

Pain Perception During Local Anesthesia Administration in Pediatric Dental Patients and The Impact of Pre-Cooling The Injection Site: An *in-vivo* Study

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INTRODUCTION

Perceived pain during dental operations in children is a major issue for both clinicians and parents. Painful experiences can lead to increased anxiety, negative attitudes toward dental care, and avoidance of future dental visits. Traditional methods to mitigate pain allied with the local anesthesia (LA) include topical anesthetics and distraction techniques, yet some patients continue to experience discomfort.^[1]

Recent advancements in pain control propose pre-cooling or cryoanalgesia as a non-pharmacological alternative

ABSTRACT

Aim: Examining how pre-cooling affects children's experience of pain during local anesthetic administration is the primary goal of this study. **Material and Methods:** This study was conducted *in vivo* and involved 60 child patients who required local anesthetic in order to undergo dental procedures. Patients were divided into two groups based on a random chance: Group I was the control group, which did not receive any pre-cooling. Group II was the pre-cooling group, which allowed the injection site to be chilled with an ice pack for one minute prior to the administration of anesthesia. The Wong-Baker FACES Pain Rating Scale was used to evaluate the participants' level of pain perception immediately following the administration of the anesthetic injection. **Results:** The group that received pre-cooling showed a reduction in pain levels that was statistically significant when compared to the group that received control ($P < 0.05$). **Conclusion:** Pediatric dental patients may decrease local anesthesia pain by pre-cooling the injection site. This technique can be simply used in dental practices to improve patient experience, especially for children with dental anxiety or needle phobia.

KEYWORDS: Local anesthesia, pain management, pediatric dentistry, pre-cooling

to conventional methods. Pre-cooling the injection site may work by slowing nerve conduction and reducing pain signal transmission to the brain. This phenomenon, known as thermal analgesia, can potentially improve patient comfort during needle penetration and anesthetic infiltration.^[2]

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The objective of the *in vivo* study that is described here is to investigate the impact that pre-cooling the injection site has on the level of discomfort that is experienced by juvenile dentistry patients. The purpose of this research is to offer empirical evidence on the usefulness of pre-cooling techniques and to explore its practical consequences in a clinical setting.

The importance of this study lies in its potential to enhance patient-centered care in pediatric dentistry by introducing an easily applicable method to reduce pain, which could transform the approach to anesthetic administration across dental practices. This could contribute to more positive dental experiences for children, fostering better attitudes toward oral health maintenance, and reducing procedural anxiety.

MATERIAL AND METHOD

Study design

A randomized controlled trial, double-blind study was conducted after getting ethical approval by the scientific committee. Safety monitoring was conducted throughout the study, with any adverse events related to the interventions recorded and addressed.

Study sample

60 pediatric patients aged 6–12 years, included in this group were patients who were scheduled to have standard dental processes that required local anesthetic for their treatment in the mandibular arch.

Inclusion criteria

Children in good general health, children who are cooperative and have a Frankl behavior rating of three or four, children who require an inferior alveolar nerve block for pulpectomies and extractions, children who have no history of systemic diseases (American Society of Anesthesiologists' Grade I status) and children who have no history of allergic reactions to cryotherapy or local anesthesia were included.

Exclusion criteria

Those patients who were excluded from the study were those who were suffering from systemic disorders, were using pain medication, or had a history of poor experiences with dental injections.

Randomization and blinding

Through the use of computer-generated random numbers, patients were randomly allocated to either the pre-cooling or control group in a ratio of one to one. One of the staff members who was not involved in the study was the one who was responsible for maintaining the randomization code. Blinding the patients and the evaluator who was assessing the pain scores was done so that neither party was aware of the group assignments.

Intervention

In the pre-cooling group, an ice pack wrapped in a gauze piece was applied to the injection site for 1 minute. In the control group, no pre-cooling was done. During inferior alveolar nerve block and Lingual nerve block, 2% lidocaine with adrenaline 1:80000 (Lidayn, Global Dent Aids Pvt Ltd, New Delhi, India) was deposited slowly (1 mL/min) following aspiration.

Pain assessment

The Wong-Baker Facial Pain Rating Scale (WBFPRS), a validated tool for children, was utilized to assess pain perception immediately after the anesthetic injection. The scale, showing faces ranging from 'no pain' to 'worst pain', was explained to each patient before their dental procedure [Figure 1].

Statistical analysis

For the purpose of comparing the levels of pain experienced by the two groups, Mann-Whitney U tests were utilized. The statistical significance of the results was determined by a *P*-value that was lower than 0.05.

