

## REVIEW ARTICLE

# A critical appraisal of the use of tools for assessing dental fear in children

M.O. Folayan, K.A. Kolawole<sup>1</sup>

*Department of Child Dental Health, Obafemi Awolowo University, Ile-Ife, Nigeria and*

*<sup>1</sup>Department of Child Dental Health, Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria.*

### Summary

**Objective:** The aim of this article is to review and evaluate the uses of the various tools for assessing dental fear in the child. **Method:** A search and review of publications related to the various identified tools used for assessing dental anxiety in children was done. Attention was paid to the empirical findings with the main focus being the function for which the instruments were designed. The features as an ideal instrument for use in the measurement of dental fear in the child were examined. **Results:** The findings indicate that most of the existing tools can be appropriately used for epidemiological studies as well as for diagnostic purposes with some limitations. However, none of the existing tools are appropriately designed for determining treatment needs as well as for assessing treatment outcomes. **Conclusion:** It was concluded that there is a need to develop culturally sensitive instruments which would enhance the objective assessment of treatment need and treatment outcomes of dental fear in children.

**Key words:** Dental, Fear, Children, Appraisal, Measures

### INTRODUCTION

Dental fear in children has continued to generate a lot of interest in pediatric dentistry. This is because of the handicapping complications associated with it. For one, it causes stress for many dentists who have to manage such children especially those who have associated behavioural problems. In addition, the chair time required to manage these children is long and some specialized training is also needed in the effective management of these children<sup>1</sup>.

However, to effectively manage this handicapping trait, it is important to determine the prevalence of the problem in a community so as help in the planning of public health services. Secondly, tools are needed to aid diagnosing its presence and the severity in individuals to help tailor individual treatment. Finally, there is also a need for tools which can measure treatment need and successes of therapy. This would help with monitoring and evaluating treatment outcomes.

### Correspondence: M. O. Folayan

*Department of Child Dental Health, Obafemi Awolowo University, Ile-Ife, Nigeria. E-mail: mukpong2@yahoo.com*

Various measures have been developed in a bid to develop a uniform method of assessing and grading dental fear in children. Many of these measures quantify dental fear by measuring, scoring and summarizing the results. The development

of a measure that can record the prevalence, help in recognizing treatment needs and priorities and help in the monitoring and evaluation of treatment outcomes would be ideal. This is because such a measure would help in ensuring uniformity in treatment planning and help in evaluation of various results.

Any such measures should be able to demonstrate the following features:

1. it should be reliable meaning it should have a high level of intra and inter examiner reproducibility
2. it should be valid, measuring what it is intended to measure
3. it should be simple and easy to use
4. it should enable the assessment required to be done quickly and accurately without the use of special instruments or special instructions
5. it must be able to distinguish between a handicapping and non handicapping trait
6. it should be objective in nature and yield quantitative data which may be analysed by current statistical methods

The currently existing measures for dental fear are numerous. Past classifications have been based on the type of the tools. They were classified as psychometric scales, behavioural rating scales, physiological and hormonal measures and projection techniques.

However, there may be the need to readdress this broad classification which does not take cognizance of the possible uses these tools could be put into. This article tries to classify the existing measures for dental fear in children based on their possible use for assessments. It also critically appraises the tools in light of the ideal requirements and makes

recommendations. It proposes a new and functional method of classifying various measures of dental fear in children. The classification is based on possible use of the tools rather than on their type.

### **Epidemiological measures.**

These are measures used to determine the prevalence of dental fear in populations. They are valuable for research and manpower and resource planning. Tools that have and can successfully be used for this purpose are the various existing psychometric scales.

Psychometric measures are inexpensive, flexible, easy to administer and often result in continuous score ranges that can easily be compiled and processed statistically. Examples of psychometric measures include the children's fear survey schedule (CFSS) developed by Scherer and Nakamura<sup>2</sup>. It consists of 80 items on a 5-point Likert-scale. It has been demonstrated to have high reliability and validity for measuring dental fear in children. The cumbersome nature of the questionnaire designed to be filled by the child patient has limited its use despite established validity report<sup>2</sup>.

