Local Anesthetics in Cosmetic Dermatology

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PRACTICE **POINTS**
- The proper delivery of local anesthesia is integral to successful cosmetic interventions.
- Regional nerve blocks can provide effective analgesia while reducing the number of injections and preserving the architecture of the cosmetic field.

Local anesthetics play an important role in cosmetic dermatology. Techniques using topical and regional anesthesia provide numerous pain management options for laser and injection treatments. In this article, we review strategies to maximize patient comfort during cosmetic interventions.

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Local anesthesia is a central component of successful interventions in cosmetic dermatology. The number of anesthetic medications and administration techniques has grown in recent years as outpatient cosmetic procedures continue to expand. Pain is a common barrier to cosmetic procedures, and alleviating the fear of painful interventions is critical to patient satisfaction and future visits. To accommodate a multitude of cosmetic interventions, it is important for clinicians to be well versed in applications of topical and regional anesthesia. In this article, we review pain management strategies for use in cosmetic practice.

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LOCAL ANESTHETICS
The sensation of pain is carried to the central nervous system by unmyelinated C nerve fibers. Local anesthetics (LAs) act by blocking fast voltage-gated sodium channels in the cell membrane of the nerve, thereby inhibiting downstream propagation of an action potential and the transmission of painful stimuli.[1] The chemical structure of LAs is fundamental to their mechanism of action and metabolism. Local anesthetics contain a lipophilic aromatic group, an intermediate chain, and a hydrophilic amine group. Broadly, agents are classified as amides or esters depending on the chemical group attached to the intermediate chain.[2] Amides (eg, lidocaine, bupivacaine, articaine, mepivacaine, prilocaine, levobupivacaine) are metabolized by the hepatic system; esters (eg, procaine, proparacaine, benzocaine, chlorprocaine, tetracaine, cocaine) are metabolized by plasma cholinesterase, which produces para-aminobenzoic acid, a potentially dangerous metabolite that has been implicated in allergic reactions.[3]

Lidocaine is the most prevalent LA used in dermatology practices. Importantly, lidocaine is a class IB antiarrhythmic agent used in cardiology to treat ventricular arrhythmias.[4] As an anesthetic, a maximum dose of 4.5 mg/kg can be administered, increasing to 7.0 mg/kg when mixed with epinephrine; with higher doses, there is a risk for central nervous system and cardiovascular toxicity.[5] Initial symptoms of lidocaine toxicity include dizziness, tinnitus, circumoral paresthesia, blurred vision, and a metallic taste in the mouth.[6] Systemic absorption of topical

anesthetics is heightened across mucosal membranes, and care should be taken when applying over large surface areas.

Allergic reactions to LAs may be local or less frequently systemic. It is important to note that LAs tend to show cross-reactivity within their class rather than across different classes.[7] Reactions can be classified as type I or type IV. Type I (IgE-mediated) reactions evolve in minutes to hours, affecting the skin and possibly leading to respiratory and circulatory collapse. Delayed reactions to LAs have increased in recent years, with type IV contact allergy most frequently found in connection with benzocaine and lidocaine.[8]

TOPICAL ANESTHESIA
Topical anesthetics are effective and easy to use and are particularly valuable in patients with needle phobia. In certain cases, these medications may be applied by the patient prior to arrival, thereby reducing visit time. Topical agents act on nerve fibers running through the dermis; therefore, efficacy is dependent on successful penetration through the stratum corneum and viable epidermis. To enhance absorption, agents may be applied under an occlusive dressing.

Topical anesthetics are most commonly used for injectable fillers, ablative and nonablative laser resurfacing, laser hair removal, and tattoo removal. The eutectic mixture of 2.5% lidocaine and 2.5% prilocaine as well as topical 4% or 5% lidocaine are the most commonly used US Food and Drug Administration–approved products for topical anesthesia. In addition, several compounded pharmacy products are available.

