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Original Article

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Taking the Sting Out of Shots: Determination of Effect of Four Different Acceptable Methods on Perception of Pain, Anxiety and Behaviour During Local Anesthesia Administration in Pediatric Patients Aged 5-9 Years- A Split Mouth Randomised Clinical Trial

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ABSTRACT

Introduction: Dental anxiety and pain acts as a barrier in accessing oral health care. Pedodontists face uncooperative children whose behaviour may hinder the effective treatment delivery and may cause possible harm to themselves and the pedodontist. Local anesthetic injection is one of the most anxiety inducing stimuli in pediatric dentistry.

Aim: This study aims to compare the efficacy of pre-cooling with ice, vibration+distraction, laser bio-stimulation and local anaesthetic (LA) gel with conventional method on reduction of pain, anxiety and behaviour of children aged 5-9 years.

Methodology: This study included 100 children requiring inferior alveolar nerve block. The children were equally divided into four groups: Group I ice group, Group II vibration+distraction group, Group III laser bio stimulation group, Group IV LA Gel group. After proper drying of the mucosa, one of the four techniques was applied for one minute followed by administration of Local Anesthesia. The pain response was assessed by Wong Baker Faces Pain Rating scale and Sound Eyes Motor Scale (SEM). The anxiety was assessed by measuring pulse rate before and after LA administration by pulse oximeter. Behaviour was assessed using Faces, Legs, Activity, Cry, Consolability Scale (FLACC)

Results: The children in vibration+distraction group had lower pulse rate, FLACC Score, and pain rating scores followed by ice, LA Gel and Laser Bio stimulation than the conventional procedure.

Conclusion: Pain management during LA injection is integral step in gaining initial trust and during subsequent visits. The present study suggests that simple methods like ice cooling and vibration+ distraction can be used as effective non pharmacological techniques to reduce injection pain.

Key Words: *Pain, Anxiety, Behaviour, Local Anesthesia, Distraction, Pediatric dentistry*

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INTRODUCTION

Dental anxiety and pain acts as a barrier in accessing oral health care. Pedodontists face uncooperative children whose behaviour may hinder the effective treatment delivery and may cause possible harm to themselves and the pedodontist. Local anesthetic(LA) injection is one of the most anxiety inducing stimuli in Pediatric dentistry. In pediatric dental practice, LA injections are usually the scariest and anxiety-provoking stimuli[1]. Most often, fear, anxiety, and the emergence of avoidance behaviour in children are also related to injection. The psychological effects of being around needles and syringes on children are detrimental. Ineffective pain management exacerbates fear of the needle and anxiety and may obstruct proper dental care. The concern of the pain that may be experienced after an anaesthetic agent injection is one of the biggest hurdles in providing quality dental care[2]. In order to successfully treat children and reduce their anxiety and pain during various treatment procedures, and to in still positive behaviour, proper local anaesthetic is crucial[3]. To ensure that the medicine diffuses as effectively as feasible and that the children have a pain-free dental experience, local anaesthetic must be applied as close to the nerve as possible. Numerous pharmacological and non-pharmacological desensitisation techniques, including the use of topical anaesthetics, slowing down the rate of infiltration, diverting the children, warming and buffering the local anesthesia, vibrating the tissue surrounding the

injection site during injection, applying heat and cold prior to the injection and computerized anesthesia delivery system (e.g., WAND), using modern devices like vibraject, dental vibe, or accupal or jet injectors have been tested to reduce the pain during administration of the LA injection. Flavoured topical anaesthetic gel is applied the most frequently in Pediatric dentistry[4]. Using ice to decrease inflammatory symptoms is a frequent practise[5]. Ice cooling decreases the release of inflammatory mediators, increases vasoconstriction, reduces tissue metabolism, and activates pain pathways that block pain signals[6]. Pre-cooling has been utilised in various medical trials to reduce pain following local anaesthetic injections and avoid edoema. In their study, Ghaderi et al. discovered that cooling the injection site for one minute before local anaesthetic infiltration greatly reduces the discomfort that paediatric patients report[7]. In dentistry, low-level lasers are used to treat pain. While administering intradermal and intramuscular injections, they have been utilised to lessen discomfort[8].Low-level laser biostimulation produces analgesia. It produces the body's natural painkillers, beta-endorphins. It affects the pain threshold through c-fiber whose activity is decreased and inhibits nerve fibre conduction[9]. The analgesic effect of vibration is based on the gate control hypothesis of pain. Vibration and touch receptors stimulate inhibitory interneurons in the spinal cord and results in abolition of pain transmission information by Aδ and C fibers to the second-order neurons of the spinal cord[10]. There is little research on the topic of using ice, low-level lasers, and vibration to reduce injection pain, anxiety and its effect on behaviour of in juvenile dental treatment. So, the goal of the current research was to determine how well LA gel, Cold, Laser Biostimulation (LBS) and Vibration+Distraction reduced pain in children receiving LA injections. The purpose of this study was to compare the effectiveness of different desensitising techniques in reducing pain in paediatric patients undergoing their first dental visit and needing Inferior alveolar nerve block during routine dental procedures. This study aims to compare the efficacy of pre-cooling with ice, vibration+distraction, laser bio-stimulation and local anesthetic (LA) gel with conventional method on reduction of pain, anxiety and behaviour of children aged 5-9 years. This scientific paper will give an outline on different acceptable methods, techniques of assessing them, their relationship with conventional technique and the significance of using them as a tool for reduction of pain, anxiety, and behaviour.

