Local and topical anesthetic techniques have long been used for office-based procedures in the specialty of otorhinolaryngology. In fact, before the advent of safer intravenous and inhaled general anesthetic techniques, many procedures now mainly performed under general anesthesia (ie, rhinoplasty, rhytidectomy, and tonsillectomy) were performed with the use of local and topical anesthesia. Tonsillectomy, presently one of the most commonly performed surgical procedures in the United States, is still performed under local anesthesia by some otorhinolaryngologists.¹,² There are numerous advantages to using local and topical anesthesia for office-based procedures, including a shorter recovery period and the maintenance of a conscious patient who can communicate with the surgeon and maintain his or her own airway during the procedure. Furthermore, in the current age of rising health care costs, the use of local and topical anesthetic techniques for office-based procedures can be an effective means to deliver less expensive, high-quality medical care. Paramount to the success of these procedures is patient selection. The patient must be cooperative, willing to follow precise instructions, and willing to remain awake for the procedure. With this in mind, numerous procedures can be performed on the external face, ear, nose, oral cavity, nasopharynx, oropharynx, hypopharynx, and larynx, using either local or topical anesthetic techniques, or a combination of both.

Infiltration of local anesthetic, such as lidocaine, into structures of the head and neck can be extremely painful for the patient because of the abundance of highly sensitive tissues. To reduce the discomfort often associated with the local blocks that are reviewed later in this article, the physician should consider buffering acidic anesthetic agents with 7.5% sodium bicarbonate solution in a 1:5 dilution by volume (eg, 1 mL 7.5% sodium bicarbonate and 5 mL 1% lidocaine).³ Infiltration should be
performed in a slow and steady manner using a fine needle such as a 27-gauge needle or smaller and placed within the dermal-subdermal or mucosal-submucosal plane to lessen pain from soft tissue dissection by the local anesthetic.4

EAR
External Ear

Indications for local anesthesia of the auricle include repair of a torn lobule, examination and treatment of traumatic lacerations, and treatment of auricular hematomas. When anesthetizing the external ear with regional blocks, the addition of epinephrine to the anesthetic solution should be used with caution if there is severe devascularization of the tissue, as this may result in tissue necrosis. However, the use of epinephrine may be of great benefit, as it reduces bleeding and prolongs anesthesia, and there is no good evidence that shows harm in its use. In fact, one study looking at more than 10,000 patients undergoing nasal and ear surgery showed that the addition of epinephrine to the anesthetic solution had a relatively small influence on blood perfusion and resulted in no cases of tissue necrosis.5

Several techniques can be used to accomplish anesthesia of the auricle. To achieve anesthesia of the posteromedial, posterolateral, and inferior auricle, local anesthetic, such as 1% lidocaine, can be injected in the posterior sulcus of the auricle (Fig. 1). Injection in this location will block branches of the greater auricular nerve and lesser occipital nerve that supply sensory innervation to the auricle. If anesthesia of the anterosuperior and anteromedial portions of the auricle is desired, a block of the auriculotemporal nerve can be performed by injecting local anesthetic just superior and anterior to the tragus. Alternatively, local anesthetic can be injected in a diamond formation around the auricle to achieve a field block of the external ear (Fig. 2).6

![Fig. 1. Injection of local anesthetic in the crescent-shaped retroauricular sulcus provides anesthesia of the posteromedial, posterolateral, and inferior auricle.](image)
Concha and External Auditory Canal

Indications for local anesthesia of the concha and external auditory canal (EAC) include removal of foreign bodies, debridement and cleaning for otitis externa, and cleaning of severe cerumen impaction. Sensory innervation to the concha and the posteroinferior quadrant of the EAC is supplied by the auricular branch of the vagus nerve, whereas the remainder of the EAC is supplied by the auriculotemporal nerve. Several techniques can be used to achieve local anesthesia of the concha and EAC. The most commonly used technique involves a 4-quadrant subcutaneous field block in the lateral portion of the cartilaginous EAC; however, this technique can be extremely painful during administration of the local anesthetic into the sensitive EAC skin. Alternatively, a series of injections can be given anterior to the tragus, along the helical root, and just lateral to the EAC in the concha to achieve the desired effect.