The Dental Subscale of Children's Fear Survey Schedule (CFSS-DS) developed by Cuthbert and Melamed<sup>3</sup> consists of fifteen items and each item can be given five different scores ranging from "not afraid at all (1)" to "very much afraid (5)". It is a well known instrument for measuring dental anxiety in children. The CFSS-DS has a total score range of 15 to 75 and a score of 38 or more has been associated with clinical dental fear<sup>3-5</sup>. It can be used to differentiate patients with high and low dental fears. Its reliability and validity has been aptly demonstrated<sup>6-8</sup>. Parents fill the questionnaire for evaluation of dental anxiety levels in the young children

because of the child's inability and probable difficulty to comprehend the content of the questionnaire and the parent's ability to predict their child's fear levels with some degree of accuracy<sup>9-11</sup>.

Although parents are required to fill the schedule for their children, older children can also fill the questionnaire for self evaluation. The inability of young patients to fill these questionnaires themselves is a limiting factor as the opinion of very young children cannot be obtained directly.

There is also a constructed Short Form of the Dental Subscale of the Children's Fear Survey Schedule (DFSS-SF) earlier used in the study by Carson and Freeman<sup>12</sup> based on the knowledge from other scales. It is a shorter form of the CFSS-DS consisting of only eight items, with a possible total score ranging from 8 to 40. It measures dental fears in children. The schedule was tested for reliability and validity by Folayan and Otuyemi<sup>13</sup>. It was found to be highly reliable and had moderate significant correlation with the Frankl's behavioural scale and a dichotomy scale. A cut off point of 19 was established as the measure for clinical dental fear; scores 19 and above indicating dental anxiety<sup>14</sup> while scores above 23 indicating high dental anxiety<sup>15</sup>.

A factor analysis of the CFSS-DS by ten Berge et al<sup>16</sup> suggest that this instrument essentially measures a one dimensional concept of dental fear; fear of invasive dental procedures. Also the questionnaire is often filled by the child before treatment. This is contrary to the design as CFSS-DS is supposed to be filled after treatment as it measure trait fear. This measure may give false results as a child may experience anticipatory anxiety prior to treatment that would be expressed in the filled

questionnaire as opposed to fear relating to the dental procedure in the here and now<sup>12</sup>.

Although psychometric scales have been popularly used over the years to assess dental fear in children, they still present a challenge to researchers. Apart from the issue of restricted age use due to the problem of comprehension of its contents, there are more fundamental issues with the schedules such as the interpretation and meaning a child gives to the various words in the questionnaire at various ages and levels of maturity.

### Diagnosis

Diagnostic tools are usually descriptive and enable diseases to be categorized. They tend to be qualitative rather than quantitative thereby limiting their use for epidemiological surveys. However, for computation purposes, they have weighted scores which enables analysis of data.

Such diagnostic tools include observational and behavioural rating scales. These are the most frequently used measures for diagnosing dental fear in children<sup>17</sup>. It is easy to administer, non-intrusive when in use and easy to conceptualise<sup>18</sup>. The rates use exhibited traits as an organizing concept to select relevant cues which is used to aid the superimposition of a dimension to the subject's behaviour<sup>18</sup>.

Various rating scales for measuring behaviours have been developed over the years. One of these is the Frankl scale developed by Frankl et al<sup>19</sup>. It rates children's reaction to dental treatment on a scale. The scale consists of four categories of behaviour, ranging from definitely negative to definitely positive. It has been used in a number of epidemiological studies.

Another scale is the Melamed Behaviour Profile Rating Scale<sup>20</sup>. It consists of 27 child related behaviour indicative of dental fear. These factors are weighted by a number that reflects the degree of its disruptiveness. The total score is obtained by multiplying the frequency at which behaviour in each category occurs by its weighted number. Each child is assessed every three minutes. The weighted frequencies are then added across categories and the sum is divided by the number of 3 minutes intervals observed. It has been demonstrated to be reliable<sup>21</sup> though its validity is not completely convincing<sup>22</sup>.

