

# How Well Can the Parents, Dentists or Dental Surgery Assistants Assess Children's Dental Anxiety Level?

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## Abstract

**Aim:** To investigate and compare parent, dentist and Dental Surgery Assistant (DSA)'s ability in assessing child's dental anxiety and to identify the factors that can influence their assessments.

**Design:** All 3-5 years old children who first visited the Paediatric Dentistry Clinic of the Prince Philip Dental Hospital were recruited. The accompanying parents were given a questionnaire which consisted of 2 parts, including (i) parent's and child's demographic backgrounds and their own dental histories, and (ii) parent's self-report Modified Dental Anxiety Scale (MDAS) and parental proxy of the Modified Child Dental Anxiety Scale (MCDAS)

Oral examination was carried out in a clinic setting and the subjects were given the Facial Image Scale (FIS) which comprises of five faces from very happy to very unhappy. The child was asked to select the one that represents him self or her self at that moment before the dental examination. The score was given by the value 1 to the happiest and 5 to the unhappiest. The parent, dentist and DSA were also asked to select the value that they thought which represented the child best at that moment.

**Results:** The mean FIS score reported by children was 2.16. The mean FIS score reported by the parents, dentist and DSA were 2.61, 2.69 and 2.59, respectively. The agreement of parents, dentist and DSA with the children regarding the FIS score was analysed using the Linear Weighted Kappa and the figure was 0.225, 0.311 and 0.328. Parent's agreement with the children regarding the FIS scores appears to be affected by whom the child's main caregiver is. Both DSA and dentist's agreement with the children regarding the FIS scores appears to be affected by the child's age.

**Conclusion:** The study showed that the agreement of the parents, dentist and DSA with the children regarding the FIS is weak. Assessment by observation is operator-biased and may be inaccurate. They tended to overrate the anxiety level. DSA and dentists showed better agreement compared to the parents. Children's self-reported level of dental anxiety should be first considered even in young children whenever it is possible.

## Introduction

Dental treatment is commonly considered as an unpleasant experience. Dental anxiety is defined by Folayan and Fatusi [1] as a "feeling of apprehension about dental treatment, which is not necessarily connected to a specific external stimulus". It is a common and distressing problem. The prevalence of dental anxiety among children has been reported to range between 5% and 20% with the mean prevalence of 11% [2]. Dental anxiety remains a challenge in treating children and has major implication to the child, parents, dental staff and the health care system. Treating children with dental anxiety is costly and time consuming [3,4]. Apart the disruptive behaviour during dental treatment and the possible need of other behaviour management measures (including sedations and general anaesthesia), dental anxiety can also affect the child's oral health and general wellbeing. The effect of dental anxiety on individuals can range from irregular attendance to total avoidance [5]. Dental anxiety also affects the oral health. Children with high level of dental anxiety were found to have higher caries rate than those with low level of dental anxiety [6,7]. Adults experiencing high levels of dental anxiety were also found to be associated with poor oral health-related quality of life [8].

The aetiology of dental anxiety remains unclear, which is believed to be multifactorial and complex [9,10]. Multiple risk factors have been identified by previous studies, including parental fear [11], general fear [11], previous negative dental experience [10,12,13] experience of dental pain [9] etc. Much emphasis has been put on identifying children with dental anxiety because the symptoms of anxiety can persist and intensify into adulthood. Dental anxiety initiated predominantly during childhood [10]. Around 50% of adult patients with dental anxiety reported childhood onset [14]. Identifying children with dental anxiety at an earlier stage would allow dentist to adjust and react accordingly. Special acclimatization programmes or behavioural management strategies may be adopted instead of routine dental procedures.

