Scientific Article

Validation of a Child Dental Pain Questionnaire Instrument for the Self-reporting of Toothache in Children

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Abstract: ***Purpose:*** *The purpose of the present study was to test the reliability and validity of a novel child dental pain questionnaire (child-DPQ).* ***Methods:*** *The child-DPQ is structured to measure toothache using 3 subscales: (1) prevalence; (2) severity; and (3) impact on daily life. It was tested on 174 8- and 9-year-old children. The instrument's reliability was assessed by testing internal and test-retest consistency, and its validity was assessed by testing construct and discriminant validity. Specifically, discriminant validity was tested by comparing the mean scores of 2 clinical groups: (1) absent or treated caries (N=110); and (2) untreated caries (N=64).* ***Results:*** *Internal consistency was confirmed by a Cronbach´s alpha coefficient of 0.93. Test-retest reliability was found to be highly reproducible (intraclass correlation coefficient=0.99). The construct validity was satisfactory, demonstrating highly significant correlations among the global indicator, the total score, and subscale scores (P<.001). The child-DPQ score was able to discriminate between the 2 clinical groups (P<.001).* ***Conclusion:*** *The present study provides evidence for the reliability and validity of the child dental pain questionnaire in assessing the impact of toothache on the daily life of children. (Pediatr Dent 2011;33:228-32) Received November 3, 2009 / Last Revision May 31, 2010 / Accepted July 2, 2010*

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Oral health is an essential component of general health with great impact on quality of life,[1] especially regarding the ability to tolerate chewing and the occurrence of pain and discomfort.[2] Despite major improvements in oral health care in recent decades, many people around the world are still affected by oral diseases such as caries, especially the poorest segments of the global population.[1] In Brazil, oral disease in children is common.[3] There is a specific and direct relationship between pain and oral health. Of the many impacts of toothache, untreated decayed teeth have among the most serious repercussions on quality of life.[4-7]

Studies have suggested that evaluating the effect of oral disease on quality of life can be useful in planning oral health care service delivery.[8] The first study reporting the construction and validation of a questionnaire for measuring the impact of children's oral health on their quality of life, however, was published as recently as 2002.[9] Most instruments related to oral health contain items that focus on dental pain, but they generally do not distinguish the impact of dental pain from the impact of other orofacial pain. Furthermore, they are longer than the instrument developed in the present investigation.

Health-related indicators of quality of life are generally assessed with questionnaires. The responses are organized in numerical scales to measure to what extent people's lives are affected by health conditions. Therefore, an important contribution of these instruments is the ability to determine the health-related quality of life of people and communities by statistical means.[10]

Adults and children have different perceptions about the impact of health problems on quality of life, as children have a singular vision related to their physical and emotional stages of development.[11] Pain is, by definition, a subjective phenomenon that must be measured by self-report.[12] There is a lack of instruments specifically designed for the assessment of self-reported children's dental pain and its impact on daily life, and even fewer instruments that have been formally validated for use on children of a specific age group. Instruments designed specifically for children allow for the accurate measurement of the impact of oral health on their quality of life.[9]

The purpose of the present study was to test the validity and reliability of a self-report questionnaire on dental pain with 8- and 9-year-old children.

Methods

The child dental pain questionnaire. The child dental pain questionnaire (**child-DPQ**) was based on a questionnaire developed by Shepherd et al., in 1999.[13] The questionnaire is

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organized into 3 subscales: (1) prevalence; (2) severity; and (3) impact of toothache on children's quality of life (Table 1). It is composed of 6 questions, with 2 items in each subscale. The total score and scores for each subscale on the child-DPQ can be calculated. The final score may either be 0 or range from 6 to 15, with lower scores indicating better oral health status. If the child answers "no" on the first item, all other items are considered "not applicable" (score=0). If the child answers "yes" on the first item, the subsequent items are then answered, with a minimum score of 1 on each item. The questionnaire was administered in interview form to reduce the possible number of subjects lost to follow-up that might be expected in self-directed forms.

A question was included for the measurement of global well-being to test the relationship between oral health and general health (ie, the extent to which toothache affects general well-being compared to other known types of debilitating pain).[14,15] Dental pain was compared to the most prevalent pain in other parts of the body (eg, headache, abdominal pain, chest pain, back pain, and pain from trauma/injury). The child was asked if she or he had ever felt pain elsewhere in the body and to clarify the type. The question on global well-being was: "Was this pain less than, more than, or equal to dental pain?" The values of the responses were recorded as: 0 (not applicable); 1 (less painful); 2 (equally painful); and 3 (more painful).

