ORIGINAL RESEARCH PAPER

Pediatric Dentistry

EFFECTIVENESS OF ICE AND TOPICAL GEL IN REDUCING PAIN PERCEPTION DURING DEPOSITION OF LOCAL ANAESTHESIA IN CHILDREN: A SPLIT-MOUTH CROSSOVER STUDY

KEY WORDS: ice stick, topical anesthesia, pain assessment

Dr. Amogh Mathur Post Graduate Student, Department Of Pediatric And Preventive Dentistry, Darshan Dental College And Hospital, Udaipur, Rajasthan

Dr. Ruchi Arora Head Of Department, Department Of Pediatric And Preventive Dentistry, Darshan Dental College And Hospital, Udaipur, Rajasthan

Dr. Parul Rawat Professor, Department Of Pediatric And Preventive Dentistry, Darshan Dental College And Hospital, Udaipur, Rajasthan

ABSTRACT

Background: Dental operatory's most feared anxiety-inducing stimuli is the injection of local anaesthetic. The goal of the current study is to compare the effects of cooling the injection site and using local anaesthetic gel to reduce pain perception in paediatric patients. **Aim:** To compare and evaluate the effect of topical cooling and the use of local anaesthetic gel before infiltration anaesthesia in reducing pain and anxiety in paediatric patients undergoing bilateral dental extractions. **Methodology/study design:** A split-mouth crossover study in which 32 children aged 6-12 years requiring buccal infiltration for bilateral dental extractions were included. They were divided into 2 groups with 16 children in each group. Group 1- At 1st appointment (site-1), 2% lignocaine gel was applied with a cotton pellet on dry oral mucosa for 1minute followed by buccal infiltration using 2% lignocaine injection. At 2nd appointment (site-2) ice stick was applied on oral mucosa for 1 minute followed by buccal infiltration. Group 2- At 1st appointment (site-1) ice stick was applied on oral mucosa for 1minute followed by buccal infiltration. At 2nd appointment (site 2) 2% lignocaine gel was applied on the dry oral mucosa for 1minute followed by buccal infiltration. To evaluate the child's anxiety, the pulse rate and oxygen saturation was noted. The perception of pain was assessed using Wong Baker Face Pain Scale and Sound Eye Motor (SEM) evaluation. Data analysed using SPSS version 22. **Result:** The study showed use of ice stick exhibited the lowest mean scores of anxiety/pain using Wong–Baker Faces Pain Rating Scale, SEM Analysis and pulse rate as compared to topical anesthesia gel. The differences in pain scores recorded were found to be statistically significant. **Conclusion:** Administration of ice stick prior to local anesthesia can reduce pain and discomfort in children.

INTRODUCTION:

Dental treatment and pain are often closely associated phenomenon in dentistry. Pain control is an important aspect of dentistry, particularly in management of pediatric dentistry patients and the practice of contemporary dentistry is inevitable without the use of local anesthesia.[1] However, the agonizing experience of dental injections incorporates a fear of dentist in children

The administration of local anaesthesia is the key to controlling pain during dental procedures. Most of the paediatric patients are fearful and anxious about the pain that they experience while the local anaesthesia is administered. The majority of young patients are scared and worried about the discomfort they may feel after local anaesthetic administration. Reduction of pain during dental procedures can nurture the relationship of the child patient and dentist, building trust, allaying fear and anxiety, and promoting a positive behavioural attitude, as well as help to provide overall comfort and well-being during the entire dental experience.[3]

The most widely advocated technique to minimize the pain of local anesthesia is the use of topical anesthetic agent before injection.[5]

The application of topical anaesthetic can minimise the discomfort of intraoral anaesthetic injections, deliver anaesthesia for intraoral operative procedures, gives symptomatic relief of pain due to superficial mucosal lesions such as ulcers or even soothe a toothache and post-extraction pain. Topical anaesthetics are available in the form of ointments, gels, sprays, or as adhesive patches.

Precooling: precooling is also called cryoanesthesia, it involves the application of cold to the surface of the oral mucosa. Unlike topical anesthesia, cryoanesthesia acts on all the cells. Many studies reported the use of precooling in children. For reducing pain due to needle insertion in block (IANB), palatal injections majority of the studies in children reported that a combination of precooling and topical anesthesia is better than the usage of topical anesthesia alone.[4]

In light of the above-mentioned statements, the objective of this study is to compare the pain and behaviour after application of topical anesthetic gel and ice stick prior to administration of local anaesthesia.

