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Numerical Scale for Anxiety Assessment in 10–15 Years Children Undergoing Dental Treatment

Zastosowanie skali numerycznej do oceny poziomu lęku u dzieci 10–15-letnich przed zabiegami stomatologicznymi

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
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Abstract

Background. Anxiety associated with dental procedures can be assessed by means of numerous scales and questionnaires. However, their completion by patients and interpretation by doctors are time-consuming.

Objectives. The aim of this study was to verify the hypothesis of legitimate and possible use of a numerical scale (NRS) to assess the intensity of anxiety in children before dental treatment.

Material and Methods. The study group consisted of 250 respondents aged 10–15 years. Before entering surgery, they were asked to fill in a proprietary survey and a number of questionnaires: Corah Dental Anxiety Scale (CDAS), Dental Belief Survey (DBS), Children Fear Survey Schedule-Dental Subscale (CFSS-DS) and NRS. Data were analyzed with Mann-Whitney test. Correlation was evaluated with Spearman test.

Results. Among the respondents, 56% were girls, 44% boys. The CDAS questionnaire showed that 41% of children were anxious, the CFSS-DS questionnaire revealed that 56% experienced a slight fear before dental appointment (the term „anxious” and „slight fear” can be considered similar). Assessing the level of anxiety using the NRS questionnaire, it was found that 40% reported low anxiety and 30% moderate anxiety. The majority of the respondents (64%) showed great trust towards the dentist, with girls displaying significantly higher level of confidence. However, gender was not found to affect the level of anxiety. A high correlation was noted between the results provided by the NRS vs. CDAS, NRS vs. CFSS-DS, and CDAS vs. CFSS-DS. The results also indicated that the higher the confidence the lower the level of anxiety towards dental treatment.

Conclusions. The NRS is a reliable tool to assess the level of anxiety in children aged 10–15 years. The unquestionable advantage of this method is short time of completion and simple interpretation of results (*Dent. Med. Probl.* 2015, 52, 3, 309–315).

Key words: children, dental anxiety, questionnaires measuring anxiety, numerical scale.

Słowa kluczowe: dzieci, lęk dentystyczny, metody oceny lęku, skala numeryczna.

Fear accompanies humans throughout their life, being one of the most common emotional states associated with the feeling of insecurity. Anxiety is also an inherent emotional reaction re-

lated to dental procedures in children and adults. The causes of dental fear can be classified into two categories, i.e. internal and external factors. The former are personality traits and therefore not di-

rectly related to treatment, whereas the external factors are a person's own experiences acquired during treatment or from the environment [1].

Dental fear can be treated as a resultant of individual personality traits and patients' own experiences acquired in the doctor's office [2]. Anxiety with external signs (verbalization, inappropriate behavior, etc.) is the most „infectious” feeling, easily spread to other people from the closest environment, regardless of age [3].

It has been found that the development of fear in children is highly influenced by behavior and attitude towards dental treatment displayed by the parents. Parents are the ones who shape the child's attitude. In a sense, they can „implant” exemplary and positive behavior, or contribute to child's negative behavior, and thus to the wrong attitude towards treatment and consequently a lack of trust in the dentist [4, 5].

The main source of dental anxiety in adults is the fear of pain, secondly fear of injury, and fear of the unknown [6]. Very similar correlations can be observed in children and adolescents, with the fear of pain during „drilling” and tooth extraction being the most dominant [7]. The very thought of pain elicits additional anxiety responses, which can be intensified in the waiting room as a result of characteristic odors and sounds of machines and dental equipment. Memories of dental treatment associated with pain make a young patient „expect” the pain during subsequent visits, which can result in dental phobia [8]. Many years of research have shown that dental anxiety before a visit to the dentist has a negative impact as it worsens mood, causes discomfort and undermines the effectiveness of the therapy. All this leads to avoidance of visits and deterioration of oral hygiene [9].

Children are very important and special dental patients. Due to high prevalence of dental decay and its negative consequences for health, early detection and treatment are essential. Oral health status of children at the age of 10–12 is of utmost significance, as it is when milk teeth are exchanged for the permanent ones. The condition of the masticatory system in the population of these patients will also have a huge impact on health-promoting attitudes in the future. Since the oral cavity is an integral part of the body, its health has an enormous effect on the entire body. Pathological processes in the mouth may contribute to the development of other systemic diseases, and can also impede the treatment of the existing disease [10].

