Evaluation of Toothache Severity in Children Using a Visual Analogue Scale of Faces

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Abstract

Purpose: Pain is a frequent symptom of oral disease. It is difficult to measure, however, due to its subjectivity, especially among children. The purpose of this study was to verify the utility and applicability of a visual analogue scale of faces (VASOF), adapted for 8- to 9-year-olds, to measure the severity of toothaches.

Methods: A cross-sectional study was undertaken, which included 601 boys and girls randomly selected from state and private schools in the city of Belo Horizonte, Minas Gerais, Brazil. They were interviewed and clinically examined, and a VASOF was applied.

Results: The VASOF's application revealed a high percentage of intense/very intense pain in the sample (39%). The presence of this pain intensity was accompanied by a high incidence of children who cried, were awakened by the pain, and were unable to carry out habitual tasks. Furthermore, this severe pain was strongly associated with less-privileged economic groups and the presence of oral pathology ($P \leq .05$). The scale was well understood by children, independent of gender or economic group.

Conclusions: A VASOF was found to be capable of measuring toothache severity experienced by school-age children. (*Pediatr Dent.* 2004;26:485-491)

KEYWORDS: TOOTHACHE, VISUAL ANALOGUE SCALE, SEVERITY, CHILDREN

Pain is a frequent symptom of oral disease[1,2] and often the most important motivation for seeking dental treatment.[3] Therefore, dentists frequently encounter clinical situations in which pain is present.

This and other symptoms, such as discomfort, fatigue, malaise, weakness, anxiety, and fear, are common experiences but generally difficult to define. This is due to the subjective nature of pain symptoms. The clinician is entirely dependent on the patient to try to quantify the extent of the problem.[4]

The majority of toothache studies have been undertaken with adults and, frequently, the elderly[1, 5-10] rather than children. This is probably due to the greater ability of adults to communicate and provide valid data.

The epidemiological studies of pain, its characteristics, and related factors in children are few in number and have only been published recently.[11-15] This paucity is probably related to the difficulty children have in verbalizing their pain.[4]

Pain measurement in children has depended on parents, caregivers, and/or health professionals in an indirect form, such as verbal reporting or observations of behaviors that suggest pain (vocalization, facial expression, and body movements). Indirect reporting can introduce bias into studies on pain. Pain evaluation based on observations by third parties must be interpreted with caution, whereas self reporting (made by the child in pain), in spite of its limitations, is considered more valuable. Questions formulated for children, however, must be different from those directed toward adults[13,16,17] to take into account emotional, cognitive, and language development factors.

Thus, the way in which children and adolescents are approached, using appropriate language for each age group, is important for the researcher. For children to understand and be capable of offering an objective response it is necessary to understand the pain language used by children.[4]

Studies have evaluated quantitative and qualitative descriptions of pain by children. They show that:

1. children can do this in a clear way, regardless of significant age differences;
2. even those as young as 4 to 6 are able to quantify these symptoms as well as adults;

3. it is possible to identify frequently used words by age, race, or gender, in sensory, affective, evaluative areas, and in the localization and intensity of pain.[18,19]

Young patients often have difficulty understanding concepts of pain, due to the incipient development of cognition and language.[20] As a result, there is an increasing amount of research aimed at discovering the best method of measuring subjective sensations, such as pain, and to define methodologies and instruments that can be applied to different age groups.

Verbal reports in the form of questionnaires and interviews have been used frequently to measure pain attributes, such as prevalence, impact, etc.[11] Other techniques using nonverbal reporting such as the visual analogue scale (VAS) have been tested in research principally to measure pain intensity.[20-23] This technique uses images that represent specific feelings and can take the form of faces, numbers, colors, cups containing different volumes of liquid, tokens, thermometers, and others. These types of scales can be understood by younger preschool-age children.[4]

This study's objective was to verify the utility and applicability of an adapted visual analogue scale of faces (VASOF) to measure toothache severity among children.

Methods

Study Location, Sample, and Criteria Selection

This cross-sectional study took place in the city of Belo Horizonte (BH), Brazil and included a sample of 601 boys and girls, each 8 or 9 years old at the time of data collection, who were enrolled in BH schools. The sample size was calculated via the estimate of proportions formula[24] using an α value of 0.05, a detectable error of 4%, and the prevalence data of toothaches in 8-year-old children from a study by Shepherd et al (1999).[10]

The eligibility criteria for children were:
1. the child was present on the day of data collection;
2. informed consent to participate was obtained from a parent/guardian;
3. the child was in an adequate physical, psychological, and mental condition to participate in the examination.

