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Comparison of dental pediatric patient's pain perception for needle free injection and conventional technique for buccal infiltration anesthesia – A randomized controlled trial

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Author Affiliation:
[1]Reader, Department of Pedodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India
[2]Post graduate student, Department of Pedodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India
[3]Reader, Department of Pedodontics, MIDSR, Latur, India
[4]Post graduate student, Department of Pedodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India
[5]Post graduate student, Department of Pedodontics, MIDSR, Latur, India
[6]Post Graduate Student, Department of endodontic, CSMSS, Aurangabad, India

✉**Corresponding author**
Reader, Department of Pedodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital,
Nagpur, India

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Pankaj Chavhan[1]✉, **Pratima Kolekar**[2], **Yogesh Somwanshi**[3], **Akash Bakal**[4], **Shruti Bhamare**[5], **Suraj Bakal**[6]

ABSTRACT

Aim: The purpose of the present study was to assess the pain perception for Jet injection and conventional injection for buccal infiltration local anesthesia among children. *Methods:* Total 106 children were selected based on inclusion criteria, from Department of Pedodontics, SDKS dental college and hospital, Nagpur. The study was carried out in Year 2021 (March-June). Children between 6-12 years of age were selected for study. Only buccal infiltrations were given to each child. Two methods have been used for buccal infiltration: needle free injection and conventional injection technique. Technique to be given first was chosen based on flip coin randomization. *Outcome:* Statistical significant difference i.e. $p<0.05$ was found between needle free injection and conventional injection technique. *Conclusion:* the needle free injection (Jet injection) was well accepted by children over conventional injection technique.

Keywords: Pain, anesthesia, needle free injection, VAS

1. INTRODUCTION

Administration of local anesthesia is the only procedure which relives pain for conscious dental treatment (Milgrom et al., 1997). There are many advantages offered by local anesthesia which gives very little excuse for not using it (Chavhan et al., 2020) paradoxically, although local anesthesia produces pain and anxiety during administration, still it is the only weapon dentist have for dental treatment. However, any procedure which produces pain and anxiety has significant negative impact in behavior of children during dental procedure (Lee and Lee, 2013). Variety of method have been suggested and

used to eliminate pain during local anesthesia infiltration administration such as the application of surface anesthesia, diversion techniques, behavior management techniques, increasing the time required for infiltration; though, this technique has found to be debatable in reducing pain (Chavhan et al., 2020; Aminabadi et al., 2009; Peedikayil and Vijayan, 2013).

Even with so many modifications and advances, pain and anxiety still considered to be a problem during local anesthesia administration. Various researches have been done by different operators to achieve complete painless anesthesia and they got success in reducing pain and anxiety related to local anesthesia administration but still complete elimination is the result they couldn't achieve (Newton et al., 2012). Pediatric dental treatment requires painless environment, as even slight pain can also create significant disruption of behavior of child during dental procedure. In dire need of painless injection, a Jet injection system can be test out as a painless dental injection (Lambrinidis et al., 1979-1980; Arapostathis et al., 2010). With a constant aim to search painless injection delivery system, a needle free injection (Jet injection) technique has been introduced to eliminate the pain (Lambrinidis et al., 1979; Arapostathis et al., 2010). It has 450 m/s supersonic speed, combined with ultrasonic wave frequency technology, without needle penetration technology.

This technique is needle free, prevents needle stick injuries and tissue damage; additionally, the needle free injection system delivers anesthetic without piercing tissue allowing for a potentially pain-free injection (Arapostathis et al., 2010). Although it is in use since 1990s, useful modifications have been done by different suppliers. Needle free injection (Jet injection) was studies and compared with existing technique; however, more conclusive evidence of high quality is need of an hour. Besides, there is shortage of literature available in the Indian scenario on the comparison of the needle free injection and conventional techniques of local anesthesia in children. Thus the aim of this study was to evaluate the pain perception of children for needle free injection (Jet injection) and conventional injection technique for buccal infiltration local anesthesia.

Aim and objective

The aim of this study was to evaluate the pain perception of children for needle free injection (Jet injection) and conventional injection technique for buccal infiltration local anesthesia, using VAS.

2. MATERIALS AND METHOD

The study was carried out in the Department of Paediatric and Preventive dentistry, SDSK dental college, Nagpur, Maharashtra. The study was started on March 2021 and completed on June 2021. It was an ethical clearance approved (IEC/Rep/STRP/03124), split mouth designed study. It is a randomized controlled trial study with single blinding was done.

Subjects

106 children (53 boys and 53 girls) between age group of 6-12 were included in the study after obtaining written consent from their parents. Children's fulfilling following criteria were included, however; others were excluded from study (Flow chart 1).

