A Smart Way of Making Dental Practice Painfree

Kajal Kiran Sahoo[1], Sudipta Sahu[2], Debashruti Naik[3], Nikita Sahu[3], Sarmistha Mohanty[4]

[1]Tutor, Department of Prosthodontics, [2]Tutor, [3]Senior Lecturer, [4]Post Graduate Trainee, Department of Public Health Dentistry, Institute of Dental Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar-751003, Odisha, India

Abstract

Local anaesthesia in dentistry has been used in dentistry for more than a century ago. The emergence of giving local anaesthesia through nerve blockade marked a new era of patient comfort while permitting more extensive and invasive procedure in dental practice. Though ages effective LA is the most important pillar upon which systems have been developed that utilizes computer technology in the LA administration. The core mechanics behind the Computerised controlled local anaesthesia Device (CCLAD) is a microprocessor that controls delivery of LA solution at constant pressure and controlled volume while monitoring the variation in the tissue resistance. This fine high suffusion flow rate of LA provides a rapid onset of anaesthesia in most dental patients. Although local anaesthesia in injection form remains the backbone of pain control in dentistry, researches are being made in constant search of new & better management of pain. These researches are focused on the advancement of local anaesthetic agent delivery devices and techniques involved in both pharmacological and non-pharmacological form. Paradoxically the injection of LA seems to be the greatest source of patients fear and inability to control pain remains a significant concern to the dental practitioner. This review article will aim towards the products, device and techniques available till now which will make dentistry more patient-friendly and non-invasive.

Keywords: *Painfree Dental Practice; Local anaesthesia; Computerised controlled local anaesthesia Device.*

Introduction

At the beginning of dentistry extractions were practised without anaesthesia and toothache was cured with few glasses of wine, brandy or herbal potions. Then with the discovery of syringes and opiates, anaesthesia became effective in dentistry. Then came the anaesthetic virtue of ether,by which the famous surgeon John Collins Warren removed a neck tumour from the volunteer, Mr Albert Abbot, who felt no pain. Then an American dentist HovaceWells was first to show the anaesthetic property of nitrous oxide. Nowadays local anaesthetic in dentistry mostly involves blocking of small and large nerve terminals through contact with active molecules of esters and starches. The local anaesthesias that are in use in present-day dentistry are lidocaine, prilocaine, bupivacaine, mepivacaine and articaine.[1] Different types of local anaesthesia routes that are preferred in dentistry are infiltration,intraligamentary,intrapul pal, intraosseous etc. But all of these routes of local anaesthesia needs needle to deliver the LA agent at the respective sites. In most of the time, the needle prick induces anxiety in children and adult dental patients even before the proper administration of LA. This poses the drawback in the dentist-patients relationship. So many alternative method to alleviate pain are tried like topical anaesthesia, CCLAD, Jet injector, Iontophor electronic dental anaesthesia etc. Desensitization of the injection site & CCLAD is most of the recommended strategies nowadays.[2]

Corresponding Author:
Dr. Kajal Kiran Sahoo
Tutor, Department of Prosthodontics, Institute of Dental Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar-751003, Odisha, India
e-mail: drkajal2@gmail.com

Method of desensitisation of the injection site: The method which are involved to reduce pain at the injection site before the injection of proper L.A are – (a) Application of topical anaesthesia; (b) Pre-cooling of the injection site.

(a) Application of topical anaesthesia: Topical anaesthetics acts on peripheral nerves and reduce the sensation of pain at the site of the needle prick, before proper LA administration. Thus it generates a positive response towards dental treatment in the patients. Traditionally topical anaesthetics contain Lidocaine or Benzocaine as active ingredients and are used in the form of solutions, gels, creams and sprays. The topical anaesthesia used in dentistry are listed in table 1. [3]