These behaviour ratings scales are often reported to have very high reliabilities<sup>19, 20, 23-25</sup>. However, reports of low or weak correlations between the behaviour ratings and other measures exist<sup>16, 26-29</sup> making the validation of these instruments problematic.

Behavioural rating scales measure situational fear. They are however subjective modalities for measuring dental fear, as there is the possible element of observer bias. A child's behaviour in one situation might obviously influence the ratings made in other instances<sup>30</sup>. The dentist's own personal opinions and views could also affect scoring<sup>30</sup>. These bias arise because scorer weighs the evidence in which the rating is based in a complex manner which is not easily specified or standardized<sup>18</sup>. Furthermore a clinical diagnosis of dental fear may be difficult to make in children who have developed coping mechanisms. Although these coping strategies lead to less clinical manifestation of dental fear<sup>31</sup>, they often enable the patient to tolerate the associated discomfort they perceive rather than be completely free from the fear. This allows for some element of bias in this subjective

assessment as the assessor often equates a child's dental fear with the ability to accept treatment. Moreover, obstinate behaviours and non-cooperation are not always due to dental fear. They could arise from a number of other reasons such as a spoilt child throwing temper tantrum in the clinic.

Other tools that can be used for diagnostic purposes include the physiological and hormonal measures. Several investigations have measured children's physiological reactions to dental settings<sup>20, 28, 32</sup>. These indirect measures of dental fear assesses heart rate, pulse rate, skin conductance, muscles tension, blood pressure, palmer sweating and decreased salivary secretion<sup>33, 34</sup>. Meyers et al<sup>35</sup> reported an increase in heart rate prior to and during injections. There are phases in dental treatments when increased anxiety would be expected and this does not necessarily translate to the fear of the situation.

A limitation to the use of these tests includes the fact that such techniques are restricted to specific test situations and requires special equipments. This in itself could affect results because the equipment could provoke anxiety<sup>30</sup>. Bastawi et al<sup>36</sup> observed that a non-fearful child might be disturbed only by procedures perceived as overtly threatening. These changes in body physiological parameters at such times do not make the patient a dentally anxious patient. Also, the dentist must have some experience in using and interpreting results from the specialized equipments not used in the normal remit of practice<sup>37</sup>. It is also a time consuming method.

The measurement of free cortisol in saliva has been found to be a reliable method of measuring stress and fear in children. Stress activates the production of adrenal hormones<sup>38-40</sup> and the amount of salivary

cortisol is equal to free cortisol in serum<sup>39,40</sup>. Thus the measurement of free salivary cortisol offers a convenient way to monitor the systemic adrenocortisol response to stimuli.

Studies have found a significant correlation was found between fear and salivary cortisol<sup>41-43</sup>. Although this technique is non-invasive, it requires special equipments and studies can only be done on few selected patient samples. However, the influences of variables like age and sex on the results have not been evaluated.

Projection techniques are of special interest as they suggest a way of revealing unconscious or hidden emotions. They enable information to be obtained about a child's feelings and thoughts about dental care<sup>30</sup> which may be hard to obtain through other methods. The technique includes, for example, the child's interpretation of picture stories, the child's drawing of a person, the child being asked to tell a story about something or someone. These measures are used commonly in clinical child psychology<sup>44</sup>.

The frequent form of use of this technique has been letting a child draw a picture of a person<sup>31,44-46</sup> and the interpretation of pictures in stories. In 1986, Nelson and Cholera<sup>47</sup> published the report of a study done on this form of diagnosis of dental fear in children. The assessment showed comparable results with the observed behaviour of children in the dental chair as well as with self reports of dental anxiety. Unfortunately, no data was presented on the reliability and validity of this method of assessing dental fear<sup>17</sup>.

Klingberg and Hwang<sup>17</sup> also developed The Child Dental Fear Picture Test as a projective technique for measuring dental

fear. A study done by Klingberg et al<sup>48</sup> ascertained the validity of this instrument and it showed high values of sensitivity and specificity for the measurement of dental fear.

