

# Development of the Turkish version of the Index of Dental Anxiety and Fear (IDAF-4C+): Dental anxiety and concomitant factors in pediatric dental patients

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**Objective:** The aim of this study was to develop the Turkish version of the Index of Dental Anxiety and Fear (IDAF-4C+) and also to explore factors associated with dental anxiety in clinical pediatric dental patients (PDPs). **Study Design:** The study sample consisted of 421 PDPs aged 12-14, 104 of whom were selected for test-retest analysis. The psychometric evaluation included linguistic validity, exploratory factor analysis, reliability by internal consistency (Cronbach's alpha) and test-retest reliability (intra-class correlation coefficient, ICC). Construct validity was tested by comparing a commonly used instrument, the Children's Fear Survey Schedule Dental Subscale (CFSS-DS). Associations between parental dental anxiety, frequency of dental visits, dental caries, dental visit behaviour and children's dental anxiety were also examined. **Results:** The Turkish version of the IDAF-4C demonstrated good internal consistency (Cronbach's alpha  $\alpha=.96$ ) and test-retest reliability (ICC=.87). Factor analysis showed a fit IDAF-4C model with a single factor, 8 items. Dental anxiety scores were significantly correlated with all measured variables ( $p<0.001$ ). Girls showed significantly higher dental anxiety scores than boys ( $p<0.05$ ). **Conclusions:** This study suggests that the Turkish version of the IDAF-4C+ is a valid and reliable instrument for assessing dental anxiety and fear in Turkish children.

**Key words:** assessment, cross-cultural adaptation, exploratory factor analysis, dental anxiety, pediatric dental patients

## INTRODUCTION

Dental anxiety is commonly viewed as an important health problem<sup>1</sup> Dental anxiety, and the avoidance of situations that involve dental treatment and care, is a major source of serious oral health problems in children<sup>2,3</sup>. Dental anxiety might cause children to put off an appointment for dental treatment or lead to some psychological or physical problems both for the patient and dentist<sup>4</sup>. The common situation that patients with high dental anxiety attend dental clinics only in emergency or when they have toothache, prevents their first line treatment, and causes increased

number of decayed teeth and bad oral hygiene, leading to more difficult treatment and increased costs<sup>5</sup>. Prevalence studies describe varying incidence of dental fear in children depending on the age of the child and the measure of dental fear used<sup>6-9</sup>.

Dental anxiety is likely to have multifactorial origins and several etiological factors in children<sup>10,11</sup>. Major factors influencing children's dental anxiety are considered to be: pain and negative experiences<sup>12</sup>, socio-economical, cultural and familial factors, and parental dental anxiety<sup>13,14</sup>. Determining whether children attending a dentist have dental anxiety before the treatment enables the dentist to be prepared for reactions that he/she might encounter during treatment, and to take the necessary precautions to reduce the anxiety level of the patient<sup>9</sup>.

Many scales have been designed to determine whether pediatric dental patients have dental fear or anxiety. Among these scales, The Children's Fear Survey Schedule Dental Subscale (CFSS-DS), Dental Fear Schedule Short Form, Corah's Dental Anxiety Scale, Modified Dental Anxiety Scale (MDAS), Modified Child Dental Anxiety Scale, Facial Image Scale, Venham picture scale and Smiley Faces programmes are the most commonly used<sup>15</sup>. The CFSS-DS is the most commonly used dental anxiety scale in the literature and consists of 15 items related to dental treatment and setting. The scores obtained are within a range of 15 to 75 points. Scores equal to or over 39 points have been taken to indicate higher levels of anxiety<sup>16</sup>.

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It is controversial whether the dental anxiety scales presented in literature, and used commonly, effectively capture the various aspects of the nature and aetiology of dental anxiety and fear<sup>17</sup>. They have several disadvantages such as their unpractical nature resulting from their length, their focus on stimuli related to fear instead of fear itself<sup>4</sup>, that they address dental fear only in terms of emotional reactivity<sup>18</sup> and that there is, for the most part, an absence of construct validity in their context or failure to meet the DSM-IV criteria for the diagnosis of people with dental phobia<sup>17</sup>.