Table 1. Topical anaesthesia used in dentistry

Benzocaine	• It is an ester-based LA that is commonly associated with hypersensitive reactions • Its poor water solubility hinders cardiovascular absorption and so effects the surface for a prolonged period • Aerosol agents may be used on soft palates to reduce gaging and gel agents used before infiltration anaesthesia • 20% of concentration produces an effect within 30 seconds.
Lidocaine and Lidocaine hydrochloride	• It is an amide-based local oral topical anaesthetic agent • It is used as 2% or5% gel, 5% ointment or 10% spray • The onset of action of the anaesthetic agent is 1-2 minute.
Prilocaine	• It is used in combination with other topical anaesthetics • It is used as 4% prilocaine or 4% prilocaine with 1:200000 Epinephrine
EMLA or Eutectic mixture of local anaesthesia	• It is 1:1 mixture of 2.5% prilocaine and 2.5% of lidocaine.
Cetacaine topical anaesthetic	• It contains 14% benzocaine, 2% butamben and 2% tetracaine-hydrochloric acid. • It is used in local pain in all mucous membrane. • It is used by using a cotton swab or micro brush.
Oraqix subgingival anaesthetics	• It contains 2.5% lidocaine and 2.5% prilocaine • It is gel anaesthetic that is administrated by insertion into gingival sulcus where it provides anaesthetic effect to enable deep scaling and root planing.

(b) Pre-cooling the injection site – In dental surgeries, palatal injection poses the most painful of all the injections. So palatal cooling is effective for relieving pain perception. It is done by (a) application of dichlorodifluoromethane sprayed cotton pellet for 5 seconds, (b) application of refrigerant eg. 1,1,1,3,3-pentafluoropropane/1,1,1,2 - tetrafluoroethane (c)application of ice popsicle etc.[4-6]

Computer-controlled local anaesthesia delivery system: Research shows that CCLAD produces lesser pain ratings and disruptive behaviour than cartridge syringe in children.CCLAD refers to the appliances that utilise computer technology in the administration of LA in patients. It precisely controls the flow rate of LA and modulates the fluid pressure by the use of computer microprocessor & electronically controlled motor to deliver the LA at a constant slow rate respecting the tissue resistance.[7] The well-known device under different commercial brands are:

1. The Wand (Milestone Scientific Livingstone, NJ)
2. Comfort Control Syringe (CCS, Dentsply, USA)
3. Quicksleeper (Dental Hi-Tec France) and
4. iCT (Dentium, Seoul,Korea)
5. Anaeject (Nippon Shika Yakuhin, Japan)
6. Ora star (Showa Uyakuhin Kako, Japan)

Basic theory of CCLAD: CCLAD reduces pain by controlling injection speed through the resistant tissue and also from the anaesthesia taking effect at the same time with injection,which then sequentially allow the

anaesthetic to be injected into already anaesthetised tissues. Because of these series of processes, the patient feels less pain.[8]

The design of CCLAD varies depending on:

I. Whether the anaesthetic cartridge is included in the main unit or not

II. Speed and mode of injection

III. A device having the possibility of aspiration or not

IV. Weight of the device

V. Ease of injection management.

The Wand system has 3 parts a base unit, a foot pedal and disposable handpiece assembled.

Base: It contains a microprocessor and connects to both the foot paddle and handpiece attachments that accepts the local anaesthetise cartridge. This microprocessor controls a piston that expels the local anesthetic solution by pushing the LA plunger up into the cartridge.[9]

Disposable handpiece: The LA solution expels through the microbore tubing, WAND handpiece and attached needle to the tissue

Foot pedal: Pressing lightly on foot pedal expresses slow injection rate (0.005 ml/second) appropriate for needle insertion, palatal injection and PDL injection. Heavier pressure increases the rate of LA solution administration (0.03 ml/second) for buccal infiltration and nerve blocks and release of foot pedal stops injection.[7-10]

Along with these, WAND is added with STA mechanism, that is Single Tooth Anaesthesia feature. This STA unit adds Dynamic Pressure Sensing(DPS) technology, which enables the dentist to feel the needle tip placement in PDL etc. The handpiece of CCLAD system seems to be a pointed ball pen rather than a syringe,which the patients particularly pediatric dental patients finds less scary than a conventional cartridge and syringe. The first computer-controlled L.A delivery system was introduced in 1997 as the Wand, (Milestone Scientific) to improve functional design and accuracy of the dental syringe. It was in the market quite for a long time due to its ease in operation, lightweight and a circumference that was half of the traditional syringe. But the Quick sleeper and Comfort Controlsyringe(CCS) have three times the size and weight handpiece that of the traditional syringe as they have both syringe and motor in this handpieces.[9,10]

