Reliability and validity of measures used in assessing dental anxiety in 5- to 15-year-old Croatian children

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**ABSTRACT**

Aim The aim of the study was to evaluate reliability and validity of different questionnaires and predict related causes, as concomitant factors in assessing different aspects of children’s dental anxiety. Study design Children were interviewed on dental anxiety, dispositional risk factors and satisfaction with the dentist after dental treatment had been accomplished. Parents were interviewed on dental anxiety as well. Methods The study population included 165 children (91 boys) aged 5 to 15 years, referred to a university dental clinic by general dental practitioners because of a history of fear and uncooperative behaviour during previous dental visits. Children were treated by two dentists, both experienced in treating fearful children. Statistics Statistical analysis was performed in Statistics for Windows, Release 5.5 and Release 7.5. Pearson’s correlation coefficients were calculated for validity and Cronbach alpha for reliability of the measures. Spearman Brown prophecy formula was used for correction of the alpha scores. Results The children’s total average CFSS-DS score was 27.02, with no significant difference with respect to gender. The highest Cronbach alpha scores regarding reliability were obtained for the S-DAI, the CFSS-DS and the PDAS. Pearson’s correlations regarding validity presented significant correlations between the CMFQ, the CDAS and the S-DAI, between the OAS, the CDAS and the S-DAI, as well as between the OAS and the DVSS-SV. Conclusion Previous negative medical experience had significant influence on children’s dental anxiety, supporting Rachman’s conditioning theory. Anxious children were more likely to show behaviour problems (aggression) and more introvert in expressing their judgement regarding the dentist. Both the S-DAI and the CFSS-DS, which were standardized in the Croatian population sample, showed the highest reliability in assessment of children’s dental anxiety.

**KEYWORDS**: Dental anxiety, Risk factors, Reliability, Validity.

Introduction

Dental fear, as a phenomenon frequently encountered in dental practice, has a proven strong negative impact on the treatment outcome. Consequently, it has been indicated in recent studies not only to influence a child dental patient, but also to have a stressful influence on the operating dentist during a dental visit, finally resulting in the child neglecting his/her oral health because of irregular dental visits [Weinstein et al., 1982; Prins et al., 1987; ten Berge et al., 1999a].

Dental fear and dental anxiety in children have been studied for years [Corah et al., 1984] and proven to be of a multifactor aetiology [Freeman, 1985; Stouthard and Hoogstraten, 1987]. Negative effects resulting from past traumatic experiences have influence on a patient’s perception of the dental environment, possibly related to fear of the unknown or injury. Moreover, effects as residual fears appear in a new dental situation and, combined with the upcoming fears, result in the so-called anticipatory anxiety [Freeman, 1985]. Many authors have come to the conclusion that most of a child’s negative reactions result from negative medical experiences acquired either in a medical or a dental office. Having experienced pain once, the child might have enough time to create negative thoughts and expectations regarding the upcoming dental treatment [de Jongh and Stouthard, 1993; Milgrom et al., 1994; de Jongh and ter Horst, 1995; Eli et al., 1997].

Assessing the true nature of dental anxiety is difficult. Studies have shown that dental procedures can be ranged depending on the level of the fear they provoke in the child patient. The most painful procedures prove to be injection, drilling the tooth and periodontal procedures (scaling and root planning) [Bedi et al., 1992; Wakiaga...
et al., 1996; Locker et al., 1996a; Desiate et al., 1997; Bergius et al., 1997; ten Berge et al., 1999b]. Different dental situations and treatment procedures, as well as factors outside the dental setting, can evoke dental anxiety in children. Knowing them, it is important to prevent the occurrence of these fearful dental situations by using appropriate behaviour management techniques. Social background and parental dental anxiety seem to play a mediating role on child’s behaviour in dental settings, as well as the child-dentist’s relationship. Anxious children might cause dental behaviour problems, although the cause-consequence relationship between them is limited. Some children sometimes tend to demonstrate emotional, age-related aggressive behaviour (tantrums, crying, freezing, clinging). Behaviour resulting from fears of this nature is recognised as a ‘childhood phobia’.

