

EVALUATING THE IMPACT OF WARMING LOCAL ANESTHETICS ON PAIN PERCEPTION DURING DENTAL INJECTIONS

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Received- 05.02.2024 | Accepted- 21.02.2024 | Published- 28.02.2024

ABSTRACT

Introduction: Effective management of dental injection pain is crucial during pediatric dental procedures. This study aimed to assess the effectiveness of administering warm local anesthetic (37 °C) compared to room temperature (21 °C) local anesthetic injections in alleviating pain during dental injections in pediatric patients.

Materials and Methods: 145 children aged 5–8 years were enrolled in this randomized study. Each participant was randomly assigned to receive either warm or room temperature local anesthesia during their first session and the opposite temperature anesthesia during their second session. Pain during injections was evaluated subjectively using the Wong-Baker Faces Pain Rating Scale and objectively by monitoring heart rate. The Face, Legs, Arms, Cry, and Consolability (FLACC) scale, assessed by dental assistants, was used to record pain perception in children.

Results: Analysis based on Wong-Baker Faces Pain Rating Scale, FLACC scale, and heart rate indicated that both boys and girls experienced significantly lower pain during dental injections at body temperature compared to room temperature.

Conclusion: Administering local anesthesia at body temperature effectively reduces pain during dental injections when contrasted with room temperature anesthesia. Therefore, warming local anesthesia before administration in children is recommended for clinicians.

Keywords: Dental anesthesia, children, Warm solution, local anesthesia.

INTRODUCTION

Local anesthetics are substances applied topically or injected into specific body areas to induce temporary pain relief without causing loss of consciousness. Building a strong doctor-patient relationship is crucial in pain management, especially in pediatric dentistry, to gain patient trust and ensure successful treatment outcomes. Besides behavioral techniques like distraction and hypnosis, several strategies have been developed to mitigate pain sensations associated with needle insertion or the application of topical anesthetics, such as prolonging injection duration, reducing needle size, employing electronic dental anesthesia or computer-assisted systems like the Wand. These approaches aim to alleviate anxiety in pediatric patients, although none have completely eradicated fear and anxiety during dental procedures [1–4].

An additional method recommended for reducing pain during local anesthetic injections involves warming the anesthetic solution to body temperature (37 °C) before administration. This technique, proven effective in ophthalmological and plastic surgery contexts, has been suggested for testing in dentistry by Hogan et al. [5–8]. Their systematic review highlighted the efficacy of warm local anesthetics in pain control during injections across various body regions, emphasizing the need for research in dental settings. Despite this, studies assessing warm local anesthetic administration's effectiveness in pediatric dentistry remain limited.

This study conducted a comparative assessment of warm local anesthetic (37 °C) administration versus room temperature (21 °C) injections in reducing pain and burning sensations during injections in pediatric dental patients.

MATERIALS AND METHODS

The current randomized trial 145 ASA class-1 patients aged 5–8 years who were admitted to the Dentistry Clinic. These patients had no prior experience with dental anesthesia, and required bilateral dental treatment in the maxillary molar area. Informed consent was obtained from all parents and children, and the treatment procedure was explained using child-friendly language to guide their behavior.

In group A, a 2 mL cartridge of local anesthetic solution was warmed to body temperature (37 °C). In group B, a cartridge containing local anesthetic solution was placed in a 21 °C water bath half an hour before the procedure.

Before the local anesthetic injection, topical anesthetic gel was applied to the injection site for 1 minute using a cotton pellet. The dose of the local anesthetic agent, comprising Lidocaine hydrochloride 2% with 1:100,000 epinephrine, was adjusted based on the child's weight and slowly injected over an average duration of 2 minutes. The buccal infiltration anesthesia

technique described by Peterz et al. [9] was used, with approximately 1 mL infiltrated per minute while gently stretching the mucosa in the maxillary molar primary dentition.

MS Excel 2010 software was utilized to randomly determine the side (right/left) of the maxilla to be infiltrated with the anesthetic solution and at which temperature (21 °C or 37 °C) during the first session. The contralateral side of the maxilla received the other local anesthetic in the second session. An experienced clinician, unaware of the study's objectives, performed all local anesthetic injections. Pain experienced and reported by the child during the injection was documented using the Wong-Baker Faces Pain Rating Scale. The patient's perceived pain during the procedure was recorded by an experienced dental assistant using the Face, Legs, Activity, Cry, and Consolability (FLACC) scale [10]. Additionally, heart rate, serving as an objective measure of pain and anxiety, was monitored using a pulse oximeter.

RESULTS

A total of 145 patients participated in the study, comprising 67 girls with a mean age of 6.31 ± 0.46 years and 78 boys with a mean age of 6.41 ± 0.51 years. The perceived pain level, as assessed using the Wong-Baker Faces Pain Rating Scale, was notably lower in both girls and boys in the body temperature (37 °C) group compared to the room temperature (21 °C) group (refer to Table 1).

