RESEARCH PAPER

Comparative Evaluation of the Effectiveness of Herbal and Non-Herbal Means of Topical Anesthetic Agent: An In-Vivo Study

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ABSTRACT

Background and Aim: This study aims to evaluate and compare the effectiveness of herbal and non-herbal means of topical anaesthetic agents.

Methods:

Forty children aged 8-12years who requiring inferior alveolar nerve block for dental procedures were included. Participants were randomly divided into one control group (group 1) and three experimental group (group 2,3,4) with 10 patients each. During the first visit written consent and intraoral screening of the patients were performed. Later Topical anesthetic agents were applied in the respective group for 1 minute and local anesthetic injections were administered in the form of inferior alveolar nerve block using 3ml single use disposable syringe. Pain perception was evaluated using Venham picture test, visual analog scale, tabulated, and statistically analyzed.

Results: The test results demonstrated that cryotherapy group has the highest mean score followed by herbal anesthetic gel and lignocaine gel.

Interpretation and conclusion:

All the three topical anesthetic agents provided similar surface anesthesia in children. The newly introduced jatamansi based herbal topical anesthetic gel showed encouraging results, hence can be used as a potent topical anesthetic agent.

Keywords: Lignocaine gel, Cryotherapy, Jatamansi extract, Topical anesthesia

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INTRODUCTION

Pain control is a cornerstone of successful dental treatment and topical anesthetic agents play a vital role in pediatric dentistry by minimizing pain and discomfort during dental procedures, enhancing patient co-operation, and ensuring successful outcomes.[1] Conventional agents such as lignocaine and benzocaine are widely used due to their rapid onset and effectiveness.[2] These agents are often associated with adverse effects, including allergic reaction, mucosal irritation, methemoglobinemia particularly in young children.[3] In past studies, Cryotherapy showed better reduction of pain perception during needle prick.[4] There has been a growing interest in the use of herbal alternatives because these formulations are derived from natural source and are generally well tolerated with minimal side effects.[5] Herbal alternative such as jatamansi extract have gained attention for their analgesic, anti-inflammatory, and anti-microbial properties with potentially fewer side effects.[6] Jatamansi extract, derived from the roots of Nardostachys jatamansi, used for reducing pain, burning sensations, and inflammation.[7]

The present in-vivo study aims to comparatively evaluate the effectiveness of herbal and non-herbal anesthetic gel when used as a topical anesthetic agent before an inferior alveolar nerve block.

MATERIALS AND METHODS

Forty children aged 8-12 years who requiring inferior alveolar nerve block for dental procedures were selected.

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They were selected from the patients visiting the department of pedodontics and preventive dentistry.

Inclusion criteria

Patients aged 8–12 years old requiring inferior alveolar nerve block for dental procedures.

Patients who are willing to participate in the study.

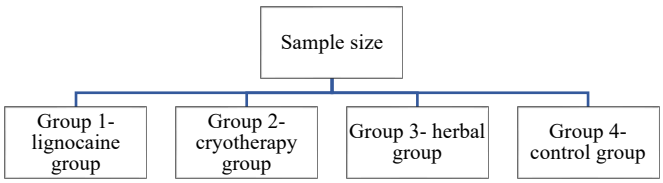
Exclusion criteria

Patients with a history of allergic to local anesthesia, systemic disease, sensitive skin, and dental abscesses in the procedure site.

Patients who are unable to follow the instructions or uncooperative.

Data Collection

The study protocol was approved by the institutional review committee of the college. The purpose of the study was explained to the children and their parents, and a voluntarily written informed parental consent was obtained. In the first visit, an intraoral screening was performed and patients requiring local anesthetic injections for further dental procedures were selected [Flowchart 1]. Children were randomly divided into four study groups with 10 subjects in each group using lottery system.



Flowchart 1: Sample design

The four study groups are as follows:

Group 1: Lignocaine group

Group 2: Cryotherapy group

Group 3: Herbal group

Group 4: Control group

Preparation of ice applicator:

The lidocaine ice applicator was prepared using lidocaine HCL 2%. The solution was loaded in a 3ml syringe and the cotton applicator tip was soaked in the LA solution in a dappen dish. All the tips are stored in a sterile container with lid. The container is stored carefully in a refrigerator between -4 ºC to 0 ºC. Later the applicator is used whenever needed.

