Is the 'MANDIBULAR BLOCK' passé?
LOCAL ANESTHETICS are the SAFEST* and MOST EFFECTIVE drugs in medicine for the PREVENTION & MANAGEMENT of pain

*when used properly
Local Anesthetics by EXPECTED duration of PULPAL anesthesia

<table>
<thead>
<tr>
<th>Short-duration (~30 minutes)</th>
<th>Intermediate-duration (~60 minutes)</th>
<th>Long-duration (&gt;90 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mepivacaine 3%, Prilocaine 4%</td>
<td>• Articaine 4%, Lidocaine 2%, Mepivacaine 2%, Prilocaine 4% (all with vasoconstrictor)</td>
<td>• Bupivacaine 0.5% (with vasoconstrictor)</td>
</tr>
</tbody>
</table>

When a local anesthetic is deposited near a nerve it must diffuse across the nerve membrane INTO the nerve to block nerve conduction.
The Importance of **Aspirating** Before and During **ALL** injections

Neurovascular bundle

- **Vein**
- **Nerve**
- **Artery**

"Aspirate x 2"

Rotate the syringe ~45 degrees after 1st aspiration test

"Change bevel orientation"

"Aspirate x 2"
Deposit a Local Anesthetic Close to a Nerve and It **WILL** Produce Pain Control

When problems achieving clinically adequate pain control occur . . .

**Where** do they happen?

<table>
<thead>
<tr>
<th>Tooth group</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Very Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary Incisors</td>
<td>1</td>
<td>3</td>
<td>17</td>
<td>37</td>
<td>3</td>
</tr>
<tr>
<td>Maxillary Canines</td>
<td>1</td>
<td>2</td>
<td>23</td>
<td>42</td>
<td>53</td>
</tr>
<tr>
<td>Maxillary Premolars</td>
<td>1</td>
<td>8</td>
<td>29</td>
<td>40</td>
<td>43</td>
</tr>
<tr>
<td>Maxillary Molars</td>
<td>1</td>
<td>19</td>
<td>31</td>
<td>41</td>
<td>29</td>
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<tr>
<td>Mandibular Incisors</td>
<td>4</td>
<td>6</td>
<td>17</td>
<td>39</td>
<td>55</td>
</tr>
<tr>
<td>Mandibular Canines</td>
<td>4</td>
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<td>47</td>
<td>32</td>
<td>21</td>
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Stiagailo SV. Local anesthesia failure problems in conservative dental therapy clinic. Stomatologiia. 2006, 85(6):6-10

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Anesthesia of Mandibular Premolars, Canine & Incisors can be (almost always) easily accomplished.

Incisive Nerve Block

**Mental Nerve Block**

Incisive NB aka Mental NB (incorrectly)

- **Needle**: 27 gauge short
- **Insertion**: MB fold at or anterior to mental foramen
- **Target**: Mental nerve as it exits mental foramen
- **Volume**: 0.6 mL
- **Aspiration**: 5.7%

Insert needle in buccal fold and advance towards mental foramen
**Aspirate**
**Deposit 0.6 mL outside foramen**
So, now we’re left with those ‘darned’ mandibular molars!

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30-Minute Time Course for Pulpal Analgesia - Articaine IANBs
Data from 5 PRP Studies – 222 Subjects (1990 – 2008)

- **Articaine**
  - N = 222

- **Lidocaine**
  - N = 1078

- **LIDOCAINE + EPI 1:100**
  - **ARTICAINE + EPI 1:100**
IANB: Lidocaine + epinephrine
Articaine + epinephrine

% clinically effective pulpal anesthesia
- 25% at 4 minutes
- 40% at 6 minutes
- 60% at 10 minutes
- 67% at 15 minutes
- 95% at 45 minutes

Kanaa JM, Whitworth JM, Corbett IP, Meechan JG. Articaine buccal infiltration enhances the effectiveness of lidocaine inferior alveolar nerve block. Int Endodont J 42:238-246, 2009

Average failure rate reported across 36 published RCT reporting on LA failure with articaine or lidocaine.

A dentist will administer approximately 30,000 IANBs in the course of a 20-year career.
A dentist will administer approximately 30,000 IANBs in the course of a 20-year career.

30,000 IANBs with a 60% success rate
18,000 successful IANBs
12,000 missed IANBs

Mandibular anesthesia

- **THE** problem with mandibular anesthesia, in the adult, is the density of the cortical plate of bone.
- It precludes the successful administration of supraperiosteal anesthesia.

