

Original Article

Assessment of pain in paediatric dental patients during administration of local anesthesia with and without the use of audiovisual distraction

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ABSTRACT

Background: Infants and children who experience pain in early life, show long-term changes in terms of pain perception and related behaviors. Local anesthesia is integral to the practice of painless dentistry but the pain of injection itself is deterrent to successful administration of local anesthesia and can be a most anxiety-provoking procedure. Distraction as a behavior management technique is successfully known to reduce pain and manage children's dental behavior by diverting their attention away from painful stimuli during invasive dental procedure. This study aimed to compare the pain associated with local anesthetic injection delivered with and without the use of distraction as a behavior management technique in 6–8-year-old children.

Materials and Methods: In this randomized, clinical, *in vivo* study with a split-mouth design we compared the pain of 30 children (6–8-year-old), requiring dental treatment necessitating the use of local anesthesia bilaterally in either of their maxillary and mandibular arches. Treatment was done in two visits, 1 week apart. Children were randomly assigned to receive the distraction (iPad) at one visit while no distraction in other visits. Two different pain assessment scales were used: Wong-Baker faces pain scale (FPS) and FPS-Revised. The Chi-square test was used for statistical analysis. $P \leq 0.05$ was considered to be statistical significance.

Results: Children who received local anesthesia with audiovisual distraction had lower pain rating scores than those who received local anesthesia with no distraction.

Conclusion: Audiovisual distraction significantly reduces pain associated with injection of local anesthesia.

Key Words: Local anesthesia, pain measurement, pain perception, self-report

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INTRODUCTION

Pain is a frequent symptom of oral disease and often the most important motivation for seeking dental treatment.^[1] For pediatric patients presenting to the emergency department, dental procedures

are often painful, unexpected and heightened by situational stress and anxiety leading to an overall unpleasant experience. Infants and children present unique challenges that necessitate consideration of

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the child's age, developmental level, cognitive and communication skills, previous pain experiences, and associated beliefs.^[2]

Infants and children who experience pain in early life show long-term changes in terms of pain perception and related behaviors.^[3] A negative attitude toward dental care often results from discomfort with the invasiveness of treatment despite efficacious pain relief with local anesthetics. When children experience pain during restorative or surgical procedures, their future as dental patients may be damaged.^[4] Numerous pharmacologic and nonpharmacologic techniques have been proposed for achieving nondisruptive behavior during the multiple visits necessary for all pediatric dental restorative procedures.^[5]

Local anesthesia is integral to the practice of painless dentistry but the pain of the injection itself can be deterrent to the successful administration of local anesthesia and a most anxiety-provoking procedure, especially in children.^[6] Effective pain control in children during regional dental injections is important to achieve comfort, co-operation, and compliance with dental care.^[7] The pain induced by the injection of local anesthetic agents can be reduced by a number of complementary methods which include reducing the speed of injection, use of fine needles with improved syringes,^[6] varying the rates of infiltration, buffering and warming the local anesthesia, and distraction techniques.^[8]

Distraction is a state of mind that draws the attention away from painful or unpleasant stimuli.^[9] Distraction is known to successfully reduce pain and manage children's dental behavior during invasive dental procedures.^[8] It is a safe and inexpensive management technique that can make the dental appointment more pleasant and of a shorter duration^[9] and may be passive or active, the former including the child listening to music on headphones or watching videos, the dentist telling the child a story, etc., and the latter involving the child's participation in activities such as playing with electronic devices, the child telling the dentist a story.^[10]

It is unfortunate that pain recording is not a part of the normal history-taking procedure.^[11] The importance of pain assessment cannot be underestimated as it is vital for diagnosis and is also helpful in predicting posttreatment healing.^[12] Pain in infants and children can be difficult to assess, which has led to the creation of numerous age-specific pain management tools and

scores.^[2] To treat pain adequately, ongoing assessment of the presence and severity of pain and the child's response to treatment is essential. Reliable, valid, and clinically sensitive assessment tools are available for neonates through adolescents.^[13] Pain can be assessed using self-report, behavioral observation, or physiologic measures, depending on the age of the child and his/her communication capabilities. Most children aged 5 years and older can provide meaningful self-reports of pain intensity if they are provided with age-appropriate tools and training.^[11]

Hence, the present study was done to provide a simple and practical method for assessing the pain perception of children during the injection of local anesthesia with and without the use of audiovisual distraction as a behavior management technique in 6–8 years of age group and further to evaluate the effect of distraction on the basis of gender.

