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Use of Cryo-Anesthesia vs Topical Anesthetic Spray to Evaluate Pain Perception by Pediatric Patients During Greater Palatine Nerve Block: A Pilot Study

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Abstract

Effective pain management is crucial in pediatric dentistry, especially during greater palatine nerve blocks (GPNB), which are often painful for children. This study compared the effectiveness of topical anesthetic spray and cryo-anesthesia in reducing pain during GPNB in children using a behavioral pain assessment scale. In this randomized, split-mouth clinical trial, children aged 7-12 years requiring bilateral maxillary posterior procedures received topical anesthetic spray at the first appointment and cryo-anesthesia at the contralateral site during the second appointment. Intervention sequence was assigned via computer-generated randomization. Standardized GPNBs were administered after pre-injection interventions, and pain was assessed using the Sound, Eye, and Motor (SEM) scale by a blinded examiner. Comparisons were made using Wilcoxon signed-rank tests. Cryo-anesthesia resulted in significantly lower SEM scores compared to topical anesthetic spray (median total SEM: 7.0 vs. 10.0, $p < 0.001$), with reductions observed in all scale components. Cryo-anesthesia is more effective than topical anesthetic spray in minimizing pain perception during GPNB in children and can be recommended as a safe, easy-to-use adjunct in pediatric dental practice.

INTRODUCTION

Pain is a fundamental warning mechanism characterized by intertwined sensory and emotional experiences that are shaped by individual perception. The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage,” and reinforces its subjective, multidimensional nature^[1]. Effective pain management is essential in dentistry, as inadequate control may result in patient discomfort, stress, or complications. Greater Palatine Nerve Block (GPNB), which provide anesthesia for posterior hard palate, is notably painful due to the densely innervated, unyielding mucoperiosteum, with factors such as injection technique and patient anxiety further influencing the experience.

To alleviate injection pain, various adjunctive methods have been explored, including topical anesthetics, cryo-anesthesia, computerized delivery systems, and psychological support.

This study aims to compare the effectiveness of topical anesthetic spray and cryo-anesthesia in minimizing pain during GPNB among children, using both behavioral and physiological responses to determine which approach yields greater comfort without increasing treatment time^[2].

MATERIALS AND METHODS

This randomized, split-mouth clinical trial was conducted at the Department of Pedodontics and Preventive Dentistry, Government Dental College and Hospital, Ahmedabad, Gujarat. Institutional Ethical Committee (IEC/GDCH/PEDO.2/2023) approval obtained prior to the commencement of the research, ensuring all procedures adhere to the ethical standards outlined in the World Medical Association Declaration of Helsinki 2013 and its later amendments.

A total of 15 systemically healthy children (ASA I classification) aged 7-12 years recruited for this study.

Inclusion Criteria:

- Children aged 7–12 years.
- ASA I (healthy) children requiring bilateral maxillary posterior dental procedures involving the palatal mucosa under local anesthesia.
- Presence of contralateral sites suitable for split-mouth design.
- Patients with Frankl Behaviour Rating Scale scores 3 or 4.

Exclusion Criteria:

- History of allergy or hypersensitivity to local anesthetics or cryoanesthetic agent.
- Presence of acute infection or inflammation at the injection site.

- Medically compromised children (ASA II and above).
- Children with special healthcare needs or those unable to cooperate.
- Previous palatal injection experience within 6 months.

Operators and Their Roles: A total of three operators were involved in the study:

Operator 1: Carried out the application of the pre-injection interventions (either topical anesthetic spray or cryo-anesthesia) based on the randomized assignment.

Operator 2 (Clinician): Performed all local anesthetic injections and subsequent dental procedures, blinded to the pre-injection intervention.

Operator 3 (Assessor): Evaluated the behavioral pain response using the SEM scale immediately after the GPNB, also blinded to the intervention

The operator were trained for one day on the clinical steps and assessment scale.