Nevertheless, children’s perception of fearful situations depends on numerous factors that contribute to the development of dental anxiety and are mediated not only by their age, but also by gender and socioeconomic status as well. No straight cause-consequence model in explanation of children’s dental anxiety has been found, because its multifactorial aetiology accounts for interaction of different dispositional and situational concomitant factors [ten Berge, 1999]. Different situational factors, such as dental treatment approach (the child-dentist’s relationship), children’s coping skills, as well as painful experience or parental influence (fear) and negative information, contribute to dental anxiety. On the other hand, dispositional factors refer to subjective direct conditioning factors, such as a child’s fear disposition and negative emotions, its coping style, pain sensitivity and temper, including also its propensity to express aggressive behaviour. In the final outcome, interference between situational and dispositional factors, child’s age, gender and social background play a role in the aetiology of dental anxiety and behaviour management problems. It explains the necessity to use various measurements in a study, which aim to assess a child’s anxiety from a more complex view prospective. However, more study on the assessment of a prediction of dental anxiety problems in children is warranted, for example by assessment of the child’s behaviour in other situations rather than dental [Aartman et al., 1998]. Different questionnaires might measure the different aspects of dental anxiety and sometimes it remains unclear which test to apply. It is advisable to use several questionnaires when assessing the child’s dental anxiety.

In this study, different questionnaires were compared with the aim of evaluating their reliability and validity in assessing different aspects or dimensions of dental anxiety. Also, an additional study on cause-

**Materials and methods**

**Patients.** The study population included 165 children (91 boys) between 5.1 and 15.1 years (boys mean age=10.02; girls mean age=9.8). The study included children with and without dental trauma experience. Children were all referred to the Dental Clinic, School of Dental Medicine, University of Zagreb, because of the manifested dental fear that had resulted in uncooperative behaviour during preceding dental interventions. Children were treated by two dentists, both with at least 7 years’ experience in treating fearful children. To study the influence of the parental attitude on the child’s dental anxiety, both children and their parents were interviewed separately.

**Questionnaires.** Psychometric measures used in the study included several questionnaires (Table 1). Child’s and parental dental anxiety were assessed by using the Corah Dental Anxiety Scale (CDAS, PDAS), the Children’s Fear Survey Schedule-Dental Subscale (CFSS-DS, S-DAI, DVSS-SV, and OAS) were applied for evaluating relationship between the child and the dentist [Hakeberg et al., 2000]. Some tests (CFSS-DS, S-DAI, DVSS-SV, and OAS) were applied for the first time in the study and thus standardized in this population sample.

**Statistics.** Pearson’s correlation coefficients were computed to evaluate the validity of the measures and to study interrelationship between the tests used in assessing children’s anxiety, children’s temper (aggression), previous negative medical experiences, socioeconomic background and the child-dentist’s relationship. Pearson’s coefficients revealed significant interrelationship between the variables at the 0.01 and 0.05 alpha level. Cronbach alpha coefficients were computed to evaluate the reliability of the measures. Finally, the Spearman Brown prophecy formula was used to predict the reliability by computing a new alpha score in the case some of the items were omitted from the test. For that purpose item score correlations, i.e. individual alpha scores for each item of the test, had to be calculated first.
Croatian Children

Results

According to the CFSS-DS, the children expressed moderate dental anxiety (total average score=27.02, SD=6.81). There was no significant difference in dental anxiety between boys (mean=26.17, SD=6.33) and girls (mean=28.08, SD=7.31).

Reliability measures. The Cronbach alpha coefficients, indicating the reliability of the tests, are given in Table 2. The highest Cronbach scores were calculated for the S-DAI, the CFSS-DS and the PDAS.

The lower Cronbach values were computed for the CDAS, the CMFQ, the OAS and the DVSS-SV. In the reliability analysis, the alpha scores computed for each item of the test revealed that only the scores obtained for the CMFQ test imply a certain internal inconsistency. In the CMFQ test the questions referring to being afraid of having had temperature measured (0.1534), heart listened to (0.1909) and ear examined (0.233) by either a doctor or a nurse, or seeing the white coats themselves (0.2519), are
represented by significantly low item-rest correlation scores. Furthermore, a lower result was also found in the CFSS-DS test referring to the children being generally afraid of the doctor (0.2547).

**Interrelations between the measures and validity measurement.** Pearson’s correlation coefficients revealed correlations between each variable. Nevertheless, for the purpose of this study only the significant correlations are shown in Table 3. The coefficients show a significant correlation between the CMFQ and their dental anxiety measured both with the S-DAI (0.515) and the CDAS (0.563). Children’s aggression evaluated by the OAS scale was significantly correlated with children’s dental anxiety measured again with both the CDAS (0.362) and the S-DAI (0.373). The only significant negative interrelation was found between the OAS and the DVSS-SV (-0.312), whereas the strongest correlation between the tests measuring children’s anxiety was represented for the S-DAI and the CDAS (0.667). Finally, no significant correlation was found regarding the socioeconomic status.

