

Pediatric Local Anaesthesia- Made Easier

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Abstract

Objective -The aim of this study is to present a review of the reported literature on

(i) Computer controlled local anaesthesia delivery system-WAND

(ii) Its clinical applications in the practice of Paediatric Dentistry.

Method

Electronic literature of scientific papers up to year 2009 was reviewed on the MEDLINE, Embase, Enteez Pubmed, and various other journals using specific key words. The search yielded 100 papers, out of which 45 were identified as conforming to the applied criteria. These papers formed the basis of the review and clinical scenarios presented which demonstrate the application of WAND in the practice of Paediatric Dentistry.

Conclusion

This paper illustrates applicability of Wand to various dental procedures & how the Wand will likely affect Pedodontist and their Pediatric patients. The cost/benefits must be weighed by each Pedodontist, but it appears that the Wand can deliver proper anaesthesia & significantly reduce the likelihood of disruptive behaviours during the initial moments of injections.

Introduction

Effective pain control in children during dental treatment is important to achieving comfort, cooperation and compliance with dental care during adulthood.¹⁻³ Several methods have been suggested to reduce injection pain, one of which is slow delivery of the anesthetic solution.⁴⁻⁷

Computer controlled local anaesthetic delivery system i.e. Compu-dent featuring the Wand Handpiece was manufactured by Milestone Scientific Company & received ADA seal of acceptance in May 1998.^{8,9}

According to council on Scientific Affairs, American Dental Association "the Wand local anaesthetic delivery system is accepted as a device that has been shown to safely and effectively deliver anaesthetic solution when used by an appropriately qualified professional".⁹

The manufacturer claims that the Wand, by using a sterile disposable handpiece that does not look like a syringe, greatly reduces fear and anxiety. The Wand unit delivers precise pressure and volume ratios (flow rate) of anesthetic solution from standard cartridges and needles. This new system, by generating a precisely controlled anesthetic flow rate, eliminates the manual pressure

required of the operator to administer injections. Even in resilient tissues, such as the palate and periodontal ligament, the Wand supposedly delivers an anesthetic drip that precedes the needle, creating an anesthetic pathway. The combination of the anesthetic pathway and the controlled flow rate results in a virtually imperceptible injection.¹⁰⁻¹³ The wand has been advocated for infiltration injections, nerve block injections & intraligamentary injections.¹⁴ Hence it can play a significant role in reducing the likelihood of disruptive behaviours during the initial moments of an injection.

Method

An electronic literature search of scientific papers up to 2009 was carried out using the MEDLINE, Embase, Enteez, Pubmed, and Scopus databases. These databases were used to search for the key words like Wand, computer controlled local anaesthetic system & new injection technique. All in vivo studies on Wand were included for reviewing with case reports. Papers not published in the English language were excluded. Use of the search keywords produced a total of 100 results. Manual checking of the reference list and application of the inclusion and exclusion criteria produced 45 citations used in this review.

Review of Wand

The review is presented in two main sections. The first section reviews the literature which has contributed to our understanding of the Computer controlled local anaesthetic delivery system. The second section reviews the clinical studies which have been reported in the search period depicting the applications of Wand in Paediatric Dentistry.

Understanding Computer controlled local anesthesia delivery system-WAND

How it works?

The Wand local anesthesia system is a microprocessor driven device that delivers a controlled infusion of anesthetic solution. The Wand accepts standard 1.8-mL dental anesthetic glass cartridges. The microprocessor monitors and varies the infusion pressure while maintaining a constant flow rate. An electronically driven plunger contacts the rubber plunger in the cartridge and expels the anesthetic solution at the precisely regulated rate. Sterile tubing connects the cartridge receptor to a pen-like, hand-held plastic Wand that is attached to a Luer-Lok needle, together forming a disposable syringe assembly. A small portion of solution from a standard cartridge is lost during the purge cycle and some of the solution remains in the cartridge and tubing, thus only 1.4 mL of a standard cartridge is delivered. Flow

rate, initiation and cessation of flow, and aspiration are controlled with a foot pedal. To prevent cross-contamination, the handpiece, microtubing and anesthetic cartridge are designed for single use only.



Fig. 1 Pen Grasp of WAND



Fig.2 The Wand with computer-assisted local anesthetic delivery unit. The Wand Plus handpiece assembly and microtubing are also seen.