MATERIALS AND METHODS

The study was conducted on a sample size of 120 children(both males and females) aged between 5-9 yearsrequiring bilateral inferior alveolar nerve block attending the Department of Pedodontics and Preventive Dentistry, Indira Gandhi Government Dental College, Jammu. Approval from Ethical committee was obtained, and a written informed consent was taken from the parents before the start of the study. The children were equally divided into four groups: Group I ice group, Group II vibration+distraction group, Group III laser bio stimulation group, Group IV LA Gel group. Each group consists of 30 subjects (15 males and 15 females) and in each one of them one side was used as experimental and the other side as control.

Inclusion Criteria

- Children(Males and Females) between 5-9 years of age.
- Children requiring bilateral inferior alveolar nerve block.
- Children with no past dental injection history.
- Children with Frankel behavioural rating.
- Subjects in good health and not taking any medications that would alter their perception of pain.

Exclusion Criteria

- Children requiring emergency treatment.
- Children with negative behaviour.
- Medically or physically compromised children.
- Any Pathology at the site of injection.

Materials used in the study (Fig 1):

Diagnostic instruments, Local Anesthetic Gel (NanzMed Science Pharma Lignocaine Hydrochloride Gel), Ice, Vibration device, Laser (SIRO Laser), Cotton applicator, Pulse oximeter (Reelom), Disposable Syringe, Local anesthetic solution (Lignocaine with adrenaline injection, Himalaya meditek)

Fig. 1: Materials used

Methodology

Subjects were randomly allocated in to four groups by fish bowl draw method. The procedure was explained both to the child and the parents.

Phase I:

Application of the experiment

Treated in two different appointments to avoid preference bias15 were treated with experiment in first appointment and using the conventional in the second appointment and remaining 15 were treated with conventional in first appointment and experiment in the second. All treatment was done by one pediatric dentist. Baseline pulse rate was noted in both appointments just before injecting anesthesia using portable pulse oximeter (Fig. 2)


Fig. 2: Preoperative anxiety level assessment using pulse oximeter

In Conventional method: Local anesthetic injection was directly administered at the rate of 1ml/min (Fig.3a and 3b).


Fig. 3(a and b): conventional method of administering Local Anesthesia

In Group I Pre-cooling with Ice: After proper drying of the buccal mucosa the ice stick (made by filling finger part of latex gloves) was applied for 2 min and then the injection was administered at the rate of 1ml/min (Fig. 4).

Fig. 4: Pre- cooling of the injection site by ice stick

In Group II Vibration + Distraction: A vibrator motor of 1.5 volts, attached to a 9-watt battery. Device was placed 2 cm away from the injection site from outside near the angle of mandible for 2 min and then the injection was administered at the rate of 1ml/min (Fig 5).

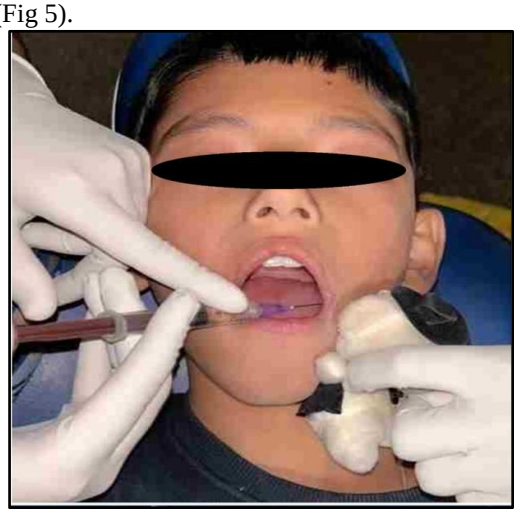

Fig. 5: Administering Local Anesthesia with vibration device in place

In Group III Laser bio-stimulation: After proper drying of the buccal mucosa Laser Bio-stimulation with probe tip 2mm away from the surface for 2 minute and then the injection was administered at the rate of 1ml/min (Fig. 6).

Fig. 6: Laser Bio-stimulation of the injection site

In Group IV Local anesthetic gel: After proper drying of the buccal mucosa Local anesthetic gel was applied with cotton applicator and the injection was administered at the rate of 1ml/min (Fig. 7).