Tympanic Membrane

Indications for local anesthesia of the tympanic membrane (TM) include tympanocentesis; myringotomy; transtympanic injection of gentamicin or steroids; and pressure-equalizing tube placement, removal, or manipulation. A 4-quadrant block of the EAC as described previously is also effective in providing anesthesia of the TM; however, topical anesthesia is generally preferred over the 4-quadrant block because of the painful nature of the 4-quadrant block.

Topical anesthesia

Topical anesthesia of the TM was first reported by Zaufel in 1884 using 10% cocaine dissolved in alcohol. Currently, the most frequently used agent is topical 80% to 90%
Fig. 3. A 4-quadrant field block of the external auditory canal is performed with subcutaneous injection of local anesthetic until a small elevation of tissue is seen in the lateral canal. An ear speculum is often useful in guiding these injections.

Fig. 4. A series of injections anterior to the tragus, along the helical root, and lateral to the EAC in the concha can also be used to anesthetize the external auditory canal.
liquefied phenol, an effective analgesic agent causing full-thickness analgesia with an immediate effect.\textsuperscript{8} The phenol is applied to the TM with an applicator causing the TM to blanch on contact; however, care must be taken to avoid application of phenol to the EAC because of the possibility of systemic absorption through the skin resulting in toxicity, and the possibility of a chemical otitis externa. Another topical agent commonly used for TM anesthesia is a solution of 8% tetracaine base in 70% isopropyl alcohol. To provide adequate anesthesia for intraoffice procedures, 5 to 10 drops of this solution may be used to fill one-third of the EAC and make contact with the TM for approximately 15 minutes.\textsuperscript{9,10} Alternatively, lidocaine and prilocaine in a eutectic mixture of local anesthetics (EMLA) may be applied to the TM using cotton pledgets for approximately 30 to 60 minutes.\textsuperscript{11–13} However, this time-consuming procedure has shown mixed results when efficacy has been compared with other topical anesthetic techniques.\textsuperscript{13,14}

\textbf{Transtympanic iontophoresis}  
Iontophoresis, a procedure in which charged molecules or ions are induced to migrate through tissues under the influence of a direct electrical current, has also been described as a method of achieving anesthesia of the TM using lidocaine or lignocaine (\textbf{Fig. 5}).\textsuperscript{15,16} However, this technique is not commonly used in a typical practice because of its cumbersome and time-consuming nature, as well as reports that the total anesthetic effect of iontophoresis on the TM may be unpredictable and inadequate.\textsuperscript{17} The first step in transtympanic iontophoresis is to fill the EAC with local anesthetic warmed to body temperature. Next, a negative electrode is applied to the patient’s skin while a positive electrode is placed into the anesthetic solution in the patient’s external canal. A current is then applied (i.e., gradual increase to a maximum of 0.5 mA at 18 V) for approximately 10 minutes, after which the current is gradually decreased and the anesthetic is suctioned from the EAC.\textsuperscript{18}

\textbf{Fig. 5.} Transtympanic iontophoresis induces charged molecules to migrate through the tympanic membrane tissue under the influence of a direct electrical current. The external canal is filled with the local anesthetic and an electrode is placed into the anesthetic solution to provide the necessary current.
NOSE

Indications for local anesthesia of the nasal cavity include examination using rigid or flexible endoscopes, nasal debridement, control of epistaxis, treatment of nasal fractures, and management of abscesses and hematomas. Both local and topical anesthetic techniques can be used for these purposes, either alone or in conjunction, and have proven to be very effective. For example, when compared with general anesthesia, the selection of one of these anesthetic methods has been shown to have no effect on the results of closed reduction of nasal fractures.19–21