The injection speed of this device could be adjustable to 2 levels: fast (30s/ml) or slow (160s/ml).the operator using the hand piece do not use the foot pedal to inject the anesthetic. Injection speed are randomly adjusted to slow or high, and the hand-piece operator and subjects are not informed of injection speed.¹⁵

Benefits and Considerations

The Wand is effective for all injections that can be performed using a standard aspirating syringe with some automation. The Wand is held like a pen, which may be less cumbersome than a traditional syringe. A foot pedal controls aspiration and injection of the anesthetic. Injections may take more time because of the reduced anesthetic flow rate. The controlled flow of anesthetic is thought to reduce pain and, thus, patient fear and anxiety.¹²

What are the advantages of The Wand?

- The Wand does not look like a needle and so does not make people feel anxious at first sight like a needle and syringe does. Researchers have found that the Wand induces less anxiety than any other injection method (Kudo et al, 2001).
- The precise control of the anesthetic flow rate and pressure reliably produces a comfortable injection, even in areas of the mouth where an injection may be slightly more difficult for the dentist such as the palate.
- Many dentists have commented that The Wand is easier to use and handle because it is light-weight and easy to handle.

What are the disadvantages of The Wand?

- The Wand is much more expensive than using traditional syringes, both for the machine and the disposables.
- The Wand takes up more room in the surgery
- The dentist needs to learn how to use The Wand which he/she may not have the time for,
- Many dentists have a steady hand and can perform painless injections without the Wand and so say that it is an useless device.

The technique for the PDLi with the Wand®

Two insertion sites are used: the mesio-buccal and the disto-buccal transitional line angle. Similar to the traditional intraligamentary technique, the needle is inserted in the sulcus parallel to the long axis of the tooth with the bevel facing the tooth. As the needle enters the sulcus, the foot switch is activated at the slow rate of flow and maintained at that rate throughout the entire injection. The needle was advanced to the maximum (approximately 2 mm below the crest of the bone), and 0.6 ml of anaesthetic is administered. Then the foot is removed from the control for 5s to enable the fluid pressure to dissipate. The needle is removed slowly looking for blanching around the tooth.¹⁶

The palatal approach-anterior superior alveolar (P-ASA) nerve block injection technique.

The technique was described by Friedman and Hochman. The initial P-ASA injection site was located at a groove just lateral to the incisive papilla. The injection was performed with a 30-gauge, ultra-short needle provided by the manufacturer (Becton Dickinson and Co, Franklin Lakes, NJ, USA). For the needle insertion phase of the injection, the needle bevel was placed against the palatal

tissue, without puncturing the tissue, and a plain cotton roll was firmly pressed on the needle tip for the prepuncture phase of needle insertion. The Wand® was activated at a slow rate (by partially depressing the foot pedal) and the handpiece was rotated in an axial manner (45 degrees clockwise and 45 degrees counter clockwise) for needle insertion. The needle was slowly advanced approximately 12 mm. The handpiece was then reoriented to an angle parallel to the facial aspect of the maxilla to gain entrance into the incisive canal. The needle was axially rotated 45 degrees and was slowly advanced (as described for the needle insertion phase) into the canal. The aspiration cycle was activated by tapping the foot pedal. The needle was inserted to a depth of at least 3 mm and no more than 5 mm. Approximately 1 ml of anaesthetic solution was delivered. Aspiration was activated again. No positive aspirations (blood in the micro-tubing) occurred. The operator waited 5 s before slowly removing the needle from the injection site. This supposedly allowed the anaesthetic solution to dissipate within the tissue and reduced the amount of solution dripping from the site before needle withdrawal.¹⁷⁻¹⁹

Other techniques in Pediatric local anesthesia

Electronic anaesthesia

It is also known as 'gate control theory' & was introduced by Melzack.²⁰ It is based on the concept of electronic dental anaesthesia (EDA) which involves application of electric current that loads the nerve stimulation pathways to the extent that pain stimulus is blocked.²¹ In a study conducted by Wilson *et al.* worked on 30 sedated patients aged 2448 months, the authors concluded that according to behavioural and physiological observations, EDA reduced the discomfort of the sedated children when receiving local anaesthesia.²² Croll & Simonsen (1994) describe the technique and reported on 45 cases. They recommended the use of this technique with co-operative children as young as 3 years of age, but not as a substitute for all other method of pain modification & pain control.²³ EDA should be viewed for use in children as an adjunctive option.²⁴