The Index of Dental Anxiety and Fear (IDAF-4C<sup>+</sup>) is a modular style scale that addresses dental fear and anxiety in many aspects and is built on solid theoretical and psychological bases. It was designed with the aim of effectively addressing the disadvantages of the available dental fear and anxiety scales<sup>17</sup>. The IDAF-4C has been originally developed for adults. But in a previous study, the IDAF-4C was used in a Spanish child population and showed good reliability and validity.<sup>6</sup> According to Armfield<sup>17</sup>, the IDAF-4C<sup>+</sup> is a dental self-reported measure scale that assesses the four components of dental anxiety and fear: cognitive, behavioural, emotional and physiological. The IDAF-4C<sup>+</sup> has two additional modules designed to assess dental phobia and dental feared stimuli. The phobia (IDAF-P) and stimulus (IDAF-S) modules can be used for epidemiological and clinical purposes, respectively, but are not designed to be used as scales. The modular structure of the IDAF-4C<sup>+</sup> provides flexibility and alternatives to dentists and researchers in their clinical studies and epidemiological researches.

The IDAF-4C<sup>+</sup> has demonstrated good reliability and validity<sup>17</sup> and has been translated into several other languages<sup>19-21</sup>. However, there is no Turkish version of the IDAF-4C<sup>+</sup> available in the literature. The applicability, reliability and validity of the children's version of the IDAF-4C<sup>+</sup> into Spanish has been previously carried out<sup>22</sup>.

The aims of this study were; a) to adapt IDAF-4C<sup>+</sup> into Turkish by performing validity, reliability and factor analysis of the scale and to assess its cross-cultural adaptation in a Turkish population b) to explore the dental anxiety with concomitant factors in clinical pediatric dental patients.

## MATERIALS AND METHOD

The study sample consisted of a consecutive sample of 421 pediatric dental patients (PDPs) who visit the Department of Pediatric Dentistry, Cumhuriyet University, Turkey. The hospital is the last centre where patients who have severe and complicated dental situations came to receive dental care in the city. Also, the department of pPediatric dentistry is legally responsible for pediatric dental patients aged from 0 to 14 in Turkey. The inclusion criteria were that children were aged 12, 13 or 14 and were physically and emotionally healthy. The participants answered descriptive questions (gender, age, frequency of dental visits) and completed the CFSS-DS and IDAF-4C scales. Also parents of the children answered the DAS to determine parental dental anxiety levels. All participants completed the questionnaires in the visiting rooms under the supervision of the researcher. A consecutive sampling method was used to obtain an appropriately sized study group on the basis of the argument that a minimum sample size of 300 or more participants is good for factor analysis<sup>23</sup>. For test-retest reliability, a randomly selected 104 participants completed the measure one month after the first one.

All participants and parents were volunteers and informed about the aims of the study. It was emphasized both verbally and in the instructions included in the data collection tool that the study was intended for scientific purposes only and the provided personal data would be kept confidential.

## Translation and adaptation

Adaptation of the IDAF-4C<sup>+</sup> into Turkish was performed in accordance with the cross-cultural adaptation procedure. First, the English form of the scale was translated to Turkish by two different language experts. Both translations were evaluated by the researcher (BB) and three specialist dentists, and the Turkish form was prepared in line with the suggestions. The Turkish form and original English forms were sent to two different bilingual specialist dentists, and the Turkish form was revised as per their opinions. The Turkish form was re-translated into English by an expert that speaks an advanced level of English. Translations were compared again by a specialist dentist, and the initial version of the translation was created. English and Turkish forms of the scale were applied to 50 students of the Department of English Language and Literature at an interval of two weeks. Correlation coefficients between English and Turkish scores were examined. Two specialist dentists were consulted for the appearance validity of the Turkish scale. Revisions were made on the Turkish form in line with the suggestions. After the revision, 20 students were interviewed to check whether the items in the scale were understood, and revisions were made on the parts that were not understood based on the suggestions of patients. With its new revisions, the scale was presented to two lecturers that are experts in Turkish language for the compatibility of language.