Topical Anesthesia

Topical anesthetics, such as lidocaine or pontocaine, are commonly administered in conjunction with a vasoconstricting substance (for decongestion of mucosal edema), such as 0.05% oxymetazoline, before examination or treatment of the nasal cavity by the otorhinolaryngologist. This solution can be sprayed in the nasal cavity via atomizer or applied to cotton pledgets, which are then placed in the nasal cavity with bayonet forceps to cover branches of the anterior and posterior ethmoid, sphenopalatine, and nasopalatine nerves, along the nasal septum and lateral nasal wall. Alternatively, cocaine is a rapidly effective and powerful topical anesthetic and vasoconstricting agent when applied to the nasal mucosa on cotton pledgets. It is available in solution preparations ranging from 2% to 10%, with 4 mL of 4% solution being the most frequently used preparation. When using cocaine for topical anesthesia of the nasal cavity, the treating physician should keep in mind the reported maximum dosage of 200 mg or 2 to 3 mg/kg, and consider using cardiopulmonary monitoring. Studies have shown that only approximately one third of cocaine solution placed on pledgets is absorbed via the nasal mucosa, although longer application times most likely result in increased absorption.22 The clinical use of cocaine in otorhinolaryngology has decreased significantly in the past 25 years, and may reflect a better understanding of its potential toxicities and the availability of safer alternative medications.23

Local Anesthesia

Sufficient anesthesia of the internal nasal cavity can be achieved by injection of local anesthetic agents, such as lidocaine, along the nasal septum and lateral walls and floor of the nasal cavity. The external nasal nerve (also termed the external branch of the anterior ethmoidal nerve) can be blocked with an intercartilaginous injection of the nasal dorsum from the region of the rhinion to the supratip region (Fig. 6). A nasopalatine nerve block can be achieved with an injection at the base of the columna and nasal tip just inside of the nasal sill.

An infraorbital nerve block can be achieved via an intranasal, intraoral, or transcunicaneous approach and injection in the region of the infraorbital foramen. Vasoconstrictors should not be used to avoid vasoconstriction of the facial artery, which may lie on either side of the needle. The infraorbital foramen can be difficult to palpate externally, but can be found on the inferior border of the infraorbital rim, in line with the pupil when the patient is looking straight ahead (see Fig. 6). This is the site of injection when using the transcunicaneous approach. The transnasal approach is performed with an injection that passes through the vestibule into the facial soft tissues, just below the mid-orbital rim in the region of the infraorbital foramen. Alternatively, for the intraoral approach, the gingivobuccal sulcus above the first premolar is anesthetized with topical anesthetic, as described in the following section about the oral cavity. Next, while keeping a palpatting finger in place over the infraorbital rim, a needle is introduced into this space and advanced approximately 2 cm toward the infraorbital foramen (although
this distance varies from patient to patient), and local anesthetic is injected in the region of the infraorbital foramen. Care should be taken to ensure that the needle is not advanced too far posteriorly and superiorly when performing this intraoral injection, so that the orbit is not entered inadvertently. Although the level of anesthesia achieved by these 3 approaches is comparable, one study found that the duration of anesthesia was prolonged significantly via the intraoral approach.  

**ORAL CAVITY AND OROPHARYNX**

Indications for local anesthesia of the oral cavity and oropharynx include examination and treatment of the teeth, closure of a laceration, incision and drainage of a peritonsillar abscess, and treatment of patients who have sustained severe dentoalveolar trauma (ie, maxillomandibular fixation for mandible fractures).

