified Child Dental Anxiety Scale (face version)** was prepared by including some smiley faces on the rating scale to the original numeric information. The scale has psychrometric features such as reliability criteria and formulate validity that is appropriately utilized to identify dental anxiety level among the population [12]. The scale consists of 8 questionnaires and five pictorial facial expressions. The question related to local anesthesia (LA) and other dental processes that create anxiety and stress among the children including dental general anesthesia (DGA) and relative analgesia (RA). The scale ranges from 5 (with no DA) to 40 (extreme DA). It is used to determine 8 - 15 years age grouped children, and the scale provides effective results because of its consistency and validity.



For the next eight questions I would like you to show me how relaxed or worried you get about the dentist and what happens at the dentist. To show me how relaxed or worried you feel, please use the simple scale below. The scale is just like a ruler going from 1 which would show that you are relaxed, to 5 which would show that you are very worried.

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

How do you feel about …					
… going to the dentist generally?	1	2	3	4	5
… having your teeth looked at?	1	2	3	4	5
… having your teeth scraped and polished?	1	2	3	4	5
… having an injection in the gum?	1	2	3	4	5
… having a filling?	1	2	3	4	5
… having a tooth taken out?	1	2	3	4	5
… being put to sleep to have treatment?	1	2	3	4	5
… having a mixture of 'gas and air' which will help you feel comfortable for treatment but cannot put you to sleep?	1	2	3	4	5

Figure: Shows the MCDAS

The review also explores the MCDAS in terms of its correlation with other rating scales along with the varied version of MCDAS.

Country	Sample	Correlation of MCDAS	Reference
China	248	CFSS - DS (r = 0.843, P < 0.01) VPT (r = 0.675, P < 0.01).	[13]
Malay	239	CFSS - DS (r = 0.67, p < 0.001)	[14]
Turkish	300	VPT (r=0.632)	[15]

The challenge associated with the MCDAS a s scale was because it is numeric rating it may lead to unsustainability while identifying the DA in very young age group children. To overcome the issues the pictorial version of CDAS is a rating scale used for 7 to 9 year old children by using picoral faces instead of original response scale [4]. A dynamic barometer was formulated to aid pediatricians by "**Children's Fear Survey Schedule - Dental Subscale (CFSS - DS) "**, was proposed by Cuthbert and Melamed. It embraces 15 questions which are supported likert scale compassess various feelings or emotion through rating from "1 (not afraid at all) to 5 (very much afraid) ". For instance, one individual indicates "I am afraid of dentists" however, another one shows "I am afraid of injections. " These feelings or indications are recorded and counted as: "not afraid at all" (1), "afraid a little" (2), "somewhat afraid" (3), "afraid" (4), or "very afraid" (5). The rating of the score was between 15 to 75 and above 38 is considered to be associated with dental anxiety. Because of its reliability and validation it is effectively utilized in several countries [16]. The questionnaires that are asked in the survey are discussed in the below figure.

1. Dentist
2. Doctors
3. Injections
4. Having somebody examine your mouth
5. Having to open your mouth
6. Having stranger touch you
7. Having somebody look at you
8. The dentist drilling
9. The sight of the dentist drilling
10. Noise of the dentist drilling
11. Having somebody put instruments in your mouth
12. Choking
13. Having to go to hospitals
14. People in white uniforms
15. Having the nurse clean your teeth

Figure: CDSS - DS Questionnaires.

Pediatric patients who score lower than 38 are identified as dentally stressed. The set of questionnaires help the dentist to understand the suffering of the child. The usual time of the questionnaire round was around 15 minutes. Study indicated that CFSS - DS perform much better in some circumstances in comparison to other anxiety rating scales, specifically VPT and DAS. This rating scale is appropriately utilized to analyze the anxiety and fear level among the child as well as identify the widespread DA among children.

Table: CFSS - DS related articles.

Country	Sample size	Mean CFSS - DS	Reference
Singapore	505	30.6 ± 6.5	[17]
India	444	37 ± 8.8	[16]
Denmark	1235	23.8 ± 8.7	[18]
New York	114	32.4 ± 3.2	[19]