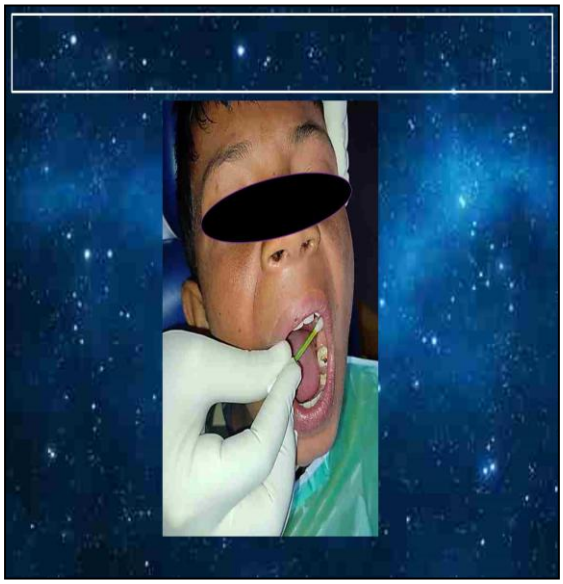

Fig. 7: Application of Local Anesthetic Gel using cotton applicator

Phase II:

Recording of scores

The subjective pain response was assessed by Wong Baker Faces Pain Rating scale[11] (Fig. 8) and objective pain response was assessed by Sound Eyes Motor Scale (SEM) (Table 1)[12]. The anxiety was assessed by measuring pulse rate by pulse oximeter attached to left index finger for 5 minutes prior to local anesthesia administration and third person noted pulse rate during LA administration (Fig. 2).Behaviour was assessed using Faces, Legs, Activity, Cry, Consolability Scale (FLACC) (Fig 9).

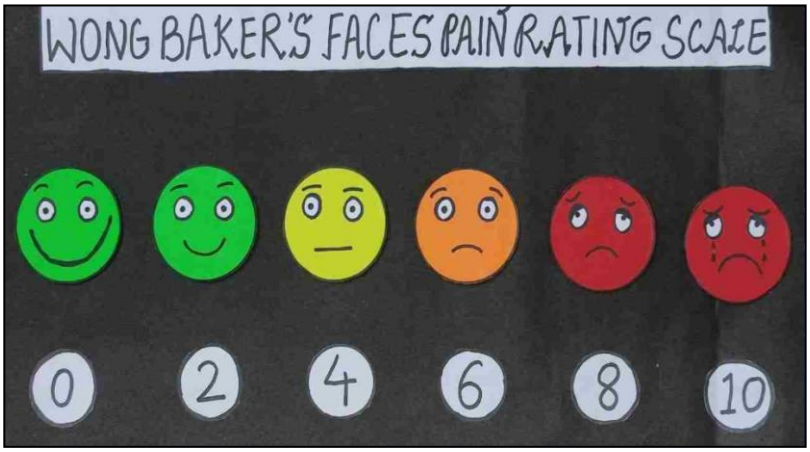

Fig.8: Wong bakers Faces Pain rating Scale

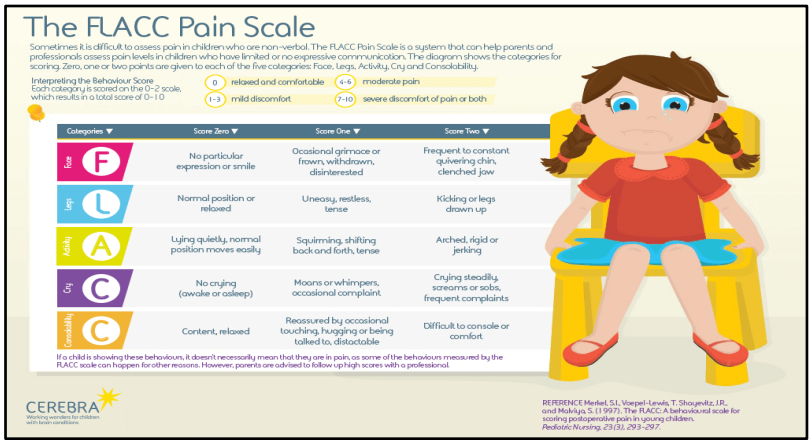

Fig.9: FLACC Scale

Table 1: SEM scale for pain assessment from child's behaviour (score 0–9)

SCORE	DESIGNATION	SOUND	EYES	MOTOR
0	Comfort	No sounds indicating pain	No eye signs of discomfort	Hands relaxed No apparent body tenseness
1	Mild Discomfort	Non- specific possible pain indications	Eyes wide show of Concern no tears	Hands show some tension
2	Moderately painful	Specific verbal complaint e.g. ow! Voice raised	Watery eyes	Random movement of arms/body grimace, twitch
3	Painful	Verbal complaint indicatesintense Pain	Crying tears running down the face	Movement of hands to make aggressive physical contact Pulling head away punching

Phase III:

Interpretation of the recorded scores

The recorded scores in each case were noted and result was interpreted using those scores.