After 60 minutes of application of the eutectic mixture of 2.5% lidocaine and 2.5% prilocaine, a 3-mm depth of analgesia is reached, and after 120 minutes, a 4.5-mm depth is reached.[9] It elicits a biphasic vascular response of vasoconstriction and blanching followed by vasodilation and erythema.[10] Most adverse events are mild and transient, but allergic contact dermatitis and contact urticaria have been reported.[11-13] In older children and adults, the maximum application area is 200 cm^2, with a maximum dose of 20 g used for no longer than 4 hours.

The 4% or 5% lidocaine cream uses a liposomal delivery system, which is designed to improve cutaneous penetration and has been shown to provide longer durations of anesthesia than nonliposomal lidocaine preparations.[14] Application should be performed 30 to 60 minutes prior to a procedure. In a study comparing the eutectic mixture of 2.5% lidocaine and 2.5% prilocaine versus lidocaine cream 5% for pain control during laser hair removal

with a 1064-nm Nd:YAG laser, no significant differences were found.[15] The maximum application area is 100 cm^2 in children weighing less than 20 kg. A study of healthy adults demonstrated safety with the use of 30 to 60 g of occluded liposomal lidocaine cream 4%.[16]

In addition to US Food and Drug Administration–approved products, several compounded pharmacy products are available for topical anesthesia. These formulations include benzocaine-lidocaine-tetracaine gel, tetracaine-adrenaline-cocaine solution, and lidocaine-epinephrine-tetracaine solution. A triple-anesthetic gel, benzocaine-lidocaine-tetracaine is widely used in cosmetic practice. The product has been shown to provide adequate anesthesia for laser resurfacing after 20 minutes without occlusion.[17] Of note, compounded anesthetics lack standardization, and different pharmacies may follow their own individual protocols.

REGIONAL ANESTHESIA
Regional nerve blockade is a useful option for more widespread or complex interventions. Using regional nerve blockade, effective analgesia can be delivered to a target area while avoiding the toxicity and pain associated with numerous anesthetic infiltrations. In addition, there is no distortion of the tissue architecture, allowing for improved visual evaluation during the procedure. Recently, hyaluronic acid fillers have been compounded with lidocaine as a means of reducing procedural pain.

Blocks for Dermal Fillers
Forehead—For dermal filler injections of the glabellar and frontalis lines, anesthesia of the forehead may be desired. The supraorbital and supratrochlear nerves supply this area. The supraorbital nerve can be injected at the supraorbital notch, which is measured roughly 2.7 cm from the glabella. The orbital rim should be palpated with the nondominant hand, and 1 to 2 mL of anesthetic should be injected just below the rim (Figure 1). The supratrochlear nerve is located roughly 1.7 cm from the midline and can be similarly injected under the orbital rim with 1 to 2 mL of anesthetic (Figure 1).

Lateral Temple Region—Anesthesia of the zygomaticotemporal nerve can be used to reduce pain from dermal filler injections of the lateral canthal and temporal areas. The nerve is identified by first palpating the zygomaticofrontal suture. A long needle is then inserted posteriorly, immediately behind the concave surface of the lateral orbital rim, and 1 to 2 mL of anesthetic is injected (Figure 1).

Malar Region—Blockade of the zygomaticofacial nerve is commonly performed in conjunction with

the zygomaticotemporal nerve and provides anesthesia to the malar region for cheek augmentation procedures. To identify the target area, the junction of the lateral and inferior orbital rim should be palpated. With the needle placed just lateral to this point, 1 to 2 mL of anesthetic is injected (Figure 1).

Blocks for Perioral Fillers

Upper Lips/Nasolabial Folds—Bilateral blockade of the infraorbital nerves provides anesthesia to the upper lip and nasolabial folds prior to filler injections. The infraorbital nerve can be targeted via an intraoral route where it exits the maxilla at the infraorbital foramen. The nerve is anesthetized by palpating the infraorbital ridge and injecting 3 to 5 mL of anesthetic roughly 1 cm below this point on the vertical axis of the midpupillary line (Figure 1). The external nasal nerve, thought to be a branch of cranial nerve V, also may be targeted if there is inadequate anesthesia from the infraorbital block. This nerve is reached by injecting at the osseocartilaginous junction of the nasal bones (Figure 1).