In everyday clinical practice dentists frequently evaluate anxiety in young patients using their own subjective judgment and deal with children in accordance with their knowledge, experience and intuition [1]. The severity of anxiety can be

assessed with appropriate psychometric scales, which are standardized self-report questionnaires, such as the Corah Dental Anxiety Scale (CDAS) designed primarily for adults under dental care and Children Fear Survey Schedule-Dental Subscale (CFSS-DS) dedicated to children. Universal research tools that can be used in other medical specialties, e.g. the Inventory of State and Trait Anxiety – STAI, are rarely applied. Single studies indicate the possibility to measure the severity of anxiety with simple one-dimensional scales used to assess pain, which, like anxiety, is a subjective sensation. The scales include the Visual Analogue Scale (VAS) and the Numerical Rating Scale (NRS). The studies focused on patients waiting for surgery and confirmed high utility of one-dimensional scales to assess anxiety in patients [11, 12].

In conclusion, it should be noted that the administration of a relatively easy-to-use research tool in dental practice would greatly facilitate the work of the dentist, help to improve comfort of treated patients, and thus improve the quality and effectiveness of therapy. Therefore, the aim of the current study was to evaluate the usefulness of the NRS to assess the level of anxiety in children aged 10–15 years before dental procedures.

Materials and Methods

A total of 250 respondents aged 10–15 years took part in the designed survey. The study was conducted in a non-public health care facility located in Katowice, Panewnicka 168 Street. The survey was completely anonymous. Each respondent was informed that participation in the study was voluntary and that privacy protection was guaranteed. The questionnaire forms were distributed by nursing staff, whose involvement in the research process was limited to the necessary minimum, i.e. clarifying the objective of the survey, instructing on form completion and distributing questionnaire forms among children after obtaining written consent from parents or legal guardians.

The questionnaire consisted of six independent modules that sought to identify the following variables: (1) Imprint – characteristics of the respondents, (2) Level of anxiety and attitudes towards dental care – rated using the Corah Dental Anxiety Scale (CDAS), (3) Trust in a dentist – rated using the Dental Belief Survey (DBS), (4) Dental anxiety grading – rated using the Children fear Survey Schedule-Dental Subscale (CFSS-DS) and (5) Subjective level of anxiety – rated using the NRS.

Questions in this part of the survey focused on demographic data, including gender, age, school class, place of residence, knowledge of dental is-

sues, i.e. which dental visit it was, how many dental clinics the patient was treated in, how often the patient visited these clinics, contacts with a dentist at school, as well as oral hygiene, i.e. frequency of brushing the teeth.

The CDAS questionnaire assessing the level of anxiety and attitude towards dental treatment consists of four questions with a choice of responses categorized in a 5-point scale. The overall score is in the range of 4–20 points. The severity of anxiety is categorized as follows: 4 points – patients with no fear, 5–8 with some fear, 9–12 with anxious-avoidant attitudes, 13–16 with a high intensity of anxiety without somatic complaints, and 17–20 with a very high intensity of anxiety and somatic symptoms. The CDAS was introduced by Corah in 1969 [13] as a tool to measure dental anxiety, allowing for a reliable assessment of the traits studied. It has been widely used by other authors [1].

The DBS questionnaire evaluates trust in a dentist. In this survey, respondents express their opinion on 16 statements by ticking the one that reflects own beliefs of study participants. Possible answers, i.e. I completely agree, I mostly agree, I partially agree, I agree to a lesser extent, and I do not agree are bulleted on a 5-point scale, respectively. The interpretation scale is as follows: up to 40 points – patients with a lot of trust, 41–60 – moderate trust and 61–80 – little trust in a dentist. The DBS is a standardized tool, allowing for a reliable assessment of the studied traits. It has been commonly applied by other authors [14].

The CFSS-DS children's fear grading questionnaire consists of fifteen items regarding the sources of anxiety and a coded 5-point intensity scale, where respondents choose an opinion identical to their own or the closest one. Referring to the potential sources of anxiety listed, the respondent can select one of five statements: I'm not afraid at all, I'm afraid a little bit, I'm scared a little, I'm afraid, I am very much afraid. The CFSS-DS has a total score range between 15 and 75, where 15 points suggests no fear, 16–20 minor fear, 31–45 considerable fear, 46–60 high fear and 61–75 extremely high fear. The CFSS-DS is the most commonly used scale to measure the level of anxiety in children and allows for a reliable assessment of the characteristics studied [1, 15].

The NRS, an 11-point easy to use scale with a score range from 0 to 10, provides the respondent with the opportunity to decide freely on the appropriate answer regarding subjectively perceived and assessed fear intensity. The respondent is asked to select a point on the scale that reflects the level of anxiety immediately before dental procedure. The study participants were informed about the assigned point values of „0” and „10”.