The draft children's version of the scale was prepared and sent to expert opinions to a team including one physiologist, one pediatric dentistry lecturer and one language expert. With the expert suggestions, two items were rewritten as "I want my parents to take me to the dentist later or delay making appointments or to go to the dentist". and "I generally try not to be taken to the dentist, or avoid going to dentist, because I find the experience unpleasant or distressing". A pilot study with 30 children (Mean=9.45, SD=1.06, Range=7 to 14) was performed using the final version of the scale. After discussion, it was decided that children who are 12 and older years old were able to entirely understand scale instructions, item contents, and the response formats and answer the Turkish version of the IDAF-4C. Thus, it was decided to apply the scale to children aged from 12 to 14 in the study.

## Measurements

The IDAF-4C<sup>+</sup> has three independent modules measuring: 1) The core module (IDAF-4C), the base module of the larger measure; 2) The phobia module (IDAF-P), using diagnostic criteria based on DSM-V; and 3) the stimulus module (IDAF-S), requiring a rating of the extent of anxiety related to various dental stimuli (Figure 1). The core IDAF-4C module contains eight questions, with two items each relating to the behavioural, emotional, cognitive, and physiological components of dental anxiety and fear. The item responses on the IDAF-4C range from "Disagree" (1) to "Strongly agree" (5), with higher scores indicating greater dental fear. Mean full scale scores were categorized as: 'No or little dental fear' (score range 1-1.5), 'Low dental fear' (score range 1.51-2.5), 'Moderate dental

FIGURE 1. The Index of Dental Anxiety and Fear (IDAF-4C+)

**The Index of Dental Anxiety and Fear (IDAF-4C+)**

The following questions relate to how you feel about going to the dentist.

| 1. How much do you agree with the following statements?   | Disagree | Agree a little | Somewhat agree | Moderately agree | Strongly agree |
|---|----------|----------------|----------------|------------------|----------------|
| (a) I feel anxious shortly before going to the dentist.   |          |                |                |                  |                |
| (b) I generally avoid going to the dentist because I find the experience unpleasant or distressing. |          |                |                |                  |                |
| (c) I get nervous or edgy about upcoming dental visits.   |          |                |                |                  |                |
| (d) I think that something really bad would happen to me if I were to visit a dentist.              |          |                |                |                  |                |
| (e) I feel afraid or fearful when visiting the dentist.   |          |                |                |                  |                |
| (f) My heart beats faster when I go to the dentist.   |          |                |                |                  |                |
| (g) I delay making appointments to go to the dentist.   |          |                |                |                  |                |
| (h) I often think about all the things that might go wrong prior to going to the dentist.           |          |                |                |                  |                |

| 2. Do the following statements apply to you?   | YES | NO |
|--|-----|----|
| (a) Going to the dentist is actively avoided or else endured with intense fear or anxiety.   |     |    |
| (b) My fear of going to the dentist has been present for at least 6 months.  |     |    |
| (c) My fear, anxiety or avoidance of going to the dentist significantly affects my life in some way (dental pain, avoiding eating some foods, embarrassed or self-conscious about appearance of teeth or mouth, etc.). |     |    |
| (d) I am afraid of going to the dentist because I am concerned I may have a panic attack (abrupt fear with sweating, pounding heart, fear of dying or losing control, chest pain etc.).                                |     |    |
| (e) I am afraid of going to the dentist because I am generally highly self-conscious or concerned about being watched or judged in social situations.  |     |    |

| 3. To what extent are you anxious about the following things when you go to the dentist? | Not at all | A little | Somewhat | Moderately | Very much |
|--|------------|----------|----------|------------|-----------|
| (a) Painful or uncomfortable procedures .....  |            |          |          |            |           |
| (b) Feeling embarrassed or ashamed .....   |            |          |          |            |           |
| (c) Not being in control of what is happening .....                                      |            |          |          |            |           |
| (d) Feeling sick, queasy or disgusted .....  |            |          |          |            |           |
| (e) Numbness caused by the anesthetic .....  |            |          |          |            |           |
| (f) Not knowing what the dentist is going to do .....                                    |            |          |          |            |           |
| (g) The cost of dental treatment .....   |            |          |          |            |           |
| (h) Needles or injections .....  |            |          |          |            |           |
| (i) Gagging or choking .....   |            |          |          |            |           |
| (j) Having an unsympathetic or unkind dentist .....                                      |            |          |          |            |           |

fear' (score range 2.51–3.5), and 'High dental fear' (score > 3.5). The phobia and stimulus modules were designed to be used not as scales but for epidemiological and clinical purposes. We used only the core anxiety and fear module of the Turkish children's version of the IDAF-4C in this study.

