Original Article

Evaluation of Pain in Children Using Animated Emoji Scale: A Novel Self-Reporting Pain Assessment Tool

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Abstract

Background: Pain perception of children in dental clinics is difficult to assess. Conventionally, visual analog scale (VAS) and Wong–Baker Faces Pain Scale (WBFPS) are used as self-reporting pain assessment tools in children. Novel animated emoji scale (AES) is recently introduced for pain assessment in pediatric patients. The aim of this study was to evaluate the pain using the novel AES in 3–14-year-old children and to compare it with frequently used VAS and WBFPS. **Methods:** A cross-sectional study recruited 266 patients in the 3–14-year age group with their first dental visit. Participants were divided into three groups on the basis of age: Group I–3–6 years, Group II–7–10 years, and Group III–11–14 years, and the pain was recorded using self-reporting tools, i.e., VAS, WBFPS, and recently introduced AES after the completion of dental procedure. Data were evaluated using the Pearson correlation test and Chi-square test. **Results:** A strong positive correlation among VAS, WBFPS, and AES in all the groups was observed ($P < 0.05$). AES was preferred more over VAS and WBFPS in all the groups for pain assessment ($P < 0.001$). **Conclusions:** AES as a self-reporting tool can be used frequently to assess the pain in children. AES was preferred over VAS and WBFPS due to its ease of understanding by children.

Keywords: Animated emoji scale, first dental visit, self-reporting tool, visual analog scale

Introduction

Appropriate pain and anxiety control are important considerations in pediatric dentistry. Studies have demonstrated that clinicians often underestimate the child's pain. What may children describe as painful may seem merely unpleasant to the dental practitioner.[1] Pain remains the most common complaint presented to dentists, and it becomes the most crucial factor, with its intensity being one of the main factors which influence a person's sense of well-being.[2] The International Association for the Study of Pain has defined pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."[3] Wong *et al*. stated that the pain sensation is not necessarily dependent on tissue damage. Since adults can elaborate the severity and nature of pain, it becomes much more challenging in children. Perceptions of pain in children are difficult to interpret, as they cannot adequately verbalize the pain and vary with his/her cognitive, emotional, and social experience.[4] In dentistry, it is initiated by conditioned stimuli such as the sound of the drill or the use of the needle during local anesthesia. Furthermore, dental fear, anxiety, and dental behavioral management problems have always been major obstacles faced by pediatric dentists toward various treatments.[5] Therefore, the etiology of fear and anxiety is mostly been due to painful dental treatments. Moreover, fear and anxiety can also increase the amount of perceived pain.[6]

Pain assessment in children in the dental clinic can be done by observer rating on pain assessment scale or by the child itself using self-reporting tool. Pain assessment through various pain rating scales helps us to accurately assess the extent of pain and enables us to understand the appropriate measures required for the management of pain.[7] Till date, there are various

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methods of assessing dental pain in young children. It should be clinically easy to use, appealing, with limited cognitive and linguistic skills to children.[8] Hence, in the present study, we used a newly developed novel animated emoji scale (AES) to assess the pain in the age group of 3–14 years and compared it with conventional pain scales, i.e., visual analog scale (VAS) and Wong–Baker Faces Pain Scale (WBFPS).

Aim and objective

The aim of this study was to evaluate the pain using the novel AES in 3–14-year-old children and to compare it with more frequently used VAS and WBFPS.

Methods

Estimation of the sample size was done using the G*Power software (version 3.1.9.2; Heinrich-Heine-University, Dusseldorf, Germany); http://www.gpower.hhu.de/). Based on the previous research,[9] considering the VAS and WBFPS analysis of variance with $P = 0.005$ for each scale among the age groups, with power of the study at 80%, and margin of error at 5%, the minimum sample size was estimated to be 184.

A cross-sectional study was carried out in 266 children aged between 3 and 14 years who attended the Department of Pedodontics and Preventive Dentistry, UCMS and GTB Hospital, Dilshad Garden, Delhi, India.

The sample selection was done randomly and divided into three groups on the basis of age: Group I–3–6 years, Group II–7–10 years, and Group III–11–14 years.

The inclusion criteria were all healthy children of age group of 3–14 years, patients requiring procedures with any forms of local anesthesia such as extraction, or any endodontic therapy such as pulpotomy, pulpectomy, and root canal treatment, and only those who had first dental visit. The exclusion criteria were physically disabled children, medically compromised children, patients who did not give the assent, and parents who did not give informed consent. Informed consent was obtained from parents before enrolment of their children in this study and confidentiality of recorded data was maintained.

