



## ARTICAINE: THE GAME CHANGER IN ENDODONTICS

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### Abstract

Local anesthetics are widely used in dentistry all around the world. Articaine is one such anesthetic which is coming across as a game changer in endodontics. When compared to the gold standard, ie lidocaine Because of its capability, invulnerability, and efficiency, lignocaine is acknowledged as the gold standard for local anesthesia.<sup>13</sup> The "gold standard" dental local anaesthetic is 2% lidocaine with 1:80,000 epinephrine ,it has proven to be of better efficacy and as far as anaesthetic action for mandibular molar extraction is concerned, Articaine has shown exceptionally good results than lidocaine.

As the times are progressing, dentistry is becoming a field for painless procedures. The better the action of anaesthetic, painless will be the procedure. In all studies conducted around the globe, articaine had a greater probability of being an anaesthetic success than lidocaine, producing similar results in smaller dose in a concentration of 4% in 1;100,000 adrenaline.

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## INTRODUCTION

Amongst the latest local anesthetic drugs available to dentists globally is Articaine. It's a type of amide LA that has thiophene in its chemical form instead of a benzene ring. The basic use of any LA is pain control i.e. analgesic, previously widely used drug was lignocaine and now as times have advanced, the accepted drug is Articaine.

### History of LA

The loss of sensation in a specific area of the body caused by a reduction in the stimulation of nerve endings or an inhibition of conduction is known as local anaesthesia.<sup>1</sup> The administration of chemical local anesthetics with reversibility is the most readily used technique to control pain i.e. to achieve analgesia in a dentist's clinic.<sup>2</sup>

After the unveiling of the adverse effects of cocaine for anesthesia, none of the new initiatives showed a favourable outcome, until November 27, 1904, when German chemist Alfred Einhorn (1856–1917)<sup>3</sup> patented 18 para-aminobenzoic compounds created in the Meister Lucius and Brüning plants at Höchst, Hesse, Germany.<sup>4</sup> Novocaine first appeared in print in a 1905 essay by Professor Heinrich Braun, who tested it with other potent local anaesthetics like stovaine and alypine. Braun compared variable amounts of novocaine and adrenaline he observed outstanding results.<sup>5</sup> Novocaine was widely accepted as the standard after its safety was established. However, the drug's anesthetic effects were inadequate and significant amounts of adrenaline were needed, especially when infiltration techniques were used. The substance was renamed Procaine in the United States during the First World War<sup>3,6</sup> Additionally, it turned out that some patients and medical personnel were severely allergic to it.<sup>7,8</sup> In 1943–1946, Nils Löfgren and Bengt Lundquist created a xylylidine derivative they termed lidocaine. Although it differs considerably in chemical from novocaine, as lidocaine is safe, has a greater effect, and exhibits very less allergenic reactivity.<sup>9</sup>

Articaine was created in Germany in 1969 under the trade name HOE 40-045, and it was granted access for clinical usage in 1976 as articaine hydrochloride.<sup>10,11</sup>

Articaine was renamed to Articaine in 1984,<sup>12</sup> and the US FDA authorized Septocaine in 2000 as a 4% preparation with 1:100,000 adrenaline (Septodont). In 2006, the FDA approved 4% articaine with 1:100,000 epinephrine.<sup>10</sup>

### Gold standard of LA

Because of its ability, invulnerability, and efficiency, lignocaine is acknowledged as the gold

standard for local anesthesia.<sup>13</sup> Two percent lidocaine with 1:80,000 epinephrine serves as the 'gold standard' in local anaesthesia used in dentistry.<sup>14</sup>

### Articaine

Several European regions are using articaine as the common local anaesthetic drug in dentistry as compared to the rest of the world.<sup>15</sup> Just like other commercially available local anaesthetics, articaine can offer clinically effective pain control in many dental treatments.<sup>16</sup> In 2006, the FDA approved 4% articaine with 1:100,000 epinephrine.<sup>10</sup>

articaine has a higher lipid solubility as compared to lidocaine, which facilitates improved absorption via nerve sheaths, making it a more potent anaesthetic than lidocaine.<sup>17</sup>

It's usually administered in the form of blocks or infiltration injections. Its metabolism is dependent on age, as aging leads to a reduction in elimination and metabolism<sup>18</sup>. The elimination serum half-life of articaine is 20 minutes<sup>6</sup>, while the half-life of articainic acid is 64 minutes.<sup>19</sup>

### Dosage

4% articaine along with 1:1,00,000 adrenaline and 2% lidocaine along with 1:1,00,000 epinephrine have similar potency.<sup>20</sup>

