



Making Local Anesthesia Delivery More Comfortable

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About the Author



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The most invasive dental procedures in this country are accomplished using local anesthesia.¹ The first "Novocaine" (procaine) was used in the United States in about 1905.² One of the main reasons that Americans do not visit the dentist regularly is fear of pain associated with dental treatment.³ Of the different minimally to extensively invasive treatments in dentistry (such as oral prophylaxis, operative restorations, implant placement or third molar removal, and others), administration of local anesthetics (fear of "the needle" or "the shot") has been shown as a main reason for this avoidant behavior.⁴ In my own practice, it has been found that some periodontal therapies that require anesthesia can be comfortably carried out using sulcular delivery systems (such as Oraqix Topical Anesthetic [Dentsply Sirona]) that do not breach the mucosal tissues. This tells us that, as a profession, we are still hurting people while anesthetizing them with traditional injections to the point that they are apprehensive about further dental care.

CAUSES OF DISCOMFORT WHEN DELIVERING LOCAL ANESTHESIA

There are 3 main causes of discomfort from local anesthesia in the oral cavity. The first is needle penetration.⁵ The mucosal tissues of the mouth are richly innervated, especially on the

palate and at the labial (particularly on the maxilla)^{6,7} so that patients readily perceive pain on piercing these tissues with dental instruments. Injection type also has an effect on needle insertion pain, with blocks being perceived as more painful than infiltrations, except at the palate. Ligamentous injections are also rated highly painful, if used initially.

The next cause of pain results from the rate of anesthetic fluid buildup inside mucosal tissues of the mouth. Rapid expansion of these tissues, if the anesthetic is infused too swiftly, will cause significant discomfort on injection.⁸ This is especially true for the palate, where the bound mucosa can be separated from its periosteum by expansion when local anesthetic is delivered too quickly.

The third main cause of pain with local anesthesia, as reported by dental patients, is an intense burning sensation during and after the injection.⁹ This is because local anesthetics are manufactured to have an acidic pH designed to prevent bacterial contamination of anesthetic carpules.¹⁰

Any one of these factors can make local anesthesia uncomfortable. In combination, they can create a truly painful experience for the patient.

TECHNIQUES TO MINIMIZE PAIN

To mitigate these factors, dentistry has implemented several strategies throughout the years. Back in the 1980s, the use of topical anesthesia (-caine-based viscous gels) became commonplace, and it has now been used in dentistry for more than 50 years.¹¹ More recently, technology (The Wand [Milestone Scientific]) has been developed to control the rate of local anesthetic infusion into mucosal tissues, with the knowledge that faster injections mean more pressure-related discomfort. To address the burning sensations created by the acidity of local anesthetics, 2 buffering systems (Onset [Onpharma] and Anutra Local Anesthetic Delivery System [Anutra Medical]) were recently introduced to neutralize anesthetic acidity. (Further discussion to follow.)

In my practice, patient comfort is of the utmost importance. My chairside team and I have evaluated and used many of these products for a number of years to learn which are most effective and why. This knowledge has allowed us to make patients comfortable with the treatment we propose with little expectation of an unpleasant experience. This is a practice builder through word-of-mouth referrals from existing patients, which includes the many positive comments made in online reviews that help to boost our practice growth.

Topical Anesthetics

With topical anesthetics, I have found that there *are* significant differences between those available and the injection techniques

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they are used for (ie, blocks versus infiltrations). In more than 30 years of general practice experience, I have found that topical gels have not been as effective as needed. It is my opinion that this is because of salivary dilution, not the particular chemical composition of any given topical. The traditional method of applying a topical gel is on the tip of a cotton swab inserted into the mucobuccal fold where the injection will be given (Figures 1 and 2). In those areas close to Wharton's duct on the maxilla, or most places on the mandible where saliva will pool, gels are quickly washed off the mucosal surfaces, usually before they have taken significant effect. I have found that they are mostly ineffective at the pterygomandibular raphe for block injections, and that they are totally inadequate on the palate.

Given these circumstances, the search began for different topical anesthetics that would be more effective than the gels. Because of the salivary adulteration problem, even in the case of infiltrations, a topical that offers more substantivity is required. My own research suggested that patch delivery vehicles¹² (such as Topical GelPatch [Premier Dental Products]) for infiltrations would achieve this end. When using patches, first dry the mucobuccal fold with a cotton roll. Then, retracting the cheek with the fingers, place a patch where the injection will be given with cotton pliers. Then cover the patch with the same cotton roll and release the cheek.

This applies positive pressure of the patch onto the mucosa and protects it from salivary immersion as well.