The projection technique however, suffers from questionable reliability and validity due to difficulties in the interpretation of stories and the standardization of scoring<sup>37</sup>. At best, a statistically significant weak correlation between drawing a picture and age, physiological response and behaviour ratings was established by Sonnenberg and Venham<sup>21</sup>. Its use is also limited because an expert is required to carry out the interview and score the tests.

Psychometric questionnaires directly measuring dental fear and designed to be filled out by parents helped to overcome some of the problems identified with the tools discussed above. A short schedule would be more appropriate for use in the clinic. However, the choice of schedule to use would depend on the objective of the assessment. The DFSS-SF may be helpful while the CFSS-DS would help give a more detailed perspective of the causes of dental fear in the child.

However, to reduce bias reporting, the child could fill out a questionnaire. This is a disadvantage since younger children cannot comply with this satisfactorily. It is therefore impossible for researchers to obtain directly, the viewpoints of very young patients<sup>30</sup>. To circumvent this problem, various techniques have been developed whereby the child can indicate his/her level of anxiety by picking out or pointing to a picture that illustrates the perceived emotion. These picture scales allow for limited cognitive and linguistic skills and can be easily administered and scored in a clinical context. One of such

developed picture test is the Facial Image Scale<sup>37</sup>.

The Facial Image Scale uses faces as an indicator of fear. It is a visual analogue scale comprising of a row of five faces ranging from very happy to very unhappy. Children are asked to point at which face they felt most like at the moment. The face is scored by giving a value of one to the most positive affect face and five to the most negative affect face with faces 4 and 5 indicating high dental fear. The tool was found to show a high correlation with the Venham Picture Test (VPT) when tested for validity<sup>37,49</sup>. It is constructed to measure situational dental fear but there are no studies yet to establish its reliability in measuring dental fear in children. It is however, quick and easy to administer.

This technique has its limitations. It is reported that younger children misinterpret drawings of facial expressions more often than older children<sup>50</sup>. The scale may also not be appropriate for older children as studies show a distorted pattern of score distribution in older children therefore not lending itself to good discrimination between them<sup>51</sup>. In addition, some of the pictures are ambiguous in what they portray and do take time to complete<sup>37</sup>.

One other limitation of the picture test is its limited use in children who cannot identify themselves with the pictures shown<sup>52</sup>.

Despite the availability of multiple diagnostic tools for formal assessment of dental fear, less than 20% of dentists use them<sup>53</sup> routinely in clinical practice. In everyday practice, most of the diagnosis of dental anxiety is based on clinical judgment. Very few studies have however been done to validate the use of subjective clinical judgments in the diagnosis of

dental fear in children. Further studies need to focus on this and then develop objective methods for judging and identifying dental fear quickly and easily in children. This would enable prompt use of appropriate techniques to manage the dentally fearful child.

### **Measures of treatment need**

Measures of dental fear treatment need should be used to determine the need for dental treatment based on potential dental care impairment, potential for adverse effect on oral health and deviation from normal dental fear levels determined for the community. The instrument should be used for planning treatment for individual patients and should also be valuable for community based studies when there is a need to plan for resource allocation to priority groups.

Presently, there are no existing measures specifically focusing on measuring treatment needs in an individual or a population. Identification of treatment needs for individuals are oftentimes based on subjective assessment by dentists. Such deductions are made from expressed behaviours by the child.

Ideally, the measure should not summarise scores as a summary would imply that the different items highlighted in the measure affect the need for treatment. These factors then become confounding.

There is presently no report discussing the community treatment need for dental fear based on scientific evaluation processes. No tools presently that can do this. A tool that may be able to identify the need for treatment of dental fear should be able to decipher that the traits present would predispose the child to increased risk of socio-psychological disturbances. Such a tool may need to have objective methods

of determining this so as to enhance uniformity in the application of the measure.

### **Measures of treatment outcome**

This measure provides an initial estimate of how far a case deviates from the normal and the differences between scores before and after treatment. This difference reflects the degree of improvement thereby providing a quantitative and reproducible measure of the score of success or failure of treatment.