Clinical Usage of Topical Anesthetics for Dental Use in Children: To reduce local anesthesia needle prick pain: Trypanophobia is the fear of needles. Injection with needles into the oral cavity is perceived as the most feared dental procedure. Most topical anesthetics are efficient in reducing needle prick pain in children.[4]

Inclusion Criteria

1. Children in the age group of 6-12 years requiring administration of buccal infiltration of local anesthesia for bilateral dental extraction.
2. Children whose parents are willing to participate in the study will be included.

Exclusion Criteria

1. Medically or physically compromised patient.
2. Any allergy to local anesthesia.
3. Children whose parents are not willing to take part in the study will be excluded

MATERIALS AND METHODS:

For the purpose of this randomized split mouth A split-mouth crossover study in which 32 children aged 6-12 years requiring buccal infiltration for bilateral dental extractions were included.

In this split mouth study design, the treatment was completed in two visits and children were randomly allocated to two different groups: Group I (cryotherapy; ice stick), Group II

(lignocaine gel)

They were divided into 2 groups with 16 children in each group.

Group 1- At 1st appointment (site-1), 2% lignocaine gel was applied with a cotton pellet on dry oral mucosa for 1minute followed by buccal infiltration using 2% lignocaine injection. At 2nd appointment (site-2) ice stick was applied on oral mucosa for 1 minute followed by buccal infiltration.

Group 2- At 1st appointment (site-1) ice stick was applied on oral mucosa for 1minute followed by buccal infiltration. At 2nd appointment (site 2) 2% lignocaine gel was applied on the dry oral mucosa for 1minute followed by buccal infiltration.

As it is extremely difficult to quantify pain in children, two different objective and subjective scales were used:

1. The SEM scale an objective scale, was used to measure pain. An assistant was trained to measure and calibrate the SEM scale.The assistant was blinded to avoid bias.
2. The second scale was Wong–Baker FPR scale, a subjective scale used to assess pain. A set of six cartoon faces were shown to the child with varying facial expressions ranging from a very smiling face to a very sad face. A brief explanation was given to the child about each face after which the child was instructed to choose the face that best described his/ her feelings while receiving local anesthesia.

Additionally, vital parameters such as oxygen saturation (SpO2) and pulse rate (PR) were recorded before, during and after anesthesia.

Statistical Analysis:

The collected data were tabulated and subjected to statistical analysis using the SPSS version 22. The statistical test employed were Paired t-test for parametric data (pulse rate, systolic pressure, diastolic pressure) and Mann-Whitney U-test for nonparametric data (WBFRS score for pain perception) for comparison between the groups. Level of statistical significance was set at p-value less than 0.05.

RESULTS:

Intergroup Comparison Of Pain:

The comparison of pain relief methods before and after switching between 2% lidocaine gel application and ice stick application reveals statistically significant changes. Before the switch, the mean pain score for the 2% lidocaine gel application was 4.875 with a standard deviation of 1.7842, whereas the mean for the ice stick application was notably lower at 2.500, with a higher variability (SD = 2.000). After switching the interventions, the mean pain score for the ice stick application dropped significantly to 1.750 (SD = 1.4376), while the mean for the 2% lidocaine gel application ice stick application increased to 4.875 (SD = 2.3058). The p-value of 0.001 indicates that these differences in pain scores, both before and after the switch, are statistically significant, suggesting that the interventions had a measurable and meaningful impact on pain levels across both groups.

Intergroup Comparison Of Sound, Eye, And Motor Scores:

Before the crossover switch, participants treated with the 2% Lidocaine Gel scored slightly higher on the **Sound** component (mean = 2.500, SD = 0.6325) compared to the Ice Stick group (mean = 2.125, SD = 0.8851), although the difference was not statistically significant (p = 0.178). On the **Eye** component, the 2% Lidocaine Gel group showed significantly higher scores (mean = 2.250, p = 0.033) than the Ice Stick group (mean = 1.750). The **Motor** scores were also higher in the 2% Lidocaine Gel group (mean = 2.438) compared to the Ice Stick group (mean = 1.813), but this difference approached significance (p = 0.059).