Mandibular anesthesia

A second problem with mandibular anesthesia, in the adult, is the lack of consistent landmarks.
Inferior Alveolar NB
“Mandibular NB”
Inferior Dental Block

The ‘HALSTED Approach’

William Stewart Halsted
1852-1922

Inferior Alveolar Nerve Block
“Mandibular NB”
Inferior Dental Block

Needle: 25- or 27-gauge long
Insertion: soft tissue on medial border of mandibular ramus
Target: IA nerve on lingual aspect of ramus prior to entering mandibular foramen
Volume: 1.5 - 1.8 mL
Aspiration: 10% - 15%

Buccal NB
“Long” Buccal

Needle: 25- or 27-gauge long
Insertion: mucous membrane distal and buccal to last mandibular molar
Target: buccal nerve passing over border of ramus
Volume: 0.2 - 0.3 mL
Aspiration: 0.7%

A basic truism regarding INJECTIONS:
Once a needle penetrates the skin or mucous membrane, every injection is BLIND
Inferior Alveolar Nerve Block
"Mandibular NB"
Inferior Dental Block

The experienced dentist administered the IANB by 'feel'
Needle is advanced towards lingual aspect of body of mandible until bone is contacted.
Dr. 'feels' or 'senses' that the needle has contacted bone at the appropriate depth (based on years of clinical experience)

The most common reason for missing the IANB is depositing local anesthetic solution too low. (BELOW the mandibular foramen)

A little bit HIGHER is a little BETTER

Following completion of IANB & Buccal NBs . . .
Seat patient comfortably upright
Speeds onset of anesthesia
The limited success of the IANB has led to the development of alternative techniques:

- Gow-Gates Mandibular Nerve Block
- Vazirani - Akinosi (closed mouth) Mandibular Nerve Block
- Periodontal ligament injection (intraligamentary)
- Intraseptal (crestal) anesthesia
- Intraseptal (crestal) anesthesia
- Articaine HCl via buccal infiltration
- Buffered local anesthetics

Is the Inferior Alveolar Nerve Block Passé?

The GOW-GATES Mandibular Nerve Block
The **GOW-GATES MANDIBULAR NERVE BLOCK** is the only true mandibular (3rd division, V₃) nerve block.

- **Mandibular condyle**
- **Coronoid process**
- **Sigmoid notch**

If a little higher is a little better, a lot higher is a lot better.
Gow-Gates Mandibular Nerve Block

**Needle:** 25 gauge long

**Insertion:** At height of ML cusp of maxillary 2nd molar, just distal to 2nd molar

**Target:** Lateral aspect of condylar neck

**Volume:** 1.8 to 3.0 mL

**Aspiration:** < 2%

***as per Dr. Gow-Gates

---

Akinosi-Vazirani Mandibular NB

Vazirani-Akinosi Mandibular NB

---

Vazirani-Akinosi Nerve Block
Akinosi-Vazirani Mandibular NB
Vazirani-Akinosi Mandibular NB

**Indications**
1. Limited mandibular opening - trismus
2. Inability to visualize landmarks for IANB (e.g., because of large tongue)

Intraosseous Anesthesia (IO)
Periodontal Ligament Injection (PDL)
• Intraligamental Injection (ILI)
Intraseptal injection (crestal)
Intraosseous Injection (IO)

Periodontal Ligament Injection

Indications
1. Mandibular molars
2. Patients in whom residual soft tissue anesthesia is undesirable
3. Where regional nerve block is contraindicated
4. Aid in diagnosing pulpal discomfort
5. Adjunct to partially successful nerve block

Periodontal Ligament Injection (PDL, ILI)
• 27 gauge short needle
• Place interproximally
• SLOWLY deposit 0.2 mL per root

Periodontal Ligament Injection
In presence of PERIAPICAL infection: PDL is not contraindicated, but may not be effective.

1980's...

Intraseptal Anesthesia

Application of Crestal Anesthesia for Treatment of Class I Caries in Posterior Mandibular Teeth:
Korouh Taheri Takesh,1 and Shiva Solahiye Kohramouli2,3

Intraseptal (Crestal) Anesthesia

Use a gentle “pecking” motion to penetrate the cortical plate.