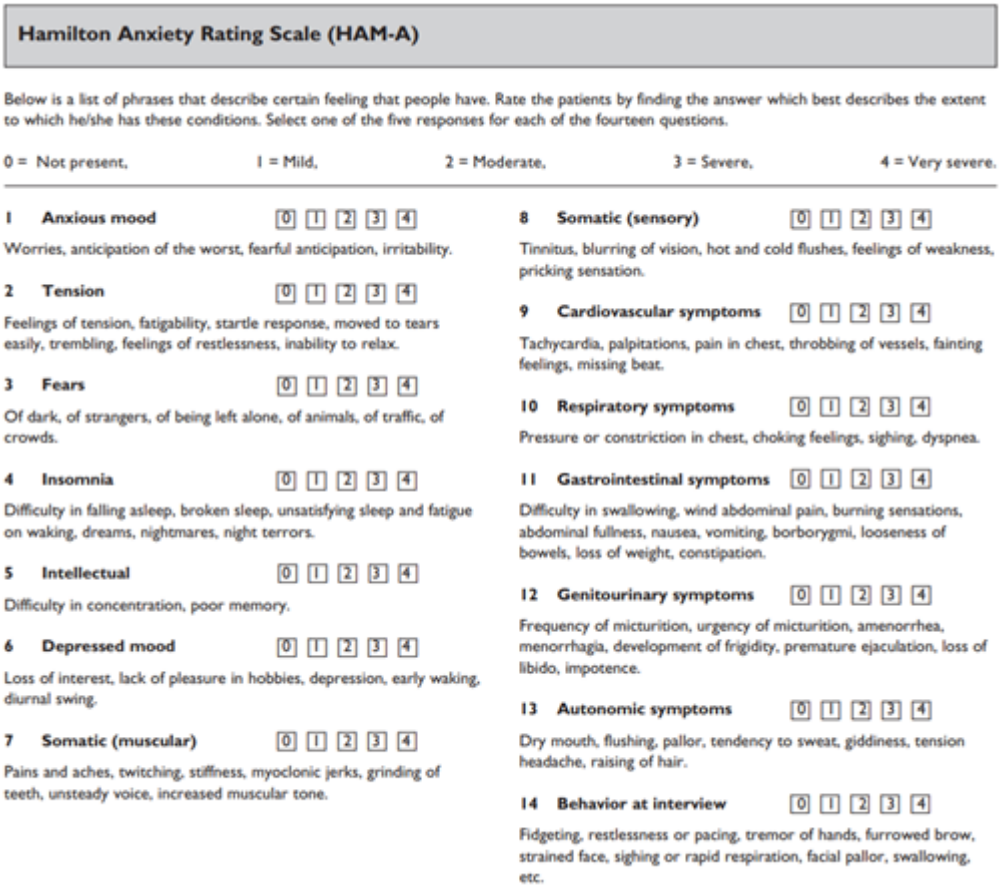
Correlation among MCDAS and CFSS - DS

The research [20] emphasizes SFP, MCDAS, and CFSS - DS to identify the dental anxiety among the children. The finding shows that there is a strong correlation among all the three rating scales as SFP and CFSS ($r = 0.6$, $p<0.01$) as well as MCDAS ($r =0.6$, $p< 0.01$). The mean anxiety score was 18. The study also identified that there is no gender difference among the dental anxiety score. The research also highlighted that children became most anxious when they face drill and local anesthesia injection and least stressed the day before the dental visit. The study [21] explored 202 samples to determine the prior dental fear and anxiety among the childrens. The study explored 3 rating scales CFSS - DS, MCDAS and CDAS. The finding shows that cooperative children show lower CFSS - DS score with BMP (behavior management problem) while MCDAS score was higher in children with BMP. The research identifies that there is a strong incorporation between MCDAS and CFSS - DS ($r = 0, 482$; $P < 0.01$). Eventually it may be extracted that CFSS - DS and MCDAS tools are trustworthy and validated rating score information for identifying prior DA in the children.

"Hamilton Anxiety Rating Scale (HAM - A)"

The rating scale is used to evaluate the DA level among adolescents. The scale assists in identifying the severity of symptoms among children, adults, and adolescents. It was proposed in the year 1959 by Hamilton. The scale has 14 questionnaires that assist in understanding the symptoms, physiological and mental abnormalities and stress level. The HAM - A is enormously used in academic and therapeutic domains, and promisingly used by clinics because of its performance. Rating scale is converted into Chinese, French, and Spanish [22].

The scoring ranges from 0 to 4, each item lies in the range where 0 denotes (no present) and 4 means (severe), with a total score value in 0–56, where the value greater than 17 shows "mild severity, 18–24 mild to moderate severity and 25–30 moderate to severe". Although, it is widely used still it was criticized because of its certain features like in appropriate to difference among antidepressant impact and anxiolytic effects as well as somatic anxiety and related after effects. However, several research indicates the scale has reliability and validity characteristics. Usually it takes for 12 to 15 minutes to answer the questions and determine the anxiety and depression score [23].



Hamilton Anxiety Rating Scale (HAM-A)

Below is a list of phrases that describe certain feeling that people have. Rate the patients by finding the answer which best describes the extent to which he/she has these conditions. Select one of the five responses for each of the fourteen questions.