Each child's dental pain was measured using three different scales: VAS, WBFPS, and AES after the completion of the procedure. The order of presentation of the scales to each child was kept sequentially from VAS to WBFPS to AES; all the scales were presented to each patient by a single investigator, and the pain scores were immediately recorded to ensure reliability and avoid bias.

A VAS is a self-reporting instrument that measures a characteristic or attitude. It is believed to range across a continuum of values and cannot easily be directly measured. It is a simple assessment tool consisting of a 10-cm line with 0 on one end, representing no pain, and 10 on the other, representing the worst pain. It is determined by measuring in millimeters from the left-hand end of the line to the point that the patient marks. Children were asked to make a mark on the line that represented their level of perceived pain intensity, and the score was recorded after the treatment [Figure 1].[10]

The Wong–Baker Faces Pain Rating Scale is a pain scale that was developed by Donna Wong and Connie Baker. There are six faces in WBFPS showing different feelings ranging from "no hurt/hurts, a little bit/hurts, a little more/hurts, even more/hurts, a whole lot to hurts worst (most positive to most negative feelings)". The children had to choose the face that best described how they felt [Figure 2].[9]

Now, the novel AES was used to assess the pain intensity. A Japanese telecom company employee, Shigetaka Kurita, developed "picture word" or "image character" called Emoji in 1997. It was taken as a mechanism or tool through which it portrays emotions and context that abolish the language barrier. It depicts six animated emoji faces showing various facial expressions ranging from happy/laughing to unhappy/sad or crying. The child was asked to choose one of these animated emojis on the electronic display/paper that best matched their feelings at that moment [Figure 3].

Once all the three scales were presented to the child and pain scores were collected, the information of the most preferred scale of the children was also recorded. Data collection was done over a period of 10-month study while patients were sitting on a dental chair after the treatment procedure. The data collected were tabulated and subjected to statistical analyses using SPSS statistical software package, version 20.0. Descriptive analysis of all the explanatory and outcome parameters was performed using frequency and proportions for categorical variables, and using mean and standard deviation for continuous variables. Independent Student's *t*-test and Kruskal–Wallis test were used to compare the mean age and the mean pain rating scores, respectively, of different rating scales between sexes. Pearson correlation test was used to correlate the pain rating scores between different rating scales. Chi-square test was used to compare the preference/liking of the different pain rating scales between sexes. The level of significance was set at $P < 0.05$.

Results

The study included 266 participants with 219 males and 47 females who visited the dentist for the first time. Participants were divided into three groups based on age: Group 1 (3–6 years) with 48 children, Group 2 (7–10 years) with 155 children, and Group 3 (11–14 years) with 63 children, respectively. The mean age of the participants in Group 1, 2, and 3 was 5.50 ± 0.65, 8.47 ± 1.13, and 12.46 ± 1.11, respectively. The distribution of participants by age and gender was compared using independent Student's *t*-test, and there was no statistically significant difference in the mean age between males and females in each group was found [*t* values and *P* shown in Table 1]. The pain scores were recorded from each scale in all the participants. The mean of pain scores for VAS, WBFPS, and AES in all the groups was compared using Kruskal–Wallis test, and a significant difference was found with P, as shown in Table 2.

Correlation measurement for animated emoji scale versus visual analog scale, animated emoji scale versus Wong–Baker Faces Pain Scale, and visual analog scale versus Wong–Baker Faces Pain Scale using Pearson correlation test

Correlation between different pain rating scales was measured using Pearson correlation test for AES versus VAS, AES versus WBFPS, and VAS versus WBFPS in Group 1, Group 2, and Group 3 individually. A strong positive correlation was found between AES and VAS (Pearson correlation coefficient in Group 1, 2, and 3 was 0.486, 0.740, and 0.323, respectively). AES was also strongly positively correlated with WBFPS with the Pearson coefficient values of 0.626, 0.800, and 0.558 in Group 1, 2, and 3, respectively. VAS and WBFPS were also showed a strong positive correlation with Pearson coefficient values of 0.721, 0.793, and 0.754 in Group 1, 2, and 3, respectively [Table 3]. Hence, it can be inferred that AES showed the pain measurement similar to the VAS and WBFPS and can be frequently used for measuring the pain in children with the age of 3–14 years.