Studies on dental anxiety in older children and adolescents usually based on self-reported anxiety level, as self-reported measures of dental anxiety completed by the children themselves are the most reliable and valid method [15]. However, assessment of dental anxiety in younger children has often relied on parents to provide their child's dental anxiety level in the form of completion of a questionnaire or dentists based on their observation of the child's reaction and behaviour. There is a lack of consensus in terms of the agreement between the parents or dentists with the children regarding their level of anxiety. In a dental surgery, other than the dentist, the dental surgery assistant also plays an important role in patient management. The agreement between the DSA and the children regarding their level of anxiety has never been reported.

The objective of this study is to investigate and compare parent, dentist and Dental Surgery Assistant (DSA)'s ability in assessing child's dental anxiety, and to identify factors that can influence their assessments.

## Materials and Methods

### Sample

This study was carried out in accordance with the recommendations of Declaration of Helsinki with written informed consent from all parents. All parents gave written informed consent in accordance with the Declaration of Helsinki. The study was reviewed and approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (IRB reference number: UW14-010).

The study population was 3-5 years old Chinese preschool children in Hong Kong. The study was carried out from August 2014 to June 2015 in the Paediatric Dentistry Clinic of the Prince Philip Dental Hospital. Continuous convenience sampling was used and children who were 3-5 years old and first visited the clinic were recruited. Children who were not accompanied by their parents or were accompanied by parent who cannot speak and read Chinese and those with a confounding medical history were excluded from the study. Subjects and their accompanying parents were approached and invited in the waiting area. An information sheet along with a written consent form was given.

### Data collection

**Questionnaire:** The parents who agreed to participate in the study were given a questionnaire, which was designed in Chinese. The questionnaire consisted of 2 parts, including (i) parent's and child's demographic backgrounds and their own dental histories, and (ii) parent's self-report Modified Dental Anxiety Scale (MDAS) and parental proxy of the Modified Child Dental Anxiety Scale (MCDAS).

Parent's self-reported MDAS and parent proxy reported dental anxiety for their children were assessed. The MDAS was a questionnaire consisting of five questions asking how the person felt in 5 different dental situations, in the scale of 1 to 5 from relax to highly anxious, giving a total score that ranges from 5-25 [16]. A cut off value of 19 and above was recommended to indicate high dental anxiety that might require special attention by dental personnel [16]. The MCDAS [17] is similar to MDAS, except it consisted of 7 questions instead of 5 and with the total score of 7 to 35. The extra

2 questions involved checking patient's feeling if they had treatment under general anaesthesia or inhalation sedation. However, the two extra questions in the MCDAS were removed from the questionnaire in the study. This is to make the questionnaire simple and uniform.

### Facial Image Scale (FIS) [3]

The subject and the accompanying parent were invited into the surgery room. The subject was being seated on the dental chair and was informed that the operator is going to "look at his/her teeth". The accompanying parent was given the Facial Image Scale (FIS) at an angle that only the parent can see, and was asked to select the face that he or she thinks that it would best represent the child. The FIS comprises of five faces from very happy to very unhappy. The score was given by the value 1 to the happiest and 5 to the most unhappy. The DSA and the dentist also rated their child's anxiety using the FIS. The subject was the last to be asked to select the one that best represent him self or her self at that moment before the dental examination. All ratings were not visible to each other.

### Oral examination

Dental examination was carried out by one of the two trained and calibrated examiners. The caries experience was assessed by recording the Decayed, Missing, and Filled Teeth (dmft) index using the criteria recommended by the World Health Organization [18]. The oral hygiene status was assessed using the full mouth Visible Plaque Index (VPI) [19]. The presence of clearly visible plaque on the buccal surfaces of each tooth was recorded.

### Data analysis

Child's and parent's demographic backgrounds and dental histories were analysed with SPSS and presented using descriptive statistics. The agreement of parents, dentist and DSA with children regarding FIS score was examined by quadratically weighted Kappa using Kapp2 function from irr package version 0.84.

To examine the association of parent's and child's characteristics with parents, DSA, and dentist's ratings, all variables of interest were simultaneously entered into the model and the binary logistic regressions were performed in a stepwise backward manner according to the Akaike Information Criteria (AIC). After each round of regression, variable whose deletion resulted in the lowest AIC value was removed and the regression was re-performed. The final model comprises the set of variables deletion of any one leads to an increased model AIC value.

