

Short Communication

Slaying The Demons - Developing Dental Technology Of Patient Friendly Local Anaesthesia Armamentarium.

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Grover HS, Saksena N, Bhardwaj A, Gupta P. **Slaying The Demons - Developing Dental Technology Of Patient Friendly Local Anaesthesia Armamentarium.** J Periodontal Med Clin Pract 2014;01: 97-100

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ABSTRACT

Local anesthesia is the backbone of dental treatment. The fear of pain is one the significant factors deterring patients from receiving non-emergency dental care in comparison to the monetary cost of treatment. The ability to provide safe and effective local anesthesia with minimal discomfort to the patient is essential to render dental treatment. A variety of agents and anesthetic delivery equipment are available today to effectively manage the pain associated with dental procedures. This article reviews the key innovations in the arena of local anaesthetic delivery equipments.

Key Words: Local Anesthesia, Anesthetic delivery equipment, pain control

INTRODUCTION

The administration of local anaesthesia is primarily performed prior to most of dental treatments. Effective local anaesthesia is unquestionably the mainstay to carry out various dental procedures successfully. To achieve profound

anaesthesia, dental surgeons must have the knowledge of the neuroanatomy of the head region, specifically of the maxillary and mandibular regions.^[1] Local anaesthetics has been a part of dentistry for more than 75 years. The American dentist Dr. Horace Wells presented the medical and dental community with his pioneering work of use of anaesthesia especially nitrous oxide (laughing gas) in dentistry and was honoured as the discoverer of modern anaesthesia in 1864 by American Dental Association. The aspirating syringe is used to administer local anaesthetic drugs.^[2] Local anaesthesia by syringe can be painful. The flow rate delivery is not constant thereby increase in pain during its administration. Another difficulty that arises is the precise control of flow rates as the plunger that drives the syringe embolus is the surgeon's hand. Thus, standardization of anaesthesia delivery remains complex.^[3] Milgrom et al in 1997 published a study analyzing the fear reactions aroused by the perspective of anaesthetic injection in the oral cavity.^[4] Factors contributing to the failure

of conventional local anaesthetic techniques must be considered before examining the rationale for any local anaesthetic adjunct.

Extensive work has been done on the concept that Dr. Horace Wells laid down, giving rise to newer, safer and effective local anaesthetic drugs. Technology driven anaesthetic delivery systems were developed alongside synergizing the achievement of profound anaesthesia as well as alleviating the fear of injection and pain among the patients.

This article reviews the key innovations in the arena of local anaesthetic delivery equipments.

Computer-controlled local anaesthesia delivery (C-CLAD) devices

The first device “the Wand” was introduced by Milestone Scientific (Piscataway, NJ, USA) in the year 1997. It was later renamed as the Wand Plus and then as CompuDent[®].^[2] The **CompuDent[®]** system has three components: a base unit, a foot pedal, and a disposable handpiece assembly. It possesses the advantage of controlled flow and pressure of anaesthetic solution with injection time of 1-2 minutes (1 drop every other second) and automatic aspiration. The feather-like weight of the handpiece provides light grasp, reduction in hand and finger strain hence providing ergonomic benefits. Apart from increasing operator confidence, there is increased patient comfort as there is decreased pain during injection and post-injection with profound anaesthesia.^[2] In 2007, Milestone Scientific presented the **STA (Single Tooth Anesthesia) system** which had the added dynamic pressure sensing (DPS) technology, which provides continuous feedback to the user about pressure at the needle tip thus help to identify ideal needle placement for PDL injections.^[2]

The **Comfort Control Syringe** has two main components: a base unit and a syringe with no foot pedal. The injection and aspiration can be controlled directly from the syringe, making it easy to use.^[2] It has a two-stage delivery system; the injection begins at an extremely slow rate to prevent the discomfort associated with quick delivery. After ten seconds the device automatically increases speed to the pre-programmed

injection rate for the techniques elected.^[5]

The C-CLAD devices have been used advantageously to administer three injections namely the anterior middle superior alveolar (AMSA), the palatal approach to the anterior superior alveolar (P-ASA), and the periodontal ligament (PDL). It is also used successfully for pediatric and dental phobic patients.^[2]

Intra-osseous (IO) induced local anaesthesia techniques

The original technique for **intra-osseous (IO) induced local anaesthesia** was too invasive for widespread acceptance. Several systems have been developed to achieve IO anaesthesia with the common aim to inject local anaesthetic solution into the cancellous bone adjacent to the apex of the tooth.^[2] Three systems are available in the United States: **Stabident** (Fairfax Dental, Miami, Florida), **X-tip** (X-tip Technologies, Lakewood, NJ, USA), and **IntraFlow** (Pro-Dex Incorporated, Santa Ana, CA, USA).^[2] The Intra Flow HTP Anaesthesia Delivery System is designed as an all-in-one system that allows the user to perforate bone and deposit anaesthetic solution in a single intraoral step.