Any topical anesthetic, of course, needs sufficient time to work. So after the patch is placed, the injection syringe is set up (I will open the sterilization pouch in front of the patient for effect), and the anesthetic is buffered. This takes a little more than a minute, which is sufficient time for the patch to take adequate effect. The infiltration is then given within the field of colored film (usually corresponding to the shade of the patch used) that is found on the mucosa after the cotton roll and patch are removed (Figure 3) with the patch normally stuck to the cotton roll (Figure 4). Needles should *not* be used for more than one injection, as the dulling that results can contribute to discomfort at subsequent sites, especially with female patients.⁶



Figure 1. Typically, topical gel anesthetic is placed on a cotton swab and routinely used before a local anesthetic injection.



Figure 2. The same swab shown, as placed in the mucobuccal fold, prior to a mental block injection. Any pooling of saliva in this area can readily dilute and disperse such gels, greatly reducing effectiveness.

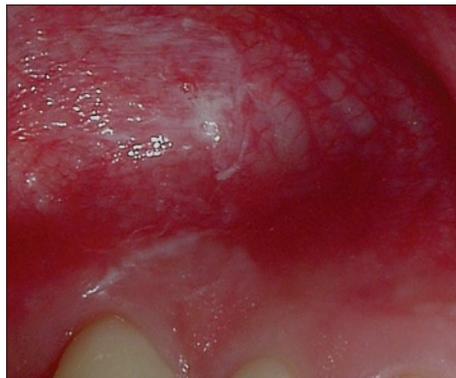


Figure 3. Residue from a patch delivery vehicle topical anesthetic seen on the upper anterior buccal mucosa just more than one minute after placement, illustrating the substantivity of these topical anesthetics.

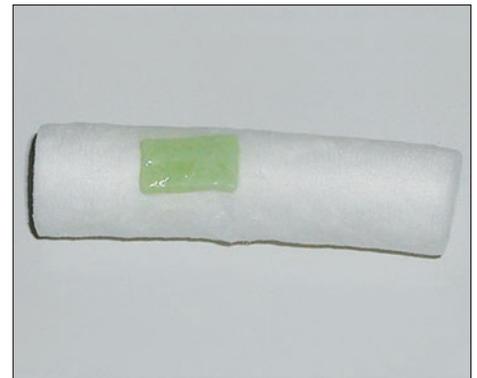


Figure 4. The patch-type topical anesthetics currently on the market will normally adhere to the cotton rolls, holding them into place in the mucobuccal fold and then coming out with the cotton roll when removed.

Mandibular Blocks and Palatal Injections

Now, let's turn our attention to mandibular blocks and palatal injections. My experience has been that gel topicals are ineffective at the pterygomandibular raphe, due to salivary pooling. Since there is no mucobuccal fold here, the patch topical process outlined above does not apply. Also, because mandibular blocks require deeper penetration than infiltrations through more anatomical structures (especially fatty tissues), topical anesthesia at this site must be subtopical to be useful. The Syrijet (Keystone Industries) (Figure 5) is a spray anesthetic injector system that provides not only topical *but also* subtopical anesthesia.¹³ After the Syrijet has been loaded with a buffered carpule of anesthetic and set to deliver 0.10 mL, its spray head is placed firmly against the soft tissue, a little less than

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halfway up the pterygomandibular raphe, before being activated. The sprayed anesthetic will penetrate into the tissue and leave a small red macule (Figure 6) on the surface where the needle will be inserted. The Syrijet should be purged with distilled water between uses to prevent clogging of its spray head by the crystalline residue of amide anesthetics (such as articaine). Used along with 4% articaine (Septocaine [Septodont]), whose chemical formula includes a thiophene ring that enhances its ability to traverse through adipose tissue,¹⁴ this technique has allowed me to give mandibular blocks that are both comfortable and effective at a higher rate of success on the first attempt. Some assertions in the literature of a higher incidence of paresthesia with mandibular blocks using 4% articaine have *not* been confirmed.¹⁵ I have only documented 3 such paresthesias, among the thousands of these injections that I have performed using this anesthetic since it became available in 2000, all of which resolved spontaneously.