The binary logistic regressions were performed using the glm function in R base. The backward elimination procedure was implemented through the step AIC function in MASS package version 7.3-45 [20] all statistical analyses were performed on R version 3.2.3 (R Development Core Team, 2015).

Duplication examinations were performed on 10% of the subjects. The intra-examiner and inter examiner reproducibility were assessed by the Intra Class Coefficient (ICC) in psych package version 1.5.8, running on R version 3.2.3 (R Development Core Team, 2015).

## Results

### Demographic backgrounds and dental histories of the study population

**Table 1:** Demographic backgrounds and dental histories of the study population (N=299).

| Variable                          | Number (N=299) | Percentage |
|-----------------------------------|----------------|------------|
| <i>Child's demographics</i>       |                |            |
| <i>Gender</i>                     |                |            |
| Male                              | 156            | 52.20%     |
| Female                            | 143            | 47.80%     |
| <i>Main caregiver</i>             |                |            |
| Mother                            | 222            | 74.20%     |
| Father                            | 9              | 3.00%      |
| Grandparents                      | 40             | 13.40%     |
| Maid                              | 25             | 8.40%      |
| Other people                      | 3              | 1.00%      |
| <i>Child is accompanied by</i>    |                |            |
| Mother                            | 184            | 61.50%     |
| Father                            | 52             | 17.40%     |
| Both                              | 63             | 21.10%     |
| <i>Child's dental history</i>     |                |            |
| <i>Previous dental experience</i> |                |            |
| No                                | 95             | 31.80%     |
| Examination                       | 133            | 44.50%     |
| Filling                           | 51             | 17.10%     |
| Pulp treatment                    | 3              | 1.00%      |
| Extraction                        | 4              | 1.30%      |
| LA                                | 10             | 3.30%      |
| GA                                | 3              | 1.00%      |
| <i>Relationship to the child</i>  |                |            |
| Mother                            | 225            | 75.20%     |
| Father                            | 74             | 24.80%     |
| <i>Age</i>                        |                |            |
| <30                               | 30             | 10%        |
| 30-39                             | 194            | 64.90%     |
| >40                               | 75             | 25.10%     |
| <i>Education level</i>            |                |            |
| No schooling/ kindergarten        | 2              | 0.70%      |
| Primary school                    | 13             | 4.30%      |
| Secondary School                  | 201            | 67.20%     |
| Post-secondary school             | 37             | 12.40%     |
| Tertiary or above                 | 46             | 15.40%     |
| <i>Monthly family income</i>      |                |            |
| <\$10000                          | 45             | 15.00%     |
| \$10000-\$19999                   | 136            | 45.50%     |
| ≥\$20000                          | 118            | 39.50%     |
| <i>Employment status</i>          |                |            |
| Employed full time                | 122            | 40.80%     |
| Employed part time                | 33             | 11.00%     |
| Unemployed                        | 13             | 4.30%      |
| Stay at home spouse               | 131            | 43.90%     |
| Variable                          | Number (N=299) | Percentage |
| <i>Dental attendance habit</i>    |                |            |
| Regular attender                  | 104            | 34.80%     |
| Non regular attender              | 195            | 65.20%     |
| <i>Dental experience</i>          |                |            |
| No dental experience              | 35             | 11.70%     |
| Only dental examination           | 43             | 14.40%     |
| Dental treatment                  | 221            | 73.90%     |