Table 1. STRUCTURE OF CHILD-DPQ QUESTIONS AND ANSWERS

Subscales	Items	Answers
Prevalence	1. Have you ever had a toothache?	0=no 1=yes
	2. When was your last toothache?	0=not applicable 1=more than a month 2=last month 3=today
Severity	3. Did you cry at the worst moment of a toothache?	0=not applicable 1=no 2=yes
	4. How was it when the pain was at its worst? (face scale)	0=not applicable 1=very mild pain 2=mild pain 3=moderate pain 4=severe pain 5=very severe pain
	5. Were you awakened at night by the pain?	0=not applicable 1=no 2=yes
Impact	6. Were you unable to carry out any normal tasks because of toothache?	0=not applicable 1=no 2=yes

Table 2. RELIABILITY STATISTICS FOR TOTAL SCALE AND SUBSCALES (N=174)

Variable	No. of items	Cronbach's alpha	Intraclass correlation coefficient (95% confidence interval)*
Total scale	**6**	**0.93**	**0.99 (0.99-0.99)**
Prevalence subscale	2	0.82	0.99 (0.99-0.99)
Severity subscale	2	0.81	0.99 (0.99-0.99)
Impact subscale	2	0.92	0.99 (0.99-0.99)

* 2-way random effects model; $P<.001$ for all values.

Evaluation of reliability and validity of the child-DPQ. The present study was carried out in the city of Belo Horizonte, which is the capital of the state of Minas Gerais, Brazil (population 2.4 million). A total of 180 8- and 9-year-old children were included in the sample. All were asked to answer the questionnaires. The participants answered the child-DPQ twice, with a 14-day interval between sessions to assess test-retest reliability. Efforts were made to reduce the number of questionnaires lost to follow-up. However, 6 children did not return for the second interview, yielding an overall response rate of approximately 97%, or 174 of 180 children. Gender and type of school were equally represented (87 females and 87 males; 87 public schools and 87 private schools). Only children intellectually and physically capable of responding to the questionnaire were included in the study. Parents and guardians gave informed consent for their children to participate. This study received approval from the Ethics Committee of the Universidade Federal de Minas Gerais, Belo Horizonte.

All participants were submitted to dental examinations and interviews. These procedures were carried out by a single pediatric dentist who took part in a training and calibration exercise (intraexaminer agreement; mean Kappa value=0.90) for the diagnosis of dental caries using color transparencies. Twenty children took part in the calibration process and were excluded from the main sample. The criteria of the World Health Organization were used for diagnosing the different stages of dental caries (defined as carious lesions involving dentin or pulp and root remnants).[16] After the interview, the standardized clinical examination (using gauze, cotton rolls, mouth mirror, and equipment for cross-infection control) was performed at the child's school under an artificial head lamp (Peltz, Tikka XP, Crolles, France), with the child's head resting on a cushion on the examiner's lap.[17]

Statistical analysis. For the analysis, the children were divided into 2 clinical groups: (1) absent or treated caries; and (2) untreated caries. SPSS software 15.0. (SPSS Inc, Chicago, Ill) was used to analyze data in a coded database.

Descriptive analyses (mean and standard deviation) were initially performed to generate the total and individual subscale scores on the child-DPQ for each participant. Internal consistency was evaluated using Cronbach's alpha coefficient and inter-item and total-item correlation coefficients. Test-retest reliability was assessed using the intraclass correlation coefficient (ICC) with a 2-way random effect model for the child-DPQ score using the data from the 174 children.[18]

To test the construct validity of the child-DPQ, associations among the scores of each subscale and the overall well-being indicator were performed using Spearman's correlation coefficient. This instrument focuses on the impact on

capacity to perform daily physical and social activities.[8] Discriminant validity was tested by comparing the mean scores on the child-DPQ of the 2 clinical groups. As the scores of the child-DPQ did not exhibit a normal distribution, the nonparametric Mann-Whitney test was used to evaluate differences in the mean scores of both groups. A value of $P \leq .05$ was considered significant.

Results

Ninety 8-year-old and 84 9-year-old children were interviewed. A total of 64 (~37%) had untreated caries and 110 (~63%) were either free of caries or had treated caries. The scores on the total scale may either be zero or range from 6 to 15, with a mean value of 4.43 (±5.35 SD). Among the 174 children, approximately 43% (N=74) reported experience of a toothache and 58% reported no past history of dental pain (score=0); regarding severity, approximately 10% (N=17) reported minimal pain, 16% (N=28) reported mild pain, and 17% (N=29) reported severe pain. Moreover, approximately 10% (N=17) reported a low impact, 22% (N=39) reported a moderate impact, and 10% (N=18) reported a high impact of pain.

Reliability, construct validity, and discriminant validity. Cronbach's alpha coefficient and test-retest reliability values for the total scale and subscales are displayed in Table 2. The results demonstrate excellent internal consistency. The correlations between the assessment of overall well-being and total scale and subscale scores achieved high values and were statistically significant (Table 3). Additionally, there were significant differences in mean scores for the total scale and prevalence, severity, and impact subscales between the children who were either free of caries or had caries treated (Group 1) and those with untreated caries (Group 2) (Table 4).

