

ALTERNATE ANESTHETIC SOLUTIONS FOR THE INFERIOR ALVEOLAR NERVE BLOCK

Plain Solutions: 3% Mepivacaine (Carbocaine[®], Polocaine[®], Scandonest[®]) and 4% Prilocaine (Citanest Plain[®]).

McLean and co-authors,² in an experimental study have shown that 3% mepivacaine plain and 4% prilocaine plain are as effective as 2% lidocaine with 1:100,000 in an inferior alveolar nerve block. Cohen et al¹² in a clinical study of patients with irreversible pulpitis, also found that 3% mepivacaine and 2% lidocaine with 1:100,000 epinephrine were equivalent for inferior alveolar nerve blocks. Clinically, this is an important finding because when medical conditions or drug therapies suggest caution in administering epinephrine-containing solutions, 3% mepivacaine can be used as an alternative.

4% Prilocaine With 1:200,000 Epinephrine (Citanest Forte[®]) and 2% Mepivacaine With 1:20,000 Levonordefrin (Carbocaine With Neo-Cobefrin[®])

Hinkley and co-authors⁴, in an experimental study have shown that 4% prilocaine with 1:200,000 epinephrine and 2% mepivacaine with 1:20,000 levonordefrin are equivalent to 2% lidocaine with 1:100,000 in an inferior alveolar nerve block in achieving pulpal anesthesia.

Levonordefrin has 75% α activity and only 25% β activity making it seem more attractive than epinephrine (50% α activity and 50% β activity).²⁶ However, levonordefrin is marketed as a 1:20,000 concentration in dental cartridges.²⁶ Clinically, the higher concentration of levonordefrin makes it equipotent to epinephrine in clinical and systemic effects.^{4,27} Therefore, 1:20,000 levonordefrin offers no clinical advantage over 1:100,000 epinephrine.

Articaine With 1:100,000 epinephrine (Septocaine[™])

Articaine was approved for use in the United States in April 2000.²⁸ The formulation is known as Septocaine[™] (Septodont, Inc., New Castle, DE) and is available as a 4% solution with 1:100,000 and 1:200,000 epinephrine. Articaine is classified as an amide and contains a thiophene ring instead of a benzene ring like other amide local anesthetics.²⁸ A second molecular difference between articaine and other amide local anesthetics is the extra ester linkage incorporated into the articaine molecule,²⁸ which results in hydrolysis of articaine by plasma esterases.

A number of studies²⁸⁻³⁶ have evaluated articaine and have concluded that it is safe when used in appropriate doses. Both lidocaine and articaine have the same maximum milligram dose of 500 mg (recommended dose of 6.6 to 7 mg/kg) for the adult patient.²⁶ Because articaine is marketed as a 4% solution, the maximum manufacturer's recommended dose for a healthy 70 kg adult would be 7 cartridges of an articaine solution compared to 13 cartridges of a 2% lidocaine solution.²⁶

Paresthesia and Methemoglobinemia With Articaine

Articaine, like prilocaine has the potential to cause methemoglobinemia and neuropathies.²⁸ While the incidence of methemoglobinemia is rare, dentists should be aware of this complication in patients who are at an increased risk of developing this condition.³⁷ Haas and Lennon³⁸ and Miller and Lennon³⁹ investigated the incidence of local anesthetic-induced neuropathies. The incidence of neuropathies (which

involved the lip and or tongue) associated with articaine and prilocaine was approximately five times more than either lidocaine or mepivacaine.³⁹ In the Haas and Lennon retrospective study,³⁸ the incidence of paresthesia was only 14 cases out of 11 million injections or approximately one in 785,000 injections. Therefore, according to these studies, the paresthesia incidence is higher for articaine and prilocaine, but it is still a clinically rare event. Pogrel⁴⁰ evaluated patients referred with a diagnosis of damage to the inferior alveolar and/or lingual nerve that could only have resulted from an inferior alveolar nerve block. He found 35% were caused by a lidocaine formulation and 30% were caused by an articaine formulation. He concluded there was not a disproportionate nerve involvement from articaine. Therefore, fear of paresthesia should not limit the use of articaine clinically.