**Table 2:** Oral health status of the children (N=299).

| Variable                                  | Number (N=299) | Percentage |
|---|----------------|------------|
| <i>Child's oral health</i>                |                |            |
| <i>Caries status</i> (Mean dmft=9.4)      |                |            |
| No caries                                 | 16             | 5.40%      |
| ECC                                       | 33             | 11.00%     |
| severe ECC                                | 250            | 83.60%     |
| <i>Oral hygiene status</i> (Mean VPI=85%) |                |            |
| VPI <50%                                  | 21             | 7.00%      |
| VPI 51-75%                                | 63             | 21.10%     |
| VPI>75%                                   | 215            | 71.90%     |
| <i>Presented with pain?</i>               |                |            |
| With pain                                 | 82             | 27.40%     |
| With no pain                              | 217            | 72.60%     |

Three hundred children were approached and one parent refused to participate in the study (Response Rate: 99.6%). A total of 299 children (156 boys and 143 girls) were included in the statistical analysis, with the mean age of 4.7 years old (SD = 0.82). Around 60% of the children were accompanied by the mother, and most of the accompanying parents were irregular attenders to dental care (Table 1).

**Children's oral health**

One-third of the children presented with pain at the visit and 68% of the children have experience in visiting a dentist. For those who have visited the dentist, only 35% had treatment done (including filling, pulp treatment and extraction). Only 5% of the children were caries free, with the mean dmft of 9.4. The oral hygiene status was also compromised, over 70% of the children were presented with VPI >75% (Table 2).

**FIS score**

The mean FIS score reported by children was 2.16 (SD 1.44). The mean FIS scores re-ported by the parents, dentist and DSA were 2.61 (SD 1.20), 2.69 (SD 1.06) and 2.59 (SD 1.17), respectively. The percentage distribution of FIS scores by children, parents, dentists and DSAs is shown in Table 3. The agreement of parents, dentist and DSA with the children regarding the FIS scores analysed using the Linear Weighted Kappa was 0.225, 0.311 and 0.328 (Table 3).

**Factors associated with the agreement on the FIS score**

The binary logistic regression of factors associated with the

**Table 3:** Percentage distribution of FIS score by children, parents, dentists and DSAs (N=299).

| FIS score | No. of children (%) | No. of parents (%) | No. of dentists (%) | No. of DSAs (%) |
|-----------|---------------------|--------------------|---------------------|-----------------|
| 1         | 150 (50.2)          | 58 (19.4)          | 37 (12.4)           | 57 (19.1)       |
| 2         | 52 (17.4)           | 99 (33.1)          | 98 (32.8)           | 94 (31.4)       |
| 3         | 35 (11.7)           | 70 (23.4)          | 105 (35.1)          | 86 (28.8)       |
| 4         | 23 (7.7)            | 47(15.7)           | 40 (13.4)           | 38 (12.7)       |
| 5         | 39 (13.0)           | 25(8.4)            | 19 (6.3)            | 24 (8.0)        |

**Table 4:** Binary logistic regression analyses: factors associated with agreement of parents, DSA, and dentists with children regarding FIS scores.

| Models and variables  | $\beta$ (SE)   | OR (95% CI)          | p-value   |
|---|----------------|----------------------|-----------|
| <b>Parents' agreement with children (Nagelkerke's R<sup>2</sup>=0.030)</b>  |                |                      |           |
| Intercept   | 0.828 (0.167)  |                      | <0.001*** |
| Family monthly income: $\geq$ 20,000  | -0.479 (0.269) | 0.620 (0.365, 1.050) | 0.075     |
| Child's main caregiver: grandparents  | 0.329 (0.385)  | 1.390 (0.668, 3.050) | 0.392     |
| Child's main caregiver: maid and others                                     | 1.086 (0.531)  | 2.963 (1.123, 9.367) | 0.041*    |
| <b>DSA's agreement with children (Nagelkerke's R<sup>2</sup>=0.038)</b>     |                |                      |           |
| Intercept   | 2.157 (0.734)  |                      | 0.003**   |
| Child's age   | -0.315 (0.153) | 0.730 (0.539, 0.982) | 0.04*     |
| Interviewee's age level: $\geq$ 40 years                                    | -0.491 (0.275) | 0.612 (0.357, 1.051) | 0.074     |
| Models and variables  | $\beta$ (SE)   | OR (95% CI)          | p-value   |
| <b>Dentists' agreement with children (Nagelkerke's R<sup>2</sup>=0.148)</b> |                |                      |           |
| Intercept   | 2.227 (0.907)  |                      | 0.014*    |
| Child's age   | -0.339 (0.171) | 0.712 (0.506, 0.993) | 0.048*    |
| Previous dental experience: history of examination                          | -0.530 (0.323) | 0.589 (0.309, 1.100) | 0.101     |
| Previous dental experience: history of dental treatment                     | -0.710 (0.364) | 0.492 (0.239, 1.000) | 0.051     |
| Parental proxy MCDAS $\geq$ 19  | 0.683 (0.347)  | 1.980 (0.973, 4.267) | 0.068     |
| Interviewee's employment status: unemployment or stay-at-home spouse        | -0.501 (0.265) | 0.606 (0.359, 1.016) | 0.058     |