Randomization: Participants who met the inclusion criteria underwent a comprehensive intra-oral examination and standardized periapical radiographs to confirm the need for bilateral maxillary posterior dental treatments. The two contralateral sites in the maxilla (e.g., right vs. left posterior palate) were

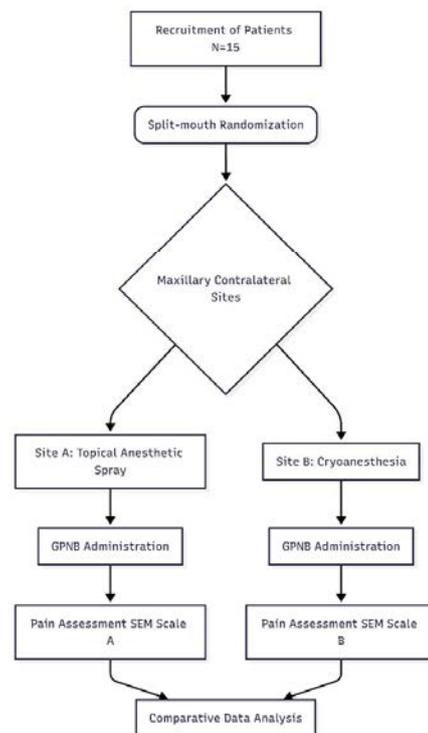


Fig. 1: Flowchart Showing Participant Recruitment, Randomization, and Intervention Assignment

allocated to either the topical anesthetic spray group (Group A) or the cryo-anesthesia group (Group B) using a computer-generated randomization sequence, ensuring unbiased allocation at the patient and site level.

Blinding: To achieve double-blinding, all local anesthetic injections and subsequent dental procedures were performed by an experienced clinician who was blinded to the pre-injection intervention applied to each site. Additionally, a third operator, also blinded to the intervention groups, independently assessed and recorded pain perception immediately following each Greater Palatine Nerve Block (GPNB).

Clinical Procedures: At the first appointment, following site randomization, the pre-injection intervention of topical anesthetic was applied. The mucosa was dried with a sterile cotton pellet, and an appropriate quantity of 2% Lignocaine topical anesthetic spray was placed over the greater palatine foramen injection site for one minute.

At the second appointment, the same patient received cryoanesthesia at the contralateral site: after drying the overlying mucosa, 1,1,1,2-tetrafluoroethane cryoanesthetic spray was applied to a sterile cotton pellet and placed over the site for a maximum of 10 seconds. Following the respective pre-injection intervention at each appointment, a standard GPNB was administered. This involved the gradual deposition of 0.6–0.8 ml of room temperature 2% Lignocaine with 1:80,000 adrenaline solution over 20 seconds, using a 27-gauge short needle, introduced from the contralateral side at a right angle to the target area with the needle bevel oriented towards the palatal soft tissue.



Fig. 2: Armamentarium (pre-anaesthetic intervention)

Pain perception assessed at the time of local anesthetic injection using Sound, Eye and Motor (SEM) Scale. Data collected from scale for each site (topical anesthetic vs. cryo-anesthesia) within each patient used for comparative analysis.

RESULTS AND DISCUSSIONS

After collection of data, the data were coded and entered in Microsoft Excel 2019. The data were described as proportions, mean, standard deviation, and median. The post-hoc analysis was done by Wilcoxon test for intra group comparison. Statistical Package for Social Science (SPSS version 23, IBM Crop.) was used for statistical analysis. The level of significance was set at $P < 5\%$.

Table 1. shows that Cryo-anesthesia consistently produced lower pain scores across all SEM components compared to the topical spray. The mean scores for the topical group were 3.33 ± 0.49 for Sound, 3.40 ± 0.51 for Eye, and 3.27 ± 0.59 for Motor, resulting in a Total SEM mean of 10.00 ± 1.07 . In contrast, the cryo-anesthesia group showed significantly lower mean scores: 2.40 ± 0.51 for Sound, 2.40 ± 0.51 for Eye, and 2.33 ± 0.49 for Motor, leading to a Total SEM mean of 7.13 ± 1.13 . The median Total SEM score for the topical group was 10, while for the cryo-anesthesia group it was 7, indicating a 3-point reduction.

Graph 1 demonstrates the superior analgesic efficacy of cryo-anesthesia compared to the topical anesthetic spray. The mean scores for all SEM components-Sound, Eye, Motor, and Total SEM-are consistently lower for the cryo-anesthesia group. The chart clearly shows that the mean Total SEM score for topical spray is 10.0 ± 1.07 , while for cryo-anesthesia it is 7.13 ± 1.13 , representing a significant 3-point reduction. Similar, clinically meaningful reductions are observed in the individual components, with approximately a 1-point reduction in each sub-score with cryo-anesthesia.