**Topical Anesthesia**

The use of topical anesthetics applied to the mucous membranes in the oral cavity is useful in alleviating the pain associated with infiltration of local anesthetics, which can be a source of great apprehension for many patients. To minimize the amount of anesthetic that is swept away by saliva, the area to be anesthetized is first dried thoroughly. The physician’s anesthetic of choice (ie, 20% benzocaine, or 10% lidocaine) is then applied to the area that is to be anesthetized with gentle pressure for a few minutes using a cotton-tip applicator. Once the topical anesthetic has taken effect, the physician may proceed with the desired procedure, although injection of local anesthetic is typically required for adequate anesthesia.
Topical anesthesia of the oropharynx can be achieved with an anesthetic spray, such as 20% benzocaine, or by asking the patient to gargle a viscous local anesthetic, such as 2% viscous lidocaine. It is important for the physician to keep in mind that topical benzocaine has been reported to rarely cause methemoglobinemia, a potentially life-threatening medical condition, with incidence rates ranging from 0.04% to 0.30%.\textsuperscript{25–28} Clinically, acquired methemoglobinemia is characterized by cyanosis, low pulse oximetric readings, and chocolate-brown blood on arterial blood gas sampling with normal arterial pO\textsubscript{2} values. Diagnosis is confirmed by measurement of elevated methemoglobin levels on arterial blood sampling, and treatment includes intravenous administration of the antidote, methylene blue. If an invasive procedure, such as incision and drainage of a peritonsillar abscess, is to be performed, topical anesthesia may be followed by submucosal injection of local anesthetic, such as 1% lidocaine, in the desired location.

\textit{Local Anesthesia}

If anesthesia of an individual tooth is desired, a slow supraperiosteal injection of local anesthetic can be administered in the area of the corresponding tooth root with the bevel of the needle facing the bone. The objective is to place the anesthetic in proximity to the supporting bony structures to achieve penetration of the anesthetic into the cortex of bone, and subsequently to reach the nerve. The palatal side of the tooth can also be injected if the desired level of anesthesia is not reached. Regional nerve blocks can be achieved using the same technique in the region of specific teeth (Fig. 7). The posterior alveolar nerve (supplying sensory innervation to the ipsilateral maxillary molar teeth) can be anesthetized with an injection in the region of the distal buccal root of the upper second molar with the needle directed toward the maxillary tuberosity, and then along the curvature of the maxillary tuberosity to a depth of approximately 2 cm. The middle superior alveolar nerve (supplying sensory innervation to the mesiobuccal root of the maxillary first molar and the ipsilateral premolars) can be anesthetized with an injection between the second premolar and first molar. The anterior

\begin{figure}
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\includegraphics[width=\textwidth]{figure7.png}
\caption{Sensory innervation of the maxillary dentition is provided by the posterior, middle, and anterior superior alveolar nerves.}
\end{figure}
superior alveolar nerve (supplying sensory innervation to the ipsilateral canine and incisors) can be anesthetized with an injection placed at the apex of the canine tooth. Alternatively, an infraorbital nerve block (described previously in the section on anesthesia of the nose), anesthetizes the anterior and middle superior alveolar nerves, in addition to the skin of the upper lip, the skin of the nose, and the lower eyelid.

An inferior alveolar nerve block provides anesthesia to all of the teeth of the ipsilateral mandible and desensitizes the lower lip and the chin via block of the mental nerve. To perform this block, the pterygomandibular triangle is first visualized and topically anesthetized by placing a thumb in the mouth and an index finger externally behind the ramus to retract the tissues. Once topical anesthesia of this area has been obtained, local anesthetic is introduced through the mucosa of the pterygomandibular triangle approximately 1 cm above the occlusal surface of the molars, and is advanced until it has reached the bone where the anesthetic agent is injected (Fig. 8). When performing this injection, the angle of entry is of great importance, as directing the needle too far posteriorly may result in temporary facial paralysis as a result of injection into the parotid tissue. To achieve the appropriate angle, the syringe should be held parallel to the occlusal surfaces of the teeth and angled so that the barrel of the syringe lies between the first and the second premolars on the contralateral side of the mandible. When a block of the inferior alveolar nerve is performed, the nearby lingual nerve is often blocked as well, resulting in anesthesia of the anterior two-thirds of the tongue. Thus, the same technique can be used if anesthesia of the tongue is desired for a procedure such as a lingual biopsy.

