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ABSTRACT

More than 100 years Local anesthetics have been in use in dental practice. In new era of patient comfort while permitting more extensive and invasive dental procedures the local anesthetics developed of nerve blockade injection techniques. A brief history and summary of the current local anesthetics available is reviewed.

KEYWORDS: Local anesthesia, Topical Anesthetics, Injectable Anesthetics.

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INTRODUCTION:

“For there was never yet another philosopher who could endure the toothache patiently”

- *William Shakespeare*

Dental fear is very prevalent in all age groups, across gender, and in all countries. In modern dental practice local anesthesia is the mainstay, with patients demanding better and more painless dental procedures. More than 120 years ago local anesthesia was introduced to the dental profession, today's options for anesthetizing specific sites in the mouth have become more varied, with dental professionals having many more options to ensure the comfort and safety of their patients.¹

Local anesthesia has been defined as a loss of sensation in an area of the body caused by a depression of excitation in nerve endings or an inhibition of the conduction process in peripheral nerves.²

The first local anesthetic agent to be widely used in dentistry was cocaine. Centuries before European exploration of the New World, Peruvian Indians had found that chewing leaves of the coca plant produced exhilaration and relief from fatigue and hunger. Following the import of coca leaves to Europe, much research was conducted to elucidate the properties of the coca leaf extract. In 1859, Albert Niemann refined the coca extract to the pure alkaloid form and named this new drug “cocaine.”³

Unlike the majority of other anesthetic drugs, which act as central nervous system depressants, local anesthetics prevent nociceptive impulses from reaching the central nervous system by blocking the progress of an action potential. A local anesthetic binds to sodium channel receptors on the axonal membrane, the permeability to sodium ions is lost and nerve conduction is interrupted.⁴

TOPICAL ANESTHETICS

A topical anesthetic is used to numb the surface of the gingiva in preparation for injecting a local anesthetic. Unlike injectable anesthesia, topicals anesthetize only the top portion of the mucous membrane or tissue and do not provide anesthesia for the teeth or bony structures. They are used to anesthetize the surface of an injection site. Most topical anesthetics require up to a minute to anesthetize the area. Whenever possible, use topical anesthetics to minimize the patient's pain associated with injections. For example, a topical anesthetic can be applied to a sterile cotton swab and placed just above a canine prior to an injection. It is important to use a topical anesthetic for maxillary lingual injections just medial to the first molar because these can be among the most painful sites for injection. A variety of topical anesthesia agents are available, including lidocaine and benzocaine. In recent years, oral cavity patches have been developed that adhere to the gingiva and deliver targeted, consistent release of topical anesthesia.

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These have been found to provide more effective pain relief than topicals applied with a swab when using large needles that are inserted to the bone.¹

INJECTABLE ANESTHETICS

Local anesthetics are classified into two general categories according to linkages: amide (NHCO) linkage and ester (COO) linkage. These specialized linkages join to a common carbon chain that is joined to a hydrophilic chain of amino (which confers the pKa of the anesthetic). One key exception is benzocaine, which lacks the amino terminus. While benzocaine is an ester and used mainly in topical formulations, most injectable anesthetics are amides.⁵ All anesthetics have a pKa of 7.5 to 9.5, making them weak bases. Procaine is the prototype for esters, although it is no longer available in dental syringe cartridge form.⁶ Absorption of the pharmacologic agent is dependent on a number of factors, including whether the pH of the tissue has dropped due to localized infection. Other factors include drug solubility, vascularity of the tissue at the injection site, and the impact of the agent on circulation. As such, duration is highly variable and specific for each drug. Onset of anesthetic action and duration are affected by a number of factors. The most significant among these appears to be the pH, which drops when infection is present. Other factors include the pKa of the anesthetics, the concentration of the drug, the amount of vasoconstrictor present, and the injection technique relative to nerve morphology. Since most anesthetics are vasodilators, leading to rapid diffusion away from the site, use of vasoconstrictors, such as epinephrine, increases the duration of anesthetics alone.¹