MATERIALS AND METHODS

In this randomized, clinical, *in vivo* study with a split-mouth design, the study sample was selected using a convenience sampling method, and carried out on children attending the department of pediatric and preventive dentistry, over a period of 4 months. Thirty healthy children (22 boys and 8 girls) of Indian origin aged between 6 and 8 years and who required dental treatment (surgical extractions and pulp therapies) bilaterally in either of their maxillary and mandibular arches were selected. All treatments necessitated the use of infiltration anesthesia for teeth in the maxillary arch and inferior alveolar nerve block anesthesia for teeth in the mandibular arch. Children with a history of unpleasant experiences in medical settings or with local anesthesia injections and with any mental, visual or auditory impairment were excluded. The study was initiated after obtaining ethical clearance from the Institutional Ethical Committee and review board, Pacific Dental College and Hospital, Udaipur, India (Ref. No-PDCH/16/EC– 12/Modified-2017).

Lignocaine hydrochloride (2% w/v) topical anesthetic gel (Wocaine[®], Wockhardt) was applied on dried mucosa for 1 min using a cotton tip applicator. A standard inferior alveolar nerve block was administered to the patients requiring treatment in the mandibular arch. The injection technique involved aspiration followed by a gradual injection of 2 ml of 2% lignocaine hydrochloride with 1:80000 epinephrine (Lignox[®] 2% A, Indoco Remedies Ltd.

India) over 1 min using a 25-gauge long needle (Dispo Van®, HVD, India). For the maxillary arch, the same procedure was employed and anesthetic solution was administered through local infiltration with a 30-gauge short needle (Dispo Van®, HVD, India). The procedure was repeated for the treatment on the other side of the arch in the next visit after an interval of 1 week. Children were randomly assigned to receive the distraction at one visit and no distraction at the other visit, but the tell-show-do technique was employed in both the visits. The entire procedure and the self-reported pain scales were explained to each child at the beginning of the study.

Distraction intervention

AniPad (Apple, California, Model A1395) memory card was loaded with a collection of animated children movies, cartoons, nursery rhymes, and video games. The children were asked to hold the iPad in their hands. Each child was taught how to use it, decrease or increase the volume, or change the movie/cartoon/video game according to their desire. Each child was given 5 min to get acclimated to the iPad before the injection procedure began. The iPad was connected to headphones for better audio distraction.

Pain assessment

Immediately following the injection procedure in each visit, the level of pain experienced by the child was assessed using a combination of two different scales – the Wong-Baker Faces Pain Scale (FPS) and the FPS-Revised (FPS-R). The Wong-Baker FPS is a self-reported pain scale and consists of a number of faces ranging from a happy face at 0-“No hurt” to a crying face at 10-“Hurts worst.”^[14] The children were asked to point out the face they felt most like at that moment which indicated the pain level they have experienced during the administration of local anesthesia. The second scale used was the FPS-R which is adapted from the FPS to make it possible to score the sensation of pain on the widely accepted 0–10 metric and can be used across the age range of 4–16 years.^[15] The child was asked to score the chosen face 0, 2, 4, 6, 8, or 10, counting from left to right, with “0” equaling “no pain” and “10” equaling “very much pain.”

Statistical analysis

Data collected were analyzed using the Statistical Package for Social Sciences software version 22 for windows (SPSS Inc., Chicago, IL, USA). Chi-square test was used for comparison of pain scores between

study techniques (distraction/no distraction) and genders. For all tests, a $P \leq 0.05$ was considered to be of statistical significance.

RESULTS

Participant characteristics

Thirty patients (age range, 6–8 years; mean age, 6.76 ± 0.76 years) were included in the study. There were 22 male (73.34%) and 8 female (26.67%) patients. Basic demographical data for the participants (age, weight, and height) are shown in Table 1.

Analysis

The results of the present study include analysis of 24 inferior alveolar nerve block injection procedures for 12 children (3 females and 9 males) and 36 maxillary infiltration procedures for 18 children (5 females and 13 males). Half of these injection procedures were done using audiovisual distraction and the other half without distraction in a split-mouth design.

