



# A comparison of warmed and room-temperature anesthetic for local anesthesia in children

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## Abstract

**Purpose:** The purpose of this study was to assess children's reactions and record their sensations while receiving a warmed local anesthetic solution for dental procedures (37°C; W) compared with one at room temperature (21°C; RT).

**Methods:** Forty-four children between the ages of 6 to 11 (mean age=7.9±2.2 years) who were undergoing dental treatment participated in the study. A random crossover design was used. Each patient was randomly assigned to receive either a W or a RT local anesthesia on the first visit and the alternate local anesthesia on the second visit. During the injection, the modified Behavioral Pain Scale (BPS) was used. For subjective evaluation, the Wong-Baker FACES Pain Rating Scale (FPS) and the Visual Analogue Scale (VAS) were used.

**Results:** No significant difference was found between the W or RT local anesthesia when used during the first or second visit. In all parameters, children's reactions to both types of injection were similar, with no statistically significant difference. Using the FPS, 19 boys (91%) ranked the experience of local anesthesia as a positive experience (0 to 2 in the scale) while 4 boys (9%) ranked the same experience as negative. This was true for both types (W and RT). All 21 girls who participated in the study ranked the local anesthesia experience using the FPS as a positive experience (0 to 2 in the scale). No significant difference was found in the mean VAS scores between the room-temperature group and the warm group (23.4±21.8 and 20.8±18.9, respectively).

**Conclusions:** There is no advantage to warming local anesthetic solution prior to injection. (*Pediatr Dent.* 2002;24:333-336)

**KEYWORDS:** LOCAL ANESTHESIA, WARMED ANESTHESIA, ANESTHETIC SOLUTIONS

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The most anxiety-provoking procedure for both children and adults in dentistry is the local anesthetic injection.<sup>1</sup> It is ironic that local anesthesia is both the salvation and the bane in modern dentistry. Dentists are trained in techniques that would minimize pain and discomfort while administering local anesthesia to children. It has been shown that girls significantly demonstrated higher levels of anxiety and fear of the needle than boys,<sup>2</sup> while no significant difference was found between boys and girls with the maxillary infiltration or mandibular block injections.<sup>3</sup>

Various techniques have been suggested to alleviate pain during the injection. Some of them are behavioral, such as reframing<sup>4</sup> and using distraction<sup>5</sup> and suggestions.<sup>6</sup> Other techniques sought a solution to the pain via instrumental approaches such as topical anesthetic agents prior to the

injection,<sup>7</sup> placing lidocaine patches on the gingiva,<sup>8</sup> electronic dental anesthesia,<sup>9</sup> and computerized devices such as the Wand.<sup>10</sup>

Another approach suggested for alleviating pain during local anesthetic injection is to warm the local anesthetic solution to body temperature. This technique has been found to effectively reduce pain during injection for eye surgery,<sup>11,12</sup> and plastic surgery.<sup>13</sup> However, some studies did not find a significant change in patients' reaction toward warmed or non-warmed local anesthetic solutions.<sup>14</sup>

The dental literature lacks solid data on this method. Rogers et al,<sup>15</sup> found some advantage in warming the local anesthetic solution prior to dental procedures. No study on the effect of warming the local anesthetic solution prior to injection has been conducted on children.

The purpose of the present study was to assess children's reactions and record their sensations while receiving a local anesthetic solution warmed at 37°C and a room-temperature (21°C) local anesthetic solution for dental procedures.

## Methods

Children who were undergoing dental treatment in two pediatric dental clinics (one in Montevideo, Uruguay and the other in Jerusalem, Israel) participated in the study.

Forty-four children between the ages of 6 to 11 (mean age = 7.89 ± 2.16 years) participated in the study. All patients were ASA Class I, with no prior dental treatment, who needed at least two clinical sessions of operative procedures preceded by local anesthetic injection in the same arch, none of which was due to emergency.

Based on a preoperative behavioral assessment using the Frankl scale,<sup>16</sup> all children demonstrated positive or definitely positive behavior during pretreatment evaluation (ranking 3 or 4 on the Frankl scale), and none of them needed a sedative or other chemical support for receiving dental treatment. All parents were informed about the treatment procedures, and an informed consent was obtained. Reframing techniques, ie, using euphemistic phrases such as "putting the tooth to sleep," were used to describe the injection to all children.

Topical anesthetic gel (5% lignocaine) on a cotton-wool roll was applied to the injection site one minute prior to injection. Administration of the local anesthetic agent was done according to the previously described method<sup>5</sup> for buccal infiltration in which the mucosa at the injection site was stretched and gently placed onto the obliquely beveled edge of the needle. The delivery of the anesthesia to the palatal zone was performed 20 seconds after the buccal infiltration through the already anesthetized buccal papilla. All of the teeth treated were anesthetized.

