

# ENDODONTIC PROCEDURES: COMPARING THE USE OF ARTICHAINE VS LIDOCAINE



**Clinical tip**

## Focus on irreversible pulpitis and root canal treatments

Each day dentists administer local anesthetics, usually using lidocaine or articaine. The main advantage of articaine is an increased potency due to its higher capability to diffuse across the nerve membrane.

Lidocaine is still the most commonly used local anesthetic for dental care in the United States and the UK, followed by articaine. Lidocaine can provide pulpal anesthesia for about 1 hour and soft tissue anesthesia for 3 to 5 hours. Articaine has greater lipid solubility compared to lidocaine and therefore a faster onset and higher success rates.

This paper summarizes four studies, executed in the specific clinical context of pain control during endodontic treatments. It will also compare the pharmacokinetic/ pharmacodynamic features of the two molecules.

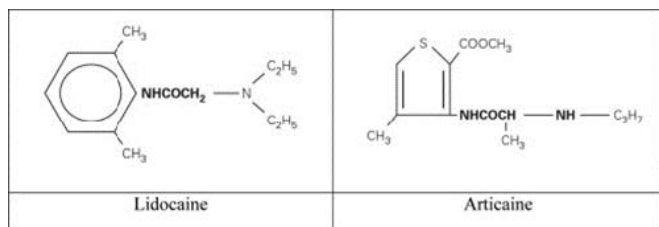


Fig.1 Lidocaine and articaine chemical structure

## Patients with symptomatic irreversible pulpitis<sup>1</sup>

Achieving profound pulpal anesthesia can be difficult in patients with symptomatic irreversible pulpitis. They can be managed using either articaine and a mandibular block technique or

lidocaine and maxillary infiltration anesthesia.

This systematic review and meta-analysis is designed to answer the population, intervention, comparison and outcome (PICO) question in adults with symptomatic irreversible pulpitis who are undergoing endodontic treatment. It also looks at the comparative efficacy of articaine compared to lidocaine in reducing pain and the incidence of adverse events.

Two hundred seventy-five studies were initially identified from the search; 10 double-blind, randomized clinical trials met the inclusion criteria, covering 746 adult patients. In the combined studies, articaine was more likely than lidocaine to achieve successful anesthesia. A maxillary infiltration subgroup analysis showed no significant difference between articaine and lidocaine. In the combined mandibular anesthesia studies, articaine was superior to lidocaine. A further subgroup analysis showed no difference for mandibular block anesthesia. When used for supplemental infiltration after successful mandibular block anesthesia, articaine was significantly more effective than lidocaine. There were no reports of adverse events. This systematic review of these double-blind, randomized clinical trials provides level 1 evidence to support the use of articaine for patients with symptomatic irreversible pulpitis.

Articaine and lidocaine have produced comparable efficacy for maxillary infiltration and for mandibular block anesthesia (inferior alveolar nerve block – IANB) alone. However, for supplemental infiltration due to persistent pulpal pain after successful mandibular block

anesthesia, articaine was significantly more effective than lidocaine.

Indeed, articaine infiltration used supplementally has been 3.55 times more likely to achieve anesthesia compared to lidocaine.

The study concluded that articaine provides a significant advantage over lidocaine in patients with symptomatic irreversible pulpitis who had endodontic treatment for supplementary infiltration after mandibular block anesthesia but no advantage over lidocaine when used for mandibular block anesthesia alone or for maxillary infiltration.



Fig.2 A maxillary buccal infiltration

### Articaine vs. Lidocaine for IANB's on pain reduction after RCT <sup>2</sup>

Lidocaine is considered as the gold standard anesthetic agent with a short onset and intermediate duration. Articaine has demonstrated to have a longer anesthetic duration with its heterocyclic thiophene ring which enhances the liposolubility that results in superior diffusion through bony tissue.

In this study, Ghazalgoo et al. (2019) have conducted a double-blind clinical trial comparing the effect of using articaine versus lidocaine local anesthetics for inferior alveolar nerve block (IANB) on root canal post-treatment (RCT) pain.

Eighty-eight patients were selected with irreversible pulpitis of a mandibular first

molar. The RCT was started after the random injection of articaine or lidocaine, lip numbness 15 minutes after the injection was a requisite.

In this study, only one cartridge of anesthetic solution per patient was used. Any patient who needed supplemental anesthesia was excluded and replaced with another patient. Individuals who received lidocaine recorded higher VAS (Visual Analog Scale) scores than the articaine group, suggesting that articaine anesthetic solution achieved higher success rates than lidocaine to control post-operative RCT pain.

The mean total post-treatment pain in the articaine group was  $25.4 \pm 26.4$ , whereas it was  $37.1 \pm 32.9$  for lidocaine group.

**Therefore, the pain after RCT in the articaine group was significantly less than the lidocaine group, concluding that using articaine for IANB may increase post-RCT comfort better than lidocaine.**



Fig.3 Root canal treatment

### Articaine bis vs. Lidocaine IANB's<sup>3</sup> for emergency rct in mandibular molars with irreversible pulpits

In this randomized controlled trial by Monteiro et al, 2015, the hypothesis that buccal infiltration with 4% articaine as the primary infiltration as an alternative to the widely used IANB using 2% lidocaine was tested.

The purpose was to determine both the anesthetic techniques and the local agent efficacy.