Lower Lips—Blockade of the mental nerve provides anesthesia to the lower lips for augmentation procedures. The mental nerve can be targeted on each side at the mental foramen, which is located below the root of the lower second premolar. Aiming roughly 1 cm below the gumline, 3 to 5 mL of anesthetic is injected intraorally (Figure 1). A transcutaneous approach toward the same target also is possible, though this technique risks visible bruising. Alternatively, the upper or lower lips can be anesthetized using 4 to 5 submucosal injections at evenly spaced intervals between the canine teeth.[18]

Blocks for Palmoplantar Hyperhidrosis

The treatment of palmoplantar hyperhidrosis benefits from regional blocks. Botulinum toxin has been well established as an effective therapy for the condition.[19-21] Given the sensitivity of palmoplantar sites, it is valuable to achieve effective analgesia of the region prior to dermal injections of botulinum toxin.

Wrists—Sensory innervation of the palm is provided by the median, ulnar, and radial nerves (Figure 2A). At the wrist, the median nerve lies between the tendons of the flexor carpi radialis muscle and the palmaris longus muscle. To facilitate identification of the palmaris longus muscle, instruct the patient to oppose the thumb and little finger while flexing the wrist. The needle should be inserted between the 2 tendons, just proximal to the wrist creases (Figure 2B). Once the fascia is pierced, 3 to 5 mL of anesthetic is injected.

The ulnar nerve is anesthetized between the ulnar artery and the flexor carpi ulnaris muscle. The artery is identified by palpation, and special care should be taken to avoid intra-arterial injection. The needle is directed toward the radial styloid, and 3 to 5 mL of anesthetic is injected roughly 1 cm proximal to the wrist crease (Figure 2B).

Anesthesia of the radial nerve can be considered a field block given the numerous small branches that supply the hand. These branches are reached by injecting anesthetic roughly 2 to 3 cm proximal
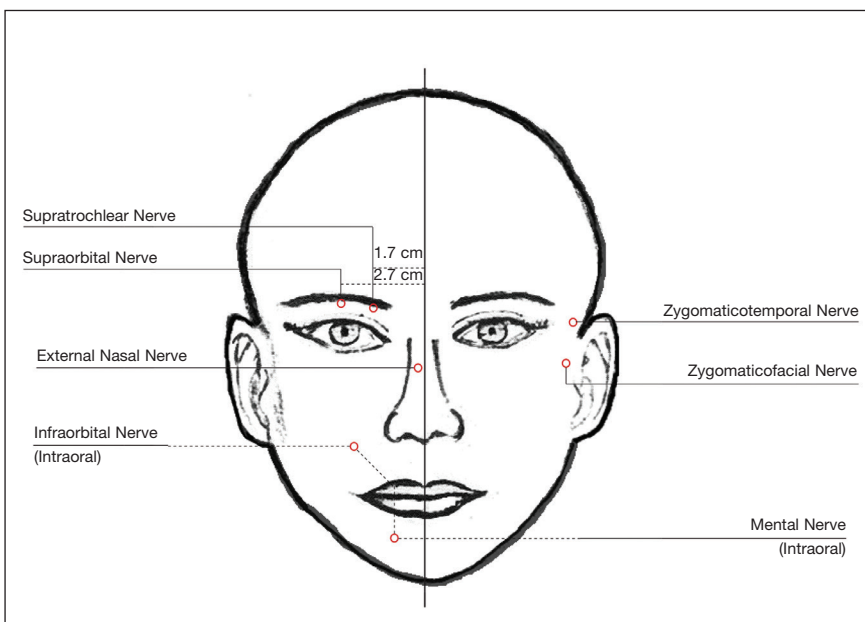

Figure 1. Regional anesthesia for the face. Red circles indicate injection points for the forehead, lateral temple region, malar region, upper lips/nasolabial folds, and lower lips.

to the radial styloid with the needle aimed medially and extending the injection dorsally (Figure 2B). A total of 4 to 6 mL of anesthetic is used.