There are different ways to interpret the results using this tool. In the current study, the method of analysis was based on a 5-grade key, in which 0 value indicates no fear at all, 1–3 slight anxiety, 4–6 moderate levels of anxiety, 7–9 strong anxiety, and 10 very strong anxiety.

Statistical Analysis

The statistical analysis was performed using Microsoft Excel computer software and STATISTICA program by StatSoft. Data was analyzed using U Mann-Whitney test. The p value of 0.05 was considered statistically significant. Spearman test was used to assess correlations. The value of $p < 0.05$ and $p < 0.001$ were assumed to be statistically significant.

Results

Description

A total of 250 respondents, children aged 10–15 years, were recruited to the study. Most study participants (45%) were at the age of 11–12. The smallest group consisted of 14 years old children (11%), whereas 10-, 13- and 15-year-old children accounted for 15%, 15% and 14%, respectively. Girls predominated (56%) vs. boys (44%).

Most children were from urban areas (87%), 12% of children were from town and only 1% from rural areas. The vast majority of children (64%) declared to brush their teeth twice a day. Every fourth child admitted to brush the teeth three times a day. Fewer patients brush their teeth once a day (10%) or rarely (1%). For nearly all respondents (97%), the visit during which they were surveyed was a subsequent visit to the dentist. Only for 3% of the study participants it was the first dental visit.

Most children visit the dentist when they have to (40%), fewer (27%) visit the dentist regularly, and 13% often, but irregularly. One fifth of the surveyed children rarely visit the dentist (20%). The majority of children (44%) visit the same dentist, 11% see different dentists, another 11% declare having no knowledge of the choice of dentist. In more than 34% of patients, parents decide about the choice and children admit they are excluded from the decision. The vast majority of children (63%) claim that „there is no dentist” in their school.

One third (32%) of the respondents stated that they „never met the dentist there”, meaning that as many as 95% of the children use dental care outside school. Only in 5% of the children dentists had some contact with children at school (2% systematically, 3% occasionally).

The CDAS questionnaire showed that 41% of the respondents feel anxious. Fewer children were characterized by anxious-avoidance attitude (29%), and one in five children (20%) was classified as showing strong fear. There were by far fewer children with an extreme attitude towards dental treatment. Only 4% of the patients were identified as not feeling any fear, and 6% as experiencing very high anxiety with somatic symptoms. Overall, extreme attitudes were presented by 10% of the respondents.

The DBS measurement showed that the majority of children (64%) had high trust in the dentist, 35% admitted having moderate trust, and only 1% expressed little confidence in the dentist. The CFSS-DS questionnaire showed that more than half of the surveyed children suffered slight anxiety (56%), every fourth child was considerably anxious (25%) and 14% of the respondents experienced high anxiety.

The minority in the study group included children reacting extremely emotionally to dental visit, i.e. patients free of anxiety (4%) and those with very high fear (approximately 1%). Measurement of the intensity of anxiety using the NRS showed that most (40%) children were characterized by low anxiety. Slightly fewer children described their level of anxiety as moderate (30%). A considerably smaller group of respondents identified their anxiety as strong (18%). The extreme values, i.e. lack of anxiety or very strong fear were chosen by 6% of the respondents, respectively.

Analysis

A very strong correlation was found between the results of the scales used to assess the severity of dental fear, i.e. NRS and CDAS (R Spearman = 0.751; $p < 0.001$).

A very strong correlation was found between the results of the NRS and CFSS-DS, i.e. the questionnaire that is typically dedicated to evaluate dental anxiety in children (R Spearman = 0.767; $p < 0.001$).

There was a moderate correlation found between the results of the NRS assessing the severity of anxiety and the DBS investigating trust in a dentist (R Spearman = 0.400; $p < 0.001$).

A strong correlation was shown between the results of the CDAS for assessing dental anxiety and the results of the CFSS-DS, typically used to assess dental anxiety in children (R Spearman = 0.700; $p < 0.001$).

A moderately correlation was found between the results of the CDAS evaluating dental anxiety and the DBS investigating the degree of trust in a dentist (R Spearman = 0.379; $p < 0.001$). The lower the trust, the higher the level of anxiety.

There was also a moderately correlation between the results of the CFSS-DS and the DBS (R Spearman = 0.413; $p < 0.001$). The lower the trust towards the dentist, the higher the level of perceived anxiety.