Success was recorded when complete pain-free root canal treatment was initiated 5 or 10 minutes after a primary injection or after one supplemental injection for emergency endodontic procedures.

A higher success rate with articaine BIs (40%) as compared to the lidocaine IANBs (10%) was obtained, even if no significant difference was found when the two patient groups were compared with one supplemental injection increasing the anesthetic success rates.

The conclusion is that single anesthesia techniques (IANB or BI) were not able to achieve pain-free emergency endodontic treatment with both articaine 4% BI and lidocaine 2% IANB in an emergency RCT in patients with symptomatic irreversible pulpitis in mandibular molars. To increase the success rate supplemental anaesthetic techniques should be considered prior this specific treatment procedure.



Fig.4 Inferior alveolar nerve block

#### **Articaine vs. lidocaine: pharmacodynamic and pharmacocynetic<sup>4</sup>**

Effective local anesthesia is a must in the management of a painful endodontic emergency.

The success rate of anesthesia may drastically decrease with irreversible pulpitis, because of:

- Local acidosis by tissue inflammation.
- Activation of nociceptors by inflammatory mediators.

This article refers to the increasing trend of endodontists in using articaine to allow painless pulpal extirpation in mandibular molars, the most difficult teeth to successfully anesthetize.

Based on the two molecule structures (articaine contains an additional ester group and a thiophene ring instead of a benzene ring of lidocaine) some pharmacokinetic/pharmacodynamic features are briefly summarized below:

1) Articaine has twice the concentration in a cartridge as compared to lidocaine: this parameter is important for managing the maximum dose, but the elimination half-time of articaine is 20 minutes compared to that of lidocaine of 90 minutes. Re-injection becomes safer when the elimination half time is longer.

2) Articaine has greater lipid solubility than lidocaine which implies also a shorter onset of Articaine vs. Lidocaine.

3) Articaine protein binding is higher than lidocaine, which positively affects the anesthetic potency.

4) Articaine has less overall toxicity because it is metabolized 90-95% in the blood and only 5-10% in the liver, while lidocaine metabolizes 70% in the liver.

5) Regarding pharmacodynamics, the potency of articaine is 1.5 times that of lidocaine, and the toxicity is similar. An unintentional intravascular injection can cause severe Central Nervous System (CNS) and Cardiovascular System (CVS) toxicity.

6) In pediatric dentistry, lidocaine has been

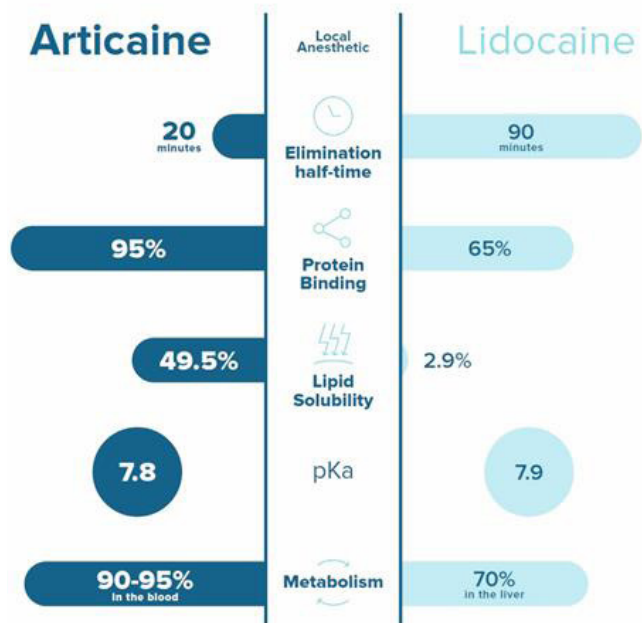
used more but studies have shown articaine safety for children over 4 years. Regardless, it is important to remember that in children, the maximum doses is the same as for adults and it can easily be achieved (0.175ml/kg). For simple procedures, the recommended dose in children above 4 years is 0.04ml/kg, while for complicated procedure it becomes 0.07ml/kg.

7) In geriatric patients, physiologic changes can alter the pharmacokinetics, absorption, metabolism and elimination of drugs. Articaine has an age-independent metabolism but due to the high serum protein binding, it could affect pharmacokinetics in the elderly patients.

## References

- 1 Kung J, et al; Does articaine provide an advantage over lidocaine in patients with symptomatic irreversible pulpitis? A systematic review and meta-analysis. J Endod 2015; 41:1784-1794
- 2 Ghazalgoo A, et al; The effect of using articaine versus lidocaine for inferior alveolar nerve block on pain after root canal treatment: a prospective, randomized clinical study. Dent Hypothesis 2018; 9:80-3
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- 4 Gufaran A S, Sanjyot M; Articaine vs lidocaine: a review IOSR Journal of Dental Medical Sciences 2014
- 5 Off the cusp; By the Numbers: Articaine vs lidocaine - May 27, 2016 <https://www.offthecusp.com/articaine-vs-lidocaine-infographic/>

## BY THE NUMBERS: ARTICAINES VS. LIDOCAINE



### Geriatric Patients

Aging and physiologic changes can alter the drug pharmacokinetics.

### Pediatric Patients

For children with small weight, the maximum dose can easily be reached.

Fig.5 Articaine vs Lidocaine, a comparative graphic

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