The Children's Fear Survey Schedule – Dental Subscale (CFSS-DS) is a commonly used questionnaire for children<sup>16</sup>. It comprises 15 items that are related to treatment and the dental setting, and it permits measurement of the trait anxiety suffered by a patient. The scores obtained are within a range of 15 to 75 points. Scores equal to or over 39 points have previously been used to indicate higher levels of anxiety<sup>16</sup>.

The clinical oral examination of the children was carried out by the researcher (BB), based on recommended World Health Organization criteria for the visual assessment of dental caries<sup>24</sup>. The classification was performed using the Decayed, Missing and Filled Teeth (DMFT Index creating caries extent categories of 'Low' ( $\leq 2$  DMFT) 'Moderate' (3–4 DMFT), and 'High' ( $\geq 5$  DMFT).

The dental visiting behaviour of the participants was assessed with the researcher (BB) using the Frankl scale<sup>25</sup> which consists of a 4-point scale in which; Score 1: definitely negative, Score 2: negative, Score 3: positive, and Score 4: definitely positive.

Frequency of dental visits was assessed by responses of parents who answered the question "How often does your child go to the dentist". The response options were a) Sporadically, b) Every year, and c) Every 6 months

The parental dental anxiety was measured with the Dental Anxiety Scale (DAS)<sup>26</sup>. The DAS consists of 4 questions with 5 answer alternatives for each. Item scores range from 4 (no anxiety) to 20 (severe anxiety). Participants who scored a total of 4–8 were categorized as 'Non-anxious', 9–12 as 'Moderately anxious', 13–14 as 'Highly anxious' and 15–20 as 'Severely anxious'.

## Statistical analyses

The correlation between the scores that were obtained from Turkish and English forms applied at an interval of two weeks for IDAF-4C+ linguistic validity was assessed using the Pearson product-moment correlation coefficient.

Internal reliability coefficients of the components specified in the scale were calculated with Cronbach  $\alpha$  and test-retest reliability was performed by intra-class correlation coefficient (ICC) values. For the construct validity, the factor structure was examined using exploratory factor analysis (EFA) with rotated principal components analysis.

The correlations between the IDAF-4C and its components and the CFSS-DS were evaluated using Pearson product-moment correlation coefficients.

The IDAF-4C was compared to the CFSS-DS measure in terms of associations with behaviour patterns, parental dental anxiety, dental caries and frequency of dental visits, using analysis of variance and measures of association tested using eta squared.

Statistical analyses were carried out using SPSS 16.0 software.

## RESULTS

In the study sample, 52% ( $n=217$ ) were males and 48% ( $n=204$ ) were females. The mean age of individuals was 12.99 years ( $SD=0.81$ ). The mean dental anxiety score was 3.15 ( $SD=1.09$ ) and dental anxiety was significantly higher ( $p<0.05$ ) for girls (Mean=3.52,  $SD=0.99$ ) than for boys (Mean=2.80,  $SD=1.06$ ).