There was a statistically significant difference in Wong-Baker FPS.^[14] (Scale 1) (Graph 1) and FPS-R.^[15] (Scale 2) (Graph 2) pain scores between the distraction and nondistraction techniques ($P < 0.001$). The pain scores on both the self-reporting pain scales were significantly lower when the distraction

Table 1: Patients' demographic characteristics

Characteristic	Male	Female
Age	6.81±0.77 (6-8)	6.62±0.69 (6-8)
Weight (kg)	21.8±2.23 (19.5-26.3)	19.96±1.57 (17.8-22)
Height (cm)	120.2±3.89 (115-127)	117.73±4.07 (114-126.4)

Values are expressed as mean±SD. SD: Standard deviation

Table 2: Comparison of frequencies of Wong-Baker faces ratings for pain of injection with and without distraction

Rating	Total	
	With distraction, n (%)	Without distraction, n (%)
0 - No hurt	5 (16.67)	0
2 - Hurts a little bit	16 (53.33)	3 (10.00)
4 - Hurts a little more	9 (30.00)	7 (23.33)
6 - Hurts even more	0	9 (30.00)
8 - Hurts a whole lot	0	8 (26.67)
10 - Hurts worst	0	3 (10.00)
Total	30 (100.00)	30 (100.00)
P	<0.001	

*Chi-square test; $P \leq 0.05$ =Statistically significant. Unit: Wong Baker Faces Pain Rating Scale^[14]

intervention was used [Tables 2 and 3]. Statistically significant differences were observed between genders in distraction-associated pain scores obtained from both scales, but not in the nondistraction pain scores. Females had higher pain scores than males [Tables 4 and 5].

Table 3: Comparison of frequencies of Faces Pain Scale (revised) ratings for pain of injection with and without distraction

Rating	Total	
	With distraction, n (%)	Without distraction, n (%)
0 - No pain	5 (16.67)	0
2 - Mild	16 (53.33)	3 (10.00)
4 - Nagging	8 (26.67)	7 (23.33)
6 - Miserable	1 (3.33)	10 (33.33)
8 - Intense	0	7 (23.33)
10 - Worst	0	3 (10.00)
Total	30 (100.00)	30 (100.00)
P	<0.001	

*Chi-square test; $P \leq 0.05$ = Statistically significant. Unit: Faces Pain Scale (revised)^[15]

Table 4: Comparison between genders of frequencies of Wong-Baker ratings for pain of injection with and without distraction

Rating	With distraction		Without distraction	
	Female	Male	Female	Male
0 - No hurt	0	5	0	0
2 - Hurts a little bit	3	13	0	3
4 - Hurts a little more	5	4	1	6
6 - Hurts even more	0	0	3	6
8 - Hurts a whole lot	0	0	3	5
10 - Hurts worst	0	0	1	2
Total	8	22	8	22
P	0.04		0.66	

*Chi-square test, $P \leq 0.05$ = Statistically significant. Unit: Wong Baker Faces Pain Rating Scale^[14]

Table 5: Comparison between genders of frequencies of Faces Pain Scale (revised) ratings for pain of injection with and without distraction

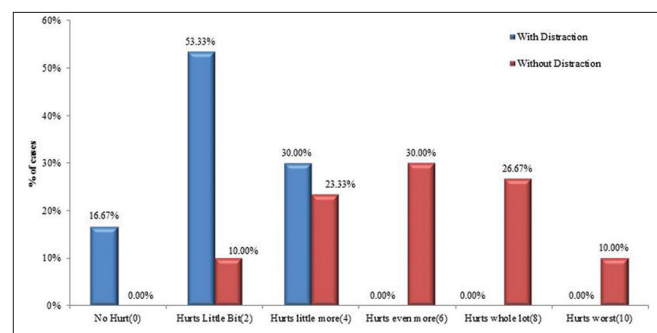
Rating	With distraction		Without distraction	
	Female	Male	Female	Male
0 - No pain	0	5	0	0
2 - Mild	3	13	0	3
4 - Nagging	5	3	0	7
6 - Miserable	0	1	4	6
8 - Intense	0	0	2	5
10 - Worst	0	0	2	1
Total	8	22	8	22
P	0.04		0.13	

*Chi-square test, $P \leq 0.05$ = Statistically significant. Unit: Faces Pain Scale (revised)^[15]

