



EFFECT OF JET INJECTION (INJEX) ON PAIN PERCEPTION AMONG A GROUP OF PEDIATRIC DENTAL PATIENTS

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ABSTRACT

Background: Administering local anesthesia by injection is still the most common method used in dentistry. However, there is a constant search for ways to avoid the invasive and often painful nature of the injection and find a more comfortable and pleasant means of achieving local anesthesia before dental procedures.

Aim: To evaluate the pain perception among a group of pediatric dental patients after using Jet injection (INJEX).

Materials & Methods: The present study was conducted on 58 teeth in 39 children; 24 boys and 15 girls. The children included in the study were requiring local anesthesia for various dental procedures. Topical anesthetic gel was used, and then anesthesia was administered using the INJEX needleless device. Face pain rating scale (FRS) was used to assess the child's pain perception during performing different dental procedures.

Results: Statistical analysis revealed no statistically significant difference between pain scores with different treatment procedures. However, comparison between boys and girls revealed that boys showed statistically Significant higher pain score than girls during cavity preparation only.

Conclusion: Local anesthesia using INJEX showed low pain perception during different dental procedures.

KEY WORDS: Jet injection, local anesthesia, pain perception, pediatric dental patients, needle free- anesthesia.

INTRODUCTION

Pain has long been associated with dentistry and has an unusual relation. Pain is the main reason that leads the patient to seek dental treatment⁽¹⁾. In addition, dental fear and anxiety are the main causes that may lead patients to bypass dental appointments⁽²⁾.

Fear-related behaviors have long been recognized as the most serious aspect of patient management and can be an impediment to dental care⁽³⁾.

Local anesthetic injections are usually the main reason for fear and anxiety during dental treatment. Therefore, control of pain, anxiety and negative

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responses during local anesthetic injections has clinical importance in dental practice ⁽²⁻³⁾.

Local anesthesia is considered to be the backbone of pain control during dental procedures. In pediatric dental clinics, local anesthesia is mandatory in everyday pediatric dental procedures like extractions, pulpotomies, root canal treatment, etc. The objective fear of the child during administration of local anesthesia ranges from sight of the needle to the pain that might be associated with needle injection, which increases the anxiety of the patient resulting in fear of receiving local anesthesia in the future ⁽⁴⁾.

Dentists have used several methods to avoid pain during administering local anesthesia such as applying topical anesthesia ⁽⁵⁾, slow infiltration ⁽⁶⁾, transcutaneous electrical nerve stimulation ⁽⁷⁾, computer-assisted local anesthesia ⁽⁸⁾ and using vibrating tactile devices ⁽⁹⁻¹⁰⁾.

Injecting local anesthesia continues to be the most common method used in dental practice. However, there is continuous efforts searching for newer alternative means to avoid the invasive and painful nature of the injection, and to find a more comfortable and pleasant means of achieving local anesthesia before various dental procedures to avoid anxiety ⁽¹¹⁻¹²⁾. Therefore, dental research continues to investigate devices of anesthetizing patients that are needleless. A variety of needleless devices have been developed to deliver anesthesia, depending on pressure which force anesthetic solution into oral tissues ⁽¹³⁻¹⁷⁾.

In addition to efficient anesthesia, a needleless method should also be acceptable by patients. Some uncontrolled studies conducted on adult and child patients who were anaesthetized using needleless devices, examined the anesthetic properties of the device used. These studies revealed that about 50% to 90% of examined patients obtained sufficient anesthesia with the devices ⁽¹³⁻¹⁴⁾. The results expressed the patients' experiences of the needleless

methods and their preference for one method over another ⁽¹⁴⁾.

Few controlled trials of needleless device have been carried out, in one of them, the needleless method (INJEX) reported faster anesthetic results with no significant difference ⁽¹⁸⁾. Another study compared a needleless device to traditional injections. All patients in the study required 2 restorations, so a split mouth was used, the patient received the first restoration after using traditional injection technique, while the second restoration was received after using INJEX. Then the dentist rated the children's facial expressions regarding pain, the researchers concluded no significance difference between both techniques ⁽¹⁹⁾.

So, the purpose of the current study was to evaluate the effect of jet injection (INJEX) on pain perception among a group of pediatric dental patients during different dental procedures.

SUBJECTS AND METHODS

The study was carried out in Outpatient clinic in Pediatric Dentistry department – Faculty of Dentistry- Cairo University on pediatric patients seeking dental treatment requiring use of local anesthesia.

The study was carried out in accordance with the ethical guidelines in research with human participants and approved by the Ethics Committee of the Faculty of Dentistry- Cairo University. These ethical guidelines are in full accordance with the World Medical Association Declaration of Helsinki, and detailed written consent was signed by the parent or the guardian of the child.