### Linguistic validity

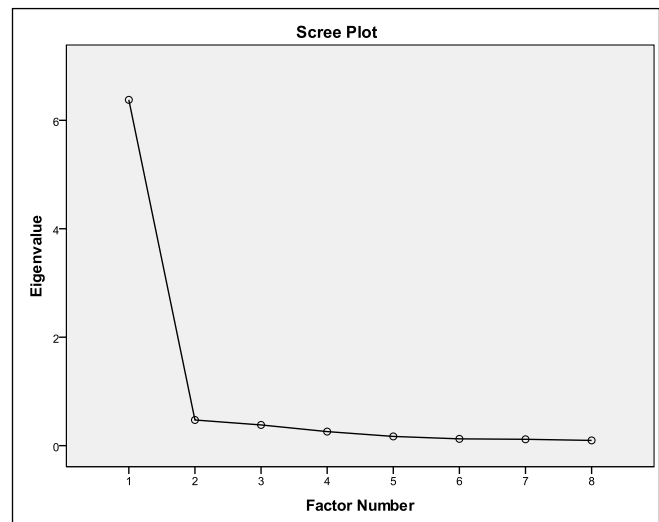
The correlation coefficients that were calculated for the 50 English Language and Literature students for language compatibility of the scale in Turkish and English forms were 0.91 and 0.87, respectively. The coefficient value indicates that the Turkish form of the scale was equivalent to the original English scale.

### Factor analysis and scale structure

#### Exploratory factor analysis (EFA)

Kaiser-Meyer-Olkin coefficient (KMO) and Bartlett sphericity test were used to identify the compatibility of IDAF-4C factor analysis. Data were found to be compatible for factor analysis since KMO value, 0.92, and result of the Bartlett's sphericity test, ( $\chi^2 = 3975.11$ ,  $p<.01$ ), were statistically significant. Items in the EFA were examined under a single factor, with an eigenvalue of 6.38 that accounted for 79.72 of variance which shows a strong relatedness between all items in the scale. The lower limit of the load value of items was found to be 0.30 after varimax rotation. None of the items were excluded from the scale since load value of all items was found to be greater than 0.30 in the analysis. As can be seen in the scree plot in Figure 2, the attribution of scale has been gathered in one factor higher than 1.

FIGURE 2. Scree Plot Graph of the IDAF-4C Factor



### Reliability of the IDAF-4C

Table 1 shows the item analysis and reliability of the IDAF-4C. Cronbach  $\alpha$  internal reliability coefficient for the IDAF-4C was calculated as 0.96. Corrected item-total correlations of the scale ranged from 0.79 to 0.90, which shows the homogeneity of IDAF-4C items. Test-retest reliability was 0.87.

**Table 1. Item analysis and reliability of the IDAF-4C**

| Item No | Mean | SD   | Corrected Item-Total Correlation | Cronbach's Alpha if item deleted | Factor Loading |
|---------|------|------|----------------------------------|----------------------------------|----------------|
| E1      | 3.25 | 1.23 | .79                              | .96                              | .92            |
| E2      | 3.23 | 1.25 | .87                              | .95                              | .92            |
| C1      | 3.16 | 1.18 | .87                              | .95                              | .90            |
| C2      | 3.19 | 1.19 | .89                              | .96                              | .90            |
| B1      | 3.05 | 1.21 | .84                              | .96                              | .89            |
| B2      | 3.13 | 1.26 | .89                              | .95                              | .88            |
| P1      | 3.06 | 1.22 | .84                              | .96                              | .88            |
| P2      | 3.12 | 1.27 | .86                              | .96                              | .84            |

E= Emotional; C= Cognitive; B= Behavioural; P=Physiological

*Validity of the IDAF-4C*

Table 2 shows the Pearson *r* correlations between the IDAF-4C and its components and the CFSS-DS. The Pearson *r* correlations between the IDAF-4C full scale score and each item of the four components of the scale were .94, .92, .94 and .91 for the cognitive, physiological, behavioural and emotional components, respectively. The Pearson *r* correlations were all statistically significant ( $p < .01$ ). However, the physiological component showed weaker associations with the other components. The IDAF-4C showed a

good correlation with the CFSS-DS ( $r = .78$ ). The physiological component of IDAF-4C showed the highest correlation with the CFSS-DS ( $r = .76$ ), while the emotional components had the lowest correlations with the CFSS-DS ( $r = .68$ ).