Paired Comparison and Statistical Significance

Table 2 shows Wilcoxon signed-rank tests confirmed that cryo-anesthesia produced statistically significant reductions in all SEM components. The median differences (Topical - Cryo) were 1 point for Sound, 1 point for Eye, and 1 point for Motor, and a total of 3 points for the Total SEM score. The V statistic was 0 for all comparisons, which signifies that every child experienced lower pain scores with cryo-anesthesia compared to the topical spray. The p-values for all components were highly significant: Sound ($p = 0.00018$), Eye ($p = 0.00027$), Motor ($p = 0.0011$), and Total SEM ($p = 0.00006$). After applying the Holm-Bonferroni adjustment to control for multiple comparisons, all three SEM components remained statistically significant.

Effective pain control during dental procedures is a cornerstone of pediatric dentistry, directly impacting the quality of care, patient cooperation, and long-term attitudes toward dental visits^[3,4]. Pain associated with local anesthetic administration, particularly the greater palatine nerve block (GPNB), has remained a significant clinical challenge, especially among pediatric patients, due to the palatal mucosa's dense innervation and



Fig. 3(a and b): Topical-spray technique application c) delivering greater-palatine nerve-block



Fig. 4(a and b): Precooling the Injection Site. c) Delivering Greater-Palatine Nerve-block



Fig. 5: Pain Calibration with SEM Scale

Observations	1 - Comfort	2 - Slight Discomfort	3 - Moderate Pain	4 - Pain
Sound	No sounds indicating pain.	Non-specific sounds which may indicate pain.	Specific verbal complaints raising voice.	Verbal complaints indicating intense pain.
Eyes	No ocular signs of pain	- Eyes wide open- Shows concern- No tears	- Watery eyes- Blinking eyes	- Crying- Tears rolling down the face
Motor	- Relaxed hands- Body apparently relaxed	- Hands show stress or tension- Grasps hold of chair- Muscular tension	- Arm or body movements with no aggressive intention- Physical contact- Pulling faces or grimacing	Hand movement for aggressive contact

Fig. 6: Sound–Eye–Motor (SEM)

limited flexibility^[5]. The anticipation and experience of pain-exacerbated by factors such as anxiety and needle phobia-can lead to distress and avoidance of dental treatment in children^[6].

In our randomized, split-mouth study comparing the analgesic efficacy of topical anesthetic spray and cryo-anesthesia during greater palatine nerve block (GPNB) in children, pain was objectively assessed using the Sound, Eye, and Motor (SEM) behavioral scale. The results revealed that cryo-anesthesia significantly reduced pain perception across all SEM components compared to topical anesthetic spray. The mean total SEM score for the topical group was 10.00 ± 1.07 , whereas the cryo-anesthesia group showed a markedly lower mean of 7.13 ± 1.13 , indicating an average

reduction of nearly 3 points (median total SEM scores of 10 vs. 7, respectively; $p < 0.001$). Analysis of individual components demonstrated a consistent pattern: mean Sound scores decreased from 3.33 ± 0.49 to 2.40 ± 0.51 , Eye scores from 3.40 ± 0.51 to 2.40 ± 0.51 , and Motor scores from 3.27 ± 0.59 to 2.33 ± 0.49 with cryo-anesthesia (all p-values < 0.001). The Hodges-Lehmann median differences further confirmed these findings, with estimated median reductions of 1 point for each SEM component and 3 points for the total SEM score. These statistically significant and clinically meaningful reductions underscore that cryo-anesthesia offers superior pain control during palatal injections in pediatric patients, enhancing treatment comfort without introducing adverse effects.

Table 1: Descriptive Statistics for SEM Components by Treatment Modality

Component	Topical Mean ± SD	Topical Median (IQR)	Cryo Mean ± SD	Cryo Median (IQR)
Sound	3.33 ± 0.49	3.0 (3.0–4.0)	2.4 ± 0.51	2.0 (2.0–3.0)
Eye	3.4 ± 0.51	3.0 (3.0–4.0)	2.4 ± 0.51	2.0 (2.0–3.0)
Motor	3.27 ± 0.59	3.0 (3.0–4.0)	2.33 ± 0.49	2.0 (2.0–3.0)
Total SEM	10.0 ± 1.07	10.0 (9.0–11.0)	7.13 ± 1.13	7.0 (6.0–8.0)

Table 2: Wilcoxon Signed-Rank Test Results (Topical vs Cryoanesthesia)

