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RECENT ADVANCES IN DENTAL LOCAL ANESTHESIA TECHNIQUES AND DEVICES

Dental Science

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ABSTRACT

Dentists use AAA triage: Advice, Antibiotics, and Analgesia. Local pain management is crucial in dentistry, with advances in anesthesia being significant. This article educates dentists on recent pain control techniques and devices, comparing them with older methods.

KEYWORDS

anesthesia, Recent advances, local anesthesia delivery device, local anesthesia delivery technique

INTRODUCTION-

The injection of local anesthetic is perhaps the greatest source of patient fear[1,2] and inability to obtain adequate pain control with minimal discomfort remains a significant concern of dental practitioners.[3,4] Local aesthetics have made a great advancement in dentistry and have changed patients' perspectives of dental procedures to a great extent.

Mostly Used Vs Recently Used Local Anesthesia

Lidocaine was marketed in 1948 and is the most commonly used local anesthetic in dentistry worldwide, though Articaine and centbucridine are two relatively recent medications that have been shown to be as effective as or perhaps more effective than lignocaine.[27]

Articaine Versus Lignocaine

Articaine has a faster onset of action and longer duration of action. Its success rate is greater. Articaine has more strong effects (1.5 times more potent) and has a lower level of systemic intoxication.[27]

Centbucridin

Centbucridine, a local anesthetic molecule developed in 1983 at Lucknow's Centre for Drug Research, is a quinolone derivative with inherent antihistaminic and vasoconstricting properties. Its anesthetic potency surpasses that of 2% lignocaine by 4-5 times, making it suitable for infiltration, nerve blocks, and spinal anesthesia at a 0.5% concentration.[28]

Recent advances in local anesthesia delivery devices

The gate control hypothesis suggests pain can be reduced by activating nerve fibers simultaneously, often utilized in modern local anesthetic devices[29]. However, Inui et al. found pain inhibition from touch or vibration doesn't require spinal input, challenging this notion.[30]

VibraJect

VibraJect is a modest and cost effective resolution to atteviate injection discomfort. On the basis of the gate-control theory, interference stimulation, such as vibration, can reduce pain, according to Kakigi and Watanabe.[31]It delivers a high-frequency vibration to the needle that is strong enough for the patient to feel.[5] Nanitsos *et al*.,[6] and Blair[7] have recommended the use of VibraJect for painless injection. In contrast, Yoshikawa *et al*.,[8] found no significant pain reduction when VibraJect was applied with a conventional dental syringe. Saijo *et al*.,[9] evaluated the effectiveness of VibraJect in combination with an electrical injection device.

DentalVibe

The DentalVibe Injectin System is a small hand-held tool used to administer anesthesia. The tool delivers percussive micro-oscillations to the injection administration site through a U-shaped vibrating tip that is handheld and cordless.[32] It also lights the injection area and has an attachment to retract the lip or cheek.[10] Ungor et al.[33] examined how DentalVibe affected adult patients' perceptions of pain and anxiety during local anesthetic injections.

Accupal

Accupal is an innovative device that pre-conditions intra-oral tissue to receive routine dental injections in a comforting way never before attained by any previous technology. The inventor of this tool is Michael Zweifler. Pressure is applied by Accupal, and it also vibrates the injection site 360 degrees around the point where the needle infiltrated and closed the "pain gate." The unit vibrates after being positioned at the injection site, and a light pressure is applied. The battery-powered motor is connected to the needle, which is positioned in a hole with a disposable tip head.[34]

Buzzy System

The device is designed like a bee, more exactly, the vibration created by the device will obstruct the afferent pain-receptive fibers (A-delta fibers and C-fibers),which will reduce discomfort.[35] On the other hand, when administered close to the nociception location, continuous cold administration stimulates the C nociceptive fibers and suppresses the A-delta signals.[36] According to Suohu et al.,[37] the Buzzy® System, which externally administers cold and vibration adjacent to the site of local anesthesia administration, can reduce children's pain and anxiety during the delivery of local anesthesia next to the tooth, which are indicated for invasive dental procedure.

Computer- Controlled Local Anesthetic Delivery System

In the mid-1990s, the development of computer-controlled local anesthetic delivery (CCLAD)[11] systems began, incorporating technology to regulate the flow of anesthetic solution through the needle. Examples include Dentapen®, Wand® STA, and SleeperOne®. CCLAD devices offer multi-speed, electronic injection for precise and painless anesthesia. Based on the principle of jet injection, they use high pressure to deliver small quantities of liquid through tiny openings, reducing tissue trauma. However, the effectiveness of this technique in dentistry remains limited.[12]

Local Anesthesia Techniques

Periodontal Ligament Injection

Another injection technique, the periodontal ligament injection, also known as the intraligamentary injection (ILI) has been extremely useful when anesthesia of a single tooth in the mandible is required.[13] High pressure is required to inject the local anesthetic into the thick oral tissues at the PDL injection site using a standard syringe.[38,39] This has resulted in many patients complaining that the PDL injection was painful.[14,15,16]

Single-tooth anesthesia

Single Tooth Anesthesia (STA™) incorporates dynamic pressure-

sensing (DPS) technology that provides a constant monitoring of the exit pressure of the local anesthetic solution in real time during all phases of the drug's administration.[17] Originally designed for use in medicine in epidural regional anesthesia,[18,19] STA utilizes an adaptation of DPS to dentistry as a means of overcoming the problems associated with PDL injection,[20]

Reversing local anesthesia

In May 2009, The FDA approved OraVerse (phentolamine mesylate; Novalar Pharmaceuticals Inc, San Diego, CA, USA) for the reversal of soft tissue anesthesia and the associated functional deficits resulting from a local dental anesthetic.[21] Phentolamine seems to be safe and effective in reducing soft tissue local anesthetic recovery time in adults and children as young as 6 years.[22,23,24] Limited data support a favorable safety profile in children as young as 4 years.[25] A recent study[26] investigated the pattern of use, dentist evaluation, and patient assessment of OraVerse.

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