Additionally, patients in the room temperature (21 °C) group exhibited significantly higher FLACC scale scores than those in the body temperature (37 °C) group, both in girls and boys (see Table 2).

Furthermore, the heart rate during injection was significantly lower among girls and boys in the body temperature (37 °C) group compared to the room temperature (21 °C) group (see Table 3)..

Table 1: Response to pain measured by Wong–Baker Pain Scale

Gender	n	Room Temperature (mean \pm SD)	Body Temperature (mean \pm SD)	p value
Girls	67	6.05 \pm 1.44	2.68 \pm 1.36	< 0.05
Boys	78	6.08 \pm 1.37	2.53 \pm 1.45	< 0.05

Table 2: Observed behavior of child on FLACC scale during dental local anesthetia

Gender	n	Room Temperature (mean \pm SD)	Body Temperature (mean \pm SD)	p value
Face				
Girls	67	1.08 \pm 0.29	0.45 \pm 0.32	< 0.05
Boys	78	1.14 \pm 0.33	0.42 \pm 0.30	< 0.05
Legs				
Girls	67	0.52 \pm 0.29	0.35 \pm 0.23	< 0.05

Boys	78	0.50 ± 0.33	0.37 ± 0.25	< 0.05
Activity				
Girls	67	0.50 ± 0.29	0.30 ± 0.25	< 0.05
Boys	78	0.35 ± 0.24	0.28 ± 0.18	< 0.05
Cry				
Girls	67	0.57 ± 0.35	0.51 ± 0.36	< 0.05
Boys	78	0.58 ± 0.38	0.56 ± 0.45	< 0.05
Consolability				
Girls	67	0.40 ± 0.23	0.32 ± 0.19	< 0.05
Boys	78	0.39 ± 0.25	0.37 ± 0.31	< 0.05

Table 3: Heart rates during dental local anesthesia injection

Gender	n	Room Temperature (mean ± SD)	Body Temperature (mean ± SD)	p value
Girls	67	106.60 ± 2.40	98.70 ± 2.60	< 0.05
Boys	78	103.20 ± 1.90	95.40 ± 2.00	< 0.05

DISCUSSION

Administration of local anesthetic injections before dental procedures is often a source of anxiety, especially among pediatric patients, leading to stress for both patients and clinicians [11]. Previous research has explored methods to minimize pain during local anesthetic administration to enhance patient comfort during dental care. This study investigated the impact of using local anesthetics warmed to body temperature on pain perception during maxillary injections.

In a UK survey, 34% of maxillofacial surgeons and 8% of general surgeons reported using warmed local anesthetic infiltration to alleviate pain [5]. Davidson et al. [12] compared the effects of room temperature (21 °C) and body temperature (37 °C) local anesthetics on pain levels post subcutaneous injection, finding that warmed solutions reduced injection pain. Similar studies in minor eyelid surgeries and dermatological procedures support the notion that warming local anesthetics can offer pain relief during injections [6, 13]. However, limited research exists on the impact of warmed local anesthetic injections specifically during dental procedures.

Pain perception can vary in pediatric patients, with expressions of discomfort not always correlating directly with pain levels. Tools like the Wong-Baker Faces Pain Rating Scale have been effective in assessing children's pain during dental procedures [14–16]. Due to children's limited ability to communicate pain verbally, standardized scales such as the FLACC scale are valuable for evaluating pain severity [10]. Both scales were utilized in this study to assess pain levels during local anesthetic injections.

Pain is subjective and can vary between individuals, prompting the use of heart rate as an objective measure of pain perception, particularly in split-mouth design studies evaluating pain perception [14, 17]. The current study also employed heart rate monitoring as an objective assessment of pain perception.

A study involving dentistry students aged 22–32 showed that warm local anesthetic injections provided significantly greater comfort compared to room temperature injections [18]. Similarly, in a split-mouth study of 72 patients aged 18–29, warm local anesthetic infiltration significantly reduced injection pain [19]. Another study with 60 children aged 6–12 demonstrated a significant reduction in injection pain with warm anesthetic solutions [20]. Consistent with these findings, our study using the Wong-Baker Faces Pain Rating Scale and FLACC scales reported significantly greater comfort with warm local anesthetics and lower heart rates compared to room temperature solutions. However, a study by Ram et al. [16] found no significant difference in pain perception between warm and room temperature local anesthetics in children aged 6–11, possibly due to methodological differences.

This study focused solely on warm local anesthetic injections during maxillary buccal infiltration, highlighting the need for further research comparing different administration techniques and assessing efficacy in various regions to confirm the benefits of warm local anesthetic injections in reducing injection pain.

CONCLUSION

The current investigation concludes that warming local anesthetics to body temperature can notably diminish injection pain during maxillary infiltrations of anesthesia in pediatric patients. Therefore, warming local anesthesia before administration in children is recommended for clinicians.

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