Component	Median Δ	Hodges-Lehmann Δ (95% CI)	Wilcoxon V	P-value
Sound	1	1.0 (0.4–1.0)	0	1.83e-04
Eye	1	1.0 (0.4–1.7)	0	2.75e-04
Motor	1	1.0 (0.0–2.0)	0	0.001054
Total SEM	3	3.0 (2.0–4.0)	0	6.10e-05

These results are consistent with the literature. Both clinical and experimental studies have highlighted the moderate-to-strong efficacy of cryo-anesthesia in reducing injection pain. For instance, Jayasuriya *et al.*^[7] (2017) and Bansal *et al.*^[8] (2020) demonstrated that cryo-anesthesia through ice application or cryospray significantly reduced pain scores for palatal and other intraoral injections compared to topical anesthetics alone. Similarly, Mohsin *et al.*^[9] (2022) and Kumari *et al.*^[10] (2024) found that cryotherapy was at least as effective as, if not superior to, topical anesthetic gels in various pediatric and adult dental settings. The analgesic effect of cryo-anesthesia is attributed to its ability to decrease nerve conduction velocity by cooling the tissues, thus temporarily inhibiting nociceptive transmission^[11].

In contrast, topical anesthetics (such as benzocaine or lignocaine sprays and gels) often provide only superficial mucosal anesthesia and may not adequately prevent discomfort associated with submucosal or periosteal needle penetration, particularly in the palatal area where tissue is less permeable.⁶ The limited effectiveness of topical anesthetics for palatal injections was validated in our study, which mirrors other findings by Rai *et al.*^[12] 2024 showing comparable or superior performance of cryo-anesthesia over topical agents for palatal nerve blocks.

From a clinical standpoint, cryo-anesthesia offers the advantages of being cost-effective, easy to administer, and well-tolerated by children. No adverse effects were reported in our study, supporting its suitability as a practical adjunct for pediatric dental procedures involving palatal injections.

Limitations of our study include the small sample size and reliance on a behavioral pain scale without additional physiological measures. Further large-scale and multi-center studies, ideally incorporating self-reported pain scales and physiological stress markers, would be valuable for consolidating these findings and broadening their application.

CONCLUSION

Our study provides strong evidence that cryo-anesthesia is more effective than topical anesthetic spray in reducing pain perception during greater palatine nerve block in children. Given its ease of use and favorable analgesic profile, cryo-anesthesia

can be recommended as a reliable adjunct in routine pediatric dental practice for palatal injections.

REFERENCES

- Raja, S. N. Et al. (2020). The revised IASP definition of pain.
- Advances in pediatric dentistry: new approaches to pain control and anxiety reduction in children- a narrative review Ravi Vijaya Remi, Athimuthu Anantharaj, Prasanna Praveen, Rani Shankarappa Prathibha, Ramakrishna Sudhir.
- Armfield JM, et al. Dental fear and anxiety: Prevalence and clinical implications. Aust Dent J. 2006.
- Caraciolo J, Colares V. Dental anxiety among children: Prevalence and behavioral implications. Int J Paediatr Dent. 2004.
- Malamed SF. Handbook of Local Anesthesia, 7th ed. Elsevier, 2019.
- Versloot J, et al. Pain behavior and ways of relating to the pain experience during local anesthesia in children. Pediatr Dent. 2008;30(1):17-23.
- Jayasuriya N S, et al. Cryoanesthesia: A simple and effective nonpharmacological technique for reducing pain during palatal injections. Contemp Clin Dent. 2017.
- Bansal N, et al. Comparison of two topical agents used as precooling agents before palatal injection: A randomized clinical trial. J Clin Diagn Res. 2020;14(9):60-63.
- Mohsin M, et al. Comparative evaluation of Ice and topical anesthetic gel: A randomized clinical trial. J Dent Anesth Pain Med. 2022;22(4):279-285.
- Kumari N, et al. Efficacy of cryotherapy and lignocaine gel in reducing pain during palatal nerve block in children: A split-mouth clinical trial. Int J Paediatr Dent. 2024.
- Arslan I, Erkmen Almaz ME. Methods for the reduction of pain during injection of local anaesthetic for children. Eur J Paediatr Dent. 2019.
- Rai S, et al. Evaluation of cryoanesthesia and topical 20% benzocaine gel for reduction of pain during greater palatine nerve block in children: A randomized split mouth clinical trial. J Indian Soc Pedod Prev Dent. 2024.