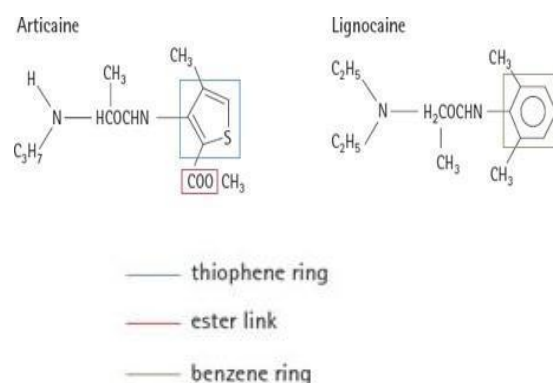
### Articaine chemical composition

Since it contains an ester group and a thiophene ring as opposed to a benzene ring, articaine is different from other members of the amide family LA.<sup>21,22,10</sup>

The ester compound of the articaine metabolises into an inert metabolite that is articainic acid which is thrown out by the kidneys helping in reducing the half life of the drug distinguishing it from other commercial available

### LAs

The chemical composition is given below:



Adapted from *Handbook of local anesthesia*<sup>2</sup>

### **Properties of Articaine**

Due to exceptional properties possessed by articaine such as accelerated action short term clearance time along with quicker return of sensory and motor sensations

### **Comparative analysis of Articaine and other anaesthetics**

Clinical trials differentiating lignocaine, the present gold standard to which all novel local anaesthetics are assessed, with articaine have differed in study design and action location, and time of action.<sup>11</sup>

In the maxillary lateral incisor, articaine had a much better efficacy than lignocaine, but not as much in the maxillary first molar.<sup>26</sup>

For anaesthetising mandibular posterior teeth<sup>26,27,28</sup> inferior alveolar nerve block and mental nerve block for mandibular anteriors<sup>29</sup> the buccal infiltration rate of articaine was better than lidocaine.

When a ligamental infiltration was given to mandibular first molars, there wasn't an evident comparison seen between articaine and lidocaine in terms of its capacity to induce anaesthesia within the pulp.<sup>30</sup>

When utilized to deliver the IANB, lignocaine, and articaine both displayed similar effectiveness rates.<sup>31</sup> While, Articaine showed a much better efficiency than lidocaine or an inactive injection when a supplement buccal infiltration was to be given, in the mandibular posterior<sup>32</sup> and anterior teeth.<sup>33</sup>

Articaine lasted much longer than mepivacaine<sup>34</sup> and lignocaine<sup>35</sup> during the postoperative period after surgically removing impacted mandibular third molars.

It has been reported that when articaine is administered in a buccal infiltration for maxillary tooth extractions, an extra palatal injection may not be required<sup>36,37</sup> and that the majority of impacted maxillary third molar extractions with articaine can be carried out without palatal anesthesia.<sup>38</sup>

Anaesthetic success with articaine is more likely to occur in the first molar region than with lignocaine, according to a meta-analysis comparing the two drugs.<sup>39</sup>

In maxillary posterior teeth, articaine was found to be more effective than lignocaine at suppressing pain during endodontic treatments.<sup>40</sup>

Articaine had a 73% success rate, prilocaine had a 57% rate, mepivacaine had a 55% rate, bupivacaine had a 53% rate, and lidocaine had a 12% success rate. this indicates that among the anaesthetic drugs

available, articaine is the most effective while lignocaine is the least effective.<sup>41</sup>

4% articaine with 1:200,000 epinephrine is the safest and efficacious for dental treatments including both restorative and surgical procedures.<sup>42</sup>

### **Safety and Adverse reactions**

Since articaine shows a fast transformation into an inert by-product (articainic acid) and reduced chances of toxic effects systemically and overdose, even after administration of subsequent injections, Articaine is one of the safer local anesthetics.<sup>15</sup>

There have been no significant documented negative effects. Post-procedural pain, headaches, facial inflammation, infections, gingivitis, and brief paraesthesia are examples of minor adverse effects.<sup>43</sup>

There have been reports of allergy<sup>44</sup>, ophthalmologic problems,<sup>45,46,47,48</sup> ischemic skin necrosis,<sup>49</sup> fever, chills, and arthralgia<sup>50</sup> in relation to articaine.

### **Teratogenicity**

Local anaesthetic has the ability to pass the placenta and enter the developing fetus.<sup>51</sup> Since the teratogenic risk is highest in the first 10 weeks, thus, it is generally recommended to avoid dental treatment during this time.<sup>52</sup> The second trimester is typically when elective dental procedures are scheduled.<sup>52</sup> Malamed recommends the usage of articaine even though it is a class C drug because it has a shorter exposure duration and an elimination half-life of only 27 minutes as opposed to 90 minutes for lidocaine.<sup>53</sup>

### **CONCLUSION**

Articaine as an anaesthetic is highly reliable and efficient. It has shown potency to be the next gold standard in the field of local anaesthesia. It's been proven by many researchers that Articaine is safe to administer and shows exceptional results. Thus concluding, the better the anaesthetic, the more painless the procedure.

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