



## RESEARCH ARTICLE

### EVALUATION OF PAIN PERCEPTION USING COMPUTER CONTROLLED LOCAL ANESTHETIC DELIVERY SYSTEM (CCLAD) VERSUS CARTRIDGE SYRINGE IN PAEDIATRIC POPULATION

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#### ABSTRACT

**Introduction:** Pain control is an important part of dentistry, particularly in the management of children. Behavior guidance, and dose and technique of administration of the local anesthetic are important considerations in the successful treatment of a pediatric patient. The purpose of the present text is to compare the current methods available in the administration of local anesthesia used for pediatric dental patients and to discuss the relevant data on topics involved.

**Aim:** to evaluate and compared the pain perception, behavioral response, physiological parameters, and the role of topical anesthetic administration during local anesthetic administration with cartridge syringe and computer controlled local anesthetic delivery system (CCLAD).

**Results:** Injections with CCLAD produced significantly lesser pain response, disruptive behavior ( $P < 0.001$ ), and pulse rate ( $P < 0.05$ ) when compared to cartridge syringe injections.

**Conclusion:** Usage of techniques which enhance behavioral response in children like injections with CCLAD can be considered as a possible step toward achieving a pain-free pediatric dental practice.

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## INTRODUCTION

Pain management during dental procedure can build a good rapport between dentist and the patient, guarantee trust for future visits with positive attitudes toward dental procedures, and reduce fear and anxiety (Nutter, 2009; Nakai *et al.*, 2000; American Academy of Pediatric Dentistry, 2010). In fact, patients are concerned about fear of pain which can induce anxiety and destruct dental attendance (Nuttall *et al.*, 2001). On the other hand, the most form of pain control in dentistry, namely local anesthesia, can itself produce anxiety and injections for local anesthesia is the most anxiety-provoking procedure for both children and adults. Besides pain and discomfort, the prospect of an injection can also provoke anxiety, particularly in children and one of the possible causes of fear and behavior problems is a painful past medical or dental visit (Versloot *et al.*, 2008; Klingberg, 2007), and dental procedures, most of the times, need several visits which takes the issue in to the consideration. Various techniques have been suggested to alleviate pain during injections, such as the use of topical anesthetics agents prior to the injection (Roghani *et al.* 1999), lidocaine patches on gingival (Houpt *et al.*, 1997), slow

deposition of fluid in to the tissue, warming solution, shaking the lip or cheek, using electronic dental anesthesia, and a computerized device (Asarch *et al.*, 1999; Ram and Peretz, 2003; Ashkenazi *et al.*, 2006). The present study was planned to assess the pain perception, behavioral response, physiological parameters, and role of topical anesthetic administration during local anesthetic administration with cartridge syringe and computer controlled local anesthetic delivery systems (CCLAD).

## MATERIALS AND METHODS

This study was carried out in the children who had reported as outpatients in Department of Pediatric Dentistry, Lenore institute of dental sciences, Rajahmundry. The study protocol was approved by the institutional review board and ethical committee consent was obtained. Written consent was obtained from parents of participating children.

### Inclusion and exclusion criteria

One hundred and twenty children were included in the study based on the following inclusion criteria:

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- Age 7-11 years;
- Children with American Society of Anesthesiologists I status;
- No previous history of dental treatment and, who needed at least two clinical sessions of operative procedures preceded by local anesthetic injection, one on either side of the maxilla or mandible, neither of which was due to emergency.

Exclusion criteria were

- Children allergic to local anesthetics (lignocaine);
- Children under medications that could alter the pain perception;
- Medically compromised and special children;
- Uncooperative patients (Frankl behavior rating 1- definitely negative).

Children were familiarized with the interpretation of modified facial image scale (FIS) after being seated on the dental chair. The injection procedure was explained to all the children using standard and similar euphemisms. The injection site was dried with cotton and topical anesthetic gel was applied and allowed to remain for 30 s. In subgroup two, the cotton applicator stick was pressed firmly to the tissue near the injection site as a counter-stimulation during the injection procedure. All injections which consisted of 2% lignocaine with 1:1,00,000 epinephrine were then administered with a one inch 30 gauge needle using the bi-rotational technique to minimize needle deflection (Hochman and Friedman, 2003). In Group A, injections were administered with STA mode (1 cc per 207 s) was used initially till 1/4<sup>th</sup> of cartridge was administered followed by the normal mode (1 cc per 35 s). In Group B, injections were given slowly at approximately 1 ml/min with an aspirating cartridge syringe (Septodont, France). All the injections were given by the same operator/primary investigator, to ensure that the results were not influenced by inter-operator variability. Objective evaluation of disruptive behavior was done using face legs activity cry consolability (FLACC) scale by a calibrated dental assistant. The physiological parameters (pulse rate, BP) were recorded during the injection procedure. Subjective evaluation of pain was rated using a modified FIS after the injection procedure. The washout period between the visits was 1-week (Ram *et al.*, 2010). During the next appointment, the child was administered local anesthetic injection using the alternative technique on other side of the jaw. The data obtained were statistically analyzed using SPSS software.