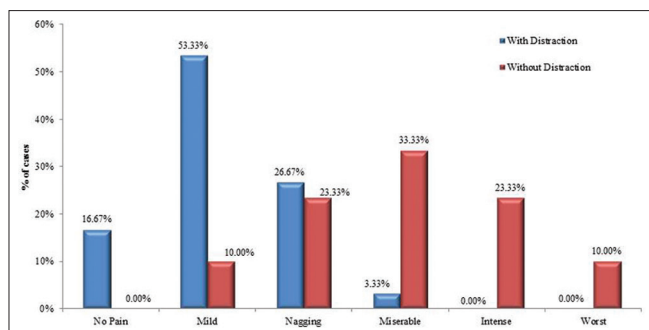
DISCUSSION

One of the most important aspects of child behavior guidance is the control of pain.^[16] Effective pain control in children during regional dental injections is important to achieve comfort, cooperation, and compliance with dental care.^[5] The present trend advocates the use of nonaversive behavior management techniques which may be equally effective and more acceptable to parents, patients, and practitioners. In distraction, the patient's attention is diverted away from what may be perceived as an unpleasant situation.^[17] Distraction limits the patient's attention capacity, resulting in the withdrawal of attention away from the noxious stimulus.^[18,19] Previous studies^[20,21] have suggested that the use of distraction during dental treatment is beneficial to patients by reducing their distress, and thereby, decreasing their perception of pain sensation, especially during local anesthetic injections.^[22] Various distraction techniques have been used previously, the first in 1999 by Peretz and Gluck,^[23] who used repeated deep breathing and blowing the air out before and during the administration of local anesthesia.

The results of a number of studies have suggested that ideal distraction requires activation of the child's various senses such as hearing, vision, and touch and active involvement of the child's emotions to counteract anxiety-causing noxious stimuli.^[24] Seyrek *et al.* found audiovisual distraction to be a better method when compared to audio distraction alone.^[25] This is in accordance with the findings of the present study which showed that children in the distraction group had lower pain scores than those in the nondistraction group. It appears that the attention of the children had been successfully occupied by the use of cartoon/music videos/games presented on the iPad. The findings of the present study were in agreement also with the findings of Aminabadi *et al.*, who studied



Graph 1: Distribution of Wong-Baker Faces Pain ratings.



Graph 2: Distribution of Faces Pain Scale (Revised) rating.

the efficacy of distraction and counter stimulation in the reduction of pain during the administration of local anesthetics and observed that children in the distraction group exhibited significantly less pain versus the control group.^[8] The results of the present study were also in accordance with those of other studies^[18,19,26] which report that audiovisual distraction was more effective than other distraction devices in reducing pain and disruptive behavior during painful dental procedures. The ability of distraction to decrease the perception of unpleasantness and avert negative or avoidance behavior has been explained on the basis of the gate control theory which suggests that the part of the brain that processes painful stimuli is less active when a person is distracted.^[27]

Children today are eager to play video games or watch cartoons and offering this option to a child during dental appointments may help in building rapport. There has always been an emphasis on establishing rapport with children, which may lead to successful patient management in the dental office.^[28] In the current study, children were offered the option of choosing a game/cartoon/music video of their choice. Several pediatric hospitals, child life specialists and nurses have tried to utilize the iPad technology with soft-padded headphones to support a child through painful medical procedures, such as the use of an intravenous needle and laceration repairs.^[29]

Contrary to the findings of the current and some other studies, Cassidy *et al.* observed that watching cartoons on TV did not distract children or reduce their pain during needle injection.^[30] The possible reason may be that children were concentrated more on the surrounding environment and not on the TV, while in the present study, they were isolated from the surrounding environment by the use of iPad which they held in their hands and the headphones and the cartoons/music video/video games presented in the

iPad were more engaging than those presented on regular TV. The results of the present study also differ from those of a study conducted by Sullivan *et al.* who found that the use of visual reality distraction during dental treatment had no significant effect on the pain perception of children.^[21]

The results of the present study were also in accordance with the findings of other studies which reported no significant difference in pain perception between boys and girls.^[24] Another study, by Attar and Baghdadi, reported that the effectiveness of video game playing in reducing pain and disruptive behavior was not influenced by gender.^[26]

It can be concluded that, in the present population, audiovisual distraction significantly reduced pain associated with injection of local anesthesia and there was no statistically significant difference in pain perception between genders.

However, there are certain limitations to this study as the age range of the children was limited. It has been reported that younger children, that is preschoolers, exhibit the most negative and aberrant behaviors during dental procedures and are the most difficult to control. Different age groups exhibit different cognitive characteristics and behavioral patterns toward audiovisual distraction technique, so it is recommended that different age groups be evaluated in future studies. The present study has been limited to self-reports of pain intensity, intensity of pain reported by the child was not measured. The children were only asked whether they were in pain or not. Further research would help in validating and finding better pain-reporting methods for children.

CONCLUSION

1. Audiovisual distraction significantly reduces pain associated with injection of local anesthesia
2. There was no statistically significant difference on pain perception on the basis of gender.

Why is this paper important to dentists?

- Audiovisual distraction is a very valuable adjunct to local anesthesia for controlling pain and reducing disruptive behavior during painful dental procedures in children
- Active distraction strategies using tools such as an iPad are recommended in the pediatric dental practice as this method was found to be effective

and safe and also appealed to a large number of child patients

- Dentists can use this technique in their clinical practice.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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