\*p<0.05; \*\*p<0.01; \*\*\*p<0.001.

agreement of parents, DSA, and dentists with children regarding FIS scores is shown in Table 4. Parent's agreement with children regarding the FIS scores appears to be affected by whom child's main care-giver is. For children who has their maid or other people as the main caregiver, the chance for the parent to agree with children's FIS score is 2.96 times as likely compared to those with parents as the main caregivers (p<0.05).

Both DSA and dentist's agreement with the children regarding the FIS scores appears to be affected by the child's age. For every 1 unit increase in the child's age, the odd for DSA and dentist to agree with children's FIS score would be 0.73 and 0.71, respectively (p<0.05) (Table 4).

### Inter and intra examiner reliability

Inter examiner and intra examiner reliability were shown to be 'excellent' [21]. The ICC of over 0.99 was reached in assessing dmft and VPI for both inter- and intra-examiner reliability. Intra-examiner reliability on the CARS was 0.93, and over 0.96 was achieved for the inter-examiner reliability on CARS.

### Discussion

The mean FIS score reported was 2.16. The majority of the preschool children were presented with low level fear and only around 20% of the children chose score 4 and 5 on the scale. It was surprising to note that over 50% of the children chose 1 on the FIS, which means that they were actually happy when they saw a dentist.

The agreement of the parents, dentist and DSA with the children regarding the FIS is weak. Previous studies also showed that parents were unable to accurately report their children's dental fear or anxiety level, when it was assessed by the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS) [22] or parent's proxy MCDAS survey

[23]. This suggests that parents, dentist and DSAs may not be reliable in assessing children's dental anxiety, and children's self-reported level of dental anxiety should be first considered when possible, even in young children.

FIS score reported by the parents, dentist and DSA were higher compared to the self-reported FIS score by the children, which mean that the children were more anxious from the parents, dentist and DSA's point of view than how the children actually felt. Similar finding was addressed in previous studies [23,24]. Parents generally reported a higher anxiety score for their children than that was reported by their children [22,23]. Luoto et al [23] suggested that parental dental fear might affect the parent's correct assessment of their child's dental fear positively. This finding is especially important to be delivered to the parents, because the dental anxiety or negative behaviour anticipated by the parents can be a burden for the children to access dental care. Parents can be reluctant to bring their child to dental care as they want to avoid embarrassment that they would expect.

There is a lack of information regarding the ability of dental nurse or other clinical staff in assessing dental fear, despite their active and important role in patient management. Dentist and DSAs showed slightly better agreement with the children regarding the FIS score compared to the parents. Parental dental fear has been identified as a reliable predictor of dental fear in children. Therefore, the assumption of the parents would know their children's dental fear well was easily made. This is also proved in studies that parents are better at predicting children's dental behaviour than dentists [2]. However, this is questioned by the results from this study. Parents' assessment on their child's dental anxiety level can easily be influenced by their child's general fear and behaviour from their daily life, as well as the parent's own dental fear or experience. The younger the child, the stronger the possibilities that the results have been affected. Whereas dentists and DSAs involved in the study were experienced dental



staff, who have been working in the Paediatric Dentistry Clinic for years. The experience of observing and interacting with children in the dental surgery may have facilitated them in understanding and noticing anxious behaviors. Dentists and DSA involved in the study share similar level of experience in paediatric patient management, the association between the experience of the staff and their ability in assess dental anxiety may require further investigation.