Sample Randomization

To select a representative sample of children of this age group, the number of schools in each administrative area (AR) was determined and a random selection was made. In all, 9 schools participated—1 from each AR—composed of 2 private, 3 municipal, and 4 state schools. From these, children who fulfilled the inclusion criteria were randomly selected among classes and attendance list names.

Consent and Response Rate

In addition to giving informed consent, parents or guardians responded to a questionnaire—the Criteria for Brazilian Economic Classification,[25] from which 3 economic groups were created, according to average income: upper, middle, and lower

In all, 751 questionnaires were distributed, of which 662 were completed, for a response rate of 88%. Of this number, 61 children were excluded due to:
1. absence on data collection days;
2. illness; or
3. a new birthday during interview periods, which placed them outside the age group of the study.

Data Collection

Through interviews with the children, this study collected a range of toothache-related pain data, such as prevalence, pain characteristics (location, cause, frequency, severity), impact on the child and family, remedial actions taken, and general information. In addition, the relationship between pain experience (for all children who reported pain in the last month) and oral health status were evaluated via clinical examination. The data collection instruments were tested and improved in 2 pilot studies. All interviews and examinations were undertaken by a single researcher.

The clinical examinations were standardized (κ=81% for intraexaminer calibration), and undertaken using recommended infection control procedures.[26] To evaluate the oral health status, a definitive criteria list was adopted[27] representing signs of disease or nonpathological conditions associated with pain symptoms and which are common among children in the age group involved. The pathological conditions noted included alterations in teeth, periodontium, occlusion, and mucosa. In addition, nonpathological painful conditions were registered that were limited to the dentition.

The impact on the child was measured based on replies to 2 basic questions:
1. "Were you awakened by the pain?"
2. "Were you unable to carry out any habitual task because of the pain?"

Severity of pain was measured based on replies to 2 questions:
1. "Did you cry when you had the toothache?"
2. "How was it when the pain was at its worst?"

This last question evaluated the VASOF, which contained drawings of boys and girls of both African American and Caucasian races, adapted from the study by Beltrame et al (Figure 1).[4] Each set consisted of 5 drawings with different expressions, ranging from a child smiling to a child crying, corresponding to variables 1 to 5, which signified:
1. very light pain, without provoking a disagreeable sensation;
2. light pain, lightly disagreeable sensation;
3. moderate pain, disagreeable sensation;
4. intense pain, very disagreeable sensation;
5. excruciating or unsupportable pain, the most disagreeable sensation.

The scale was shown to each child with the following questions according to their abilty to understand:
1. "Point to how you felt when the tooth hurt most," or
2. "When you were in the most pain, which of these pictures did you look like?"

The corresponding image chosen by the child was noted in the data form.

The VASOF was tested twice, with a 1-week interval on the same 20 children who participated in the second pilot study. Its reliability was very high (κ=90%).

Children requiring treatment were guaranteed care at health centers and emergency clinics in the area, with the backing of the local health department. This study was approved by the relevant ethical committee for human research of the Federal University of Minas Gerais.

Statistical Analysis

SPSS version 8.0 (Statistical Package for Social Science, Chicago, Ill) was used for processing the data and performing the chi-square test of association and comparison of proportions.

Results

Interviewed were 328/601 (55%) girls and 273/601 (45%) boys, among whom 62% (375/601) were 8 and 38% (226/601) were 9 years old. Separate analysis of the 2 age groups was not considered necessary. Of the total, 11% (65/601) considered upper class, 29% (173/601) middle class, and 60% (363/601) lower class.

The toothache prevalence was 46% (276/601), of whom 34% (94/276) reported pain in the 4 weeks prior to the interview. Approximately one third of the children with pain cried (91/276), and 39% (109/276) classified their pain as "intense" or "very intense" (scores=4 and 5 on a scale of 1-5). Furthermore, 19% (51/276) classified their pain as "moderate" (score=3) and 42% (116/276) as "very light" and "light" (scores=1 and 2).

Among children with a toothache (276), 157 were girls and 119 boys. It was observed that 34% (52/157) of the girls and 33% (39/119) of the boys cried. This difference was not statistically significant difference (P=.893).