0 = Not present, 1 = Mild, 2 = Moderate, 3 = Severe, 4 = Very severe.

1 **Anxious mood** [0] [1] [2] [3] [4]
Worries, anticipation of the worst, fearful anticipation, irritability.

2 **Tension** [0] [1] [2] [3] [4]
Feelings of tension, fatigability, startle response, moved to tears easily, trembling, feelings of restlessness, inability to relax.

3 **Fears** [0] [1] [2] [3] [4]
Of dark, of strangers, of being left alone, of animals, of traffic, of crowds.

4 **Insomnia** [0] [1] [2] [3] [4]
Difficulty in falling asleep, broken sleep, unsatisfying sleep and fatigue on waking, dreams, nightmares, night terrors.

5 **Intellectual** [0] [1] [2] [3] [4]
Difficulty in concentration, poor memory.

6 **Depressed mood** [0] [1] [2] [3] [4]
Loss of interest, lack of pleasure in hobbies, depression, early waking, diurnal swing.

7 **Somatic (muscular)** [0] [1] [2] [3] [4]
Pains and aches, twitching, stiffness, myoclonic jerks, grinding of teeth, unsteady voice, increased muscular tone.

8 **Somatic (sensory)** [0] [1] [2] [3] [4]
Tinnitus, blurring of vision, hot and cold flushes, feelings of weakness, pricking sensation.

9 **Cardiovascular symptoms** [0] [1] [2] [3] [4]
Tachycardia, palpitations, pain in chest, throbbing of vessels, fainting feelings, missing beat.

10 **Respiratory symptoms** [0] [1] [2] [3] [4]
Pressure or constriction in chest, choking feelings, sighing, dyspnea.

11 **Gastrointestinal symptoms** [0] [1] [2] [3] [4]
Difficulty in swallowing, wind abdominal pain, burning sensations, abdominal fullness, nausea, vomiting, borborygmi, looseness of bowels, loss of weight, constipation.

12 **Genitourinary symptoms** [0] [1] [2] [3] [4]
Frequency of micturition, urgency of micturition, amenorrhea, menorrhagia, development of frigidity, premature ejaculation, loss of libido, impotence.

13 **Autonomic symptoms** [0] [1] [2] [3] [4]
Dry mouth, flushing, pallor, tendency to sweat, giddiness, tension headache, raising of hair.

14 **Behavior at interview** [0] [1] [2] [3] [4]
Fidgeting, restlessness or pacing, tremor of hands, furrowed brow, strained face, sighing or rapid respiration, facial pallor, swallowing, etc.

Figure: HAM - A and related questionnaires.

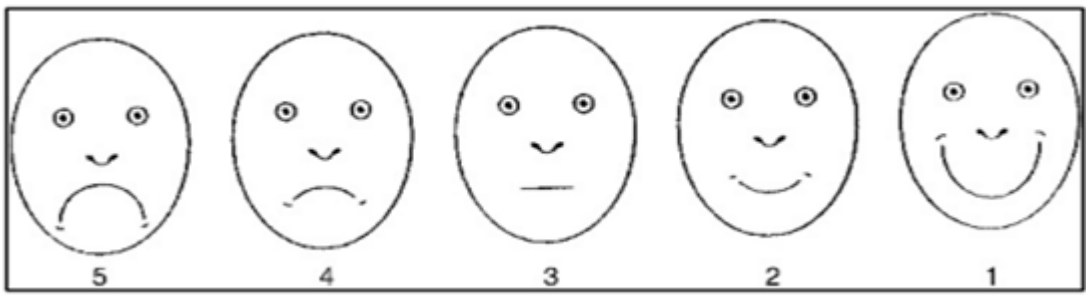
Venham Picture Test

The rating scale was proposed in the year 1977, by B. Larry and L. Venham. It is an anxiety rating scale which exhibits in the form of pictorial representation covering all the parameters to describe anxiety level. Ranges from 8 different pictures where two pictures on each card and forming 8 cards. Individual cards consist of two opposite figures, one denoting stress or depressed figures and another card is a non - stress figure [24]. It asked the children to point to any of the figures in every card and analyze what they felt at a particular movement. Individual cards are allotted numbers that show the order of anxiety. If the child

pointed to an anxiety figure, the score of one was mentioned and if they picked the opposite card the score was zero. After picking all the cards, and if the child scores higher then it shows anxiety level and if the child scores minimum level it shows non anxiety level. The maximum score is 8 for all 8 cards. Picture test score is a vital component for children's self reported dental anxiety as well as for practitioner cooperativeness rating.