Insurance Carrier Hysteria With Articaine

A letter was sent to thousands of U.S. dentists by Emery and Webb/ACE USA stating "...we have noticed an increase in reversible and, in some cases, nonreversible paresthesias [with Septocaine]. ...We are writing you to alert you to these events in hopes that you will not fall victim to one of these incidents."⁴¹

Knowledgeable dentists and educators communicated their concerns and a Notice of Retraction was issued: "Unfortunately, we at Emery & Webb discovered upon further review, and subsequent to the mailings, that both documents contained inaccuracies and an alarmist tone, which was not warranted." Emery and Webb has not noted an increase in malpractice claims or lawsuits in connection with articaine. It should be made clear that Emery and Webb has not conducted any scientific investigation, sampling, testing, or other investigation of the articaine anesthetic, and has no independent knowledge or data which would restrict the use of the product."⁴¹

We must also be very careful of Web chat sites and colleagues' clinical endorsements because they may not accurately reflect the correct information regarding articaine.

Clinical Effectiveness of Articaine for Inferior Alveolar Nerve Blocks

Articaine has a reputation of providing an improved local anesthetic effect.⁴² The available literature indicates that articaine is equally effective when statistically compared to other local anesthetics.^{36, 43-50} When comparing the anesthetic efficacy of 4% articaine with 1:100,000 epinephrine to 2% lidocaine with 1:100,000 epinephrine for inferior alveolar nerve blocks, Mikesell and co-authors⁴⁹ found that the two solutions were not significantly different. Tofoli et al⁵¹ found that 4% articaine with 1:100,000 epinephrine was equivalent to 4% articaine with 1:200,000 epinephrine in inferior alveolar nerve blocks. Moore et al⁵² found no difference in clinical efficacy between 4% articaine with 1:100,000 and 1:200,000 epinephrine in clinical studies. However, for maxillary periodontal surgery, Moore et al⁵³ found the 1:100,000 epinephrine concentration for 4% articaine provided better visualization of the surgical field and less bleeding.

Claffey and co-authors⁵⁰ compared the anesthetic efficacy of 4% articaine with 1:100,000 epinephrine to 2% lidocaine with 1:100,000 epinephrine for inferior alveolar nerve blocks in patients experiencing irreversible pulpitis in mandibular posterior teeth. The success rate (none or mild pain upon endodontic access or initial instrumentation) for the inferior alveolar nerve block using the articaine solution was 24% and for the lidocaine solution success was 23%. There was no significant difference between the articaine and lidocaine solutions. Neither solution resulted in an acceptable rate of anesthetic success in mandibular posterior teeth. In summary, repeated clinical trials have failed to demonstrate any statistical superiority of articaine over lidocaine for **nerve blocks**.

Long-Acting Anesthetic Agents

Clinical trials with bupivacaine (Marcaine[®], Vivacaine[™]) and etidocaine (Duranest[®]) have been performed in oral surgery,^{54,55} endodontics^{56,57} and periodontics.^{58,59} Etidocaine has been withdrawn from the market by Dentsply Pharmaceuticals. Bupivacaine provides a prolonged analgesic period and is indicated when postoperative pain is anticipated. However, not all patients want lip numbness for extended periods of time⁵⁵ and patients should be questioned regarding their preference. Bupivacaine, as compared to lidocaine, has been shown to have a somewhat slower onset but almost double the duration of pulpal anesthesia (approximately 4 hours) in the mandible.²³

A relatively new long-acting local anesthetic is ropivacaine (Naropin[®]). It is a structural homologue of bupivacaine.⁶⁰ A number of studies have demonstrated that ropivacaine has a lower potential for central nervous system and cardiovascular toxic effects than bupivacaine.⁶⁰ Kennedy and co-authors⁶⁰ concluded that 0.5% ropivacaine with 1:200,000 epinephrine was equivalent to 0.5% bupivacaine with 1:200,000 epinephrine in pharmacologic action. El-Sharawy and Yagiela⁶¹ found that 0.5% and 0.75% concentrations of ropivacaine without epinephrine were effective for inferior alveolar nerve blocks. Another study⁶² evaluated levobupivacaine for inferior alveolar nerve blocks and found it was equivalent to bupivacaine. Therefore, ropivacaine and levobupivacaine have the potential to replace bupivacaine in clinical dental practice due to the decreased potential for cardiac and central nervous system toxicity.