**Discussion**

In assessing child’s and parental dental anxiety, three questionnaires were used (CFSS-DS, DAS and S-DAI). The highest alpha scores were obtained for the S-DAI, the CFSS-DS and the PDAS tests. The S-DAI questionnaire was used in this study in a children’s dental population for the first time and seems to be very reliable in assessing children’s anxiety levels, having an alpha value even higher than the CFSS-DS.

As to reliability, the alpha coefficient results were in concordance with recent studies in which the CFSS-DS questionnaire had already been proved to be a quite reliable in assessing a child’s dental anxiety [Aartman et al., 1998]. The PDAS scores (alpha=0.8732) were higher than the CDAS scores (alpha=0.7896), probably as the result of child’s age, which is important regarding his/her understanding the DAS scale, and the child-dentist’s relationship during interviewing of the child. The fact that parents were interviewed in the waiting room, and children in the dental chair after the treatment, might account for the difference in the results obtained by the same scale. Furthermore, the Corah scale seemed to be difficult for young children to understand and it probably underlines more physical aspects of a child’s reactions in fearful situations. Thus it neglects other possible expressions of the child’s anxious behaviour [Aartman et al., 1998; Locker et al., 1996b].

On the contrary, the Corah scale has perhaps been used most frequently because its simplicity was regarded as a strong point. Nevertheless, recent studies have reported on the necessity of combining different scales with the aim of getting more precise and thorough estimations regarding a child’s dental anxiety. It might lead to an hypothesis that the reliability of the DAS test could be improved by changing some questions when applied to young children, but this should be further investigated. However, omitting the questions would mean decreasing its specificity and, on the contrary, the intention is to increase it by introducing questions referring to the very specific parts of fear provoking dental situations. Recent studies have suggested modifications of the DAS test without reporting on its reliability using Cronbach alpha scores and thus final comparison regarding reliability of the CDAS questionnaire cannot be done. It remains to be evaluated in the further studies.

Because the CFSS-DS has proven to be valid and

**Table 2 - Cronbach alpha coefficients representing reliability of the tests used in a study of reliability and validity of measures for assessment of dental anxiety in 5- to 15-year-old Croatian children.**

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Cronbach alpha coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PDAS</td>
<td>0.8732**</td>
</tr>
<tr>
<td>2. S-DAI</td>
<td>0.8606**</td>
</tr>
<tr>
<td>3. CFSS-DS</td>
<td>0.8348**</td>
</tr>
<tr>
<td>4. CDAS</td>
<td>0.7896*</td>
</tr>
<tr>
<td>5. OAS</td>
<td>0.7836*</td>
</tr>
<tr>
<td>6. CMFQ</td>
<td>0.7294*</td>
</tr>
<tr>
<td>7. DVSS-SV</td>
<td>0.7195*</td>
</tr>
</tbody>
</table>

**Table 3 - Pearson’s correlation coefficients representing interrelationships between variables tests used in a study of reliability and validity of measures for assessment of dental anxiety in 5- to 15-year-old Croatian children.**

<table>
<thead>
<tr>
<th></th>
<th>CDAS</th>
<th>CMFQ</th>
<th>DVSS-SV</th>
<th>S-DAI</th>
<th>OAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDAS</td>
<td>-</td>
<td>0.563**</td>
<td>-0.081</td>
<td>0.667**</td>
<td>0.362*</td>
</tr>
<tr>
<td>CMFQ</td>
<td>0.563**</td>
<td>-</td>
<td>-0.070</td>
<td>0.515**</td>
<td>0.021</td>
</tr>
<tr>
<td>DVSS-SV</td>
<td>-0.081</td>
<td>-0.070</td>
<td>-</td>
<td>-0.263</td>
<td>-0.312*</td>
</tr>
<tr>
<td>S-DAI</td>
<td>0.667**</td>
<td>0.515**</td>
<td>-0.263</td>
<td>-</td>
<td>0.373*</td>
</tr>
<tr>
<td>OAS</td>
<td>0.362*</td>
<td>0.021</td>
<td>-0.312*</td>
<td>0.373*</td>
<td>-</td>
</tr>
</tbody>
</table>

**correlation significant at the 0.01 level (2-tailed)**

**correlation significant at the 0.05 level (2-tailed)**
reliable for different purposes, including for instance assessment of dental fear in children, in this study it was used to assess the children’s general dental anxiety given by the total mean score.

The data obtained by using the CFSS-DS scale indicated that the results for this Croatian population (mean 27.02) were in concordance with those reported in other studies [Milgrom et al., 1994]. The moderate mean score might be explained by children being sent to the Clinic primarily because of a general practitioners’ inability to cope with their uncooperative behaviour, which could imply anxiety as well. However, anxiety is not the only reason for behaviour problems. It again underlies the multifactorial nature of dental anxiety that has to be regarded as a complex phenomenon, because many different factors contribute to its appearance. Furthermore, it could then be understandable why some factors as parental dental anxiety and socioeconomic status do not have much influence on it, whereas a dentist does.