CCLAD handpiece must be held stable for a longer period than a conventional cartridge to ensure safe administration of anaesthesia. So new products are introduced which offer lightweight designs. Further technical advances are awaiting to develop much lighter CCLAD. In the aspect of injection speed of local anaesthetic solution Wand,Quick sleeper & CCS have injection speed of three, four and five stages respectively. The iCT device allows three stages which allow the full cartridge to be injected 250,120 & 50 seconds. In the aspect of whether aspiration can be done or not,it is an important fact that all Wand,CCS and Smartjet have the option of aspiration before injecting the local anaesthesia to the particular tissue.[7-10]

Advantage of CCLAD: CCLAD has more accurate needle insertion for deep nerve block.In the second or recurrent visits, the children who receive CCLAD shows less disruptive behaviour than the children receiving an injection with a cartridge system. Thusthe use of CCLAD can be carried as a possible step towards a pain-free pediatric dental practice in coming days.[7-10]

Disadvantages of CCLAD: The added cost of CCLAD and single-use hand piece for different patient injection might not be affordable to every practitioner. If the cost is reduced it may be possible for every practitioner to use it his/her clinic. In many cases, a total of 4 minutes is required to completely express a cartridge, which may cause impatience and stress in the patients. CCLAD doesn't reduce the discomfort of needle insertion in case of palatal injection.[9,10]

Conclusion

Thus the most accepted mode of pain control is by administering local anaesthesia with the use of needle though it may be an anxiety-provoking procedure for both children and adult dental patients. Of all the alternative method of delivering anaesthesia, CCLAD is the most accepted mode of delivering anaesthesia without pain. Though it is of high cost and time taking procedure to deliver anaesthesia it can be considered by the dentist.

Ethical Permission: Not Required

Conflict of Interests: None

Funding: None

References

1. Arora R. Influence of pain-free dentistry and convenience of dental office on the choice of a dental practitioner: an experimental investigation. Health Mark Q. 1999;16(3):43-54.
2. Angelo Z, Polyvios C. Alternative practices of achieving anaesthesia for dental procedures: a review. J Dent Anesth Pain Med. 2018;18(2):79-88.
3. Saxena P, Gupta SK, Newaskar V, Chandra A. Advances in dental local anaesthesia techniques and devices: An update. Natl J Maxillofac Surg. 2013;4(1):19-24.
4. McPherson JS, Dixon SA, Townsend R, Vandewalle KS. Effect of needle design on pain from dental local anaesthetic injections. Anesth Prog. 2015;62(1):2-7.
5. Arapostathis KN, Dabarakis NN, Coolidge T, Tsirlis A, Kotsanos N. Comparison of acceptance, preference, and efficacy between jet injection INJEX and local infiltration anaesthesia in 6 to 11-year-old dental patients. Anesth Prog. 2010;57(1):3-12.
6. Makade CS, Shenoi PR, Gunwal MK. Comparison of acceptance, preference and efficacy between pressure anaesthesia and classical needle infiltration anaesthesia for dental restorative procedures in adult patients. J Conserv Dent. 2014;17(2):169-174.
7. Kwak EJ, Pang NS, Cho JH, Jung BY, Kim KD, Park W. Computer-controlled local anaesthetic delivery for painless anaesthesia: a literature review. J Dent Anesth Pain Med. 2016;16(2):81-88.
8. Yenisey M. Comparison of the pain levels of computer-controlled and conventional anaesthesia techniques in prosthodontic treatment. J Appl Oral Sci. 2009;17(5):414-420.
9. Davoudi A, Rismanchian M, Akhavan A, et al. A brief review on the efficacy of different possible and nonpharmacological techniques in eliminating the discomfort of local anaesthesia injection during dental procedures. Anesth Essays Res. 2016;10(1):13-16.
10. Saoji H, Nainan MT, Nanjappa N, Khairnar MR, Hishikar M, Jadhav V. Assessment of a computer-controlled local anaesthetic delivery system for pain control during restorative procedures: A randomized controlled trial. J Dent Res Dent Clin Dent Prospects. 2019;13(4):298-304.