The guide sleeve remains in place until you are sure you have adequate anesthesia.
Intraosseous Anesthesia

Endodontics:
Study #1: 88% success on mandibular molars with SIP where 2 IANB had failed
Study #2: 91% success on mandibular molars with SIP where 2 IANB had failed

Onset & Duration:
• Onset of anesthesia almost immediate
• Duration of pulpal anesthesia adequate to permit extirpation of pulpal tissues
• Duration of pulpal anesthesia may not be adequate for prolonged restorative procedures
  • Reinject as needed

ADVANTAGES
Relatively comfortable
Single / multiple tooth anesthesia
No lip / tongue
Intraosseous Anesthesia (IO)

**DISADVANTAGES**
- Highly vascular region
- LA OD
- Vasopressor “shakes” or tremor
  - use 1:200k or plain
- Can’t locate hole with needle

---

**ARTICAINE**

Articaine

- Synthesized in Germany 1969
- Introduced Germany 1979
- Canada 1985
- USA 2000

1st & only Local anesthetic designed for dentistry

- 4% with epinephrine
  - 1:100,000
  - 1:200,000

Articaine hydrochloride 4% epinephrine 1:100 000
Registered in 71 countries, 24 countries in the EU and in 45 non-EU countries and in two non-EU countries by license import.

Articaine hydrochloride 4% epinephrine 1:200 000
Registered in 58 countries, 24 countries in the EU, 32 non-EU countries

Articaine hydrochloride 4% plain

Articaine hydrochloride 2% epinephrine 1:200 000
Articaine market share

<table>
<thead>
<tr>
<th>Country</th>
<th>Market Share</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>98%</td>
<td>GFK data</td>
</tr>
<tr>
<td>Poland</td>
<td>90%</td>
<td>keystone</td>
</tr>
<tr>
<td>France</td>
<td>70%</td>
<td>estimated sales</td>
</tr>
<tr>
<td>Spain</td>
<td>68%</td>
<td>keystone</td>
</tr>
<tr>
<td>Italy</td>
<td>53.4%</td>
<td>keystone</td>
</tr>
<tr>
<td>United States</td>
<td>40.7%</td>
<td>2019 (2nd quarter)</td>
</tr>
</tbody>
</table>

Articaine 4% with epinephrine

- 1:100,000
- 1:200,000

600,000,000 articaine cartridges used in dentistry annually (worldwide)

2nd most used LA in USA 2018 (lidocaine #1 = 46.8%; articaine = 39.3%)

Proprietary names in the USA:

- Articadent
- Orabloc
- Septocaine
- Zorcaine
- Vivacaine
Since 1973 there have been more than 200 papers published in the dental / medical literature on articaine HCl.

Articaine has been compared to lidocaine, mepivacaine and prilocaine.

Virtually ALL studies have demonstrated that articaine is AS SAFE and AS EFFECTIVE as the drug it which it was compared.

A retrospective survey reports the use of articaine HCl as an anesthetic in children under 4 years of age. Data was collected by a record audit in 2 pediatric dental offices. Articaine anesthetic was administered to 211 patients, 29 having additional administrations of the agent. In some instances, the dosages exceeded the recommended concentrations for older children. No systemic adverse reactions were noted on the charts or known to the clinicians. The present report provides initial evidence for the use of articaine in children under 4 years of age.

Virtually ALL studies have demonstrated that articaine is AS SAFE and AS EFFECTIVE as the drug it which it was compared.
The **SCIENCE** of Articaine HCl

**WHY?**
Because local anesthetics are VERY EFFECTIVE drugs

---

**Before Articaine HCl**
**Pre-2000 (USA)**

- Lidocaine + epinephrine
- Mepivacaine + epinephrine
- Prilocaine + epinephrine

---

**So, what, if any, are the clinical advantages** of articaine HCl compared with the other amide LAs?

---

**THE problem with mandibular anesthesia, in the adult, is the density of the cortical plate of bone. It precludes the successful administration of supraperiosteal anesthesia**
Articaine HCl
by
Mandibular Buccal Infiltration
in Adults

Articaine infiltration as a **sole** injection for mandibular anesthesia

**Design:**
- **N = 60**
- Infiltration mandibular buccal fold by #30
  - Lidocaine 2% + epi 1:100K
  - Articaine 4% + epi 1:100K
- Randomized
  - At least 7 days apart
  - 60 on right side
  - 60 on left side
  - 1.8 mL in 60 seconds

**EPT**
- Teeth tested: 1st and 2nd molar, 1st and 2nd premolar
- Baseline
- EPT @ 1 min = molars
- EPT @ 2 min = premolars
- EPT @ 3 min = Control (contralateral canine)
- Repeated cycle every 3 minutes for 60 minutes

**Criteria for success:**
- No response to 2 or more consecutive 80uA tests
The anesthetic efficacy of articaine in buccal infiltration of mandibular posterior teeth

Results -1:
Pulp test every 3 min.

