

## Comparison of Two Standard Scales for Pain Perception during Local Anesthetic Injection in Children

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### Abstract

**Background and Aim:** Local anesthetic injection is among the most anxiety-provoking procedures in children. Some scales are currently available to quantify the level of pain experienced based on the child's behavior. The purpose of this study was to compare two commonly used pain scales.

**Materials and Methods:** This split-mouth study was conducted on 49 healthy children aged 3.5 to 9 years who needed dental treatment of bilateral primary molars under local anesthesia. The patients were randomly assigned to two groups. The level of anxiety was recorded at baseline and during local anesthetic injection according to the face-legs-activity-cry-consolability (FLACC) and the sound-eyes-motor (SEM) scales in the two groups. Then, the level of pain experienced by the child was determined according to the visual analog scale (VAS). Data were analyzed by SPSS version 20 using Mann-Whitney and Wilcoxon tests at 0.05 level of significance.

**Results:** There was no statistically significant difference in pain score based on VAS after local anesthetic injection in the first and second sessions between the SEM (P=0.877) and FLACC (P=1.00) groups.

**Conclusion:** This study showed that there was no difference between the SEM and FLACC scales regarding pain perception during local anesthetic injection in children, and some parameters of the two scales that were measured in the children's face area were behaviors that the children exhibited during local anesthetic injection.

**Key Words:** Pediatric Dentistry, Visual Analog Scale, Pain, Child Behavior

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### Introduction

Dental fear, behavior prediction, and response to the therapeutic process by children are important challenges encountered by many pediatric dentists (1,2). Pediatric dentists try to decrease dental fear and anxiety of children with the aid of existing behavioral control techniques (3). Fear can sometimes increase the feeling of pain and disrupt the process of

treatment (4). The level of fear depends on personality characteristics, gender, parental anxiety level, dental trauma history, and irregular dental visit patterns. The children may cry, scream, or moan, or show anxiety, and pain (5). Several scales have been introduced to assess the child's behavior during dental treatment. The facial image scale is an indicator that is most commonly used to assess the level

of pain perceived by a child but it is dependent on the response of the child. Other child behavior rating scales include the face-legs-activity-cry-consolability (FLACC) scale, the sound-eyes-motor (SEM) scale, the Frankl scale, the modified Frankl scale, and the Venham behavior scale, which measure the child's fear, anxiety and pain levels based on the child's behavior during dental treatment, and are independent of the response of the child (6).

Due to the subjective nature of pain, children would not be able to correctly express the intensity of pain they experience. It is difficult to determine whether behavior of the child is due to fear and anxiety, or due to pain. However, the success of dental treatment depends on painless provision of treatment and if the child's behavior during treatment is solely due to fear and anxiety, the pediatric dentist can calm the child and continue treatment by using behavioral control techniques. When the child has pain, the behavioral control techniques would not be generally effective and would discourage the dentist.

This study used two well-known scales of SEM and FLACC to assess the level of fear, anxiety, and pain in children. These two scales are among the most reliable tools that complement each other; for example, the SEM scale evaluates the motor and posture of eyes, and the FLACC scale evaluates the motor of legs. The purpose of this study was to compare FLACC and SEM scales for children's pain perception and behavioral feedback during local anesthetic injection, which is the strongest painful stimulus. (7)

### Materials and Methods

This split-mouth study was approved by the Ethics Committee of School of Dentistry of Kerman University of Medical Sciences (Ethical Code: IR.KMU.REC.1398.323).

The study was conducted at the Pediatric Dentistry Department of School of Dentistry of Kerman University of Medical Sciences, Iran, by a senior post-graduate student of pediatric dentistry on 49 children aged 3.5 to 9 years. Informed consent was obtained from all parents.

The inclusion criteria were physical and mental health, living with both parents, no dental treatment experience, and having at least two identical teeth in one jaw requiring local anesthetic injection.

The exclusion criteria were history of mental or any degree of cognitive impairment, not understanding explanations and commands, history of physical disorder, history of chronic illness, inflammation at the injection site, history of systemic diseases, allergy to local anesthetics, hospitalization experience, administration of analgesics, sedatives and medications altering the perception of pain, living with a single parent, history of dental treatment, any abscess or fistula in the buccal or palatal region adjacent to the injection site, high gag reflex, and poor or no cooperation of the child (Frankl scale rating I).

A total of 49 patients were selected according to the eligibility criteria. In this study, the perceived pain intensity was measured objectively based on the child's behavior and movements during local anesthetic injection.