A weak correlation was found between the age of surveyed children and the results of the NRS (R Spearman = -0.287; $p < 0.001$), CDAS (R Spearman = -0.259; $p < 0.001$) and CFSS-DS (R Spearman = -0.266; $p < 0.001$). Younger children had a higher intensity of anxiety than older children. The age of children had a marginal effect on the trust in dentist measured by the DBS (R Spearman = -0.167; $p < 0.05$), although older children showed a slightly higher trust than younger children. Gender did not significantly differentiate patients in terms of the level of anxiety measured by the CDAS, CFSS-DS and NRS. At the same time, girls showed a significantly higher degree of trust in a dentist than boys (Table 1).

Discussion

Dental anxiety affects all age groups, both children and adults. However, children and adolescents constitute an exceptional group of patients with complex emotions that may sometimes get out of control and turn into dental phobia. In contrast, as indicated by clinical experience, the effectiveness of each treatment depends on the relationship, which may evolve on the basis of patients' trust in the dentist.

Each patient, especially a child, in the dental office expects not only empathy, but also encouragement and support that will help overcome even minor anxiety. The severity of dental fear in children is the result of both the specific characteristics of the child's personality as well as personal experience in the dental office. It is assumed that anxiety elicits in childhood, then peaks in adulthood and decreases in elderhood [16]. Locker et al. [17] demonstrated that a negative experience with a dentist in childhood increased the risk of dental anxiety in adulthood 22 times. All that suggests the need for research into negative emotions that accompany patients during dental treatment.

Evaluation of the intensity of dental anxiety combined with appropriate procedures aimed to minimize such anxiety nowadays becomes increasingly important. Young patients aged 10–15 expect their dentist to have not only practical and theoretical knowledge in the field of dentistry, but also psychosocial knowledge and psychological approach. The dentist assessing the level of anxiety in children before treatment is able to avoid the trauma caused by dental treatment. Data on the

Table 1. The relationship between the NRS, CDAS, CFSS-DS, DBS and the age and gender

Variable	<i>n</i>	<i>p</i> value	Coefficient	Statistical test
Age & NRS	250	<0.001	<i>r</i> = 0.287	R Spearman
Age & CDAS	250	<0.001	<i>r</i> = 0.259	R Spearman
Age & CFSS-DS	250	<0.001	<i>r</i> = -0.266	R Spearman
Age & DBS	250	<0.05	<i>r</i> = -0.167	R Spearman
Gender & CDAS	250	0.85	<i>Z</i> = 0.180	U Mann-Whitney Test
Gender & CFSS-DS	250	0.41	<i>Z</i> = -0.810	U Mann-Whitney Test
Gender & NRS	250	0.49	<i>Z</i> = 0.643	U Mann-Whitney Test
Gender & DBS	250	<0.05	<i>Z</i> = 1.901	U Mann-Whitney Test
NRS & CDAS	250	<0.001	<i>r</i> = 0.751	R Spearman
NRS & CFSS-DS	250	<0.001	<i>r</i> = 0.767	R Spearman
NRS & DBS	250	<0.001	<i>r</i> = 0.400	R Spearman
CDAS & CFSS-DS	250	<0.001	<i>r</i> = 0.700	R Spearman
CDAS & DBS	250	<0.001	<i>r</i> = 0.379	R Spearman
CFSS-DS & DBS	250	<0.001	<i>r</i> = 0.413	R Spearman

occurrence of a high level of anxiety in children is divergent and fits in a fairly wide range (from 6.5 to 20%) [18, 19].

In the current study, 250 children were involved, at the age ranging from 10 to 15 years. As shown by the CDAS, 46% of the respondents were characterized by a low level of anxiety, which is consistent with other studies, in which 45% of children between 12 to 15 years of age described their level of anxiety as low or moderate, and 10% as high. Thus, it seems that the low level of anxiety in these children should not be a barrier to the regular treatment. Young patients who represented the anxious-avoidant group accounted for 29% of the respondents. This group requires a very skillful approach during each dental visit. Improper approach of the dentist towards these patients may have a negative impact on their emotional state, shifting them to the group of patients with a high level of anxiety, who avoid dental treatment. The study shows that children with high levels of anxiety, who scored more than 13 points accounted for 26% of the surveyed population. These findings are largely consistent with the existing literature [20].

Gender of the respondents had no major impact on the attitude towards dental care. Girls' ratings on the CDAS did not differ significantly from those of boys, which is consistent with literature data [21]. However, there is a noticeable relationship suggesting that the older the child, the less severe the anxiety. The correlation is weak, but significant. The literature data on this issue is extremely divergent. Paryab and Hosseinbor [22] found that younger children (6–7 years old) had a higher level of anxiety as compared to their old-

er peers, which is consistent with our current findings. On the other hand, Lee et al. [24] and Rantavuori et al. [23] reported completely opposite observations. Presumably, the divergence may have been caused by cultural differences, oral hygiene or a different model of health care – such arguments have also been stated by other authors.