"Facial Image Scale (FIS) "

FIS was proposed by "Buchanan and Niven" in 2002. It is a type of rating scale which is used to identify dental anxiety level of the children which consist of five facial pictorial representations. These 5 facial icons range from very unhappy to very happy, allotting the number value of 1 to 5 where one indicates no anxiety i. e most happy face, and 5 indicates higher level of anxiety. In this rating scale children were questioned to cite the face they feel most of the time [25].



Both the tools (VPT and FIS) are effectively utilized because of their convenience and easy understanding among the children as well as young children can also appropriately show their perception. Number of studies identify the emotional stress involving anxiety, depression and related behavior of children who are going through dental therapy. Number of studies utilizing FIS along with VPT to obtain reliable and accurate information. The study [26] illustrates that there is no association between VPT and FIS as the finding shows ($r = 0.087$, $n = 52$, $P > 0.05$). As well as the mean FIS (2.94 ±1.34) and VPT (2.8 ±1.73) score for 52 children. Moreover around 37% of the children show 4 or 5 scores on the facial image scale. The study also provided gender based analysis of anxiety scores among the children and interpreted that gender difference was not associated with dental anxiety. Another study [27] collected a sample of 109 children from school students and determined their dental anxiety based on pictures' scale rating. The mean FIS was found to be 2.33 and mean of VPT was 2.17. The study also showed no gender respective dental anxiety was identified. This study also highlighted the age wise difference among the dental anxiety and identified that there is no such correlation found among the anxiety status and the age. The researcher Oliveira et al., seeks to intervene in prior dental anxiety among 30 children [28]. The finding stated that 70% of the children were anxiety free with 30% of the children having some degree of anxiety by using the VPT test. In comparison to the FIS test which indicates that 87% of children are free from anxiety and 13% of the children have some level of anxiety. The study also indicates

that both the tests are found to be easy and attractive from children's perspective and they themselves use the rating scale.

3. Related Studies

This section provides a summary of distinct research that is comprehensively analyzed in this review to enhance the understanding and the utility of anxiety rating scale.

S. No	Design of Study	Sample Size	Age Group	Analysis	References
1	Observational cross - sectional study	100 (50 male, 50 female)	3 - 15 years	FIS (2.2 - mean) VPT (1.4 - mean)	25
2	Observational cross - sectional study	240 (SFP= 48 M, 52 F) (MDAS =120F, 120M)	4 - 10 years	SFP and CFSS (r = 0.6, p<0.01) as well as MCDAS (r =0.6, p< 0.01)	20
3	Observational cross - sectional study	52 (28M, 28F)	6 - 12 years	FIS (2.9 - mean) VPT (2.8 - mean)	26
4	Observational cross - sectional study	287 (191F, 96M)	8 - 10 years	MCDAS and CFSS are correlated	29
5	Observational cross - sectional study	300 (174F, 126M)	6 - 12 years	VPT and MCDAS (r=0.632), MCDAS showed high internal consistency (0.703)	15
6	Observational cross - sectional study	248	4 - 11 years	MCDAS and CFSS - DS (r = 0.843	13

4. Conclusion

It is very crucial to identify dental anxiety before providing appropriate medication among the children by the pediatric dentist. It is the duty of clinicians to assure a positive attitude for dentistry because they are not only responsible for identifying the anxiety status but also to instill a positive attitude. Child dental anxiety is a usual and capable distressing challenge from a child and dental care perspective. Henceforth, to determine and quantify anxiety trade can be based on scale which embraces certain features like short length procedures will maximize response from the child and minimize duration for diagnosis and medication, approach to obtain the attention of the children, and mechanism should be short and simple, conveniently scored and interpretable. Moreover self - reported scale is one of the prominent and vital ingredients that assist to identify and dissolve the prior dentist anxiety symptoms addressed by children.

The review comprehensively explores the anxiety and related symptoms previously felt by the children before visiting the dental clinic. These prior identifying measures are “subjective and objective measures”. Subjective measures are also known as self - reporting rating scale which by using pictorial and language assistance determine the prior dental anxiety. Some of the measures that come under subjective domains are pediatric “Corah’s Dental Anxiety scale, Modified Dental Anxiety scale, Venham Picture scale, Children’s Fear Survey Schedule - Dental Subscale and others. On the other hand, objective measures are the indicator that identify the fear, uneasiness through pulse rate and other techniques such as “Heart rate, Blood Pressure (systolic and diastolic), Oxygen saturation (SpO2) ”. These are the physiological measures which are identified separately for every child.

5. Suggestions

It is crucial for dentists, specifically pediatric dentists, to determine dental anxiety among the children before taking dental treatment. The components that can play a crucial role to deal with the dental anxiety is pre appointment counseling and behavior management. Along with this motivational and educational campaign regarding dental activities by the dental professional can play a significant role to deal with prior dental anxiety among the childrens.

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