Syrjet

This instrument (National Keystone, Cherry Hill, NJ, USA) was developed to achieve local anaesthesia for dental procedures without the use of a needle [53]. This is accomplished by delivering the anaesthetic solution under high compressive forces. The method was tested on 34 children ranging in age between 5 and 15 years, on whom 45 dental procedures were completed. There was a statistically significant difference in favour of the instrument, with 25 children reporting a preference for it. The instrument was completely successful in providing anaesthesia in 36 of the 45 procedures.²⁵

Local anesthesia by imagery suggestions

It is based on controlling the patient's behaviour and at the same time mitigates the effect of stress by use of suggestions.²⁶ Benjamin Peretz & Enrique Bimstein evaluated the effect of suggestions in a group of children

before and during the receiving of a local anesthetic injection. They found that visualization suggestions may be effective in children from the age of three. They also concluded that the utilization of the child's imaginations is a valuable behaviour management adjuvant during dental treatment.²⁷

Recent advancement in Wand technology

STA™ (Single Tooth anesthesia) System, a patented CCLAD system that incorporates the "pressure feedback" element of Milestone's patented compuFlo technology, thereby allowing dentists to administer injections accurately and painlessly into the periodontal ligament space, effectively anesthetizing a single tooth. This injection is of significant value in that it allow the dentist to profoundly anesthetize the patient within one or two minutes, allowing for a significant savings of waiting time.²⁸

Clinical studies of Wand

Hochman et al (1997) assessed the changes in the perception of pain on using WAND with a controlled group of traditional syringe. The results concluded that the Wand was found to be two to three times less painful than the manual injection.⁶

Todd Asarch et al (1999) evaluated the efficacy of a computerized local anesthesia device in Pediatric dentistry and found no significant difference between the computerized & the traditional method of administering local anesthesia when comparing pain ratings & pain behaviour.²⁹

Gary G. Goodell et al (2000) compared a device that controls flow rate during injection through use of a foot pedal with a conventional atraumatic syringe injection technique. They also determined the change from preinjection to postinjection anxiety, the pain perception, procedure tolerance and anxiety about future injections & found that the conventional atraumatic syringe injection technique was superior to controlled injection pressure system in all above mentioned aspects.³⁰

E.G. Grace et al (2000) compared patient & dentist satisfaction in computerized local dental anesthetic system with traditional method of anesthetic delivery. They concluded that both methods were accepted equally well by both dentist and patients.³¹

Y. Burns et al (2000) compared the anesthetic efficacy of 2% lidocaine with 1:1,00,000 epinephrine and 3% mepivacaine using the computer-assisted Wand injection system to administer the P-ASA block. They found no significant difference between both the groups.³²

Gibson et al (2000) evaluated the efficacy of a computerized anesthesia delivery system and compared it with a traditional anesthesia, with respect to reduction of disruptive pain related behaviour injections. They concluded that wand injections delivered proper anesthesia, utilizing one palatal injection site & significantly reduce the likelihood of disruptive behaviour during the initial moments if an injection.³³

Fagi S. Saloum et al (2000) compared the pain response of a group of 40 volunteers to the Wand with the response to syringe injections & found that Wand provide less painful injections than that of syringe injections.¹³

D. Ram & B. Peretz (2002) reviewed data on topics with connected with the administration of local anaesthesia & found various new techniques for locally anaesthetizing dental patients i.e. electronic anaesthesia, intraoral lidocaine patch, computerized local anaesthesia(Wand) & Syrijet can be used in paediatric patients. They concluded that despite of numerous techniques, the injection remain the method of choice.^{34,35}

Primosch & Brooks(2002) compared pain response between two different flow rates of local anesthetic solution injected into palatal tissue using WAND & concluded that WAND did not eliminate pain elicited by palatal injection(contrary to manufacturer's claim) & a slow, constant flow rate of a 0.3 mL volume of local anesthetic solution was statistically less painful than a fast flow rate.³⁶

S.L.Lee et al (2002) determined the anesthetic efficacy of the AMSA nerve block using the computer-assisted Wand injection system versus a traditional syringe. They found no difference between the success rate of the Wand versus the traditional syringe.³⁷

John Nusstein et al (2004) compared the pain between injection and post-injection of the AMSA injection using the computer-assisted Wand Plus injection system & a conventional syringe. They concluded upon solution deposition that Wand was less painful than conventional syringes.³⁸