**TABLE 2. Correlations Between the IDAF-4C and Its Components and the CFSS-DS**

| Measure                           | 1 | 2   | 3   | 4   | 5   | 6   |
|-----------------------------------|---|-----|-----|-----|-----|-----|
| <b>1. IDAF-4C</b>                 | - | .94 | .92 | .94 | .91 | .78 |
| <b>2. IDAF -C (Cognitive)</b>     |   | -   | .80 | .86 | .82 | .71 |
| <b>3. IDAF -P (Physiological)</b> |   |     | -   | .83 | .77 | .76 |
| <b>4. IDAF -B (Behavioural)</b>   |   |     |     | -   | .80 | .74 |
| <b>5. IDAF -E (Emotional)</b>     |   |     |     |     | -   | .68 |
| <b>6. CFSS-DS</b>                 |   |     |     |     |     | -   |

Table 3 shows the associations between the two dental fear measures and the other variables examined in the study sample. Dental anxiety scores were significantly correlated with all variables ( $p < .001$ ). Both dental fear measures, the IDAF-4C and CFSS-DS, were significantly associated with frequency of dental visits, parental dental anxiety, behaviour pattern and dental caries ( $p < .001$ ). For all of these variables, IDAF-4C explained a greater percentage of the variance than did the CFSS-DS.

**TABLE 3. Associations between the two dental fear measures and other measured variables**

| Variables                             | n   | IDAF          |                 | CFSS-DS       |                 |
|---------------------------------------|-----|---------------|-----------------|---------------|-----------------|
|                                       |     | Mean          | 95% CI          | Mean          | 95% CI          |
| <b>Frequency of dental visits</b>     |     |               |                 |               |                 |
| Sporadically <i>a-b,c SS</i>          | 234 | 3.49          | [3.39, 3.59]    | 34.80         | [33.32, 36.28]  |
| Every year <i>b-a SS</i>              | 127 | 2.79          | [2.56, 3.02]    | 28.77         | [26.34, 31.19]  |
| 6 months <i>c-a SS</i>                | 60  | 2.55          | [2.26, 2.83]    | 26.71         | [23.70, 29.72]  |
|                                       |     | $p < 0.001$ , | $\eta^2 = .130$ | $p < 0.001$ , | $\eta^2 = .071$ |
| <b>Parental dental anxiety</b>        |     |               |                 |               |                 |
| Non-anxious <i>a-b,c,d SS</i>         | 89  | 2.35          | [2.15, 2.55]    | 24.40         | [22.38, 26.42]  |
| Moderate <i>b-a,c,d SS</i>            | 161 | 3.08          | [2.91, 3.25]    | 31.77         | [29.77, 33.77]  |
| High <i>c-a,b,d SS</i>                | 115 | 3.44          | [3.28, 3.60]    | 33.02         | [31.03, 35.01]  |
| Severe <i>d-a,b,c SS</i>              | 56  | 3.99          | [3.76, 4.22]    | 41.35         | [37.80, 44.90]  |
|                                       |     | $p < 0.001$ , | $\eta^2 = .215$ | $p < 0.001$ , | $\eta^2 = .150$ |
| <b>Behaviour Pattern</b>              |     |               |                 |               |                 |
| Definitely Positive <i>a-c,d SS</i>   | 92  | 2.45          | [2.23, 2.67]    | 26.23         | [24.05, 28.42]  |
| Positive <i>b-c,d SS</i>              | 126 | 2.72          | [2.57, 2.87]    | 27.34         | [25.64, 29.03]  |
| Negative <i>c-a,b,d SS</i>            | 138 | 3.46          | [3.30, 3.63]    | 34.29         | [32.04, 36.54]  |
| Definitely Negative <i>d-a,b,c SS</i> | 65  | 4.28          | [4.14, 4.42]    | 43.23         | [40.69, 45.76]  |
|                                       |     | $p < 0.001$ , | $\eta^2 = .330$ | $p < 0.001$ , | $\eta^2 = .217$ |
| <b>Dental Caries</b>                  |     |               |                 |               |                 |
| Low <i>a-c SS</i>                     | 41  | 2.58          | [2.34, 2.83]    | 27.17         | [24.11, 30.22]  |
| Moderate <i>b-c SS</i>                | 208 | 2.95          | [2.78, 3.09]    | 29.78         | [28.00, 31.55]  |
| High <i>c-a,b SS</i>                  | 172 | 3.15          | [3.39, 3.68]    | 35.42         | [33.60, 37.24]  |
|                                       |     | $p < 0.001$ , | $\eta^2 = .095$ | $p < 0.001$ , | $\eta^2 = .059$ |