STATISTICAL ANALYSIS

The obtained data was calculated using relevant statistical tools such as Students T test. Recorded Scores were analysed thrice. The mean results were evaluated statistically using IBM SPSS software 21. Students'ttests were used for comparison of the parameters and pvalue< *0.05* was considered as statistically significant.

RESULTS

The Comparison of post operative pain (subjective) among experimental and conventional groups was statistically significant with p value< 0.05 (Table 2).

Table 2: Comparison of post operative pain (subjective) among experimental and conventional groups

	MEAN	SD	COMPARISONS WITH POST OP PAIN USING CONVENTIONAL (P-VALUE)
POST OP PAIN USING LA GEL	1.466667	1.479360	0.000021*
POST OP PAIN USING ICE	1.200000	1.349329	0.000001*
POST OP PAIN USING LASER	2.400000	1.773366	0.021670*
POST OP PAIN USING VIBRATION + DISTRACTION	0.733333	1.112107	0.000001*
POST OP PAIN USING CONVENTIONAL	3.533333	1.942862	

* Statistically significant

The mean subjective pain score using conventional method was 3.5±1.9. Thegreatest pain reduction was observed in the Group II with Wong-Baker FACES mean pain score 0.7±1.1 followed by Group I with mean pain score 1.2±1.3, then Group IV with mean score of 1.4±1.4 and lastly Laser Bio stimulation with 2.4±1.7being the mean score. The intergroup comparison of post operative subjective pain score among each group showed statistically significant result with p value< 0.05 except for Gel Vs Ice group having p value = 0.4 which is not significant (Table3, Fig 10).

Table 3: Inter group comparison of post operative pain (subjective) in each group

COMPARISONS OF MEANS	P-VALUE
GEL VS ICE	0.468657
GEL VS LASER	0.030803*
GEL VS VIBRATION + DISTRACTION	0.034094*
ICE VS LASER	0.004582*
ICE VS VIBRATION + DISTRACTION	0.149195
LASER VS VIBRATION + DISTRACTION	0.000054*

* Statistically significant

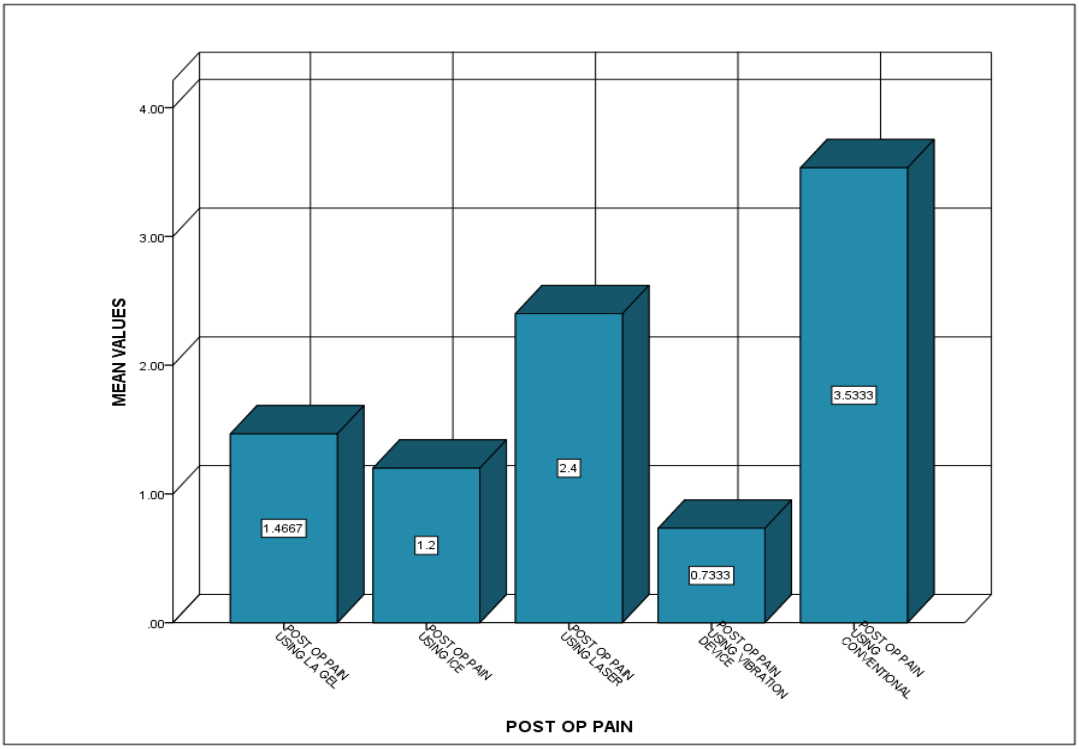

Fig.10: Shows mean of subjective pain score readings after intervention using the conventional and experimental methods

The Comparison of post operative pain (objective) among experimental and conventional groups was statistically significant with p value< 0.05 (Table 4).