Extract preparation

The dried ethanolic extract of the part material of jatamansi plant were prepared using ethanol in the cold maceration technique were used for preparing extract for formulation of herbal anesthetic gel. (Fig 1)

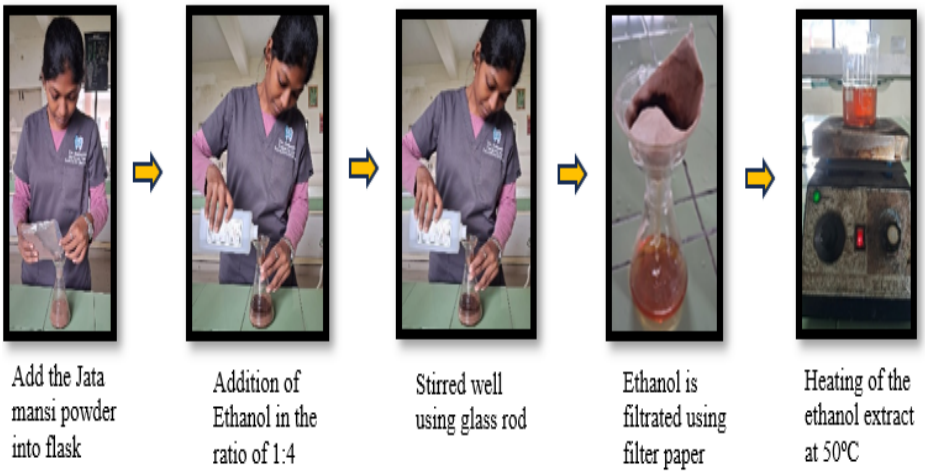


Fig 1: Extract preparation

Formulation of herbal gel

Carbopol 940 was It was kept aside for 15 mins to swell, which was further stirred to form a gel. Required quantity of methyl paraben was dissolved in distilled water with the aid of heat on water bath. Solution was cooled & glycerine, peppermint oil, aloe vera gel was added to it. Further required quantity of ethanolic extract of jatamansi was mixed to the above mixture and volume made up to 100 mL by adding remaining distilled water. All the ingredients were mixed properly and with continuous stirring. Triethanolamine was added drop wise to the formulation for the adjustment of skin pH (6.8–7) and also to obtain a gel at required consistency.4,5 The formula was mentioned in (Table 1).

S.NO	INGREDIENTS	QUANTITY
1	Ethanolic extract of Jata mansi powder	5g
2	Carbopol 940	1g
3	Triethanolamine	0.50g
4	Peppermint oil	2 drops
5	Glycerine	10g
6	Aleo vera gel	10g
7	Methyl paraben	0.18g
8	Distilled water	70g

Table 1: Formulation of herbal anesthetic gel containing ethanolic extract of jata mansi

Once the children were allocated into the respective groups, the sites for the application of the topical anesthetic agents were determined, marked, and isolated. The topical anesthetic agents were applied in the respective groups for 1 min. The topical anesthetic agents were applied onto the mucosa for 1 min using sterile, cotton applicator. The ice applicator tip was used for the study were made by soaking the cotton applicator tip in the water and transferred into sterile container and freezing it. Following the application of the topical anesthetic and precooling of the site in the respective groups, local anesthetic injections were performed using 0.45 mm x 38 mm sterile single use syringes. After local anesthetic (LA) injections, the patients were asked to individually rate their pain experience using visual analog scale. The subjective evaluation of pain perception on injection during LA administration was done using a Venham picture test and visual analog scale by the patient immediately after the LA procedure, during the needle prick and before injecting (Fig 2). Physiological parameters such as Pulse rate and blood pressure were recorded before, during, and after LA administration using a finger pulse oximeter and sphygmomanometer. The scores were calculated and tabulated.