A.M.Palm et al(2004) compared the perception of pain and time of onset in relation to mandibular alveolar nerve block administration by a computerized anesthesia delivery system(Wand) & a traditional anesthesia system(syringe).They found that mandibular alveolar block analgesia seems to be less painful when using the Wand than when using a traditional syringe.³⁹

Malka Ashkenazi et al(2005) evaluated a computerized delivery system for intrasulcular (CDS-IS) anesthesia in primary molars. They found that it was less effective in children (2-4yrs) &exhibited low pain-related behavior during anesthetic administration, with no differences between boys and girls. They concluded that CDS-IS was effective for anesthetizing primary molars, mainly for amalgam, resin-based composite and stainless steel crown restorations.⁴⁰

J.Versloot et al(2005) compared the behavioral reaction of children who received local anesthesia with a traditional syringe with the behavioural reaction of children who received local anesthesia with a computerized device(Wand) and to differentiate between the reaction of highly anxious children with those displaying low anxiety. They concluded that low-anxious children seem to benefit from the use of wand instead of traditional syringe in receiving local anesthesia.⁴¹

D. Ram & J. Kassirer(2006) compared the reaction of children while receiving local anaesthesia for anaesthetizing maxillary incisors with a computerized device Wand®: a periodontal ligament injection (PDLi) and a palatal approach-anterior superior alveolar (P-ASA) nerve block compared with a conventional buccal infiltration (CBi), and to assess the efficacy of the anaesthesia and children's reaction after treatment. They concluded that Same effectiveness was achieved with the Wand® and the CBi. Children displayed better behaviour during injection when they received local anaesthesia with the Wand® than they did when the CBi was used. They did not scratch the upper lip/nose and/or cried after treatment when they received the PDLi and the P-ASA, whereas they did when receiving a CBi.⁴²

Ozgur Onder Kuscu & Serap Akyuz(2008) investigated the influence of anxiety and type of dental injection, a plastic syringe or an electronic computerized device on the pain perceived by children. They found no significant differences in injection pain scores were observed between the wand and traditional plastic injector. They also concluded that anxiety plays an important role in the pain reaction of children and was found to be more determinative in pain perception than the injection devices preferred.⁴³

Effects of injection pressure of dental local anesthesia on pain & anxiety

Masaru Kudo(2005) assessed injection pressure, pain & anxiety at the injection of a local anesthetic into the oral mucosa, and confirmed the relationship between injection pressure and pain, as well as between injection pressure & anxiety. He also recommended that to minimize pain & anxiety, local anesthesia should be injected under lower pressure.⁴⁴

Eliezer Kaufman et al (2005) evaluated that inferior alveolar injection was the most painful injection & periodontal ligament yielded the highest pressure score. They also suggested the importance of awareness of local anesthesia injection pain, pressure & discomfort together with efficacy of technique.⁴⁵

Conclusion

This paper illustrates applicability of Wand to various dental procedures & how the Wand will likely affect Pedodontist and their Pediatric patients. It is one of the recent advancement made in administrating Pediatric local anesthesia. The cost/benefits must be weighed by each Pedodontist, but it appears that the wand can deliver proper anesthesia & significantly reduce the likelihood of disruptive behaviors during the initial moments of an injections.

Pediatric Dentistry has seen many recent changes in both material and equipment that have changed our everyday practice. The wand appears to be another tool that we can employ in order to help our patients better accept dental treatment. Administering local anaesthesia by injection is still the most 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 to find a more comfortable and pleasant means of producing local anaesthesia before dental procedure.

What this paper adds

This paper provides a synopsis of the Computer controlled local anesthesia delivery system- Wand with its comparison with the conventional technique.

This paper reviews the available evidence on the effectiveness of Wand in a range of clinical applications. It also highlights weaknesses in the literature and points to the need for further studies.

Why this paper is important to paediatric dentists

All paediatric dentists should be familiar with the fundamental properties of the materials they use on patients. This paper provides readers with helpful information on a relatively new method of delivering local anaesthesia to their patients with less painful injections.

Paediatric dentists may be hesitant to adopt a relatively new anaesthetic delivery system into their clinical regimes, lacking confidence in the available evidence or having concerns about its cost and handling characteristics. This paper provides illustrated evidence on the success which can accompany the use of Wand in various routine dental treatment including pulpotomy, pulpectomy root canal treatment, crowns & extractions.

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