The results showed that parent's agreement with the children regarding the FIS scores appeared to be affected by whom child's main caregiver was. For the children who has the maid or other people as the main caregiver, the chance for the parent to agree with children's FIS score is higher. Parents may appear to be more emotionally associated with the child when they are the child's main caregiver. They may be more subjective and easily be affected by the child's behaviour in other situations (e.g. visiting medical doctor or in school) while rating their dental anxiety level.

The child's age appears to be the contributing factors to the level of dentist and DSA's agreement. There is a better agreement between the dental staff and younger children compared to older children. As child gets older and the cognitive and social skill development continues, they may have better control of their emotions and possibly internalizing their feelings and fear. Whereas younger children may simply be expressing their anxiety by crying or other uncooperative behaviours. Therefore, it is more difficult for dental staff to predict the feeling of an older child.

The facial image scale was developed to assess the dental anxiety in age group of 3 to 18 [3]. The FIS is one of the few self reported anxiety scale that is suitable for the use in very young children. It is easy and cheap to use in both clinical setting and dental research, which demonstrated developmental validity. The scale of 5 faces ranging from 1 to 5 provides a simple and clear scale that young children can understand and be directed by the researcher/operator with simple instruction.

It should be addressed that the study was subjected to a few limitations. When interpreting the results, it is important to note that only the cognitive component of dental fear was being assessed when using a self-reported dental anxiety scale [25]. FIS assesses dental anxiety by asking for the child's feelings at the dental visit. The child's feelings may not be a total reflection of his or her dental anxiety level, as it can be affected by other factors (e.g. children's mood, other incidence in school or at home). The subjects were asked about their feelings before the dental examination, despite their history of previous dental experience. Around 30% of the subjects had no previous dental experience and 45% of the subjects had examination done by other dentists. The nature of a child's dental anxiety may vary, some children present with fears to specific dental stimuli (e.g. sound and vibration from hand piece or needle during local anaesthesia) and some children are fearful of the dental setting. Children presented with negative feeling in this study are more likely to be due to the dental setting instead of specific dental treatment. Winer suggests that anxiety in dental setting reflected a more general and basic type of anxiety [26]. Dental anxiety level should be assessed at different stages of treatment to give a better understanding of the cause of child's dental fear.

## Conclusion

The agreement of the parents, dentist and DSA with the children regarding the FIS is weak. Assessments by observation are operator biased and may be inaccurate. Children's self-reported level of dental anxiety should be first considered even in young children whenever it is possible.