With regard to delivering palatal anesthesia, no topical I have ever used has proven to be satisfactory for this most sensitive area of the mouth. As a result, I developed the transpapillary technique to comfortably anesthetize this area.¹⁶ In this method, a buccal infiltration is first accomplished to anesthetize the buccal interproximal papilla. Then, a ligamentous injector is used to diffuse more anesthetic through the papilla across the col (the interproximal soft tissue between the palatal and lingual papillae) into the palatal tissues (Figure 7). Blanching of the palatal tissues, observed thereafter, indicates where a palatal needle penetration can be completed without discomfort (Figure 8). Further studies have confirmed this technique's efficacy.¹⁷

Another concern is the rate of anesthetic infusion. Realizing that rapid injection is correlated with patient discomfort, it is best to inject a carpule of anesthetic in about 60 to 90 seconds. Although I know that there are products on the market specifically developed to aid the dentist with this, it is possible to reach the same result as a machine if the clinician simply exercises patience when delivering an injection. Studies on the subject of computer-assisted local anesthetic delivery systems have arrived at contradictory conclusions.^{18,19} However, there are many clinicians who appreciate the help of these computer-controlled devices along with the benefits of a consistent and carefully controlled injection technique.

Buffering Systems

Lastly, recent advances in buffering systems for dental anesthetics have greatly reduced the burning feel associated with local



Figure 5. The Syrijet (Keystone Industries) anesthetic spray injector provides subtopical anesthesia at the pterygomandibular raphe for mandibular block injections. (Shown here with the sterilizable spray head [left] sheath.)



Figure 6. Site of anesthetic entrance, after delivery by the Syrijet spray injector at the pterygomandibular raphe.

anesthesia delivery. As detailed above, local anesthetics are manufactured at an acidic pH to inhibit bacterial colonization. This pH is quite low, around 3.9, so it is not surprising that burning sensations on injection would result. I started using Onset (Onpharma) in mid-2015 and, since then, upon anesthetizing the corresponding teeth on contralateral sides of the same patient's mouth using buffered and unbuffered anesthetic without revealing which was which, I have almost uniformly been told that burning was felt on the unbuffered side only. The buffering process is quite simple and not too time consuming. A carpule of anesthetic is inserted into the receiving port of the buffering device (Figure 9) that has a canula

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that pierces the rubber hub on the carpule. The port is then rotated and pressed further into the device so that the canula also penetrates the buffering solution (sodium bicarbonate suspension) chamber. Then, the amount of solution to be added to the carpule is set with the selector knob at the other end of the device appropriately to the type of anesthetic being used. (Lidocaine needs about 3 times as much as articaine, for example.) After this, the buffering device is activated with a firm palm blow to the end of the selector knob, and then the receiving port is rotated back before the carpule is withdrawn and loaded into a syringe. This process takes all of about 15 seconds, without feeling the need to rush the procedure. The only negative I can report about the buffering process is that I had noted a significant increase in the incidence of vasoconstrictive infarct lesions that are associated with the transpapillary technique¹⁶ that immediately abated when I discontinued buffering the anesthetic for these injections. My patients did not report any increase in burning sensations after this discontinuance; this led me to believe that it never really was an issue to begin with, most likely because the anesthetic is diffusing from tissue that has already been anesthetized in that method.

IN SUMMARY

Recognizing the different factors that contribute to dental local anesthetic injection discomfort (such as injection type, region of the oral cavity to be anesthetized, topical anesthetic effectiveness, anesthetic infusion rate, and anesthetic solution pH) is the first step in alleviating that discomfort. Taking the steps detailed above, one can greatly minimize the impact that the 3 main contributors to local anesthetic administration discomfort have on the delivery of a local anesthetic. Following these techniques that assist in making the delivery of local anesthetic more comfortable can be a major practice builder, while also greatly reducing stress levels for both the doctor and the patient. ♦

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Figure 7. Administration of local anesthetic to the palate using a ligamentous injector in the transpapillary technique through the mesiobuccal papilla of tooth No. 3.



Figure 8. Blanching of the palatal tissue after transpapillary injection indicated where comfortable needle penetration could be achieved.



Figure 9. The Onset (Onpharma) local anesthetic buffering system with a carpule of 4% articaine in place. The selector knob (right) controls the amount of buffering solution to be utilized, appropriate to the type of anesthetic used.

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POST EXAMINATION QUESTIONS

1. Of the different minimally to extensively invasive treatments in dentistry, administration of local anesthetics (fear of “the needle” or “the shot”) has been shown as a main reason for avoidant behavior.
 - a. True
 - b. False
2. Injection type also has an effect on needle insertion pain, with infiltrations being perceived as more painful than blocks.
 - a. True
 - b. False
3. Needles should *not* be used for more than one injection, as the dulling that results can contribute to discomfort at subsequent sites, especially with male patients.
 - a. True
 - b. False
4. Studies on computer-assisted local anesthetic delivery systems have arrived at contradictory conclusions.
 - a. True
 - b. False
5. Injection type, region of the oral cavity to be anesthetized, topical anesthetic effectiveness, and anesthetic infusion rate and anesthetic solution pH are all contributing factors to local anesthetic injection discomfort.
 - a. True
 - b. False