Within each level of VASOF scores, there was no statistically significant difference between sexes. For boys and girls, the most prevalent scores were "very light"/"light" and "intense"/"very intense" pain. The percentages were similar but statistically different from the percentage of scores with "moderate pain" (P<.001), whose occurrence was less frequent.

A comparison among economic groups showed that severe pain (scores=4 and 5) occurred more frequently among lower class children, while less severe pain (scores=1 and 2) was more common among upper class children. This difference was statistically significant (P=.002).

Comparing the children's responses to the VASOF and occurrence of crying due to pain (Table 1), a statistically significant association was observed (P<.001). Among whose who cried, there was a predominance of scores of higher intensity. For those who did not cry, there was a higher percentage of low scores. The differences were statistically significant. Cry/not cry proportions within each level of VASOF scores can be seen in Table 1.
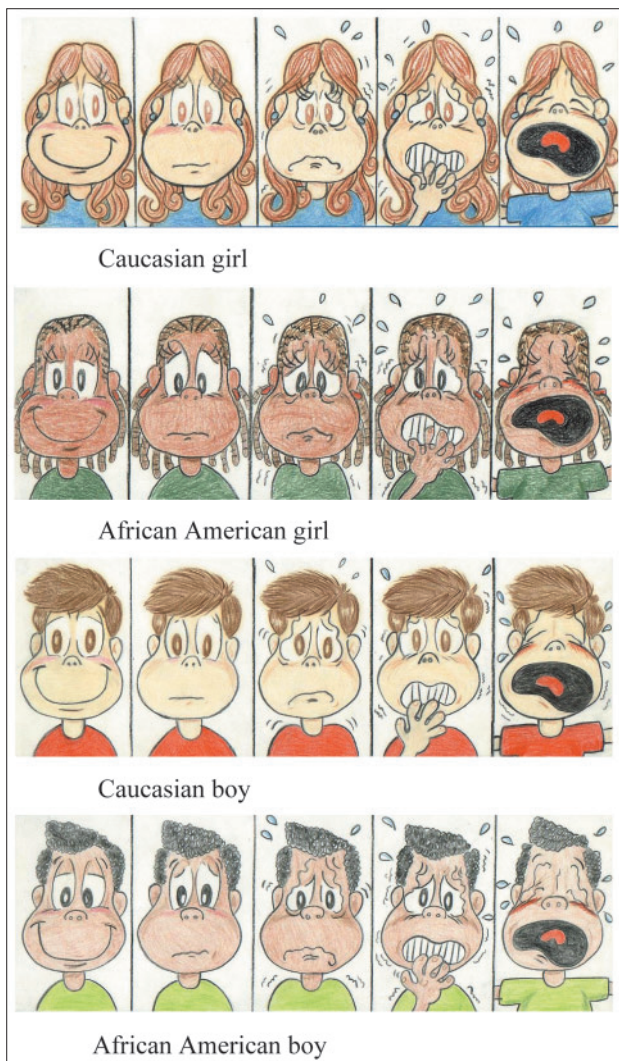

Figure 1. Visual analogue scale of faces (VASOF).

A statistically significant association was found between the fact that the child was awakened by pain and the pain's intensity or magnitude (P<.001; Table 2).

Similarly, there was a statistically significant association between pain intensity and the child's inability to carry out a habitual activity (P<.001; Table 3). The greater the intensity of pain, the greater the percentage of children who were unable to carry out some activities.

Comparing the clinical examination and the intensity scores of the VASOF (Table 4), the children's choice of lower scores ("very light"/"light" pain) was significantly associated only with nonpathological conditions or alterations in the dentition (P<.001). The predominance of problems was shared between the dentition and teeth for the children who chose scores of higher intensity ("intense"/"very intense" pain) could be observed that the presence of alterations were statistically significantly higher when compared to the absence of such alterations (P<.001) only for the two problems. The intermediate score did not

Table 1. Frequency of Child Crying in Relation to Pain Intensity, as Measured by Visual Analogue Scale of Faces (VASOF)

How did you feel when the pain was at its worst? (VASOF)*	Did you cry when the pain was at its worst?				P†
	Yes N (%)	No N (%)	Do not remember N (%)	Total N (%)	
Very light/ light pain	9 (10)	105 (57)	2 (100)	116 (42)	<.001
Moderate pain	17 (19)	34 (19)	-	51 (19)	.984
Intense/very intense pain	65 (71)	44 (24)	-	109 (39)	<.001
Total	91 (100)	183 (100)	2 (100)	276 (100)	
P‡	<.001	<.001	-		

*Test of association between variables: chi-square=67.25, P<.001 (without considering the response "Do not remember").
†Chi-square test for the comparison of proportions between yes/no responses (without considering the response "Do not remember").
‡Chi-square test for the comparison of proportions within yes/no responses.