## RESULTS

Children who received injections with CCLAD showed a significant decrease ( $P < 0.002$ ) in pain perception as seen by FIS scores when compared to cartridge group. There was a significant decrease ( $P < 0.001$ ) in the disruptive behavior on comparing the two groups. Pulse rate was significantly increased ( $P = 0.04$ ) in cartridge group. However, there were no significant differences in systolic and diastolic BP ( $P > 0.05$ ) among the groups during injection (Table 1).

### Patient behavior and Preference

The children receiving cartridge syringe injections showed more facial expressions, leg movements and were difficult to console when compared to CCLAD injections. On assessing

the overall children's behavior, 71 children (64%) showed better behavioral response while receiving CCLAD injections. 13 children (12%) demonstrated better behavioral response with cartridge syringe injections. 26 children (26%) showed similar behavioral response during both modes of local anesthetic administration. Thirty-eight children preferred receiving local anesthesia with CCLAD while only 6 children preferred cartridge syringe injections. 66 children found both methods to be similar.

**Table 1. Comparison of mean FIS & FLACC scores in cartridge and CCLAD group**

GROUP	n	Mean±SD	P
FIS			
Cartridge	115	1.70± 0.69	
CCLAD*	115	1.42± 0.60	0.002
FLACC			
Cartridge	115	2.64 ±2.28	
CCLAD	115	1.85 ±2.15	0.001

FIS: Facial image scale; FLACC: Face leg activity cry consol ability; CCLAD: Computer controlled local anesthesia delivery system

## DISCUSSION

Computerized local anesthesia or the Wand system consists of a disposable handpiece component and a computer control unit. The handpiece is an ultralight pen-like handle which is linked to a conventional anesthetic cartridge with plastic micro tubing. The core technology is an automatic delivery of local anesthetic solution at a fixed pressure; volume ratio is regardless of variations in tissue resistance. This results in a controlled, highly effective, and comfortable injection even in resilient tissues such as the palate and periodontal ligament (Koyuturk *et al.*, 2009). While 'the Wand' has been shown to reduce the pain associated with the delivery of the anesthetic solution, the time involved in the procedure appears to negate the effectiveness of the device; a review of computer-controlled delivery devices as well as other alternative anesthesia delivery methods found that they each present adverse side effects and generally are more expensive than conventional methods (Koyuturk *et al.*, 2009; Blanton, 2003). The present study suggests that children who received injections with CCLAD showed significantly less pain and disruptive behavior when compared to children who received injection by cartridge. Gibson *et al.* compared CCLAD and traditional syringe in children of 5-13 years and concluded that no significant difference in pain ratings between them (Gibson *et al.*, 2000). Palm *et al.* compared the pain perception while administering mandibular block with CCLAD and traditional method in children aged 7-18 years and concluded that mandibular block was less painful with the CCLAD (Palm *et al.* 2014). Langthasa *et al.* compared pain perception while experiencing injections with a comfort control syringe (CCS) and conventional syringe in children aged 6-14 years. Injections with CCS were less painful and produced significantly less disruptive behaviors than a conventional syringe (Langthasa *et al.*, 2012). The age of patients and site of injection varied in all the above studies. Thus, the use of CCLAD produced less pain ratings irrespective of age and site of injection when compared to the traditional technique. In the present study, children who received injections with cartridge showed more disruptive behavior as measured by FLACC scale. Gibson *et al.* reported that significantly fewer children cried or exhibited body movements while receiving injections with CCLAD during first 15 s (Gibson *et al.*, 2000).

Allen *et al.* reported a gradual increase in disruptive behavior in CCLAD group after the initial 15 s contrary to the above results (Allen *et al.*, 2002). This may be due to increased injection time with CCLAD, which might result in restless behavior particularly in preschool children. Asarch *et al.*, Ram and Peretz reported no significant differences in disruptive behavior while receiving injections with CCLAD and a traditional method respectively (Ram and Peretz, 2003). Asarch *et al.*, Gibson *et al.*, Allen *et al.* in their studies blindfolded the patients and switched on the sound of CCLAD during both injection procedures to reduce bias (Gibson *et al.*, 2000; Allen *et al.*, 2002). However, in our study we did not practice this as we believed blindfolding a child during the first visit for treatment might increase his/her anxiety level and alter the pain perception and physiological parameters. Standard and similar euphemisms and distraction techniques were used as alternative methods to reduce anxiety in both the groups.

## Conclusion

Usage of techniques which enhance behavioral response in children like injections with CCLAD can be considered as a possible step toward achieving a pain-free pediatric dental practice.

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