In this study, 49 children were randomly divided into two groups for the two scales, and each child was compared with him/herself during two sessions of similar treatment. The clinical phases in each group were as follows:

- 1- Recording the demographic information
- 2- Measuring and recording the child's anxiety and fear levels based on one of the two scales when positioning the child on dental chair
- 3- Application of 20% benzocaine (Dentonics, Inc., Monroe, NC, USA) for topical anesthesia at the injection site by the tell, show, do technique for 1 min using an applicator to minimize the needle insertion pain and then administration of local anesthetic injection by using 2% lidocaine plus 1:80,000 epinephrine (Persocaine, Darupakhsh Co., Tehran, Iran) for 1 min, while talking with the child and distracting him during local anesthetic injection.
- 4- Rating the child's level of anxiety and pain during local anesthetic injection based on one of the two scales by video taping the child's behavior and then viewing the episode by a postgraduate student of pediatric dentistry and

a pediatric dentist and rating the child's behavior.

5- Measuring the level of pain perceived by the child after the end of injection using a visual analog scale (VAS) based on the choice of one of the six emojis by the child.

6- Repeating local anesthetic injection for the other quadrant of the same jaw in the second session, with a time interval of 1 week after the first session, according to the above-mentioned five steps in both groups.

The reason for scheduling the second session was to have experience of local anesthetic injection in the first session, which can have an impact on both the scales measured by the postgraduate student of pediatric dentistry and the level of pain determined by the child using a VAS.

#### *Statistical analysis:*

Data were analyzed by SPSS version 20 and reported as mean, standard deviation, frequency, and percentage. Since data were not normally distributed, nonparametric tests were applied. Comparison of the mean FLACC scale scores with the mean VAS scores, as well as the mean SEM scale scores with the mean VAS scores was performed by the Mann-Whitney test. The Wilcoxon test was used to compare the frequency of responses to each question in the FLACC scale with the SEM scale before and during injection. The test-retest method was performed to calculate the reliability of the questionnaires (consistency of measurements over time) in the first and second sessions. The significance level was set at 0.05.

### **Results**

The study consisted of 49 children ranging in age from 3.5 to 9 years with a mean age of  $5.8 \pm 1.9$  years, including 28 (57.1%) girls and 21 (42.9%) boys, 25 (51.0%) in the SEM group and 24 (49.0%) in the FLACC group.

As shown in Table 1, there was no statistically significant difference in pain score based on VAS after local anesthetic injection in the first and second sessions between the SEM and FLACC groups ( $P > 0.05$ ). The VAS scores ranged from 1 to 6 based on the child's perceived pain intensity.

Table 2 compares the frequency of parameters measurable in children in the SEM group before and during local anesthetic injection in the first and second sessions. The difference in the severity of "sound" and "eyes" parameters before and during local anesthetic injection was statistically significant in the first session. The difference in the severity of "sound", "eyes" and "motor" parameters before and during local anesthetic injection was statistically significant in the second session. The SEM scale score ranged from 1 to 4 based on the intensity of the child's behavior.

Table 3 compares the frequency of parameters measurable in children in the FLACC group before and during local anesthetic injection in the first and second sessions. The difference in severity of "cry" and "dace" parameters before and during local anesthetic injection was statistically significant in the first session. The difference in the severity of "cry", "face" and "consolability" before and during local anesthetic injection was statistically significant in the second session. The FLACC scale score ranged from 1 to 3 based on the intensity of the child's behavior.

### **Discussion**

The present study used the existing standard scales measuring the child's behavior as an objective criterion to determine the child's level of pain, anxiety, and fear during dental treatment in order to distinguish pain-related behaviors from fear and anxiety-related behaviors. Thus, the child's behavior during local anesthetic injection was video-taped and scored according to the SEM and FLACC scales. The local anesthetic injection affected the child's behavior. The child's behavior was monitored according to both scales of pain and anxiety, but the child did not show more pain and anxiety during local anesthetic injection in the second treatment session, despite having painful memories from the first session. This result suggests that repeated treatment sessions have no effect on the child's level of anxiety and fear. This was confirmed by the VAS, which determined the level of pain perceived by the child by selecting one of the six

**Table 1.** Mean and standard deviation of VAS scores in the first and second sessions between SEM and FLACC groups

Group	Treatment session	Sample size	VAS score		P-value
			Mean	Standard deviation	
SEM	First	25	1.84	1.625	0.877
	Second	25	1.80	1.443	
FLACC	First	24	2.37	2.039	1.00
	Second	24	2.37	2.102	

**Table 2.** Comparison of SEM scale parameters before and during local anesthetic injection in the two treatment sessions