Table 1: Distribution of samples by age and gender using Independent Student's *t*-test

Groups	Gender	*n* (participants)	Mean age±SD	*t*	*P*
Group 1	Male	40	5.50±0.67	0.000	1.000
	Female	8	5.50±0.53		
	Total	48	5.50±0.65		
Group 2	Male	126	8.48±1.12	0.301	0.764
	Female	29	8.41±1.18		
	Total	155	8.47±1.13		
Group 3	Male	53	12.55±1.08	1.430	0.158
	Female	10	12.00±1.24		
	Total	63	12.46±1.11		

SD: Standard deviation

Table 2: Comparison of mean pain scores between different groups among the study subjects using Kruskal-Wallis test

Scales	Mean±SD			*P*
	Group 1	Group 2	Group 3	
VAS	4.17±3.07	3.16±3.05	2.22±2.34	<0.05*
WBFPS	3.79±3.20	2.62±2.93	1.87±2.02	<0.05*
AES	2.33±2.83	1.86±2.54	1.27±1.79	<0.05*

*Significant value. SD: Standard deviation, VAS: Visual analog scale, WBFPS: Wong-Baker Faces Pain Scale, AES: Animated emoji scale

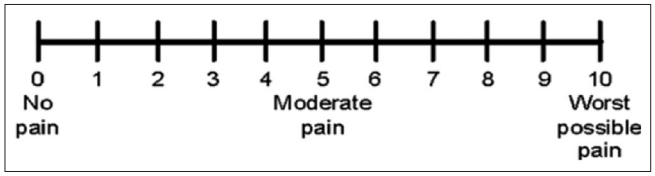

Figure 1: Visual analog scale.

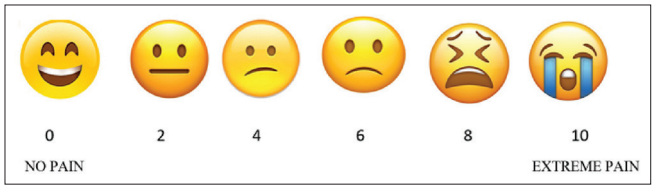

Figure 3: Novel animated emoji scale.

Liking/preferences among animated emoji scale, Wong–Baker Faces Pain Scale, and visual analog scale (age and gender wise)

In this study, the distribution of liking/preference was measured by Chi-square test. On comparing the preference among AES, WBFPS, and VAS, AES was most preferred in all the groups. In Group 1, 2, and 3, 95.8%, 92.3%, and 66.7%, respectively, of the participants preferred AES [Figure 4]. The order of liking/preference of different pain rating scales among children in all groups was AES>>WBFPS > VAS. On comparing the distribution of preference among pain scales between the groups using Chi-square test, a statistically significant difference was found ($P < 0.0001$). On comparing the preference of different pain rating scales between males and females in each group, no statistically significant difference was observed [Table 4]. Hence, it is indicated by these results that the AES is more preferred than VAS and WBFPS for the pain measurement by children in the age group of 3–14 years.

Discussion

Interpretation of sensation such as pain is difficult to convey, especially in children. Appropriate pain management depends

Figure 2: Wong–Baker Faces Pain Scale.

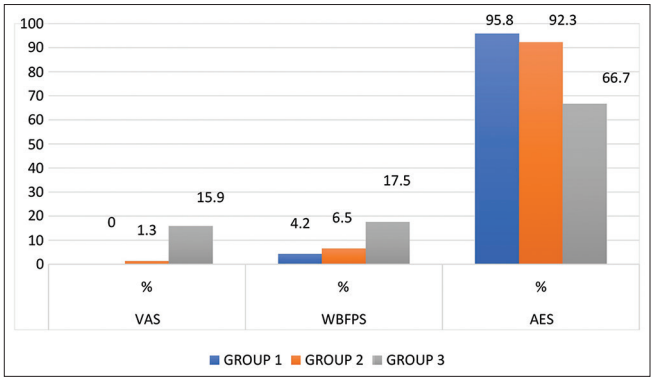

Figure 4: Patients pain scale preference among visual analog scale, Wong–Baker Faces Pain Scale, and animated emoji scale.