SS and italic: Statistically significant

## DISCUSSION

The IDAF-4C+ is a newly developed dental anxiety assessment scale, consistent with the Cognitive Vulnerability Model, a theoretical framework which addresses dental anxiety and phobia in many aspects, and which has been or is in the process of being translated into a number of languages<sup>17, 19, 20</sup>. In this study, Turkish adaptation and psychometric analysis of IDAF-4C+ was performed in a clinical PDP population. The Turkish version of the IDAF-4C+ was found to be a valid and reliable dental anxiety and phobia assessment tool in Turkish PDPs. In the factor analyses and correlation analyses performed, the IDAF-4C+ demonstrated high compatibility both with its own components and another commonly used dental anxiety assessment tool, the CFSS-DS.

Some of the commonly used dental fear and anxiety scales in the literature have been translated into Turkish<sup>27, 28</sup>, however there are some disadvantages such as constructional and theoretical deficiencies available in the original versions of the scales used, and insufficiency of the psychometric analyses in the adaptation studies conducted. Unlike many other scale development and adaptation studies, our study not only included the translation of IDAF-4C+ into Turkish but also a cross-cultural adaptation through a detailed factor analysis and examination of psychometric characteristics. In most of the dental anxiety and phobia scales or adaptation studies available in literature, factor analysis and construct validity have not been examined in a statistically solid manner<sup>29</sup>. EFA was used in our study unlike many dental anxiety and phobia development and adaptation studies. In this way, we were able to examine which items of the IDAF-4C scale assessed which factor as well as the compatibility and construct validity of items in the factor. By considering the differences between the Australian culture, where the original scale was developed, and the Turkish culture to which the scale was adapted, its compatibility to Turkish and Turkish culture was enabled. A precise and lengthy method has been followed in the translation of scale into Turkish, and thus translation and interpretation mistakes that could occur were minimized.

In our study, the IDAF-4C demonstrated a good correlation with the CFSS-DS. Moreover, all components of the IDAF-4C showed high correlations both with each other and with the CFSS-DS. Behavioural and cognitive components of IDAF-4C showed the highest correlation with CFSS-DS. These findings indicate compatibility with the original and other versions of the scale<sup>17, 19, 21</sup>.

In the present study, for all variables, IDAF-4C explained a greater percentage of the variance than did the CFSS-DS. This finding is consistent with the original version of the scale<sup>17</sup>, and also suggests that the IDAF-4C represents a significant improvement over the CFSS-DS regarding prediction of the clinically relevant outcomes.

According to the analyses using Cronbach  $\alpha$  internal reliability coefficient to identify the internal reliability of IDAF-4C,  $\alpha$  was calculated as 0.96, which was found to higher than the original version of IDAF-4C ( $\alpha=0.91$ )<sup>17</sup> and the Spanish children's version ( $\alpha=0.93$ )<sup>6</sup>. The EFA results of this study revealed a single factor structure, with an eigenvalue of 6.38 that accounted for 79.72% of variance; factor loading 0.84 to 0.92, which is higher than the Spanish children's version of the IDAF-4C; (Eigenvalue=5.44; 68.0% of variance explained; factor loading 0.78 to 0.88).

Armfield<sup>17</sup> stated that examining the association between dental anxiety measures and clinical concomitant factors, such as behaviour-based assessments, dental caries and dental visits, would improve the validity of the dental anxiety scales. In our study we clinically examined these factors with Frankl scales and DMFT scores. This study found higher dental anxiety and DMFT scores than previous studies performed in Turkey<sup>7, 30</sup>. This may be associated with the hospital where the study was conducted. The hospital is the last centre where patients who have severe and complicated dental situations came to receive dental care in the city. Also the city where the study was conducted has a moderate socioeconomic status compared to the rest of Turkey. This situation may also lead higher anxiety, DMFT scores and lower frequency of dental visits. Mumcu et al.<sup>31</sup> reported that the Turkish people do not perceive oral health as important and consider it to be of low priority.