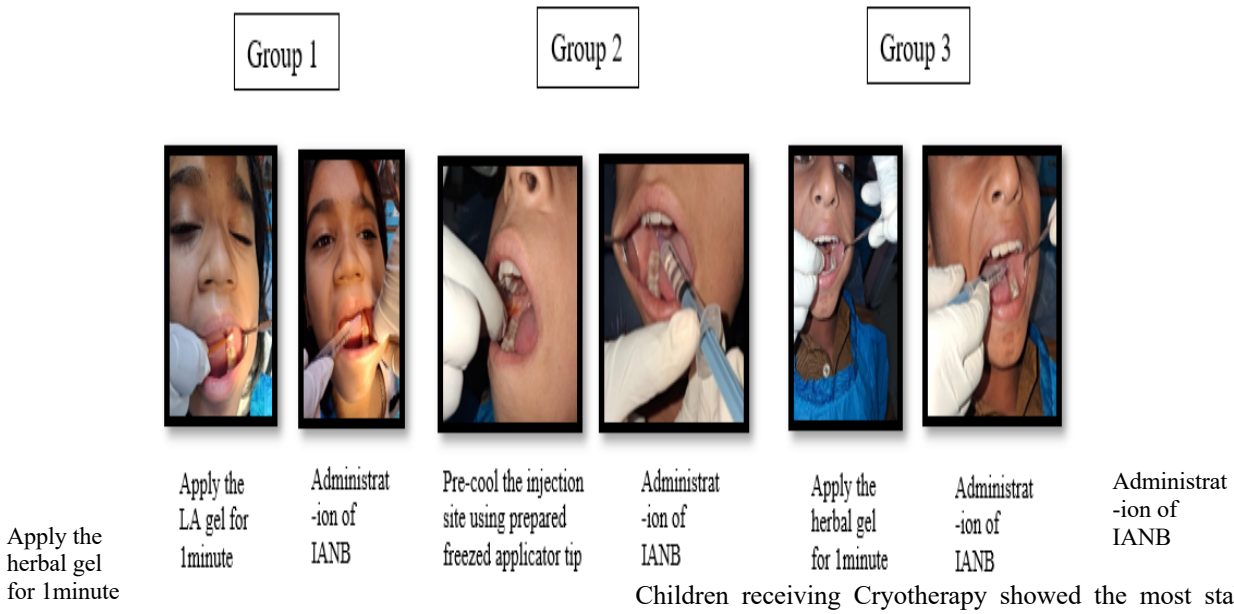


Fig 2: Procedure

Statistical Analysis

All the data were recorded in Microsoft Excel 365 and were subjected to statistical analysis using Statistical Product and service solution (SPSS) version 21.0 (IBM SPSS Statistics 21.0 US) with P value considered significant at <0.05. The data were represented as either mean value with standard deviation, medians with interquartile ranges, numbers, or percentages. Parametric variables, such as the patient's age, were analysed using t-tests. Chi-Square was used for frequency analysis (number and percentage) of categorical data. The mean VPT and VAS scores were evaluated with post hoc analysis.

RESULTS

The results are presented in terms of pulse rate, blood pressure, Venham picture test and visual analog scale. The test results demonstrate that cryotherapy group have highest mean VPT, VAS score followed by herbal gel and then lignocaine gel. When comparing the pulse rate and blood pressure During the treatment phase, a highly significant intergroup difference was observed (p = 0.001), with the Cryotherapy group demonstrating the greatest reduction in pulse rate (86.2 ± 5.9) compared with both the Herbal gel (92.6 ± 6.3) and Lignocaine gel groups (93.1 ± 6.1). Children receiving Cryotherapy showed the most stable systolic levels (112.1 ± 6.8), while those in the Herbal gel (116.4 ± 7.3) and Lignocaine gel (117.1 ± 7.6) groups exhibited comparatively greater increases. During the procedure, however, a significant intergroup difference emerged (p = 0.003). The Cryotherapy group maintained more stable diastolic values (73.1 ± 4.9), whereas both the Herbal gel (77.4 ± 5.1) and Lignocaine gel (77.9 ± 5.3) groups exhibited higher readings. (Table 2) Cryotherapy produced the greatest reduction in anxiety, decreasing from 3.20 ± 0.78 to 1.10 ± 0.32, whereas the Herbal gel group reduced from 3.30 ± 0.82 to 1.70 ± 0.48, and the Lignocaine gel group. (Table 3) Cryotherapy resulted in the greatest reduction in pain intensity, decreasing from 4.50 ± 1.10 to 1.80 ± 0.60, while the Herbal gel group reduced from 4.60 ± 1.05 to 2.40 ± 0.70, and the Lignocaine gel group.