Vibrotactile Devices

The **Dentalvibe[®]** is a cordless rechargeable lightweight handheld device designed to aid in improving the local anaesthetic experience. It has a latex-free disposable tip with oscillating vibration which gently stimulates the sensory receptors at the site to be injected effectively closing the neural pain gate. Along with it illuminates the area to be injected and retracts the tissue. Thus, the amalgamation of technique and technology forms the means to achieve a perfect local anaesthesia.

The **VibraJect** (Miltex Inc, York, PA) is a small device that uses vibrations to block pain sensation during local anaesthetic injections. A battery-operated device which has an attachment that snaps on to the standard dental syringe. It produces vibrations at high frequency on to the needle which inhibits pain sensation at the time of injecting anaesthetic.^[6]

The **Accupal** (Hot Springs, AR, USA) is a cordless battery-operated device used for inferior alveolar blocks and palatal injections. It uses vibration as well as pressure to precondition

the alveolar or palatal mucosa. Accupal provides pressure and vibrates the injection site, 360° proximal to the needle penetration this shuts the pain gate mechanism which blocks the pain sensation.^[7]

Jet Injection devices

Jet-injection technology is based on the principle of using mechanical energy to create a pressure sufficient to push a dose of liquid medication through a very small orifice. It creates a thin column of fluid with enough force that can penetrate soft tissue into the subcutaneous tissue without a needle. Jet injectors have advantages of being fast and easy to use, with little or no pain, less tissue damage, faster drug absorption and less chances of infection at the site. Jet-injector technology has been confined to intramuscular injections.^[8]

The **Syrijet Mark II jet injector** (Keystone Industries, Cherry Hill, NJ, USA) is mainly used by periodontist. It uses the standard 1.8-ml cartridges of local anesthetic solution which permits the administration of a variable volume of solution from 0 to 0.2 ml. The Syrijet Mark II has a nozzle pressure of 2000 pounds per square inch (psi) which provides penetration of anaesthetics solution comparable to that produced by needle injection to near 1 cm depth, with quantities up to 0.2 ml per injection.^[9]

The **Med-Jet** (Medical International Technologies, Montreal, QC, Canada) is needle-free injection system using compressed air for injection delivery. The head of the device is placed firmly against the mucosa and the trigger is released, this forces the solution through mucosa to produce anesthesia.^[7]

Pain control techniques in dentistry rely on local anesthesia. The local anesthetics are the safest and most effective drugs in all of medicine for the prevention and management of pain. The decision regarding which drug to select should be based on the estimated duration of action required, the patient's medical history and potential drug interactions. However, the administration of these drugs is the most frightening and uncomfortable moment for most patients. Fear of pain is a

significant factor deterring adults from receiving non-emergency dental care in comparison to the monetary cost of treatment. From a patient's perspective, it is the needle that represents the most fear-provoking part of dental treatment. The ability of a dentist to administer a local anesthetic injection painlessly is considered by patients the most important factor when it comes to selecting a dentist.^[10]

Recent advances have been made to regulate the delivery and rate of flow of local anesthetics at the injection site to reduce the associated discomfort with injections. This on going rapid development must be credited to the pioneers in the field of anaesthesia whose vision to make surgical procedures pain-free, minimizing patient discomfort and ensure treatment is given to one and all without pain acting as a limitation. The dental fraternity can take pride in its role in leading the development of the art and science of anesthesia. Dr. Horace Wells, a Connecticut dentist, became the first person to use anesthesia for therapeutic reasons. Adopting this noble vision, today's dental professionals are motivated and determined to administer perfect local anaesthesia for various dental procedures.

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Competing interest / Conflict of interest The author(s) have no competing interests for financial support, publication of this research, patents and royalties through this collaborative research. All authors were equally involved in discussed research work. There is no financial conflict with the subject matter discussed in the manuscript.

Source of support: NIL

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