Fig. 8. The inferior alveolar nerve courses along the medial surface of the mandibular ramus where a block can be performed by injecting local anesthetic in the region of the pterygomandibular triangle.
If anesthesia of only the ipsilateral lower lip is desired, an isolated mental nerve block can be achieved by infiltration of local anesthetic around the mental foramen. This can be accomplished via an intraoral or an extraoral approach, although the intraoral technique has been shown to be less painful. The mental foramen is identified by palpation about 1 cm inferior and anterior to the second premolar, roughly in line with the pupil when the patient is looking straight ahead. When using the intraoral approach, the lower labial fold adjacent to the first or second premolar is topically anesthetized, and the injection is directed toward the mental foramen.

**LARYNX**

Indications for local anesthesia of the larynx include diagnostic laryngoscopy and bronchoscopy, transnasal esophagoscopy, and placement of an endotracheal tube when awake endotracheal intubation is indicated either electively or emergently.

**Topical Anesthesia**

Topical anesthesia of the oropharyngeal and nasal mucosa can be helpful when performing endoscopic procedures. Techniques for topical anesthesia of the nasal mucosa and oropharyngeal mucosa were previously described in this text. In the nasal cavity, this includes application of a topical anesthetic, typically used in conjunction with a vasoconstricting substance, in the form of a spray via atomizer or application using cotton pledgets. Benzocaine 20% spray or 2% viscous lidocaine can similarly be used to anesthetize the oropharyngeal mucosa. To anesthetize the vocal cords, the patient may be asked to inspire deeply while topical anesthetic is sprayed into the nasal cavity. Alternatively, transnasal esophagoscopes can be used to apply 4% lidocaine directly to the larynx through the irrigation port on the endoscope.

**Local Anesthesia**

A superior laryngeal nerve block can be used to anesthetize the supraglottic larynx by effectively blocking the internal branch of the superior laryngeal nerve, which supplies sensory input from the inferior aspect of the epiglottis down to the vocal cords. To perform a superior laryngeal nerve block, the patient’s neck is extended and the hyoid bone is displaced laterally toward the side to be blocked. A small-gauge needle, such as a 27-gauge needle, is advanced approximately 3 mm inferior to the greater cornu of the hyoid bone, providing anesthesia to the supraglottic larynx.

Fig. 9. A superior laryngeal nerve block can be performed by injecting local anesthetic medial and lateral to the thyrohyoid membrane at a level just inferior to the greater cornu of the hyoid bone, providing anesthesia to the supraglottic larynx.
the hyoid bone until it passes through the thyrohyoid membrane, at which point a slight loss of resistance is felt (Fig. 9). Once this has been accomplished, 3 mL of local anesthetic solution is injected superficial and deep to the thyrohyoid membrane.

If anesthesia of the subglottis and trachea is desired, a translaryngeal block can be performed by locating the cricothyroid membrane and introducing a small-caliber needle in the midline. Once confirmation of correct placement is established by aspiration of air, 5 mL of 4% lidocaine can be injected rapidly. This will usually result in stimulation of a forceful cough reflex, which aids in distributing the topical anesthetic within the subglottis and trachea.

**SUMMARY**

Topical and local anesthetic techniques have long been used safely by otorhinolaryngologists for office procedures. There are numerous advantages to using these techniques, including reduced cost of procedures and postprocedure care, faster recovery times, and the maintenance of a conscious patient with the ability to maintain his or her own airway, contain his or her own gastric secretions, and communicate with the treating physician. Using various techniques in topical application and injection of local anesthetics, numerous procedures can be performed safely on the external face, ear, nose, oral cavity, nasopharynx, oropharynx, hypopharynx, and larynx.

**REFERENCES**