Sample size calculation

A power analysis was designed to have adequate power to apply a 2-sided statistical test of the research hypothesis (Null hypothesis) that there was no change in pain scores as measured by Face Pain Rating Scale. According to the results of **Langthasa et al; (2012)** ⁽²⁰⁾, using alpha (α) level of 0.05 (5%)

and Beta (β) level of 0.20 (20%) i.e. power = 80%; the predicted minimum sample size (n) was a total of 31 cases. However, oversampling was done, and we used 39 cases (58 teeth). Sample size calculation was performed using G*Power Version 3.1.9.2

Study design:

The study is a case series study

Patient selection:

The study was conducted on 58 teeth in 39 patients, 24 boys and 15 girls, who attended the outpatient clinic of Pediatric Dentistry Department.

Inclusion criteria:

- Children aged 4.5-11 years requiring local anesthesia for various dental procedures.
- Apparently healthy.

Exclusion criteria:

- Patients having behavioral management problems.
- Patients having previous negative dental experience.

Detailed information about the use and application of the INJEX device (fig.1) in delivering local anesthesia can be found at the manufacturers' website ⁽²¹⁾. According to this, the INJEX may



Fig. (1): INJEX syringe

be used on all primary teeth for restorations and extractions. The operator ensured that the child could hear the popping sound of the device when anesthesia was delivered.

One operator performed the whole procedure including the administration of anesthesia till the final restoration or even extraction. Topical anesthetic gel (Benzocaine 20% Sultan Healthcare, VDI Healthcare, Brampton, Ontario) was applied for 2 minutes before using the INJEX. The local anesthetic used in INJEX was (Articaine 4% with epinephrine 1:100,000, Septodont, France).

Only 0.3 mL of the anesthetic solution was administered buccally to the tooth to be treated, then according to the indications of the specific tooth, lingual or palatal anesthesia was delivered subsequently (0.1 mL), the injector was placed in the same position and angles as traditional needle into the bucco-gingival sulcus, at the point of the sulcus that is close as possible to the attached gingiva, (the INJEX was used for infiltration anesthesia for both maxillary and mandibular arches), 5 minutes were allowed to pass after the local anesthesia had been administered before starting any dental procedures ⁽²²⁾.

A rubber dam was placed in case of cavity preparation or pulpotomy. Each tooth was treated according to the required procedure either cavity preparation with restoration, pulpotomy or extraction. After completing the dental procedure for each patient, the perceived pain was assessed using Faces Pain rating scale, where each child was given a printed form of the scale and asked to choose one face that best described how he/she felt and this selection was evaluated by the other operator (Fig.2) ⁽²³⁾.

The scores of all patients were collected and tabulated and statistically analyzed.

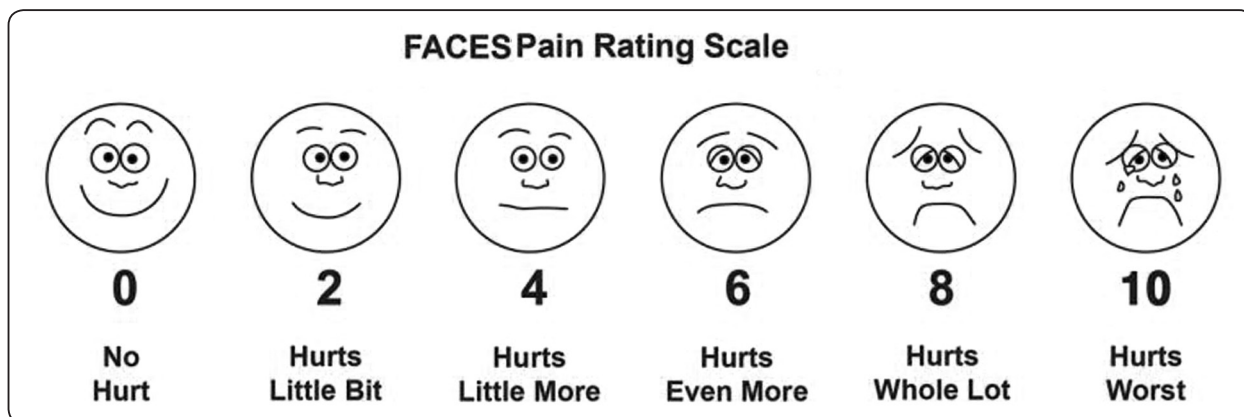


Fig. (2): Faces pain rating scale

Statistical Analysis

Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows.

Numerical data were presented as mean, median, standard deviation (SD) and range values. Pain scores were treated as non-parametric data. Pain scores of the three treatment modalities were compared using Kruskal-Wallis test. Mann-Whitney U test was used to compare between boys and girls. Qualitative data were presented as frequencies and percentages. The significance level was set at $P \leq 0.05$.

RESULTS

The present study was conducted on 58 teeth in 39 children; 24 boys (41.4%) and 15 girls (25.9%). The mean age was 6.6 years with a minimum of 4.5 years and a maximum of 11.0 years old.

Twenty teeth (34.5%) were anterior teeth while 38 teeth (65.5%) were posterior teeth. Twenty-five teeth (43.1%) were mandibular teeth while 33 teeth (56.9%) were maxillary teeth.

The mean \pm standard deviation values of pain scores were 0.5 ± 0.6 , median was 0.0 with a minimum of 0.0 and a maximum of 2.0.

There was no statistically significant difference between pain scores with different treatment procedures (P -value = 0.768), as shown in (table 1 & fig.3).