To deliver the mandibular block, each child was asked to open his or her mouth as wide as possible, and a mechanical mouth prop was used. The operator positioned the ball of the thumb on the coronoid notch of the anterior border of the ramus, and the fingers were placed on the posterior border of the ramus. The needle was gently inserted between the internal oblique ridge and the pterigomandibular raphe. A small amount of solution was injected, and, after a negative aspiration, the needle advanced very gently and slowly. The long buccal nerve was then anesthetized.

Half an hour prior to the beginning of each injection, a cartridge of local anesthetic solution was placed in a temperature-controlled water bath maintained at 37°C and another one in a water bath at room temperature (21°C). All the operative procedures both in the maxilla and in the mandible were similar and were performed using a rubber dam.

Injection of the local anesthetic was slow, with an average duration of nearly two minutes for approximately 1 ml per minute. A random crossover design was used so that each child served as his or her own control, receiving each treatment on the opposite side of the same arch (right vs left).

Each patient was randomly assigned to receive either the warmed or room-temperature local anesthetic for the first visit, with the other local anesthetic administered during the second visit. During the injection of 2% Lidocaine 1:100,000 epinephrine (Lidocadren 2%, Teva Pharmaceutical Industries, Petach Tikva, Israel), the modified Behavior Pain Scale (BPS) suggested by Taddio et al,<sup>17</sup> was used for objective evaluation of the children. The scale comprised the following parameters: (1) facial display; (2) arm/leg movements; (3) torso movements; and (4) crying. The facial display followed Craig's behavioral description of facial actions, which describes pain.<sup>18</sup> Only two of the four of Craig's most descriptive facial actions were evident (eyebrow bulge or eye squeeze), because during injection the mouth was open and the nose was partly covered by the operator's hand.

Two trained dental assistants (one in Jerusalem and the other in Montevideo), who did not participate in the treatment, recorded by self assessment the behavioral parameters in each center. The principal author trained both assistants and calibrated them. For intraobserver calibration, they evaluated as a pilot study 15 patients that were not included in this study. All the injections were carried out by the same experienced pediatric dentist in each center. They met and calibrated the injection techniques and the volume of the injection solution (1.8 ml).

Immediately after the injections, children were asked to complete the Wong-Baker FACES Pain Rating Scale (FPS)<sup>19</sup> for subjective evaluation of feeling after the injection. Verbal instructions were given to the child on how to utilize the FPS. The FPS measures the unpleasantness or affective dimension of a child's pain experience, and is used in children aged 3 to 17 years old. The child is shown a set of 5 cartoon faces with varying facial expressions ranging from a smile/laughter to that of tears. Each face has a numerical value. The child selects the facial expression that best represents his/her experience of discomfort. The child is asked to select the face "which looks like how you feel deep down inside, not the face you show to the world."

The FPS shows good construct validity as a self-report pain measure.<sup>19</sup> A Visual Analogue Scale (VAS)<sup>20</sup> was used to confirm the results of the FPS scale. The VAS scale comprises a 100 mm line from left to right, where 0 indicates "no pain" and 100 indicates "most painful." Both operators used the same narrative words and approaches to explain to the children procedures for the use of FPS and VAS. Scores of the VAS were measured using a millimeter rule.

Pain-behavioral parameters were evaluated by chi-square analysis, and the *t* test was performed to compare the means of the VAS scores. Significance was set at *P* < .05.

## Results

Twenty-one girls aged 7.6 ± 2.1 years and 23 boys aged 8 ± 2.3 years participated in the study.

Table 1 shows the facial expressions, crying, and hand, leg and torso movements during the administration of the warmed and the room-temperature local anesthetic injection

**Table 1. Behavior Using Local Anesthesia Both at Room Temperature (RT) and Warmed at 37°C (W)**

	Room-temperature LA			37°C LA			Chi-square*
	Boys	Girls	Total	Boys	Girls	Total	
<b>Crying</b>							
No	20(87%)	20(95%)	40(91%)	19(86%)	20(95%)	40(95%)	0.14
Yes	3(13%)	1(5%)	4(9%)	3(14%)	1(5%)	4(5%)	
<b>Eyes squeezing</b>							
No	15(65%)	14(67%)	29(66%)	15(65%)	14(67%)	29(66%)	0.51
Yes	8(35%)	7(33%)	15(34%)	8(35%)	7(33%)	15(34%)	
<b>Hand movements</b>							
No	21(91%)	18(86%)	39(89%)	19(83%)	20(95%)	39(89%)	0.11
Yes	2(9%)	3(14%)	5(11%)	4(17%)	1(5%)	5(11%)	
<b>Leg movements</b>							
No	23(100%)	21(100%)	44(100%)	22(96%)	21(100%)	43(98%)	0.00
Yes	0	0	0	1(4%)	0	1(2%)	
<b>Torso movements</b>							
No	23(100%)	21(100%)	44(100%)	23(100%)	21(100%)	44(100%)	NA
Yes	0	0	0	0	0	0	