The CFSS-DS questionnaire is dedicated to the assessment of children's anxiety. Results of the CFSS-DS scale are encoded in a 5 point Likert scale. Caprioglio et al. [25] and Coric et al. [21] proposed their own interpretation of the CFSS-DS score, where the value > 39 points meant marked anxiety. Caprioglio et al. [25] investigated the population of 8-year-old children. Those who scored more than 39 points in the study accounted for 26% of the respondents, the result being comparable to our current findings (24%). Other researchers using the CFSS-DS questionnaire in children at the age of 7–15 years showed that 11% of respondents declared marked anxiety (more than 39 points on CFSS-DS), 14% were on the „border” of fear (CFSS-DS 32–38 points), while 75% of respondents showed low level or lack of anxiety. In their study, there were no further significant differences between girls and boys. A high correlation between the results of CDAS and CFSS-DS was also shown [21], which is consistent with the results of our study.

When considering dental anxiety, trust in the dentist and the whole process of dental treatment should be taken into account. A study by Olszewska [26], among others, showed such a correlation, i.e. patients reporting high levels of anxiety were characterized by low trust in the dentist. We found that children have trust in their dentist.

As many as 64% of the respondents reported such trust, 35% reported moderate trust, and only 1% admitted having little trust in the dentist. Moreover, a moderately strong correlation was revealed between the level of anxiety measured by the NRS, CDAS and CFSS-DS and the degree of trust measured with the DBS questionnaire.

A tendency has been noted that anxiety decreases with increasing trust in the dentist. In a study carried among Lithuanian children (aged 12–15 years) Recine [27] observed that both age and gender determine the level of anxiety (younger children and girls showed higher levels of anxiety). However, contrary to our observations trust in the dentist was not a factor that differentiated between boys and girls.

The analysis of the causes of anxiety in dentistry has shown that its main source is the fear of pain during treatment procedures. Exploring that issue, Borowy et al. [28] came to the conclusion that the most unpleasant experience during dental visit was the fear of pain during treatment, as this feeling was reported by 48.9% of respondents. In a study by Wilk-Sieczak and Sozańska [29], 17.5% of young respondents mentioned pain as the cause of their last visit to the dentist. Frequently parents who experienced high levels of dental anxiety in the past want to save their children from pain and unpleasant sensations accompanying treatment. In consequence dental treatment comes too late, i.e. when the toothache gets stronger. Such behavior may lead to avoidance of preventive dental visits by young patients in the future. Pain should not be the main reason for dental visit. Young patients should use dental services regularly, every six months, in order to avoid pain and consequently anxiety and fear of treatment.

Psychometric questionnaires such as CDAS and CFSS-DS applied in the current study are not used in everyday dental practice as they are time consuming and laborious. Firstly, young patients have to fill in a questionnaire (not always straight-

forward), then the dentist should assess and analyze them. Clinical practice suggests that most dentists cannot afford to perform complex surveys for various reasons. Thus, in modern dentistry there is an increasing need for simple and easy to use tools for reliable and quick assessment of anxiety – especially in children. Numerical scales have long been used to determine the severity of pain in medical fields such as anesthesiology, oncology and dentistry [12, 30]. The VAS and NRS are both used for clinical purposes, as well as in the implementation of research plans. In dentistry, the NRS has been used for assessing the effectiveness of intraligamentary anesthesia [31]. The VAS, which is an analogous scale to the NRS, was used in the study by Meisel-Denes et al. [30] to assess pain and anxiety during nitrous oxide sedation. In the present study, the scale was also used to evaluate dental anxiety before dental treatment, revealing slight anxiety in 40% of the study children, moderate in 30% and strong and very strong in 25%. Comparison and statistical analysis of the results obtained with the CDAS, CFSS-DS questionnaires and the NRS showed a high correlation, which may lead to the conclusion that these tools offer similar assessment of anxiety. Each of these methods revealed a small percentage of extreme attitudes, i.e. children completely devoid of anxiety and children scared with anxiety before dental visit. The largest group consisted of children who were “slightly anxious”. It should be noted that the attitudes characterized by high and moderate anxiety were fairly common.

These observations suggest that a significant percentage of children require relevant non-pharmacological or pharmacological „interventions” in order to ensure appropriate treatment standards. However, the level of anxiety has to be determined first. The results of this study indicate that the NRS is a relatively simple, easy to use tool in the assessment of dental anxiety in 10–15 years old children before procedures.

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