Table 4: Comparison of post operative pain(objective) among experimental and conventional groups

	MEAN	SD	COMPARISONS WITH POST OP PAINUSING CONVENTIONAL (P-VALUE)
POST OP PAIN USING LA GEL	0.700000	0.651259	0.000001*
POST OP PAIN USING ICE	0.600000	0.674665	0.000001*
POST OP PAIN USING LASER	1.000000	0.587220	0.000021*
POST OP PAIN USING VIBRATION + DISTRACTION	0.233333	0.430183	0.000001*
POST OP PAIN USING CONVENTIONAL	1.833333	0.791478	

* Statistically significant

The mean objective pain score using conventional method was 1.8±0.7. Thegreatest pain reduction was observed in the Group II with SEM Scale mean pain score 0.2±0.4 followed by Group I with mean pain score 0.6±0.6, then Group IV with mean score of 0.7±0.6 and lastly Laser Biostimulation with 1.0±0.5 being the mean score (Table 5). The intergroup comparison of post operative objective pain score among each group showed statistically significant result with p value< 0.05 except for Gel Vs Ice group with p value+0.5 and Gel Vs Laser group with p value=0.06 which is not significant(Table5, Fig 11)

Table 5: Intergroup comparison of post operative pain (objective)

COMPARISONS OF MEANS	P-VALUE
GEL VS ICE	0.561416
GEL VS LASER	0.065995
GEL VS VIBRATION + DISTRACTION	0.001786*
ICE VS LASER	0.017347*
ICE VS VIBRATION + DISTRACTION	0.014888*
LASER VS VIBRATION + DISTRACTION	0.017347*

* Statistically significant

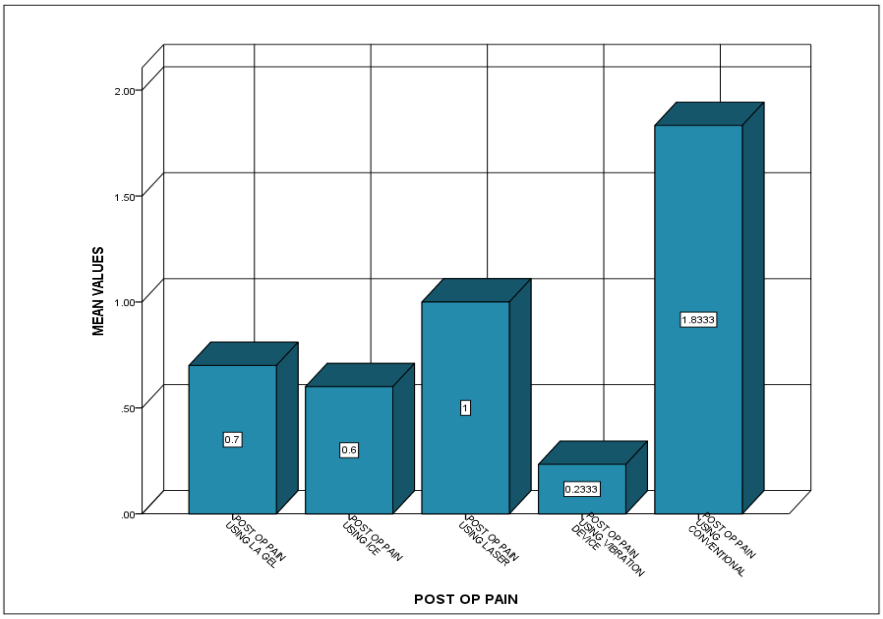

Fig. 11: Shows mean of objective pain score readings after intervention using the conventional and experimental methods

There was a reduction in mean pulse rate during the administration of local anesthesia using the Vibration+distraction device method, which indicates a lower level of anxiety. The mean baseline pulse rate and pulse rate during treatment using the conventional method were 98.6±0.8bpm and 103±1.04 bpm, respectively. The comparison of Intra- operative anxiety among the experimental and conventional groups was statistically significant with p value <0.05 (Table 6).