Group	Venham picture test		Visual analog scale	
	Before (Mean ± SD)	After (Mean ± SD)	Before (Mean ± SD)	After (Mean ± SD)
Cryotherapy	3.20 ± 0.78	1.10 ± 0.32	4.50 ± 1.10	1.80 ± 0.60
Herbal Gel	3.30 ± 0.82	1.70 ± 0.48	4.60 ± 1.05	2.40 ± 0.70

Lignocaine Gel	3.25 ± 0.80	1.75 ± 0.50	4.55 ± 1.00	2.45 ± 0.75
Control	3.28 ± 0.81	2.95 ± 0.76	4.58 ± 1.08	4.20 ± 1.02
Intergroup p-value	0.961	0.002	0.945	0.001

Table 2: Intergroup Comparison of Mean Venham Picture and Visual Analog Scores Between the Groups

Group	**Blood pressure**			**Pulse rate**		
	Before	**During**	**After**	**Before**	**During**	**After**
Cryotherapy	108.6 ± 7.5	112.1 ± 6.8	109.3 ± 6.4	102.4 ± 6.8	86.2 ± 5.9	80.5 ± 5.2
Herbal Gel	107.9 ± 6.9	116.4 ± 7.3	111.6 ± 6.8	101.8 ± 7.1	92.6 ± 6.3	87.4 ± 5.9
Lignocaine Gel	108.2 ± 7.2	117.1 ± 7.6	112.2 ± 6.7	102.1 ± 6.5	93.1 ± 6.1	87.9 ± 5.7
Control	108.0 ± 7.0	109.2 ± 6.8	108.5 ± 6.6	101.5 ± 6.9	100.2 ± 6.6	99.4 ± 6.4
p-value (Intergroup)	0.954	0.010	0.041	0.912	0.001	0.002

Table 3: Intergroup Comparison of Mean Blood Pressure and Pulse Rate Scores Between the Groups

DISCUSSION

"Precooling" is a type of counter-stimulation that was first explored on palatal anesthesia by Harbert. Cryotherapy"[8] or "Cryoanaesthesia" decreases the conduction of nerve along with localized blood flow to the affected part and acts on each cell, including nerve cell creating instant anesthesia.[9] In addition, it operates on the tenets of the gate control theory, which asserts that the brain perceives cold stimuli before pain stimuli.[10] PC also serves as a distraction during LA injections.[11] PC can be done with internal coolants or external devices with a vibratory component.[12] Coolant used for internal PC can be ice or combination of ice and topical anesthetics or refrigerant sprays.[13]

Study conducted by Anantharaj et al in 2020 suggest that precooling of the injection site before LA provided better anesthetic results.[14] Study conducted by Nagpal et al evaluated the effect of lidocaine ice button as topical anesthesia. The study concluded that there was a greater reduction in pain of injection for maxillary infiltrations than lidocaine gel in children.[15] Dabarakis et al in an animal study revealed that potency of lignocaine increases with cooling the anesthetic solution.[16] Chilakamuri et al. (2021) found 2-minute ice application reduced pain scores (VAS and SEM scales) more than topical anesthetics in children.[17]

Lidocaine gel provides surface-level numbing for dental procedures by targeting nerve membranes directly.[1] Its action suits precooling protocols, enhancing overall pain control during injections.[18] Lignocaine gel acts mainly by blocking voltage-gated sodium channels in neuronal cell membrane.[19]

Mohite V et al conducted a comparative study on herbal and lignocaine gel and they concluded that 2% lignocaine gel proved to be effective in reducing pain due to needle stick.[20] Yet Amin et al. (2021) reported lignocaine with lower pain scores (insignificant) and better taste in kids.[21] Tirupathi et al. (2022) reviewed herbal vs. lignocaine/clove gels; lignocaine edged out clove in some cases, but eugenol-based herbals matched benzocaine/lignocaine for needle-prick pain.[22]

Jatamansi enhances the activity of gaba which is the chief inhibitory neurotransmitter.[23] Pandey et al. (2013) reviewed Jatamansi's neuroprotective role against oxidative stress, attributing effects to valepotriates and GABA enhancement—mechanisms supporting analgesic potential.[24]

Shivam Sharma did a review on Concept of Sangyaharana (Anaesthesia) and Pain Management in Ayurveda states that jata mansi shows sedative and analgesic effects.[25] Sharma (2021) trialed oral Jatamansi tablets (1000mg BD) vs. imipramine for GAD anxiety, with Hamilton Anxiety Scale improvements ($P<0.05$), confirming sedative efficacy.[26]

CONCLUSION

In the present study, among the three agents, precooling of the injection site before LA provided better anesthetic results when compared to other agents, even though statistically significant difference was not obtained.

The herbal anesthetic gel was found to be comparable to lignocaine and with minimum adverse effects. So, its safe and effective to use as a topical anesthetic agent in reducing the pain from needle insertion.

Moreover, further detail clinical trial may be carried in respect of its safety and efficacy profile.

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