Ankles—An ankle block provides anesthesia to the dorsal and plantar surfaces of the foot.[22] The region is supplied by the superficial peroneal nerve, deep peroneal nerve, sural nerve, saphenous nerve, and branches of the posterior tibial nerve (Figure 3A).

To anesthetize the deep peroneal nerve, the extensor hallucis longus tendon is first identified on the anterior surface of the ankle through dorsiflexion of the toes; the dorsalis pedis artery runs in close
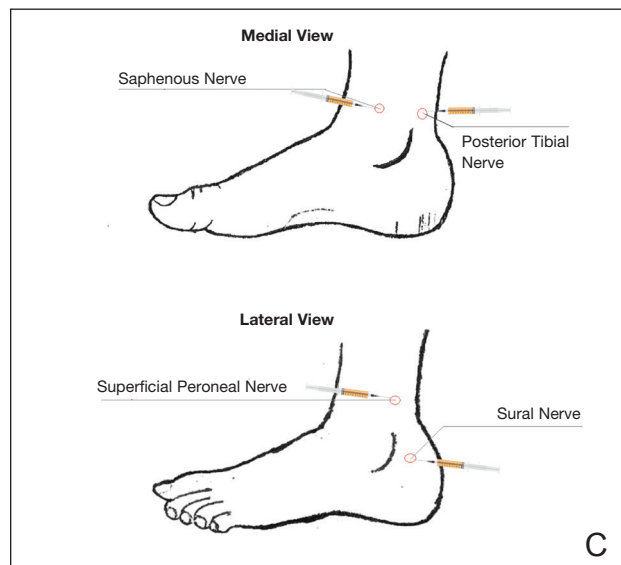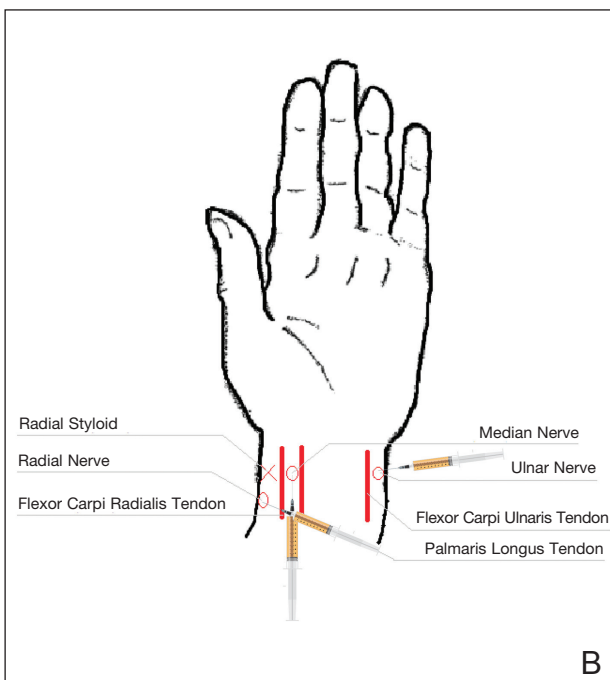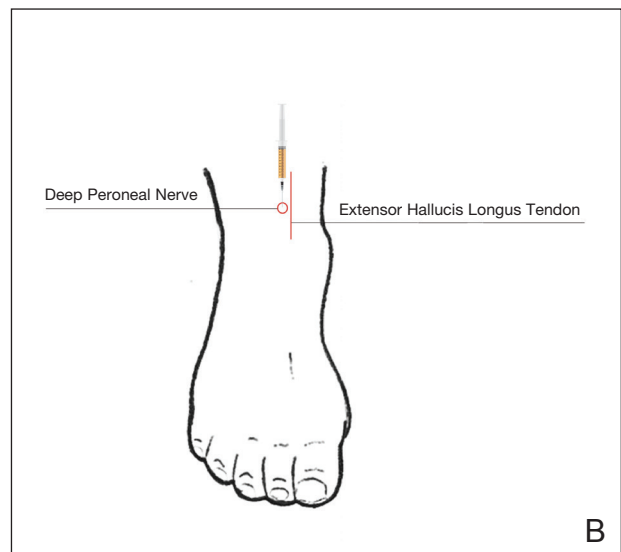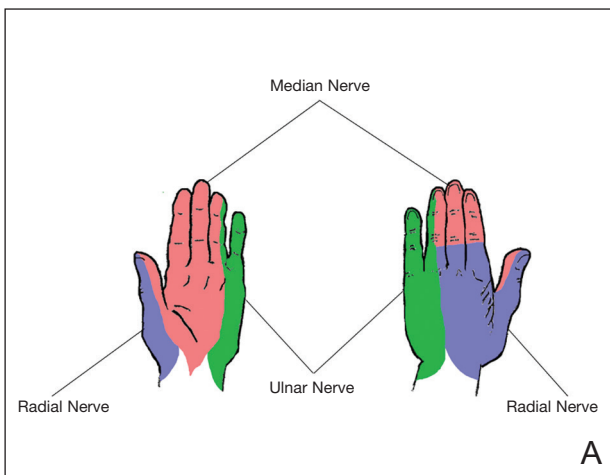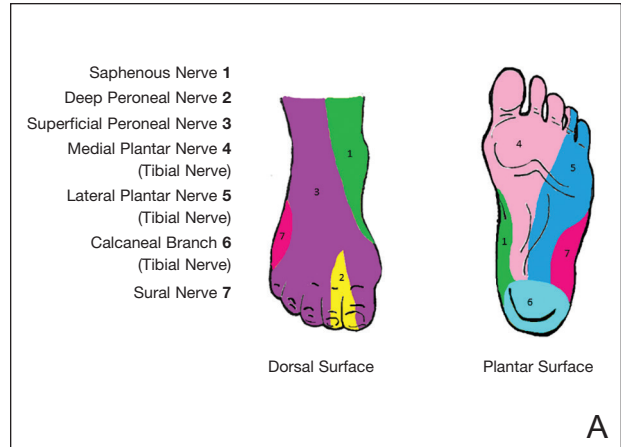
Figure 2. Regional anesthesia for the wrists. Sensory innervation of the hand (A), and injection points for the median, radial, and ulnar nerves (B).