After the crossover switch, the Ice Stick group demonstrated significantly higher **Sound** scores (mean = 2.875, p = 0.001) compared to the 2% Lidocaine Gel group (mean = 1.563). Similarly, the Ice Stick group scored higher in the **Eye** (mean = 2.375, p = 0.001) and **Motor** components (mean = 2.750, p = 0.001) compared to the 2% Lidocaine Gel group (mean Eye = 1.250 and Motor = 1.188). This indicates that the Ice Stick application resulted in more active responses after the crossover.

Intergroup Comparison Of Pulse Rate:

Prior to the switch, there was no statistically significant difference in **pulse rate** between the 2% Lidocaine Gel group (mean = 92.375 bpm) and the Ice Stick group (mean = 89.875 bpm), with a p-value of 0.438. However, during the application, the pulse rate was significantly higher in the 2% Lidocaine Gel group (mean = 103.625 bpm, p = 0.023) compared to the Ice Stick group (mean = 99.188 bpm).After the application, the pulse rate remained significantly elevated in the 2% Lidocaine Gel group (mean = 92.250 bpm, p = 0.006) compared to the Ice Stick group (mean = 84.375 bpm).

After the switch, the Ice Stick group showed a significantly higher **pulse rate** (mean = 91.688 bpm, p = 0.048) compared to the 2% Lidocaine Gel group (mean = 85.438 bpm) before the application. During the application, the Ice Stick group continued to exhibit a significantly higher pulse rate (mean = 103.375 bpm, p = 0.004) than the 2% Lidocaine Gel group (mean = 97.750 bpm). However, the pulse rates between the two groups after the application were not significantly different (p = 0.264).

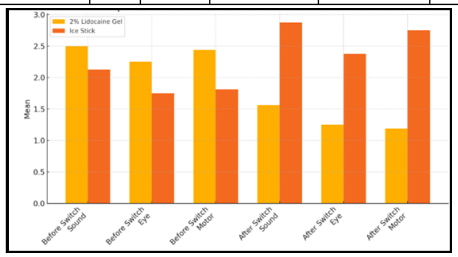
Table 1: Intergroup comparison of Wong Baker pain rating scale

		N	Mean	Std. Deviation	Std. Error Mean	P value
Before switch	2% Lidocaine Gel Application	16	4.875	1.7842	.4460	0.001
	Ice Stick Application	16	2.500	2.0000	.5000	
After switch	Ice Stick Application	16	1.750	1.4376	.3594	0.001
	2% Lidocaine Gel Application	16	4.875	2.3058	.5764	

Table 2: Intergroup Comparison of Sound, Eye, and Motor Scores

	N	Mean	Std. Deviation	Std. Error Mean	P Value
Before Switch					
Sound					0.178
2% Lidocaine Gel	16	2.500	0.6325	0.1581	
Ice Stick	16	2.125	0.8851	0.2213	
Eye					0.033
2% Lidocaine Gel	16	2.250	0.5774	0.1443	
Ice Stick	16	1.750	0.6831	0.1708	
Motor					0.059
2% Lidocaine Gel	16	2.438	0.8921	0.2230	
Ice Stick	16	1.813	0.9106	0.2276	
After Switch					
Sound					0.001
2% Lidocaine Gel	16	1.563	0.5123	0.1281	
Ice Stick	16	2.875	0.7188	0.1797	
Eye					0.001
2% Lidocaine Gel	16	1.250	0.4472	0.1118	

Ice Stick	16	2.375	0.7188	0.1797	
Motor					0.001
2% Lidocaine Gel	16	1.188	0.4031	0.1008	
Ice Stick	16	2.750	0.9309	0.2327	



Graph 1: Intergroup Comparison of Sound, Eye, and Motor Scores

Table 3: Intergroup Comparison Of Pulse Rate:

	N	Mean	Std. Deviation	Std. Error Mean	P Value
Before Switch					
PR-Before					0.438
2% Lidocaine Gel	16	92.375	9.1497	2.2874	
Ice Stick	16	89.875	8.8384	2.2096	
PR-During					0.023
2% Lidocaine Gel	16	103.625	4.3031	1.0758	
Ice Stick	16	99.188	6.0246	1.5062	
PR-After					0.006
2% Lidocaine Gel	16	92.250	7.8443	1.9611	
Ice Stick	16	84.375	7.3383	1.8346	
After Switch					
PR-Before					0.048
2% Lidocaine Gel	16	85.438	8.3024	2.0756	
Ice Stick	16	91.688	8.8673	2.2168	
PR-During					0.004
2% Lidocaine Gel	16	97.750	4.0906	1.0227	
Ice Stick	16	103.375	5.9763	1.4941	
PR-After					0.264
2% Lidocaine Gel	16	89.438	6.2393	1.5598	
Ice Stick	16	86.875	6.4795	1.6199	