It is often desirable to use the same instrument to measure treatment need and treatment outcome. Though often the same instrument is used to assess the treatment need and treatment outcomes in children managed for dental fear, the instruments were however not designed or validated for that purpose. At best, the instrument measures the degree of residual treatment but this does not sufficiently assess significant differences in treatment efficacy.

Psychological measuring scales which have clustered items based on factor analytic techniques and not just the use of conceptual or logical grouping may help in assessing the pre and post therapeutic effects of dental fear reduction measures. The CFSS-DS and the DFSS-SF may not be ideal for this purpose as they measure only one dimensional construct of dental fear and uses score summaries for assessing levels of dental fear. The possible limitation of the use of psychometric scales with score summation was highlighted by Folayan and Idehen<sup>54</sup>.

An ideal tool for measuring treatment outcome must therefore be a numerical measure obtained through the measure of dental fear traits that are selected based on their potential for causing psychosocial

handicap. It must be able to rank dental fear causing items objectively and reliably. This could possibly be so through the use of a mathematical formula for the estimation of societal norms for dental fear there by differentiating between handicapping and non handicapping dental fear.

Such a developed measure should be used within the context of specialized practice and it could provide the means to compare treatment threshold in different countries thereby serving as a basis for quality assurance standards in the management of dental fear in children. This aspect is important because of the possible effect of culture on dental fear and its expressions<sup>55</sup>.

### **CONCLUSION**

The various existing measures for assessing different aspects of dental fear have served various research purposes. However, their uses as measures to determine treatment need and treatment outcomes are limited. There is therefore a need to develop culturally sensitive instruments which would enhance the objective assessment of treatment need and treatment outcomes of dental fear in children. Such instruments would help in effectively determining the efficacy of various treatment modalities for dental fear in children.

### **REFERENCES**

1. Folayan MO, Idehen E. Factors influencing the use of behavioural management techniques during child management by dentists. *J Clin Pediatr Dent* 2004; 28: 155-161
2. Scherer MW and Nakamura NY. A fear schedule for children: a factor analytic comparison with manifest anxiety. *Behav. Res. & Therapy* 1968;6:173-182.

3. Cuthbert ML and Melamed BG. A screening device: Children at risk for dental fear and management problems *J. Dent. Child.* 1982; 49:432-436.
4. Klingman A, Melamed BG, Cuthbert ML and Hormecz DA. Effects of participant modeling on information acquisition and skill utilization. *J. Consult. Clin. Psychol.* 1984; 52:414-422.
5. Klingberg G, Berggen U and Noren JG. Dental fear in an urban Sweden child population: prevalence and concomitant factors. *Community Dental Health*, 1994; 11(4):208-214.
6. Alvesalo I, Murtomaa H, Honkanen A, Karjalainen M and Tay K-M. The Dental fear survey schedule: a study of Finnish children. *Int. Paediatr. Dent.* 1993;3:193-198.
7. Milgrom P, Jie Z, Yang Z and Tay KM. Cross cultural validity of a parent's version of the Dental fear survey schedule for children in Chinese. *Behav. Res. Ther.* 1994;32:131-135.
8. Milgrom P, Mancl L, King B, et al. Origins of childhood dental fear. *Behav. Res. Ther* 1995;33:313-319.
9. Johnson R and Baldwin DC. Maternal anxiety and child behaviour. *Journal of Dentistry for Children* 1969; 36: 87-92
10. Koenigsberg SR and Johnson R. Child behaviour during sequential dental visits. *Journal of Dentistry for Children* 1975; 42: 197-220
11. Klingberg G. Reliability and validity of the Swedish version of the Dental Subscale of the Children's Fear Survey Schedule, CFSS-DS. *Acta Odontol Scand.* 1994; 52: 255-256
12. Carson P and Freeman R. Assessing child dental anxiety: the validity of clinical observations: *Int. J. Paed. Dent* 1997;7:171-176
13. Folayan MO and Otuyemi OD. Reliability and validity of a Short Form of the Dental Subscale of the Child fear Survey Schedule used in a Nigerian children population. *Nigerian Journal of Medicine* 2002;11:161-163
14. Folayan MO, Idehen EE and Ufomata D. The effect of sociodemographic factors on dental anxiety in children seen in a suburban Nigerian Hospital. *Int J Paediatr Dent.* 2003;13:20-26
15. Folayan MO. Prevalence and effect of psychological management of dental anxiety in children treated at the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife. A dissertation submitted to the West African College of Surgeons. October 2000.
16. ten Berge M, Hoostraten J, Veerkamp JSJ, Prins PJM. The dental Subscale of the Children's Fear Survey Schedule: a factor analytical study in the Netherlands. *Community Dent. Oral Epidemiol.* 1998;26:340-343.
17. Klingberg G and Hwang CP. Children's dental fear picture test (CDFP): A projective test for the assessment of child dental fear. *J. Dent. Child* 1994;61:89-98.
18. Venham LL, Gaulin-Kramer E, Munster E, Bengston-Audia D and Cohan J. Interval rating scales for children's dental anxiety and uncooperative behaviour. *Pediatr Dent.* 1980; 2: 195-202
19. Frankl SN, Shiere FR and Fogels HR. Should the parent remain with the child in the dental operator? *J. Dent. Child* 1962; 29:150-163.
20. Melamed BG, Weinstein D, Hawes R and Katin-Borland M. Reduction of fear-related dental management problems with use of filmed



