Recent Techniques in Dental LA

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Significant research has occurred in the area of local anesthesia in recent years. In an education course, Stanley Malamed, DDS, University of Southern California, Los Angeles, California, USA, discussed various newer techniques, including mandibular infiltration of articaine, local anesthetic (LA) reversal, LA buffering, and intranasal mist administration for maxillary local anesthesia.

ARTICAINE HYDROCHLORIDE BY MANDIBULAR INFILTRATION

Use of the amide LA articaine hydrochloride (HCl) is gaining popularity in dental anesthesia. It is more lipid soluble than other LA agents and therefore diffuses more easily through soft and hard tissues. The technique of mandibular infiltration of articaine HCl is an effective method of anesthetizing the mandible in adult patients. It provides a similar duration of pulpal anesthesia to the nerve block and so is indicated for dental therapy of approximately 60 minutes. It also produces a depth of pulpal anesthesia that allows for treatment of pulpally involved teeth.

Advantages of using articaine HCl lie in the fact that it is the least likely of the LAs to induce overdose due to administration of too many cartridges. With its elimination half-life of 27 minutes, it is the preferred LA for use in pediatric patients or those who are pregnant or nursing. It also enhances the efficacy of lidocaine inferior alveolar nerve block [Kanaa MD et al. *Int Endodont J.* 2009].

Dr Malamed emphasized that reports of an increased risk of paresthesia with the use of articaine have been merely anecdotal and there is no scientific evidence to indicate that this agent is associated with a greater risk of paresthesia than any other LA agent. He also indicated that it is preferable to use articaine 4% with 1:200 000 epinephrine (rather than 1:100 000) because there is no difference in either depth or duration of anesthesia between the 2 concentrations. However, with the higher concentration, it does provide better hemostasis.

LA REVERSAL

Dr Malamed described phentolamine mesylate, a local anesthesia reversal agent, as the LA "off switch." This alpha adrenergic agonist produces vasodilation, leading to increased vascular perfusion at the injection site. This subsequently accelerates the rate at which the LA diffuses out of the nerve and into the cardiovascular system, thereby decreasing the duration of residual soft tissue anesthesia (Table 1).

According to Dr Malamed, indications for its administration include conservative dental treatment, as well as pediatric, geriatric, special needs, or medically compromised patients. For dentists considering this compound, he advised administering it immediately after the final surgical incision is made so that patients will experience the reversal effect by the time that they leave the office.

ANESTHETIC BUFFERING

Dr Malamed explained that plain LA solutions provide anesthesia that is not very profound and lasts only a short duration. To improve on both these factors, a vasoconstrictor agent such as epinephrine is added. LAs are acidic, and while plain anesthetic solutions have a pH of approximately 6.5, those containing epinephrine have a much lower pH of approximately 3.5.

Table 1. Reversal of Soft Tissue Anesthesia via Phentolamine Mesylate

Perception of normal appearance and function	Accelerated by 60 min
Restoration of normal function	Accelerated by 60 min
Restoration of normal sensation of tongue	Accelerated by 65 min

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The anesthetic cartridge contains 2 forms of the LA: a nonionized active form (RN) that is lipid soluble and can therefore cross the nerve membrane and an ionized form (RNH+) that is nonlipid soluble and therefore does not cross the nerve membrane. Following administration of an LA, the body naturally and slowly buffers the anesthetic solution to a pH of 7.4. The anesthetic effect does not begin until the body has buffered the solution toward this physiologic range, and this takes longer for solutions that are more acidic, such as LAs containing vasoconstrictors. However, LA solutions can be modified to accelerate this biochemical process.

Anesthetic buffering decreases the amount of ionized to nonionized forms, allowing the LA to pass more rapidly across the nerve membrane and thereby reducing the time for onset of anesthesia. Buffering of LA agents has been shown to counteract their undesirable effects, such as the burning sensation upon injection and their slow onset of action. Recent technological advances have enabled buffering of dental LA cartridges to be performed immediately before injection. This technique alkalinizes the LA, increasing its onset of action, providing more patient comfort during and after injection, and inducing more profound anesthesia. Dr Malamed described this effect as the LA "on switch." He also added that when buffering is performed correctly, it has no effect on the duration of anesthesia.

The buffering process involves addition of a sodium bicarbonate solution to the LA cartridge. However, Dr Malamed stressed that buffering must occur within a few minutes of injection of the LA because one of the products formed as a result of the addition of bicarbonate is carbon dioxide.

MAXILLARY PULPAL ANESTHESIA WITHOUT INJECTION

Clinical studies are underway to evaluate the safety and efficacy of a novel intranasal LA mist that could eliminate the need for conventional injections, with syringes attached to needles, for many maxillary dental procedures.

The intranasal mist comprises 3% tetracaine (an ester-type LA frequently used by ear, nose, and throat surgeons) plus oxymetazoline (a vasoconstrictor agent and active agent in many decongestants). In a phase 2 study, such a mist was 84% successful at inducing maxillary anesthesia from first molar to first molar, compared with 94% with injectable lidocaine plus epinephrine [Giannakopoulos H et al. *J Am Dent Assoc.* 2012]. Although additional safety and efficacy data are required for the intranasal mist, data so far have shown that it is generally well tolerated by patients for achieving anesthesia of the maxilla.

According to Dr Malamed, by mid-2015, intranasal administration of a LA will likely provide profound pulpal anesthesia from maxillary teeth 4 to 13.

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