Lower alpha scores were obtained for the OAS scale because children were not referred to the Paediatric Dentistry Department for psychiatric disorders. The alpha results account mostly for the first (verbal aggression) and the third (aggression toward oneself) items, expressing moderate aggressive behaviour in children. The OAS scale was found to be sufficiently reliable (alpha=0.7836). The reason might be that children were not so eager in admitting their verbal aggression and, secondly, they did not have verbal or physical aggressive episodes at the time they were interviewed. Although some other studies have documented successful application of the OAS in routine clinical practice regarding evaluation of both severity and characteristics of overtly aggressive behaviour in children, the results obtained in this study suggest further investigation regarding the measures applied in assessing children’s aggression [Yudofsky et al., 1986].

Dentally anxious children may exhibit overt aggressive behaviour (Pearson’s correlation, Table 3), meaning that a child’s behaviour outside the dental setting might influence its dental anxiety. Studying the cause, as a consequence of a relationship between the child’s dental anxiety and its behavioural problems (including also the aggressive component), no significant interrelationship was found in a low-income population [Raadal et al., 1995].

As to a child’s fear of medical treatment evaluated by the CMFQ questionnaire, the alpha coefficients were lower than expected (Table 2). This was if the new alpha score was calculated for the CMFQ test by using the Spearman Brown formula, and after omitting items with the lowest alpha scores, then the reliability for the CMFQ test increased (alpha = 0.8017). It might be that these questions, although referring to certain medical situations, do not seem to be specifically medically fear provoking ones or they do not cover specific fear provoking situations in a physician’s office in older children.

However, further studies based on the scores achieved by other tests, used in assessing children’s medical fear, should be conducted. Children who are more afraid of doctors (CMFQ) are also likely to be more dentally anxious (S-DAI, CDAS) (Table 3). This supports Rachman’s conditioning theory [1977] in fear acquisition regarding past medical experiences, but it could also account for explaining children’s dental anxiety related to emergency dental situations and dental caries, although the cause-consequence has not been made completely clear [Milgrom et al., 1994].

Items from the CFSS-DS that refer generally to children’s fear of doctors and fear of having their teeth cleaned showed also quite a low alpha scores, although it does not compromise internal consistency of the test. Reduction in alpha scores might be due to the age range of the group, which included children from 5 to 15 years. Fear of unknown situations is age related and medical situations might fit into this concept, meaning that older children are less afraid. Because these questions overlap to a certain degree with medically fear provoking situations, children can associate them with fears acquired in the physician’s office. Calculating a new alpha score for the CFSS-DS test, by using the Spearman Brown prophecy formula for correction in case the second item (being afraid of going to the doctor) is omitted, slightly improves its reliability (alpha=0.8450). However, as the presence or absence of this second item does not seem to play an important role, the CFSS-DS test could generally be regarded as highly reliable. If those modifications had been introduced, it would more or less mean creating a new questionnaire. In this case the alpha results should be compared with a ‘gold standard’ of ideal behaviour and then specificity and reliability could be further discussed.

Cronbach alpha coefficients for the DVSS-SV questionnaire (Table 2) are represented by the lower alpha scores in comparison with findings of Hakeberg et al. [2000], who applied the questionnaire to Swedish, USA and Dutch populations [Yudofsky et al., 1986].

According to the Pearson’s correlation results (Table 3), aggressive behaviour is present in dentally anxious children who have statistically significant lower DVSS-SV scores. It could be compared with the report on relationships between children’s satisfaction with their dentist and their dental anxiety level given by Hakeberg et al. [2000]. Children’s aggression outside the dental
setting might influence their dental anxiety, which results in more introvert behaviour and less criticism regarding the dentist and his treatment.

**Conclusion**

Significant correlations between the questionnaires used in this study imply a possible cause-consequence relationship between the variables, whereas the alpha coefficients confirm reliability of the tests used. Previous medical fear in children has a significant influence on children’s dental anxiety, thus supporting the Rachman’s conditioning theory on fear acquisition. Anxious children are more likely to exhibit behaviour problems, including aggression, and are more introvert in expressing their satisfaction with the dentist and the dental treatment. The S-DAI showed the highest reliability and internal consistency when used with children. Finally, the CFSS-DS test, which was standardized for the Croatian population sample, also proved highly reliable in the assessment of children’s dental anxiety.


**References**


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