\*With continuity correction

**Table 2. Distribution of Subjects at Different Ratings of the Wong-Baker FACES Pain Rating Scale When Receiving Local Anesthesia Both at Room-Temperature (RT) and Warmed at 37°C (W)**

Ratings	RT			W		
	Boys	Girls	Total	Boys	Girls	Total
0	7(31%)	9(43%)	16(36%)	7(31%)	8(38%)	15(34%)
1	6(26%)	5(24%)	11(25%)	7(31%)	7(33%)	14(32%)
2	6(26%)	7(33%)	13(30%)	5(21%)	6(29%)	11(25%)
3	3(13%)	0	3(7%)	4(17%)	0	4(9%)
4	1(4%)	0	1(2%)	0	0	0
5	0	0	0	0	0	0
Total	23(100%)	21(100%)	44(100%)	23(100%)	21(100%)	44(100%)

in both groups and by gender. In all parameters, the children's reactions to injection in both groups were similar, with no statistically significant difference.

Table 2 shows the subjective ranking, measured using the FPS. Nineteen boys (91%) ranked the experience of local anesthesia as a positive experience (0 to 2 in the scale) while 4 boys (9%) ranked the same experience as negative. This was true for both groups (warmed solution and room-temperature solution). However, all 21 girls that participated in the study ranked the local anesthesia experience using the FPS as a positive experience (0 to 2 in the scale). The same children ranked both experiences similarly.

Table 3 shows the distribution of the VAS scores. In 29 cases (15 among the warmed solution group and 14 among the room-temperature solution group) VAS scores were 0. In 40 cases (18 among the warmed solution group and 22

**Table 3. VAS Scores for Local Anesthesia Solutions at Room-Temperature (RT) and Warmed (W)**

VAS score (mm)	RT	W
0	14	15
1- 40	22	18
41-70	9	11

among the room-temperature solution group), VAS scores were between 1 mm and 40 mm. Finally, in 20 cases (11 among the warmed solution group and 9 among the room-temperature solution group), VAS scores were between 41 mm and 70 mm. No significant difference was found in the mean VAS scores among the room-temperature solution group and the warmed solution group (23±22 and 21±19, respectively). Also, no difference was found whether children received a room-temperature or warmed maxillary infiltration or a room-temperature or warmed mandibular block injection.

### Discussion

This study showed no significant difference in children's objective reactions to the use of room-temperature or warmed local anesthetic solution. Also, no significant difference was found between boys and girls in

either group according to the objective and subjective signs using the VAS and the FPS. This finding is in accord with a previous study<sup>3</sup> where boys and girls showed the same reaction when receiving local anesthesia.

No difference was found in the self-report of children using the VAS when receiving a warmed or an ambient-temperature local anesthesia. This is in accord with the findings of Dalton,<sup>14</sup> who found no significant difference reducing the pain of injection when infiltrating the skin. However, this finding is not in accord with Rogers et al,<sup>15</sup> who found in a study conducted with dental students aged 22 to 32 years that, using the VAS measure, the warmed dental injection was significantly more comfortable than the ambient-temperature injection. In this study, objective signs were not recorded. Furthermore, the lack of difference between warmed and ambient-temperature local anesthetic

solution found in this study is not in agreement with other studies on eye and plastic surgery,<sup>11,13</sup> which showed an advantage of warming the solution prior to injection.

Again, the different results may be due to different behavior management techniques used in those studies as well as in this study. In addition, it may be that local anesthesia in eye surgery and plastic surgery cannot be compared with dental local anesthesia since the sensation of pain may be different in the skin, eye and oral tissues.

Children ranked both experiences similarly, and this may suggest that children's reactions are based on an individual's behavior pattern.

Children reacted in the same way whether they received maxillary infiltration or mandibular block injections, and this finding is in accord with a previous study.<sup>3</sup>

### Conclusions

1. The findings of this study showed no difference in any of the objective and subjective parameters between children who received room-temperature or warmed local anesthetic solution.
2. There is no advantage to warming the local anesthetic solution prior to injection.

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