Session of treatment	SEM Scale																	
	First								p-value	Second								p-value
	1		2		3		4			1		2		3		4		
Grade	Before	During	Before	During	Before	During	Before	During	Before	During	Before	During	Before	During	Before	During		
Parameter	Before	During	Before	During	Before	During	Before	During		Before	During	Before	During	Before	During	Before	During	
Sound (N)	22	12	2	11	1	2	0	0	0.008	23	13	2	7	0	5	0	0	0.001
Eye (N)	23	14	1	10	1	1	0	0	0.003	24	14	1	9	0	2	0	0	0.001
Motor (N)	24	23	0	2	0	0	0	0	1.000	24	19	1	3	0	3	0	0	0.038

**Table 3.** Comparison of FLACC scale parameters before and during local anesthetic injection in two treatment sessions

Session of treatment	FLACC behavioral assessment Scale														
	First							p-value	Second						
	1		2		3				1		2		3		
Grade	Before	During	Before	During	Before	During	Before	During	Before	During	Before	During	Before	During	
Parameter	Before	During	Before	During	Before	During		Before	During	Before	During	Before	During		
Face (N)	20	8	4	16	0	1	0.001	20	10	4	14	0	0	0.002	
Legs (N)	23	24	1	0	0	0	0.317	23	24	1	0	0	0	0.317	
Activity(N)	23	24	1	0	0	0	0.317	23	24	1	5	0	3	0.317	
Cry (N)	22	18	2	5	1	0	0.014	22	17	1	0	0	0	0.008	
Consolability (N)	22	19	2	5	0	0	0.083	21	17	3	7	0	0	0.046	

emojis, showing that there was no difference in the level of perceived pain during local anesthetic injection between the second and first sessions. However, it is important for pediatric dentists to be able to assess and evaluate psychological and personal traits and behavioral responses of children in order to identify the need for any modifications in management approaches to minimize dental anxiety (8).

The SEM and FLACC scales are among the most commonly used pain and anxiety-measuring instruments in children. Kim et al. examined children aged 3 to 10 years after local anesthetic injection using the FLACC scale (9). Dasaraju and Svsg used this scale to compare the behavior of 90 children aged 7 to 11 years after local anesthetic injection following the use of three types of anesthetic gels (10). According to the abovementioned two studies, the present study utilized these two scales.

Anesthesia and pain control are the main steps in any dental treatment. Proper pain control enhances the child's cooperation, and establishes a reliable relationship between the child and the dentist, which diminishes the child's fear and anxiety. Effective pain control has a significant role in providing high quality dental treatment (11). Le May et al. reported that the VAS is highly validated in children (12). The present study also used this scale for measurement of perceived pain levels by children. Setty et al. designed a new animated emoji scale to assess the children's anxiety during their first dental session. The reason for choosing this scale was the close relationship between children and multimedia these days. In this study, 102 healthy children aged 4 to 14 years were assessed using this scale. The results showed that it could be a friendly tool to detect the anxiety in children (13). Altan et al. asked the children with toothache to choose the pain-related colors. Thus, 147 children aged 4 to 14 years experiencing toothache for the first time in the past month due to a deep carious lesion received a box of 24 standard colored pencils. Then, they were asked to exhibit the experience of toothache by coloring the circles, and to display the pain intensity with the VAS.

The children mostly chose red to paint the circles. The description of pain with color was a useful tool for improvement of patient-dentist as well as parent-dentist relationships (14). Therefore, this study also attempted to objectify the abstract feeling of pain.

Further studies are required to introduce a new scale that merely describes a child's behavior based on pain, not anxiety or fear. Thus, subjective pain expression can be converted to objective pain. Introducing such a scale can help pediatric dentists to control the direction of treatment in order to not only comfort the children during treatment, but also create a sense of satisfaction in their parents and provide conditions for provision of high quality treatment.

One limitation of this study was to distinguish fear and anxiety from pain since local anesthetic injection, as the most painful pediatric dental stimulus, can be inherently stressful. The nature of pain and anxiety seems to be inseparable. Aside from this limitation, every dentist is interested in analyzing the behavior of pediatric patients, and find out the reason behind the poor cooperation of children, being fear and anxiety or pain. This limitation can be overcome by further clinical studies to provide a deeper understanding of child psychology.

### Conclusion

The current results suggest that there was no difference between the SEM and FLACC scales for pain perception during local anesthetic injection in children and the parameters of the two scales that were measured in the child's face area were behaviors that any child would exhibit during local anesthetic injection.

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