In our study, there was a high correlation between the dental visit behaviour and dental anxiety. Patients who had negative behaviours had significantly more dental anxiety scores. This finding is compatible with the literature<sup>11, 32</sup>. We can also explain this situation by the fact that patients with higher dental caries scores and untreated deep carious lesions, come to the dental clinic only when they have severe toothache. This likely makes the patients more fearful about the procedure of dental treatment and leads to uncooperative behaviours<sup>17</sup>.

We found a high correlation between the childrens' and parents' dental anxiety. Similar to our study, Peretz et al.<sup>33</sup> stated that a positive correlation exists between parental and children's dental anxiety. Also, Cinar and Murtomma<sup>30</sup> stated that parents' dental anxiety levels play an important role in their children's dental anxiety. Their levels of dental anxiety correlate positively with those of their children. Mothers of anxious children reported higher levels of state anxiety than mothers of the non-anxious children. Also, in consistent with previous studies<sup>9, 16, 34</sup>, we found that dental anxiety scores were significantly higher for girls than for boys. In dental literature, this difference has been well elucidated and found mainly in older children<sup>9</sup>. Schuller et al.<sup>34</sup> stated that girls can express their feelings and admit their fears more freely than boys due to cultural factors or associated stigmas. This may be why girls have higher dental anxiety scores than boys in the current study.

In this study, there was a negative correlation between frequency of dental visits and dental anxiety in children. Children who have a lower frequency of visits demonstrated higher dental anxiety scores. Similar to these results, Rantovuori et al.<sup>35</sup> reported that children with more dental visits after the first visit were less likely to be anxious after a problematic first visit. Carillo-Diaz et al.<sup>12</sup> stated that a higher frequency of dental visits was associated with less dental fear and a decreased belief in the probability of negative events occurring during treatment. According to them, the effect of frequency of visits on dental anxiety comes from a direct path (presumably the habituation of the anxiety response owing to a repeated exposure to dental events) as well as from an indirect path involving cognitive elements like probability expectations.

There are some limitations in our study. One limitation of the present study is that the IDAF-4C has been originally developed for adults. But in a previous study, the IDAF-4C was used in a Spanish child population and showed good reliability and validity.<sup>6</sup> In that study, participants mean age 12.30 (SD=2.30) was similar to present

study (Mean=12.99, SD=0.81). Also, we performed a pilot study including focus group discussion with children, expert opinions to eliminate this limitation. The rationales to use only 12,13 or 14 year old children to validate Turkish version of the IDAF-4C were based on this group discussion and expert opinions and also for the legal procedure of that the department of pediatric dentistry is responsible for pediatric dental patients aged from 0 to 14 in Turkey. Within this limitation, the results of this study can be generalized to children aged ranging from 12 to 14. Further studies are needed to evaluate the applicability and validity of the Turkish version of IDAF-4C in different age groups. Another limitation is that the dental visiting behaviour of the participants was assessed by one observer which may cause a bias. To avoid such a limitation, previously calibrated observers should have assessed the behaviour of the children. As another limitation, the participants completed the questionnaires in the visiting rooms under the supervision of the researcher which has the potential of responder bias. Due to the environment in which the participants are present and the presence of the researcher, there is a possibility of a bias in the answers of the participants.

The IDAF-4C+ is a newly developed dental anxiety assessment scale which explores dental anxiety and phobia in many aspects. It may be preferred over existing instruments because it has a solid

theoretical base for measuring dental anxiety. Also, its modular structure allows flexibility for specific purposes in clinical, epidemiological and related studies. Also, it is an easy and short instrument to be filled by the patients. It is comparatively better at predicting dental avoidance, specific fears and dental phobia than the over existing measures. These strengths make it especially suited for use in the fields of clinical dentistry, and also epidemiological and related studies.

### CONCLUSIONS

This Turkish version of the IDAF-4C<sup>+</sup> appears to be a valid and reliable dental anxiety assessment tool that is important both in terms of addressing dental fear and anxiety in many aspects and being suitable for use in clinical and epidemiological studies. By adapting the IDAF-4C<sup>+</sup> into Turkish language and taking into account Turkish culture, the scale will be useful in Turkish children populations as a future assessment tool.

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