Table 6: Comparison of post operative anxiety among experimental and conventional groups

	MEAN	SD	COMPARISONS WITH POST OP ANXIETY USING CONVENTIONAL (BPM) (P-VALUE)
PRE OP ANXIETY(BPM)	98.60000	0.855006	0.0001*
POST OP ANXIETY USING LA GEL (BPM)	93.70000	1.055364	0.0001*
POST OP ANXIETY USING ICE (BPM)	92.76667	1.040004	0.0001*
POST OP ANXIETY USING LASER (BPM)	95.76667	0.935261	0.0001*
POST OP ANXIETY USING VIBRATION + DISTRACTION (BPM)	92.06667	1.172481	0.0001*
POST OP ANXIETY USING CONVENTIONAL (BPM)	103.0667	1.048261	

The mean pulse rate during treatment was less for Group II being 92±1.1 bpm followed by Group I with mean pulse rate was 92.7±1.04 bpm, then Group IV and Group III with mean pulse rate of 93.7±1.05bpm and 95.7±0.93 bpm respectively. By contrast, there was no significant difference in the baseline pulse rate readings while using the conventional and experimental methods in all the groups (Table1).The intergroup comparison of intra- operative anxiety via pulse rate was also found to be statistically significant with p value < 0.001 (Table 7, Fig 12).

Table 7: Intergroup comparison of post operative anxiety in each group

COMPARISONS OF MEANS	P-VALUE
GEL VS ICE	0.0001*
GEL VS LASER	0.0001*
GEL VS VIBRATION + DISTRACTION	0.0001*
ICE VS LASER	0.0015*
ICE VS VIBRATION + DISTRACTION	0.0001*
LASER VS VIBRATION + DISTRACTION	0.0001*

*** Statistically significant**

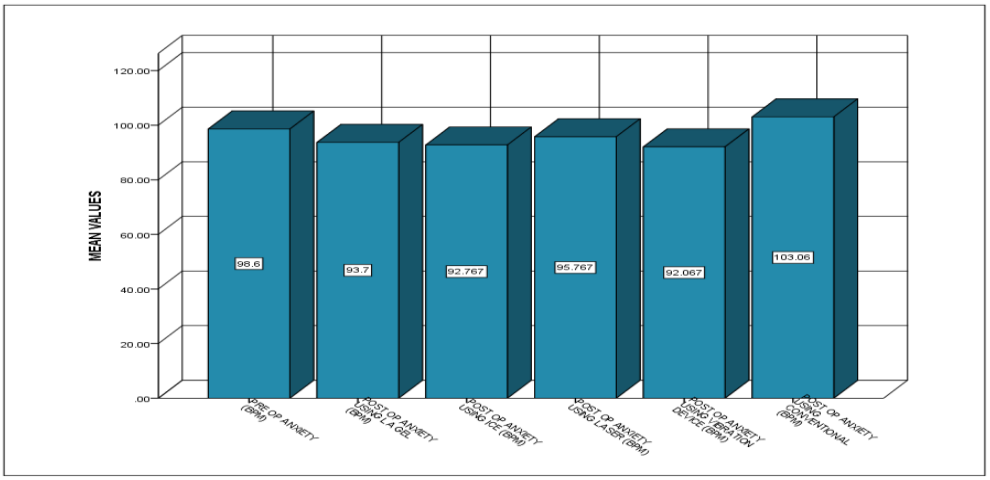

Fig. 12: Shows mean pulse oximeter readings before and after intervention using the conventional and experimental methods

The FLACC scores showed that a higher proportion of patients in both age groups were relaxed while the anesthesia was administered using the vibration+distraction device method, indicating a better behavior. Several patients were relaxed or showed very mild discomfort while receiving anesthesia using the device method, whereas a larger number of patients experienced pain while receiving anesthesia using the conventional method. After receiving local anesthesia using the conventional and experimental methods, the FLACC scores of all the groups were compared and the results were statistically significant with p value <0.05 except for Laser Biostimulation group having p value= 0.2 (Table 8, Table 9 and Fig 13).

Table 8: Comparison of post operative behaviour among experimental and conventional groups

	MEAN	SD	COMPARISONS WITH POST OP BEHAVIOUR USING CONVENTIONAL (P-VALUE)
POST OP BEHAVIOUR USING LA GEL	1.800000	1.989628	0.045310*
POST OP BEHAVIOUR USING ICE	1.733333	1.740657	0.025289*
POST OP BEHAVIOUR USING LASER	2.266667	1.998850	0.244618
POST OP BEHAVIOUR USING VIBRATION + DISTRACTION	0.900000	1.348051	0.000069*
POST OP BEHAVIOUR USING CONVENTIONAL	2.900000	2.171127	

*** Statistically significant**

Table 9: Inter group comparison of post operative behaviour.