Table 3: Correlations between different pain rating scales using Pearson correlation test

	Group 1		Group 2		Group 3	
	Pearson correlation coefficient	*P*	Pearson correlation coefficient	*P*	Pearson correlation coefficient	*P*
AES versus VAS	0.486	0.0001*	0.740	0.0001*	0.323	0.01*
AES versus WBFPS	0.626	0.0001*	0.800	0.0001*	0.558	0.0001*
VAS versus WBFPS	0.721	0.0001*	0.793	0.0001*	0.754	0.0001*

*Significant value. VAS: Visual analog scale, WBFPS: Wong-Baker Faces Pain Scale, AES: Animated emoji scale

Table 4: Age- and gender-wise comparison of liking/preference for different pain rating scales among study subjects using Chi-square test

Variables	Category	Groups	VAS, *n* (%)	WBFPS, *n* (%)	AES, *n* (%)	χ^2	*P*
Age group (years)	3-6	1	0	2 (4.2)	46 (95.8)	35.318	0.0001*
	7-10	2	2 (1.3)	10 (6.5)	143 (92.3)		
	11-14	3	10 (15.9)	11 (17.5)	42 (66.7)		
Gender	Male	1	0	2 (5.0)	38 (95.0)	0.000	1.000
	Female		0	0	8 (100)		
	Male	2	1 (0.8)	7 (5.6)	118 (93.7)	2.267	0.322
	Female		1 (3.4)	3 (10.3)	25 (86.2)		
	Male	3	9 (17.0)	10 (18.9)	34 (64.2)	0.954	0.621
	Female		1 (10.0)	1 (10.0)	8 (80.0)		

*Significant value

on the ability to precisely evaluate the level of pain using a valid tool. Self-reporting is known to be the main method of evaluation when pain is predominantly an emotional experience, and often children aged 3–4 years and older can give accurate assessments of pain severity using proper pain assessment tools since patient self-reporting is recognized as a gold standard for pain measurement and these methods should be easy and straightforward to use.[11] Right interpretation of the children's pain and its management helps to develop a positive relationship with the pediatric dentist.[12] Conventionally, VAS and WBFPS are being frequently used to assess the pain in children as a self-report tool.[10] A novel pain assessment tool AES was used in our study to assess pain in 266 children, and we compared it with frequently used VAS and WBFPS, and it was found that AES showed a strong correlation with both of these conventional self-reporting pain assessment tools and is almost equally effective in the children of the age group of 3–14 years. Furthermore, a significant relationship was found among all the scales used. These findings were consistent with most studies that consider these measures to be accurate and suitable for use in clinical practice.[10-13] They further agree with Hjermstad *et al*., who observed in a systematic review that most of the articles analyzed were generally consistent on the association between scales.[14]

In response to unpleasant stimuli, cognitive development begins early in childhood, which can also be inferred by our study where there is a decrease in the mean pain score by children with increasing age.[15] The mean pain score for WBFPS and AES in our study was found similar to the mean pain score of (Facial Image Scale [FIS]) and (novel Animated Visual Facial Pain/Anxiety Rating Scale), respectively, after the extraction procedure, in the study by Prasad *et al*.[15] When age increases, the threshold for pain drops and the self-management of pain increases.[10] The decreasing trend of mean pain score with increasing age was found in our study which was similar to findings of Khatri *et al*., which supported the result of our study.[9] In our study, the mean pain score for AES was found almost twice as compared to that of a similar pain rating scale used, i.e., Chhota Bheem–Chutki Scale in the study by Prasad *et al*.[15] where it was recorded after extraction.

The choice or preference of the scale depends on the individual interest of the patients, and also on the potential of the patients to explain the feeling of pain they are undergoing.[16] In this study, majority of children in each group preferred the AES with a significant relationship with the age. 95.8% in Group 1, 92.3% in Group 2, and 66.7% in Group 3 preferred the AES with the highest preference percentage in the lower age group, i.e., 3–6 years. In the VAS scale, there was more difficulty in the understanding by the children and it took more time to explain it to them, which was comparatively less for the WBFPS and there was no difficulty observed in recording the AES by the children at all. Potential explanations for these preference results may be the widespread use of emojis in digital gadgets these days and cognitive development of children. Hence, it may be assumed that due to more familiarity of the children with emojis themselves, they have chosen AES over others. In the study conducted by Setty *et al*, when these scales were used to assess anxiety in the children of age group 4-14 years, the majority preferred AES over VPT and FIS, supporting the result of our study.[8]

Nonetheless, additional studies incorporating larger samples are indispensable in justifying the finding of this study. The

result of this study suggested that children were able to express their pain experience more easily through AES. Thus, it is suggested that AES should be used as a pain assessment tool because AES was proven valid in assessing pain.

Conclusions

AES showed a strong positive correlation with both conventional self-reporting pain assessment tools and is almost equally effective for measuring pain in the children of 3–14-year age group. AES was preferred significantly more in all the age groups, with maximum preference in the youngest age group as it was found to be easier to understand.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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