Inclusion criteria

Children under ASA category I
First time local anesthesia receiver
At least two procedures, one on each side after local anesthesia

Exclusion criteria

Any systemic disease
Medically compromised
History of needle rejection
Previous negative dental visit

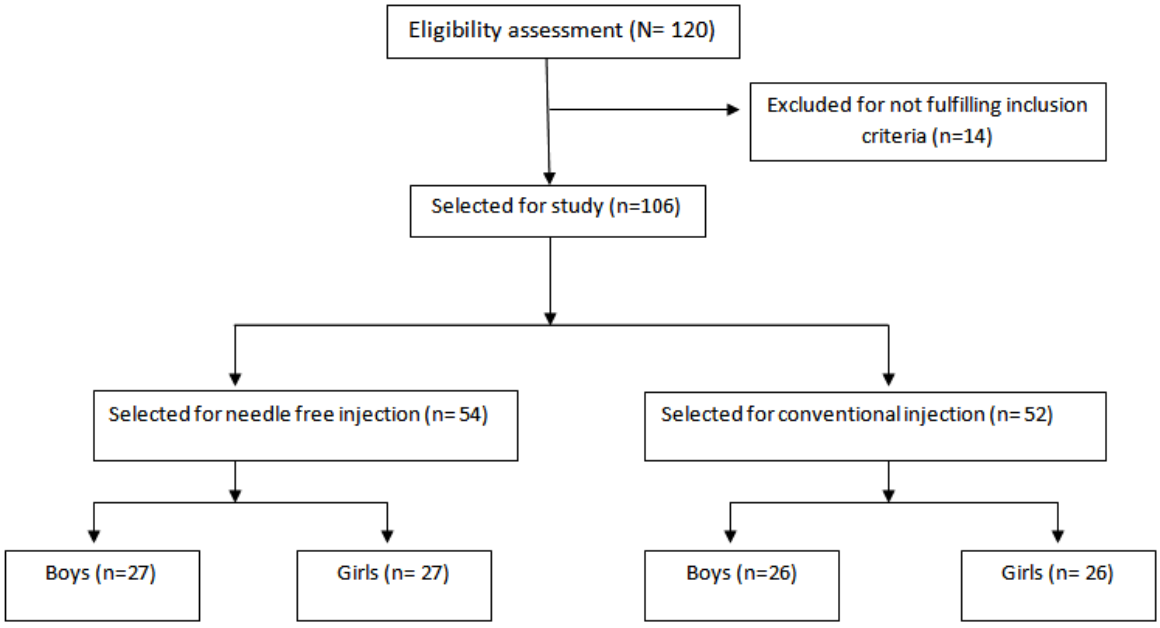
Procedure

Children received two techniques: needle free injection (Jet injection) and conventional for local anesthesia. Before administering injection behavior management technique were used. Children were told that there tooth is going to sleep after this liquid administration. VAS was explained to each and every child before infiltration. Independent person was designated to flip the Coin for selection of technique first to be administered. Prior administration topical gel was applied for 1 min over injection site for both the techniques, by the same operator. Lignocaine (2% lignocaine 1:80000 adrenaline) was used as anesthetic agent. 30 gauge needles

were used for conventional infiltration technique. As per manufacturer's recommendation, 0.3 cc local anesthetic was delivered for buccal infiltration using needle free injection (Jet injection) whereas, 1 cc of local anesthetic administration done with conventional injection syringe. Needle free injection does not require any time limit for deposition; whereas, the conventional injection required 2–3 min for deposition. Pain perception rating was noted on 10 point VAS scale after infiltration for both the techniques (Downie et al., 1978).

Sample size estimation

Previously published article was used for sample size estimation (Langthasa et al., 2012). Previous study has shown significant result between two injection techniques. Using Beta value 0.1996 and alpha value 0.05 with 95% confidence interval, the sample size was estimated to be 96. Considering 10% dropouts, 106 children were selected for this study.



Flow chart 1 consort participant's flow chart

Statistical methods

Data analysis was done using SPSS 19 software. Paired t test was used to compare VAS mean score for Needle free injection (Jet injection) and conventional injection technique.

3. RESULTS

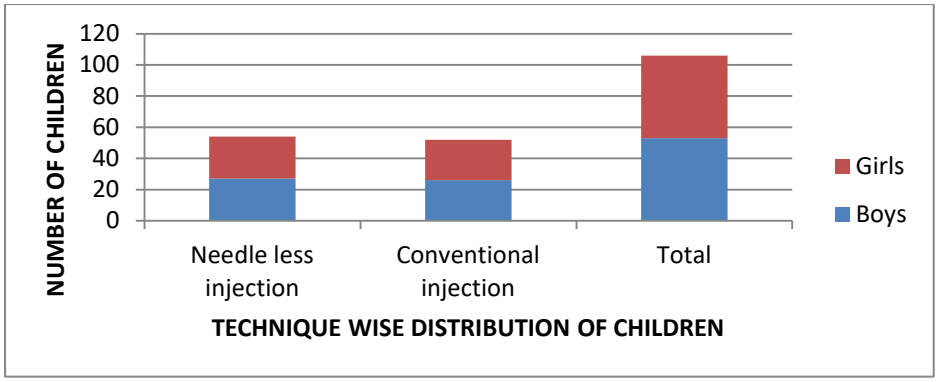
Demographic characteristics: Total 106 children were included; out of which 54 children were assigned the needle free injection (jet injection) technique to be given first , whereas, 52 children were given conventional injection first. There were even distribution of boys and girls in the sample of 106 children (Table 1 & Graph 1). The mean pain perception (VAS score) for the needle free injection (Jet injection) technique in all children was 0.16 (± 0.69) and mean pain perception (VAS score) for the conventional technique in all children was 2.42 (± 3.02). This difference came out to be statistically significant ($t = -7.51$, $p < 0.0001$) (Table 2 & Graph 2).