However, in table 2 comparison between boys and girls revealed that boys showed statistically significantly higher pain score than girls during cavity preparation (P -value = 0.025). While during pulpotomy as well as extraction, there was no statistically significant difference between boys and girls (P -value = 0.516 and 0.105, respectively).

TABLE (1): Descriptive results of Kruskal-Wallis test for comparison between pain scores with different types of treatment

	Cavity preparation	Pulpotomy	Extraction	<i>P</i> -value
Mean (SD)	0.5(0.5)	0.5(0.8)	0.5(0.8)	0.768
Median (Range)	1.0 (0.0-1.0)	0.0 (0.0-2.0)	0.0(0.0-2.0)	

*: Significant at $P \leq 0.05$

TABLE (2): Descriptive results of Mann-Whitney U test for comparison between pain scores in boys and girls.

Treatment		Boys	Girls	P-value
Cavity preparation	Median(SD)	0.8 (0.4)	0.2 (0.4)	0.025*
	Median(Range)	1.0 (0.0-1.0)	0.0(0.0-1.0)	
Pulpotomy	Mean (SD)	0.5 (0.9)	0.6 (0.7)	0.516
	Median(Range)	0.0 (0.0 – 2.0)	0.0 (0.0 – 2.0)	
Extraction	Mean (SD)	0.4 (0.5)	0.8 (0.4)	0.105
	Median(Range)	0.0 (0.0 – 1.0)	1.0 (0.0 – 1.0)	

*: Significant at $P \leq 0.05$

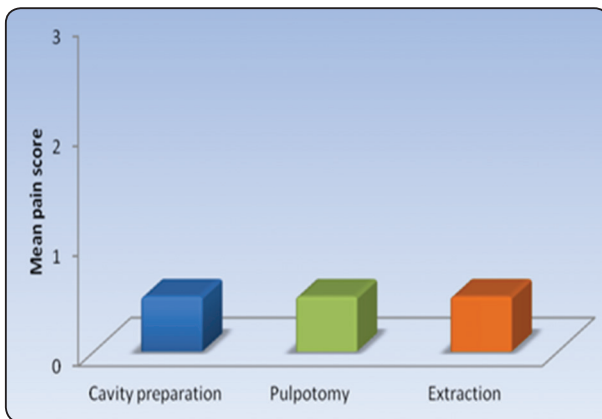


Fig. (3): Bar chart representing mean pain scores of the three treatments modalities

DISCUSSION

Jet-injection technology principle is based upon using a mechanical energy source to create a release of pressure sufficient to introduce a dose of anesthetic solution through a very small orifice, creating a thin column of fluid with sufficient force that can penetrate soft tissues into the subcutaneous tissues without a needle. Jet injectors are believed to offer advantages over traditional syringes by being fast and easy to use, with little or no pain, less tissue damage, and faster drug absorption at the injection site⁽²⁴⁾.

The present study was conducted to evaluate the effect of jet injection (INJEX) on pain perception among a group of pediatric dental patients during

different dental procedures, as studies evaluating efficacy and effectiveness of the technique in dentistry has been reported to be limited⁽¹⁷⁾.

Children in this study were selected in age range from 4.5-11 years, as this age range seek different dental procedures from cavity preparation, pulpotomy to extraction.

On evaluating the pain perception, the Faces pain rating scale was used as it is simple and widely used by many researches, in addition it is easy to use with children, as the child can easily and simply choose the face which matches how he/ she feels⁽²⁵⁻²⁶⁾.

The results of the current study concluded that the mean values of pain scores were low with no statistical significant difference among different dental procedures, these results go in accordance with **Schmidt; 1996**⁽²⁷⁾, **Saleh and Raab; 2002**⁽¹⁸⁾, **Geenen et al; 2004**⁽¹⁹⁾ and **Gunwal et al; 2014**⁽²⁸⁾ who indicated that needleless devices are often successful in controlling pain. On contradiction, a study by **Arapostathis et al; 2010**⁽²²⁾ reported that on using INJEX a significant percentage of the children reported annoyance or pain and fear during dental treatment, this may be due to that the children in this study were with no previous experience of dental anesthesia or dental injections and may be also due to pressure sensation during administration of anesthesia, and fear may result from the popping sound.

Moreover, the results of the present study on comparing boys to girls, revealed that boys showed

statistical significant higher pain scores in cavity preparation only and no difference in pulpotomies and extractions, this was in on contrast to **Saravia and Bush; 1991**⁽¹³⁾ who revealed no gender difference, this may be attributed to variation in pain threshold between patients, increased bone density as the age range selected was wide (4.5-11 years) which may affect the penetration of anesthesia and finally this may be due to larger sample of boys than girls.

CONCLUSIONS

- 1- There was no difference between pain scores in different dental procedures.
- 2- Boys showed higher pain scores than girls only in cavity preparation.

Recommendations:

- 1- Further researches on larger scale are recommended.
- 2- Comparative studies with different local anesthetic techniques are needed to reveal the difference in pain perception.

Conflict of interest:

The authors declared they do not have any conflict of interest.

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