Table 2. Absolute and Relative Frequencies of Pain Intensity, Measured by the Visual Analogue Scale of Faces (VASOF), Considering the Child was Awakened by Pain

How did you feel when the pain was at its worst? (VASOF)*	Did you wake up because of the pain?			P†
	Yes N (%)	No N (%)	Total N (%)	
Very light/ light pain	23 (24)	93 (52)	116 (42)	.000
Moderate pain	22 (23)	29 (16)	51 (19)	.172
Intense/very intense pain	51 (53)	57 (32)	108 (39)	.001
Total	96 (100)	179 (100)	275‡ (100)	
P§	<.001	<.001		

*Test of association between variables: chi-square=20.34, P<.001.
†Chi-square test for the comparison of proportions between yes/no responses.
‡Total differs from the number of children who felt pain (276) because one child did not remember.
§Chi-square test for the comparison of proportions within yes/no responses.

show a statistically significant relation with alterations observed during clinical examination (Table 4).

Discussion

Despite the limitations of a cross-sectional study to evaluate the applicability of a measurement instrument—such as the VASOF, in which memory bias is certainly found—the present study was undertaken to minimize these problems and be representative of the study population.

One of the techniques used to reach this objective was the selection of a representative sample of children of this age group from BH. Control of the documentation related to informed consent and the classification of economic groups was necessary—especially when questionnaires were sent home—to avoid a low level of return, and sample loss.[28] The response rate (88%) is satisfactory when compared to similar studies using questionnaires.[7,9-12,14]

Other sampling included:
1. schools randomly selected from official Local and State Education Department of Minas Gerais lists;
2. classes randomly selected from data provided by the school's head teacher;
3. children randomly selected from attendance lists including student names and dates of birth.

The sample distribution was proportional to the actual distribution of schools in the city, which was possible via stratification by ARs.[29] Thus, the distribution of state or municipal and private schools throughout the 9 administrative regions of BH was reflected in the sample.

To reduce the memory bias typical of cross-sectional studies, the relationship between pain intensity and oral health status was assessed in only the 94 children who had pain within the previous month. For those in pain more than 1 month prior to examination, the probability increased that the oral condition had been resolved through dental treatment or had deteriorated with progression of the disease. The period of 1 month was considered insufficient for these changes to occur in a way significant enough to influence the results.

Table 3. Frequency of Pain Intensity, Measured by Visual Analogue Scale of Faces (VASOF), in Relation to Habitual Activities					
Were you unable to carry out some activity due to the pain?*	How did you feel when the pain was at its worst? (VASOF)				P†
	Very light/ light pain N (%)	Moderate pain N (%)	Intense/ very intense pain N (%)	Total N (%)	
Yes	52 (45)	39 (76)	85 (78)	176 (64)	<.001
What activity?					
Sleeping	19 (28)	22 (32)	50 (35)	91 (33)	.591
Eating	22 (32)	20 (29)	27 (19)	69 (25)	.066
Chewing on affected side	17 (25)	8 (12)	21 (15)	46 (16)	.077
Going to school	3 (4)	5 (7)	13 (9)	21 (7)	.481
Studying	2 (3)	3 (4)	7 (5)	12 (4)	-
Cleaning teeth	1 (2)	4 (6)	5 (3)	10 (4)	-
Playing	1 (2)	4 (6)	4 (3)	9 (3)	-
Other	3 (4)	3 (4)	16 (11)	22 (8)	.106
No	64 (55)	12 (24)	24 (22)	100 (36)	<.001
Total	116 (100)	51 (100)	109 (100)	276 (100)	
P‡	.115	<.001	<.001		
P§	<.001	<.001	<.001		

*Test of association between variables (only with yes/no responses): chi-square=31.10, P<.001.
†Chi-square test for comparison of proportions, between levels of VASOP scores, for yes/no responses and for the activities.
‡P value of chi-square test for comparison of proportions, within each level of scores, for yes/no responses.
§P value of chi-square test for comparison of proportions, within each level of scores, relative to the activities.