Discussion

Data collection was carried out in both public and private schools to represent the perspectives of children from different economic classes.[19] The questionnaire was administered to children in the classroom in interview form. As a technique for data collection, an interview offers certain advantages for working with children, such as an opportunity to obtain more precise information and immediately detect discrepancies. It also allows the interviewer to assess whether the questionnaire is being understood. In population studies with a large sample size, it is more practical to use self-administered questionnaires.[18] A recent study involving 144 9- to 16-year-old children demonstrated that the self-administered child oral impacts on daily performances questionnaire obtained the same results as the original interviewer-administered mode, thereby reducing the administrative burden.[20]

Test-retest reliability for the total scale was confirmed with the ICC (0.99). Cronbach's alpha coefficient was 0.93 for the total scale, indicating satisfactory internal consistency (values ≥0.5 are considered acceptable). For the subscales, the values of this coefficient ranged from 0.81 for pain severity to 0.92 for pain impact. Results from validation studies of other instruments that assess oral-health-related quality of life in Brazil are noted for reference, but they have no direct comparative value, as they do not specifically address toothache. Goursand et al., reported an alpha value of 0.52 for the oral symptoms subscale of the child perceptions questionnaire (in which toothache is included) among 11- to 14-year-olds.[18] In another study involving 8- to 10-year-olds, the alpha value was 0.63 (confidence interval=0.60-0.89) on the same subscale.[21] In a study carried out in the United States for the assessment of health-related quality of life among 2-month to 5-year-old children, the alpha value was 0.80 for items related to pain and discomfort.[22] The values found in the present study were more reliable and consistent than the aforementioned studies.

The present study demonstrates that the child-DPQ discriminates between 2 clinical groups of children. Individuals with untreated caries had higher mean total and subscale scores than those who were free of caries or who had treated caries ($P<.05$). Other studies have demonstrated that the average number of decayed and filled tooth surfaces and the number of missing primary teeth due to caries are higher in children who report that pain has kept them awake at night.[23] Children with decayed teeth clearly experience toothache more often than children without decayed teeth.[24]

The indicator of overall well-being was satisfactorily correlated with all subscale scores. Other authors who studied

Table 3. CONSTRUCT VALIDITY: RANK CORRELATIONS BETWEEN TOTAL SCALE, SUBSCALE SCORES, AND OVERALL WELL-BEING (N=174)

	Overall well-being question	
	r*	*P*-value
Total scale	0.403	<.001
Prevalence subscale	0.458	<.001
Severity subscale	0.376	<.001
Impact subscale	0.414	<.001

* Spearman's correlation coefficient.

Table 4. DISCRIMINANT VALIDITY: TOTAL AND SUBSCALE SCORES FOR GROUP 1 (ABSENT OR TREATED CARIES) AND GROUP 2 (UNTREATED CARIES)

	Group 1 (N=110)		Group 2 (N=64)		*P*-value*
	Mean±(SD)	Median	Mean±(SD)	Median	
Total scale	1.56±3.77	0.00	9.36±3.89	10.00	<.001
Prevalence subscale	0.40±0.09	0.00	2.25±0.13	2.00	<.001
Severity subscale	0.70±0.17	0.00	4.42±0.26	4.00	<.001
Impact subscale	0.46±0.11	0.00	2.69±0.15	3.00	<.001

* Mann-Whitney U test.

a similar age group reported that the oral symptoms subscale was significantly correlated with a global indicator of children's well-being.[21]

It is not possible to directly compare these results with those from the few studies that specifically measure toothache, as those instruments are not standardized, test different populations, and analyze different age groups.[22,24,25] The toddler child quality of life questionnaire is a parent-administered measure and was tested in a convenience sample involving 2- to 6-year-olds in Ohio.[22] The internal consistency of the dental discomfort questionnaire was assessed using a sample of 30- to 59-month-olds in the Netherlands.[24] Validation of the dental pain questionnaire was performed with adults who were at least 18-years-old in London, England.[25] Jamieson et al., examined the clinical validity and reliability of dental self-report items in a national child nutrition survey in New Zealand using a sample similar to the children in the present study. Only 1 item of their instrument, however, was related to pain.[23] A number of authors have adapted questions from the 1999 questionnaire of Shepherd et al., or developed similar questions of their own, underscoring the importance of this instrument.[5,11,13,26-28] None of those studies, however, make reference to validity. The present study represents a first step toward a valid toothache self-report reference measure, which may facilitate comparability with future studies.

Pain is necessarily a subjective experience. Therefore, self-reported pain measures are the gold standard for assessing children's perceptual or psychological experiences of pain.[24] To maximize results, self-report items should be brief, easy to interpret, and easily incorporated into clinical routines. Moreover, they should not require complex training for their use and must demonstrate appropriate validity and reliability.[23] The child-DPQ meets these requirements and offers the advantage of being shorter than the major child health and quality of life instruments containing items on pain.

Dental pain is a major consequence of oral conditions such as untreated dental caries, which is a common disease in countries such as Brazil.[29] It should be measured with specific instruments and highlighted in quality of life assessments. The child-DPQ should be considered for use in future studies on pediatric dental caries, pain, or treatment outcomes. Epidemiological studies on the effects of toothache on daily family, social, physical, and psychological functioning in different age groups of children—including investigations addressing explanatory factors and involving larger samples—are needed to further establish dental pain as a major public health problem.

Conclusions

1. This study provides evidence that recommends the child-DPQ as a reliable and valid instrument to assess the impact of toothaches on the daily lives of 8- and 9-year-old children.
2. It should be further tested in other populations with known differences in their sociocultural backgrounds.

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