SUCCESS = 80/80 on 2 consecutive tests.

<table>
<thead>
<tr>
<th></th>
<th>Articaine</th>
<th>Lidocaine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandibular 2nd Molar</td>
<td>75%</td>
<td>45%</td>
</tr>
<tr>
<td>Mandibular 1st Molar</td>
<td>87%</td>
<td>57%</td>
</tr>
<tr>
<td>Mandibular 2nd Premolar</td>
<td>92%</td>
<td>67%</td>
</tr>
<tr>
<td>Mandibular 1st Premolar</td>
<td>86%</td>
<td>61%</td>
</tr>
</tbody>
</table>

P value for all: >.0001

Results -2:

Onset of anesthesia

<table>
<thead>
<tr>
<th></th>
<th>Articaine</th>
<th>Lidocaine</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandibular 2nd Molar</td>
<td>4.6 +/- 4.0</td>
<td>11.1 +/- 9.5</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mandibular 1st Molar</td>
<td>4.2 +/- 3.1</td>
<td>7.7 +/- 4.3</td>
<td>0.0002</td>
</tr>
<tr>
<td>Mandibular 2nd Premolar</td>
<td>4.3 +/- 2.3</td>
<td>6.9 +/- 6.6</td>
<td>0.0014</td>
</tr>
<tr>
<td>Mandibular 1st Premolar</td>
<td>4.7 +/- 2.4</td>
<td>6.3 +/- 3.1</td>
<td>0.0137</td>
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2007

Onset of anesthesia

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2007

Thiophene ring: > lipid solubility

Lidocaine

Benzene ring

Articaine

2002

Design:

Articaine 4% + epi 1:100K
Lidocaine 2% + epi 1:80K
Infiltration buccal fold by lateral incisor
• 0.5 mL
Infiltration buccal & lingual by lateral incisor
• 0.5 mL per site
EPT q 3 min for 45 minutes

2002
Results

Infiltration **buccal** fold by lateral incisor
- **94%** articaine; **70%** lidocaine

Infiltration **buccal & lingual** by lateral incisor
- **97%** articaine; **88%** lidocaine

---


Lidocaine (2% + epi) Buccal alone **2%**
Lidocaine Buccal + Lingual **~10%**
Articaine (4% + epi) Buccal alone **~60%**
Articaine Buccal + Lingual **~70%**

2002
Advantages
1. Profound pulpal anesthesia
2. 30 to 40 minute duration of pulpal anesthesia
3. Minimal accessory soft tissue anesthesia
   - Tongue

Disadvantage
Just like maxillary infiltration, I can’t think of any, unless it doesn’t work!

Articaine buccal infiltration as a supplement to IANB
IANB’s at each of 2 visits = 2% lidocaine + epi 1:80K

One visit = 4% articaine + epi 1:100K infiltration buccal fold 1st molar (2.0 mL)

One visit = ‘dummy injection’ buccal fold 1st molar

Pulp test for 45 minutes

Kanaa JM, Whitworth JM, Corbett IP, Meechan JG. Articaine buccal infiltration enhances the effectiveness of lidocaine inferior alveolar nerve block. Int Endodont J 42:238-246, 2009

BUFFERED LOCAL ANESTHETICS

The local anesthetic “ON SWITCH”

Buffered Local Anesthetics
Alkalized Local Anesthetics
**Six-Hour Time Course for Pulpal Analgesia (EPT)**
IANB Second Premolar

45 minutes

So the question is:
How long does it **REALLY** take for pulpal anesthesia to develop?

---

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset (textbook)</th>
<th>Pulpal</th>
<th>Soft Tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine 2%</td>
<td>Epi 1:50k, 1:100k</td>
<td>3 - 5 min</td>
<td>60 min</td>
</tr>
<tr>
<td>Articaine 4%</td>
<td>Epi 1:100k, 1:200k</td>
<td>2 - 3 min</td>
<td>60 min</td>
</tr>
<tr>
<td>Mepivacaine 2%</td>
<td>Levo 1:20k</td>
<td>3 - 5 min</td>
<td>60 min</td>
</tr>
<tr>
<td>Prilocaine 4%</td>
<td>Epi 1:200k</td>
<td>3 - 5 min</td>
<td>60 min</td>
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Notes:
- 95% of patients will (eventually) get numb if given a 45-minute waiting period.
- The other 5% are anatomical misses.
- Why?
- Six-Hour Time Course for Pulpal Analgesia (EPT)
- IANB Second Premolar