- modeling. *J. Am. Dent. Assoc.* 1975;90 : 822-826.
21. Greenbaum PE, Lumley MA, Turner C and Melamed BG. Dentist's reassuring touch: effect on children's behaviour. *Paediatric Dentistry.* 1993; 15: 150-163
  22. Aartman IHA, van Everdingen T, Hoogstraten J and Schuurs AHB. Appraisal of behavioral measurement techniques for assessing dental anxiety and fear in children; a review. *Journal of Psychopathology and Behavioral Assessment* 1996; 18: 153-171
  23. Wright GZ, Alpern GD and Leake JL. A cross-validation of some variable affecting children's cooperative behaviour. *J. Canad. Dent. Assn.* 1973;39:268-273
  24. Machen JB and Johnson R. Desensitisation, model learning and the dental behaviour of children. *J. Dent Res.* 1974; 53:83-87
  25. Aartman IHA, van Everdingen T, Hoogstraten J and Schuurs AHB. Self-report measurements of dental anxiety and fear in children: a critical assessment. *J Dent Child* 1998; July to August:252-258.
  26. Melamed BG, Yercheson R, Fleece TL, Hutcherson S and Hawes R. Effects of film modeling on the reduction of anxiety – related behaviours in individuals varying in level of previous experiences in the stress. *J. Consult. Clin. Psychol.* 1978;46: 1357-1367.
  27. Klorman R, Ratner R, Arata CLG, King Jr, JB and Sween OB. Predicting the child's uncooperativeness in dental treatment from maternal trait, state and dental anxiety *J. Dent. Child.* 1978;45:62-67.
  28. Klorman R, Micheal R, Hilpert PL and Sveen OB. A further assessment of predictors of the child's behaviour in dental treatment. *J. Dent. Res.* 1979; 58:2338-2343.
  29. Winer GA. A review and analysis of children's fearful behaviour in dental setting, *Child Develop* 1982;53:1111-1133.
  30. Klingberg G. Dental fear and behaviour management problems in children. *Swed. Dent. J. Supplement* 1995; 103:1-78.
  31. Blount RL, David W, Powers SW and Robert MC. The influence of environmental factors and coping style on children's coping and distress. *Clin. Psychol. Rev.* 1991;11:93-116.
  32. Tuutti H. Dental anxiety in children and adolescents (Thesis) Kuopio, Finland: Publications of the University of Kuopio: original reports, Community Health, 1986.
  33. Lavelle L. Stress and anxiety in dental treatment. In *applied oral physiology.* 2<sup>nd</sup> Ed. London, Boston, Sydney, Wright CO. 1938:121-127.
  34. Irwin M and Hauger RL. Development aspects of psychoneuroimmunology in child and adolescent psychiatry. A comprehensive textbook. In: M. Lewis (Ed). *Williams and Wilkins* 1991:51-62.
  35. Meyers DR, Kramer WS and Sullivan RE. A study of the heart action of the child dental patient. *J. Dent. Child.* 1972;39:99-106.
  36. Bastawi AE, Reid KH and West GA. Relative utility of different measures of stress induced by dental procedures. *J. Dent. Res.* 1979; 58:1484.
  37. Buchanan H and Niven N. Validation of a Facial Image Scale to assess child dental anxiety. *International Journal of Paediatric Dentistry* 2002;12:47-52