Table 1 Demographic distribution of participants.

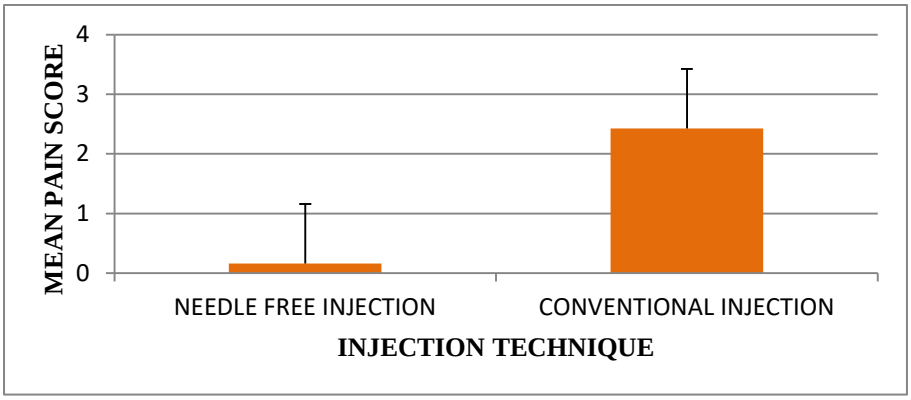
No Of Children	Boys	Girls	Total
Needle Free Injection	27	27	54
Conventional Injection	26	26	52
Total	53	53	106

Table 2 T test, mean pain score comparison between needle free and conventional injection

Age	Needle free injection (Jet injection) VAS Mean	Needle free injection (Jet injection) VAS standard deviation	Conventional injection VAS Mean	Conventional injection VAS standard deviation	t-test	significance
All (6-12) years	0.16	0.69	2.42	3.02	-7.51	P < 0.0001



Graph 1 Bar chart representing distribution of children for techniques



Graph 2 Bar diagram showing mean pain score comparison between needle free and Conventional injection

4. DISCUSSION

In our study we could able to find inclination of lower pain perception towards needle free injection technique. i.e. needle free injection produced less pain perception score as compared to conventional technique. Similar study reports have been published by authors (Makade et al., 2014; El Tawil and El dokky, 2018; Saravia and Bush, 1991). However; there are studies which does not favor our outcome (Arapostathis et al., 2010; Dabarakis et al., 2009). Behavior management techniques prior to local anesthesia play a key role for change in pain perception of child. Pain associated with local anesthesia is aggravated by needle prick, gauge of needle, consistency of tissue and the speed of deposition of local anesthetic, earlier negative experience etc. may vary the pain perception of children and thus we have included children's who are undergoing first dental experience. In our study, we used the "Reframing technique" for behavior management of children.

Topical anesthetic gel was applied before using both the techniques for a time period of 60s, to reduce pain associated with needle prick and to standardize both the procedures. For conventional technique 30 gauge needles was used so that pain should be reduced to minimal level. Approximately 1 ml of solution was deposited for conventional technique over a period of 2-3 min (ml/minute). To homogenize the technique of local anesthesia delivery using needle free injection, a pilot study was conducted by operator, himself, in which he administered 25 injections to children.

In our study we have included children between age group of 6-12 years of age, as children in this age children have reported significance difference in pain perception (Versloot et al., 2008). Only one study was found to include age group of 6-11 years. There

is very much scarcity of literature for this age group. The current study encounters few limitations. Although sample size estimation was done by statistical method still sample was selected by convenient method. Children were selected from pedodontics department. This sample may not generalize the whole population. As these two techniques are different, blinding of the subject and the operator was not possible. Only the statistician was blinded in current study. Pain responses have different characteristics, and VAS cannot portray all of them for pain. However, we selected VAS as these was widely used in children for different local anesthesia delivery technique compared to conventional injection (Ran and Peretz, 2003; Tahmassebi et al., 2009; Kandiah and Tahmassebi, 2012).

As the study was performed in college department settings wherein the children gets all free dental treatment, the impact of cost of needle free injection (jet injection) could not be find, which is way more expensive than the conventional technique.

5. CONCLUSION

Based on our results, we can say that pain perception for needle free injection is significantly lower than conventional injection technique. The needle free injection found to be more efficient than conventional technique.

Recommendations

We recommend that needle less injection (jet injection) can be one of the delivery method for painless injection. Painless injection can also be used as topical anesthetic system, as it can deposit as low as 0.1ml of solution also.

Ethical approval

The study was approved by the research Committee of Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India (IEC/Rep/STRP/03124).

Funding

This study has not received any external funding.

Conflict of Interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are presented in the paper.

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