Figure 3. Regional anesthesia for the ankles. Sensory innervation of the foot (A); injection point for the deep peroneal nerve (B); and injection points for the superficial peroneal, sural, saphenous, and posterior tibial nerves (C).

proximity. The injection should be placed lateral to the tendon and artery (Figure 3B). The needle should be inserted until bone is reached, withdrawn slightly, and then 3 to 5 mL of anesthetic should be injected. To block the saphenous nerve, the needle can then be directed superficially toward the medial malleolus, and 3 to 5 mL should be injected in a subcutaneous wheal (Figure 3C). To block the superficial peroneal nerve, the needle should then be directed toward the lateral malleolus, and 3 to 5 mL should be injected in a subcutaneous wheal (Figure 3C).

The posterior tibial nerve is located posterior to the medial malleolus. The dorsalis pedis artery can be palpated near this location. The needle should be inserted posterior to the artery, extending until bone is reached (Figure 3C). The needle is then withdrawn slightly, and 3 to 5 mL of anesthetic is injected. Finally, the sural nerve is anesthetized between the Achilles tendon and the lateral malleolus, using 5 mL of anesthetic to raise a subcutaneous wheal (Figure 3C).

Conclusion

Proper pain management is integral to ensuring a positive experience for cosmetic patients. Enhanced knowledge of local anesthetic techniques allows the clinician to provide for a variety of procedural indications and patient preferences. As anesthetic strategies are continually evolving, it is important for practitioners to remain informed of these developments.

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