## References

1. Folayan MO, Fatusi A. Effect of psychological management techniques on specific item score change during the management of dental fear in children. *J Clin Pediatr Dent.* 2005; 29: 335-340.
2. Klingberg G, Broberg AG. Dental fear/anxiety and dental behaviour management problems in children and adolescents: a review of prevalence and concomitant psychological factors. *Int J Paediatr Dent.* 2007; 17: 391-406.
3. Buchanan H, Niven N. Validation of a Facial Image Scale to assess child dental anxiety. *Int J Paediatr Dent.* 2002; 12: 47-52.
4. Buchanan H, Niven N. Further evidence for the validity of the Facial Image Scale. *Int J Paediatr Dent.* 2003; 13: 368-369.
5. Skaret E, Raadal M, Berg E, Kvale G. Dental anxiety and dental avoidance among 12 to 18 year olds in Norway. *Eur J Oral Sci.* 1999; 107: 422-428.
6. Rantavuori K, Lahti S, Hausen H, Seppä L, Kärkkäinen S. Dental fear and oral health and family characteristics of Finnish children. *Acta Odontol Scand.* 2004; 62: 207-213.
7. Nicolas E, Bessadet M, Collado V, Carrasco P, Rogerleroi V, Hennequin M. Factors affecting dental fear in French children aged 5-12 years. *Int J Paediatr Dent.* 2010; 20: 366-373.
8. McGrath C, Bedi R. The association between dental anxiety and oral health-related quality of life in Britain. *Community Dent Oral Epidemiol.* 2004; 32: 67-72.
9. Oliveira MM, Colares V. The relationship between dental anxiety and dental pain in children aged 18 to 59 months: a study in Recife, Pernambuco State, Brazil. *Cad SaudePublica.* 2009; 25: 743-750.
10. Tickle M, Jones C, Buchanan K, Milsom KM, Blinkhorn AS, Humphris GM. A prospective study of dental anxiety in a cohort of children followed from 5 to 9 years of age. *Int J Paediatr Dent.* 2009; 19: 225-232.
11. Milsom KM, Tickle M, Humphris GM, Blinkhorn AS. The relationship between anxiety and dental treatment experience in 5-year-old children. *Br Dent J.* 2003; 194: 503-506.
12. Townend E, Dimigen G, Fung D. A clinical study of child dental anxiety. *Behav Res Ther.* 2000; 38: 31-46.
13. Ten Berge M, Veerkamp JS, Hoogstraten J. The etiology of childhood dental fear: the role of dental and conditioning experiences. *J Anxiety Disord.* 2002; 16: 321-329.
14. Locker D, Liddell A, Dempster L, Shapiro D. Age of onset of dental anxiety. *J Dent Res.* 1999; 78: 790-796.
15. Porritt J, Buchanan H, Hall M, Gilchrist F, Marshman Z. Assessing children's dental anxiety: a systematic review of current measures. *Community Dent Oral Epidemiol.* 2013; 41: 130-142.
16. Humphris GM, Dyer TA, Robinson PG. The modified dental anxiety scale: UK general public population norms in 2008 with further psychometrics and effects of age. *BMC Oral Health.* 2009; 26: 9-20.
17. Wong HM, Humphris GM, Lee GT. Preliminary validation and reliability of the Modified Child Dental Anxiety Scale. *Psychol Rep.* 1998; 83: 1179-1186.
18. World Health Organization. *Oral Health Surveys Basic Methods.* 4<sup>th</sup> edition. Geneva: World Health Organization; 1997.
19. Ainamo J, Bay I. Problems and proposals for recording gingivitis and plaque. *Int Dent J.* 1975; 25: 229-235.

20. Venables WN, Ripley BD Modern applied statistics with S. Fourth Edition. Springer, New York. 2002; ISBN 0-387-95457-0.
21. Fleiss JL. Statistical Methods for Rates and Proportions. 2<sup>nd</sup> Ed. New York: Wiley; 1981.
22. Gustafsson A, Arnrup K, Broberg AG, Bodin L, Berggren U. Child dental fear as measured with the Dental Subscale of the Children's Fear Survey Schedule: the impact of referral status and type of informant ... Community Dent Oral Epidemiol. 2010; 38: 256-266.
23. Luoto A, Tolvanen M, Rantavuori K, Pohjola V, Lahti S. Can parents and children evaluate each other's dental fear? Eur J Oral Sci. 2010; 118: 254-258.
24. Patel H, Reid C, Wilson K, Girdler NM. Inter-rater agreement between children's self reported and parents' proxy reported dental anxiety. Br Dent J. 2015; 218: E6.
25. Aartman IH, van Everdingen T, Hoogstraten J, Schuurs AH. Self-report measurements of dental anxiety and fear in children: a critical assessment. ASDC J Dent Child. 1998; 65: 252-8, 229-230.
26. Winer GA. A review and analysis of children's fearful behavior in dental settings. Child Dev. 1982; 53: 1111-1133.