---

### 30-Minute Time Course for Pulpal Analgesia - Lidocaine IANBs
Data from 28 PRP Studies - 1078 Subjects (1991 – 2008)

**'MEAN'**
50% above
50% below
Some doctors use soft tissue anesthesia as a sign of pulpal anesthesia.

IANB: Lidocaine + epinephrine
Articaine + epinephrine

% clinically effective pulpal anesthesia
- 25% at 4 minutes
- 40% at 6 minutes
- 60% at 10 minutes
- 67% at 15 minutes
- 95% at 45 minutes

At 6 minutes:
- 85% soft tissue numb
- 40% pulpal anesthesia

Can we speed the onset of anesthesia... by changing the pH of the LA solution?

**YES**

Can we speed the onset of anesthesia by buffering the solution?

**pH of Local Anesthetics**

- 'Plain' LA solution = ~6.5
- Articaine = 4.0 - 5.5
- Vasoconstrictor LA solution = 3.0 - 4.4
- Lemon juice = 3.3
Patients were appointed twice. Received IANB each time. At least 1 week between appointments. Pulp tested mandibular premolar prior to start. IANB administered.

- Traditional lidocaine + epi 1:100k (pH ~3.5)
- Buffered lidocaine + epi 1:100k (pH 7.35)

Timer started. Endo-ice applied to premolar q20sec until no response. Confirmed with EPT. Onset of anesthesia when BOTH tests negative.

Three ways to buffer (as of March 2020):

1. The ‘medical way’ = DIY (do it yourself)
2. Anutra
3. Onset

Physicians who use local anesthetics use MULTIDOSE vials of lidocaine 1% or 2% with epinephrine 1:100,000.
Buffered Local Anesthetics

When buffering is done properly, the following advantages can be expected from the increase in pH:

1. More comfortable injection for patient
   - pH of anesthetic 7.3 to 7.4
2. More rapid onset on pulpal anesthesia
3. More profound anesthesia
4. Less post-injection soreness
5. No effect on duration of action
6. No increase in LA blood level (safety)

Buffered Local Anesthetics

Mandibular anesthesia - IANB

1. Administer buffered LA IANB
2. DO NOT LEAVE THE PATIENT!!!
3. You know if your block is successful in 2 minutes

Buffered Local Anesthetics

Mandibular anesthesia - IANB

4. Check for pulpal anesthesia:
   - EPT or Endo-Ice
5. In 2 minutes following IANB either begin tooth preparation or readminister LA

Buffered Local Anesthetics

Mandibular anesthesia - IANB

March 2019
This investigation revealed that buffered LAs are more effective than unbuffered LAs when used for mandibular or maxillary anesthesia in pulpally involved teeth.

Buffering of LAs has a 2.29 greater likelihood of achieving successful anesthesia.

The local anesthetic “ON SWITCH”

**Buffered** Local Anesthetics

**Alkalized** Local Anesthetics

- Incisive (mental) nerve block
- Gow-Gates mandibular nerve block
- Akinosi-Vazirani nerve block
- PDL, Intraosseous, Intraseptal
- Articaine by mandibular infiltration
- Buffered local anesthetic

Recommendations for MANDIBULAR ANESTHESIA
Recommendation
Premolars and Canine and Incisors

No need for inferior alveolar nerve block

Incisive (mental) NB
• (Buffered) lidocaine, articaine, mepivacaine
• 0.6 - 0.9 mL

If ineffective:
• PDL or Intraseptal

Infiltration of buffered articaine
• 0.6 - 0.9 mL buccal fold

Infiltration of buffered articaine
• 0.6 mL buccal fold and REPEAT if needed
IANB or GGMNB utilizing
* (Buffered) lidocaine, articaine, mepivacaine, followed by
* (Buffered) articaine buccal infiltration at apex of tooth
  * 0.6 - 0.9 mL

Recommendation
Posterior teeth - option #1

(Buffered) articaine
* 0.6 - 0.9 mL in buccal fold
  (as for maxillary infiltration)

Recommendation
Posterior teeth - option #2

So . . .

Is the “MANDIBULAR NERVE BLOCK” passé?

YES!
Will NO!
Most dentists are traditionalists
IANB?

Please!
Articaine buccal infiltration
Buffer all mandibular injections

The ‘MANDIBULAR BLOCK’ is passé!

Is the ‘MANDIBULAR BLOCK’ passé?
Stanley F. Malamed, DDS
6 March 2020