Previous studies used similar methods (ie, projective test) and had the same objective as this study (ie, data collection on prevalence, severity, and impact of toothache)[11-13]. In 2 of those studies,[11, 13] the scale was presented in the form of numbers for the child to visualize. In the study by Beltrame et al,[4] images of characters from popular comic books were used to make the scale more attractive to children.

Recent studies undertaken in the area of medicine have highlighted success in the use of the VASOF to measure pain among African-American children, confirming the relevance of applying this instrument to other ethnic groups.[30-31] This reinforces the possible advantages of subdividing the scale by race.

The children were able to discriminate across the VASOF scale. They had no difficulty identifying the intermediate images, resulting in distribution of scores. This suggests that the instrument was an acceptable toothache scale and the number of scores (5) was sufficient, in contrast to that observed by Hunter et al,[22] who used a set of 7 images.

The intense/very intense distribution of scores among children with toothaches was similar to that of other studies undertaken on children in which a VAS was also used. In one study,[11] pain was considered intense by 40% of children who experienced recent pain. In a second study,[13] intense pain was the level most frequently reported (38%). A third study[12] showed greater percentages of lower scores, with a classification of pain as:

1. light (36% of children);
2. discomfort (38%);
3. excruciating (26%).

While differences between sexes in response to pain have been noted by some investigators,[10,12,16] the data presented here suggest that for children of this age group the pain severity is independent of sex. Apparently, few differences exist between girls and boys regarding the interpretation of the facial expressions in the VASOF.

The finding of greater toothache severity among children of lower-economic groups is reflected in the literature.[32-34] Therefore, it appears that VASOF is valid across economic groups.

The VASOF appears to be a valid and reliable instrument for quantifing pain experienced by children. It is easily administered and understood by the children, making it an attractive instrument in clinical practice.[4,20-22]

Conclusions

Based on this study's results, the following conclusions can be made:

1. Eight- to 9-year-old children in BH, experienced a high prevalence of toothache, and the pain was of considerable severity—with significant percentages reporting "intense" or "very intense" pain (39%) that makes children cry (33%).
2. The VASOF scale's internal validity, as well as its

Clinical examination result		How did you feel when the pain was at its worst? (VASOF) N (%)			Total N (%)
		Very light/ light pain	Moderate pain	Intense/ very intense pain	
Alteration in dentition*	Yes	35 (81)	11 (65)	29 (85)	75 (80)
	No	8 (19)	6 (35)	5 (15)	19 (20)
	P	.000	.086	.000	
Alteration in teeth†	Yes	25 (58)	11 (65)	29 (85)	65 (69)
	No	18 (42)	6 (35)	5 (15)	29 (31)
	P	.131	.086	.000	
Alteration in periodontium‡	Yes	5 (12)	5 (29)	16 (47)	26 (28)
	No	38 (88)	12 (71)	18 (53)	68 (72)
	P	.000	.016	.628	
Alteration in occlusion§	Yes	20 (46)	6 (35)	13 (38)	39 (41)
	No	23 (54)	11 (65)	21 (62)	55 (59)
	P	.518	.086	.052	
Alteration in mucosa††	Yes	8 (19)	-	2 (6)	10 (11)
	No	35 (81)	17 (100)	32 (94)	84 (89)
	P	<.001	<.001	<.001	

Table 4. Frequency of Pain Intensity, Measured by Visual Analogue Scale of Faces (VASOF), in Relation to the Clinical Examination Result

*Physiological mobility or tooth in process of eruption.
†Acute and chronic carious lesions involving dentin, and/or pulp, retained root, trauma, inadequate restoration, disturbance in dentin formation with loss of hard tissue, pathological mobility, tooth out of position in dental arch, tooth missing.
‡Bleeding, calculus, change in gingival morphology.
§Crowding, midline shift, posterior crossbite, bruxism, overjet, anterior crossbite, overbite, anterior openbite, edge-to-edge bite (excluding those under active treatment).
††Acute inflammatory conditions, fistula, mucous lesions.

psychometric capacity to describe children's feelings, was demonstrated through statistically significant associations between the highest level of pain and:
a. presence of crying by these children;
b. impact on their lives;
c. their poor state of oral health.

Acknowledgements

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