RESULT

Demographics and baseline data

In each of the groups, there were a total of 30 participants (15 males and 15 females), ensuring that the demographics were balanced. It was determined that there were no significant differences in terms of age, gender, or oral health status between the group that was pre-cooled and the control group, which established an equivalent baseline.

Pain perception scores

The analysis of pain scores using the WBFPRS indicated that the pre-cooling group had significantly lower pain perception compared to the control group. The median pain score in the pre-cooling group was [3.25 ± 0.6], while in the control group, it was [5.34 ± 0.5] (*P* < 0.05) [Table 1].

DISCUSSION

The purpose of this study was to investigate the effect that pre-cooling the injection site had on the experience of pain experienced by juvenile dental patients during the administration of local anesthesia. According to the Gate Control Theory of Pain, which postulates that non-painful input (such as cooling) closes the nerve "gates" to

Table 1: WBFPRS Score

Groups	Mean pain score	Mean-Whitney statistic
Group I Control	5.34±0.5	<i>P</i> <0.05*
Group II Pre-cooling	3.25±0.6	

*Significant



Figure 1: WBFPRS

painful input, thereby inhibiting pain sensation, our findings suggest that pre-cooling significantly reduces pain perception without incurring adverse events. This is a significant finding that aligns with the theory.^[3]

The practical reduction in pain scores among the pre-cooling group has clinically relevant implications. First, it highlights pre-cooling as a noninvasive, cost-effective measure for improving pediatric patient experience, an essential aspect, considering the vulnerability of this population to dental anxiety and fear. Reducing discomfort could potentially decrease the development of dental phobias and improve long-term dental visit compliance.^[4]

According to the findings of the current research, pre-cooling the anesthetic site results in a significant reduction in the amount of discomfort experienced during the administration of local anesthesia. The same findings were observed in the research carried out by Harbert (1989)^[5] and Ghaderi *et al.*(2013)^[6] who used ice to alleviate the sensation of discomfort that was linked with palatal injections. The administration of ice for 2 minutes prior to receiving an infra-alveolar nerve block injection was found to be effective in reducing the sensation of pain, as reported by Aminabadi and colleagues^[7] in 2009.

Ice is often used to alleviate inflammation. This first-aid treatment treats fractures, sprains, and soft tissue bruising.^[5] Ice cools the tissues and constricts blood vessels that delays inflammatory mediator release and activates inhibitory pain pathways to lessen pain.^[8]

However, this study is not without its limitations. Our sample size, although sufficient to demonstrate a statistical difference, was relatively small. A larger cohort could provide more robust data and allow for subgroup analyses, which could consider the impact of age, previous dental experiences, and individual pain thresholds. Additionally, our reliance on the WBFPRS, while validated for pediatric use, is inherently subjective. Future studies might incorporate objective measures

such as physiological stress indicators to corroborate self-reported pain levels.

CONCLUSION

In conclusion, pre-cooling before anesthetic injections in pediatric dental patients shows promise as an evidence-based approach to pain management. Its simplicity, safety, and efficacy commend it as a technique that could be readily adopted in clinical practice. Nonetheless, further investigation is warranted to consolidate these findings and explore additional facets of pain perception, patient experience, and long-term outcomes.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Appukuttan DP. Strategies to manage patients with dental anxiety and dental phobia: Literature review. *Clin Cosmet Investig Dent* 2016;8:35-50.
2. Tirupathi SP, Rajasekhar S. Effect of precooling on pain during local anesthesia administration in children: A systematic review. *J Dent Anesth Pain Med* 2020;20:119-27.
3. Melzack R, Wall PD. Pain mechanisms: A new theory. *Science* 1965;150:971-9.
4. Locker D. Psychosocial consequences of dental fear and anxiety. *Community Dent Oral Epidemiol* 2003;31:144-51.
5. Harbert H. Topical ice: A precursor to palatal injections. *J Endod* 1989;15:27-8.
6. Ghaderi F, Banakar S, Rostami S. Effect of pre-cooling injection site on pain perception in pediatric dentistry: "A randomized clinical trial". *Dent Res J (Isfahan)* 2013;10:790-4.
7. Aminabadi NA, Farahani RM. The effect of pre-cooling the injection site on pediatric pain perception during the administration of local anesthesia. *J Contemp Dent Pract* 2009;10:43-50.
8. AmruthaVarshini I, Vinay C, Uloopi KS, RojaRamya KS, Chandrasekhar R, Penmatsa C. Effectiveness of Pre-cooling the Injection Site, Laser Biostimulation, and Topical Local Anesthetic Gel in Reduction of Local Anesthesia Injection Pain in Children. *Int J Clin Pediatr Dent* 2021;14:81-83.