NON-INJECTABLE ANESTHETICS

Non-injectable local anesthetics are a more recent development in dental anesthesiology. U.S. Food and Drug Administration (FDA)-approved for use in adults who need localized anesthesia in periodontal pockets during scaling or root planing,

A lidocaine and prilocaine periodontal gel is packaged into single-use cartridges and applied directly into the pocket with a blunt-tip applicator and its specially designed dispenser; it is not for injection. With a 30-second onset and 20-minute duration, it can be applied to one or more periodontal pockets simultaneously. It can be reapplied as needed up to the maximum dosage of five full cartridges at one appointment.¹

Dentists currently have a variety of anesthetic solutions at their disposal, with the major difference being their expected duration of clinical anesthesia. Although these solutions are considered to be generally effective in providing a pain free oral environment for dental treatment, local anesthetic failure remains a common problem in certain instances.

EFFICIENCY

The dentist is dependent on the local anesthesia agents as well as his technique.⁷ The success of mandibular block anesthesia has traditionally been determined by the presence of a feeling of "lip numbness".⁴ Evaluating the efficacy of local anesthetics is more uncertain in symptomatic teeth. Effectively anesthetizing a tooth that contains an acutely inflamed pulp is often difficult. Many factors may affect the success of local anesthesia, some within the practitioner's control and some clearly not. While no single technique will be successful for every patient, guidelines exist that can help reduce the incidence of failure. For this discussion, a failure will be defined as inadequate depth and/or duration of anesthesia to begin or to continue a dental procedure.⁸ Due to a number of factors, such as thicker cortical plates; a denser trabecular pattern; larger, more myelin(lipid)-rich nerve bundles; and more variable innervation pathways^{9,10} more problems of inadequate anesthesia occur in the mandibular arch than in the maxillary. Although failures are more common in the mandibular arch, maxillary failures do occur and can be equally frustrating.⁸ Most problems with maxillary anesthesia can be attributed to individual

variances of normal anatomical nerve pathways through the maxillary bone.¹¹

Problems with mandibular anesthesia are most common in the molar region but are by no means limited to these teeth.^{12,13,14} As in the maxilla, most anesthesia problems encountered in the mandible are due to individual variations in the nerve pathways, in other words, accessory innervations.¹⁴

The first, and simplest, guideline relates to the extent of anesthesia achieved if, for example, a patient reports profound anesthesia of his or her lower lip and tongue after receiving an inferior alveolar and lingual nerve block injection, but the tooth in question is still sensitive, it is probable that those two nerves have been successfully anesthetized and that the tooth sensitivity is very likely due to accessory innervation.⁸

Anesthetizing the tooth with an irreversible pulpitis, can be one of the most frustrating problems for any dental practitioner. Whenever possible, prescribing antibiotic therapy to reduce inflammation and allowing the site to settle down may constitute the best course of action. When such a course is not an option, the first step in working through this situation is to deliver an appropriate nerve block injection as far back as possible along the innervation pathway of the hypersensitive tooth. If all of the surrounding soft tissues are numb, but the tooth itself is still sensitive, use of an intraosseous technique, which has a highly

predictable success rate, is recommended.^{15,16} Less predictable, but also potentially effective, is a periodontal ligament injection technique.^{17,18} A last resort is to quickly access a pulp horn, creating a hole just large enough to insert a needle, and injecting anesthetic directly into the pulp chamber of the tooth. The major limitation of all three of these injection techniques is the inability to anesthetize multiple teeth with a single needle penetration and the relatively short duration of anesthesia achieved.¹⁸

CONCLUSION

Local Anaesthesia remains the backbone of pain control in dentistry. Research has continued both in medicine and dentistry to seek new and better means of managing pain associated with many surgical treatments. Much of this research has focused on improvements in the area of local anaesthetic needle and syringes, more successful techniques of regional nerve block and newer drugs.

With the current increased use of sedation techniques pain and anxiety control the need for local anaesthesia has not decreased. It must be remembered that the sedated patient is still conscious and will react to painful stimuli unless these stimuli are properly blocked by a local anaesthetic. That is why a good local anaesthetic technique is stressed as the cornerstone for effective pain and anxiety control.

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