38. Neyzi O and Ertugrul T. Pediatric Istanbul. Noble Tip Kitabevi, 1990:1927.
39. Behrman RE. Disorders of the adrenal glands. In: Nelson Textbook of Pediatrics. 14<sup>th</sup> ed, London. Montreal. Tokyo. W.B. Saunders Co. 1992:1438.
40. McCartan RE, Izme, PJ, Wallace AN, Duffy FA and Charskul S. Salivary cortisol levels and anxiety in recurrent aphthous stomatitis. J. Dent. Res. 1988;67: Abs. No. 14.
41. Shinkai S, Watanabe S, Kurokawa Y and Toni J. Salivary cortisol for monitoring circadian rhythm in adrenal activity during shift-work. Int. Arch. Occup. Environ Health 1983;64:499-502.
42. Bell JR, Martino G, Meredith KE, Schwartz GT, Siani MM and Morrow FD. Vascular diseases risk factors, urinary free cortisol and health histories in older adults. Boil. Psychol. 1993;35:37-49.
43. Bellak L and Bellak S. A manual for the children's apperception test. 7<sup>th</sup> ed. New York: C.P.S 1982.
44. Baldwin DC Jr. An investigation of psychological and behavioural responses to dental extraction of children. J. Dent. Res. 1966;45: 1637-1651.
45. Eichenbaum IW and Dunn NA. Projective drawings by children under repeated dental stress. J Dent Child. 1971;38:164-174.
46. Tuomi T, Niemi P, Karppinen S, Harju J, Mietttilci T, Siltvenius – Pura A-M and Ylonene M. Hammashoitopelon arriointi lasten piirustutsista. Suomen Hammaslaakarilehti 1990;37:1062-1071
47. Nelson WM and Cholera SN. Projective-cognitive assessment of thoughts and feelings and their relationship to adaptive behaviour in a dental situation. Adolescence. 1986; 21: 855-862
48. Klingberg G, Lofqvist LV and Hwang PC. Validity of the Children's Dental Fear picture Test (CDFP). Eur. J. Oral Sci. 1995;103:55-60.
49. Buchanan H and Niven N. Self-report treatment techniques used by dentists to treat dentally anxious children: a preliminary investigation. Int J Paediatr Dent. 2003; 13: 9-12
50. Wilson S, Flood T, Kramer N, McTigue J and Steinberg B. A study of facially expressed emotions as a function of age, exposure, time and sex in children. Pediatr Dent. 1990;12:28-32.
51. Christophorou S, Lee GTR and Humphris GM. The reliability and validity of the modified child dental anxiety scale: a study of Greek Cypriot school children. Eur J Paediatr Dent 2000;1:75-81
52. Corah NL. Development of a dental anxiety scale. J Dent Res 1969;48:596.
53. Dailey YM, Humphris GM and Lennon MA. The use of dental anxiety questionnaires: a survey of a group of UK dental practitioners. Br Dent J. 2001; 190:450-453
54. Folayan MO and Idehen EE. The effectiveness of psychometric schedules in measuring dental fear treatment outcome in children. (in review)
55. Folayan MO, Idehen EE and Ojo OO. The modulating effect of culture on the expression of dental anxiety in children: a literature review. International Journal of Paediatric Dentistry (in Press).