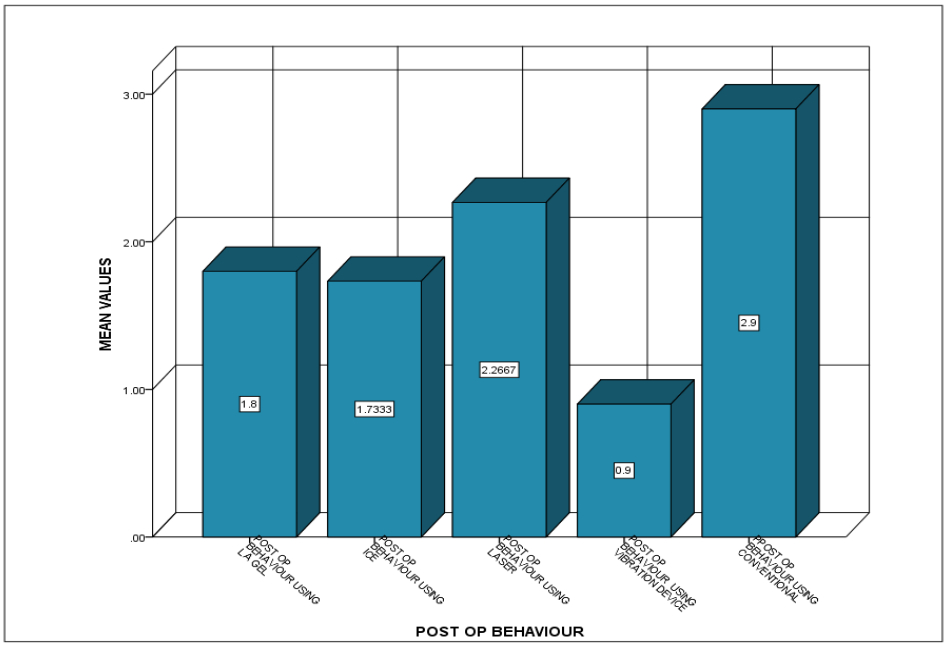

Fig. 13: Shows mean of FLACC score readings after intervention using the conventional and experimental methods

The mean Flacc score was less for Group II being 0.9+1.3 followed by Group I, Group IV and Group III scores being 1.7±1.7, 1.8±1.9 and 2.2±1.9 respectively. The mean FLACC score using Conventional method was 2.9±2.17. the intergroup comparison of FLACC scores was found to statistically significant with p value <0.05 except for Gel Vs Ice, Gel V s Laser and Ice Vs Laser.

DISCUSSION

Children frequently experience anxiety related to dental procedures and dentists. One factor affecting the degree of dental anxiety among young patients is age. Patients between the ages of 5 and 9 were chosen for the study as children in this age range have high cognitive skills.

In the present study, a new, simple, and child-friendly device with an added effect of both distraction and vibration was used. It was constructed and used to reduce pain, lessen anxiety, and inculcate positive behaviour in children during dental injections. The advantage of using this device is it's easy use, cost effectiveness, compactness and advantage of having vibration and distraction in the same device. The device is reusable, battery operated, and a vibrating soft toy teddy bear containing two vibrator motors of 1.5 volts attached to a 9-watt battery. In this study, the device has proven to be superior to the conventional method of dental injection in reducing pain and anxiety and in managing the child's behaviour during dental injection. It is a new, simple, efficient, and child-friendly device, which can result in enhanced outcomes related to anxiety and fear of dental treatment. Application of topical anesthetic gel at the site of injection before local anesthesia is the most followed technique to abolish the pain associated with the LA injection[13]. In the present study, lignocaine hydrochloride gel was used as the effective topical anesthetic agent commonly used in pediatric dentistry[14]. Rare allergic reactions are being reported on prolonged and repeated use of 2% lignocaine hydrochloride gel manifesting its safety in children[15]. Since olden days, cooling the injured tissues to suppress/reduce inflammatory signs has been in practice. Local application of ice packs for pain relief is accepted widely for treating sprain and burn injuries, bruises, insect bites, and musculoskeletal pain. The application of ice is used as one of the test groups for reducing pain at the site of injection based on the understanding of its effectiveness in reducing pain, ease of making the desired shape, and being economical[16]. The application of lasers for many soft and hard tissue procedures is commonly applied practice in dentistry. It is least invasive causing less discomfort to the patients[17,18]. Laser biostimulation is another test group to reduce pain at the injection site based on the premise that low-level lasers are effectual in producing analgesia[19].

In the present study, most children showed very mild discomfort or pain during anesthesia administration using the device method followed by Ice group, local anesthetic gel group and laser biostimulation group, whereas most children experienced pain during anesthesia administration using the conventional method. Several pain rating scales are accessible and developed primarily for pediatric population.The Wong-Baker Faces Pain Rating Scale is repeatable, easy to use, and has found to have a significant positive correlation. It has been used for subjective pain assessment in children and adults in various studies[20]. Hence, Wong-Baker Faces Pain Rating Scale was used in the present study for subjective pain assessment. SEM scale was used for objective measurement of pain as it considers eyes, movements of the body, and verbal expressions. In the present study, the mean subjective and objective pain scores for vibration device group were lower followed by ice group, local anesthetic gel group and laser bio stimulation group. The values for all of these were lower than the conventional method, indicating that children experienced less pain when using thetest group with vibration+distraction device method being the best.