DISCUSSION:

Local anesthetics have been widely used to alleviate pain of dental procedures such as extractions, pulpotomies, root canal therapies/pulpectomies and drainage of abscess. However, it is ironical that the local anesthetic agents used to eliminate pain are themselves associated with pain, resulting in aggravation of fear and anxiety caused by the sight of needles, also referred to as trypanophobia. [3]

Intraoral local anesthesia is frequently used in children to reduce pain during various dental procedures. Paradoxically, administration of LA injection itself produces pain and anxiety which may cause subsequent unfavorable behavior. Application of topical anesthetic gel at the site of injection is the most practiced technique to reduce the pain associated with the LA injection. [9]

In the present study, we evaluated and compared the efficacy of precooling of anesthetic site before infiltration evidence to consider it as the most effective topical anesthetic agent used in pediatric dentistry. [9]

Cooling the injured tissues to suppress/reduce inflammatory signs was in practice since the olden days. Local application of ice packs for pain relief is being done for treating sprain and burn injuries, bruises, insect bites, and musculoskeletal pain. We considered the application of ice for reducing injection pain as one of the test groups based on the understanding of its effectiveness in reducing pain, ease of making the desired shape, and low cost. [9]

Pain during local anesthesia deposition can be attributed to needle prick during deposition of the solution into the tissue and after removal of the needle.

In the present study, we considered the pain perception of the patient during the deposition of the local anesthetic solution into the tissue, which could be due to the expansion of the tissues, activation of both A-delta and C fibres, and the pH of the solution.

In the study, the patient's behavior was evaluated for pain perception using SEM scale and WBFR Scale by the operator. Sound, eye, motor scale takes into account the SEM component of patient's response to stimulation and was used because it enables the assessment of the relationship between pain and the reactions which the sensation of pain generates in the patient's eyes, bodily movements and verbal expressions of discomfort. [8]

Wong-Baker Faces Pain Rating Scale is a type of facial image pain scale and considered one of the simplest pain assessment tools to be used in pediatric dental practice. Furthermore, it has been found to be reproducible in children as young as 3 years of age. This scale consists of six facial images. Each image is designated from 0 to 10 numbers, where 0 represents "no hurt" and 10 represents "hurts worst." The patient was shown this scale and was asked to select the image closest to his/her current pain experience. [8]

Another study presented by Ghaderi et al.stating that holding 10 mL of 30% sucrose solution was effective in reducing pain of dental injections. Kakeda et al.20 through the use of fMRI (function magnetic resonance imaging) demonstrated that holding a sweet-tasting solution in the mouth resulted in a positive elevated affective state has the potential to reduce pain perception. [1]

A split-mouth design was selected for the present study as the confounding factors of pain and discomfort varies from person to person. [1]

Typically, pain signals are rapidly transmitted via the myelinated A-delta fibres and the non-myelinated C-fibres are the slow-conducting fibres. As the tissue temperature decreases, the nerve conduction velocity also decreases in both A-delta and C-fibres. Thus, a fall in skin temperature tends to increase the pain threshold in an individual. Additionally, sucrose also produces an analgesic effect by stimulating the gustatory receptors that subsequently, release endogenous opioid (-endorphins) and resulted in a morphine like analgesia. [1]

The objective parameters of SpO2,pulserate and SEM scale also show significant reduction on pain in ice stick application. [1]

The advantage of this technique is that it comfortable, safe and physiologically effective. Moreover, ice is inexpensive and readily available everywhere in India and is a material which is familiar to the patient's, thereby, is less likely to induce anxiety and subjective fear.

Limitation Of The Study:

It was a split mouth trial with less sample size. Future studies with higher sample size should be conducted to compare multiple injection techniques and materials for different procedures on primary teeth.

Future studies can expand on our research and examine other materials and techniques to compare their effectiveness as a pre injection anesthetic with that of ice stick.

CONCLUSION:

It can be concluded that administration of ice prior to local anesthesia can reduce pain and discomfort in children. In today's era, where several methods are available for pain management, using ice stick in pediatric patients can be a safe and effective alternative to the conventional topical anesthetic agents in minimizing pain as the ice acts a reward and offers the advantage of providing a positive dental experience, relieve pain and reduce anxiety for the patient.

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