Gate control theory of pain by Melzack and Wall has explained the analgesic effect of vibration, which was stipulated to minimize concurrent pain. The findings observed by Chaudary et al. using VibraJect in children[21], Shilpapriya et al. using dental vibe in children[22], and Aminah et al. using extra-oral massager[23] were consistent with this theory. However, in the present study extra-oral vibration using a child-friendly device was used for alleviating pain in children during dental injection. Also, distraction is a behaviour management technique that involves distraction of the patient away from the stimuli that causes anxiety and thereby allaying it. The objective of this technique is to relax the patient and reduce the anxiety during treatment. According to previous studies, the ideal distractor must possess an optimal amount of attention, which involves the use of multiple sensory modalities (visual, auditory, and kinesthetic), active emotional involvement, and participation of the patient to compete with the signals from the noxious stimuli[24]. Active forms of distraction involves child's participation involving different sensory components such as interactive toys, virtual reality, guided imageryand moving their leg in the air. Conversely, the passive forms could be used for distraction by asking a child to observe an activity or stimulus rather than allowing them to categorically involve in a certain activity such as watching television or listening to music[25]. In the present study, a toy teddy bear with vibrations was used to distract their thought and attention to the needle, which worked excellently.

Topical cold application triggers myelinated A-fibers, activating inhibitory pain pathways, which in turn represses the pain perception[26]. The observations by Mohiuddin et al. have shown that pre-cooling before infiltration anesthesia reduced the pain perception in pediatric patients when compared to topical anesthetic gel[27]. Laser biostimulation was found to be less efficient compared to LA gel and pre-cooling with ice in reducing the pain at the site of injection. Similar observations were reported by Ghaderi et al., who concluded that there was almost no reduction in pain perception with the concurrent application of laser and topical anesthetic agent on the buccal mucosa before the administration of LA injection[28]. Contrarily, Sattayut when evaluated the effectiveness of laser biostimulation, topical anesthesia, pressure, and light touch for pain reduction during palatal injection, found no significant differences in pain scores among the different techniques used[29]. Variations in choice of laser parameters such as the wavelength of the laser unit, the power delivered, mode of application, i.e., either contact or non-contact, time of exposure, type of tissue exposed, and physiological condition of the tissue exposed could affect the outcome[30].

In humans, pulse rate serves as a direct indicator of physiological arousal. Changes in pulse rate are ascribed to stress during dental procedures; hence, it could be an index of the patient's response to dental stimuli. The commonly ascribed response to dental stimuli when the child first visits the dental clinic is believed to be fear or anxiety; thus, monitoring pulse rate using a pulse oximeter is an objective way to assess anxiety levels in children. It has also been used in various

studies to measure anxiety in children during dental treatment[31]. In the present study, there was a reduction in mean pulse rate during the administration of local anesthesia using the device method followed by ice method, local anesthetic method and laser bio stimulation method indicating that the level of anxiety of children for a local anesthetic injection is best reduced with the device method.

The FLACC Behavioural Pain Rating Scale comprises behavioural categories and a variety of descriptors that are reliably associated with pain in children, adults with cognitive impairment, and critical illness, supporting the validity of this tool in these groups. Recent studies have used the FLACC scale to rate the behaviour of children during dental treatment[32]. In the present study, both age groups showed reduced pain and lower anxiety levels and positive behaviour during local anesthesia administration while using the vibration+distraction device followed by ice method, local anesthetic method and laser biostimulation method. This finding indicated that the device is highly effective in both younger and adolescent age groups for better clinical outcomes. Various other systems used to reduce pain during injection were Wand and computer-controlled injection system for children; however, the major disadvantages projected with this system are the time taken to administer the local anesthesia and the cost and complexity of the equipment[33,20].

CONCLUSION

The various means could be used to administer local anesthesia in children allaying pain and anxiety. It is concluded that application of ice and vibration application were highly significant in reducing the experienced pain, anxiety and modify the behaviour to a positive one during local anesthesia in children. Local anesthetic group and laser biostimulation were found to be less effective in comparison to vibration group and ice group. Also, the distraction along with vibration device was found to help in reducing anxiety among children. The order of effectiveness being Group II(Vibration) > Group I(Ice) > Group III(Local anesthetic) > Group IV(Laser biostimulation). Vibration device is a novel, simple, effective, and child-friendly device, which can result in improved outcomes related to pain and anxiety of dental treatment. Also, pre-cooling of the injection site before local anesthesia is an easy, reliable, and an effective technique being economical and was found to be beneficial to be applied to all pediatric patients which reduces discomfort and facilitates clinical management. A larger sample size could be undertaken to conduct future research on the effectiveness of these procedures for different intraoral locations and local anaesthetic approaches, especially in young children.

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