Facial Nerve-Block Anesthesia in Cosmetic Dermatology

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Abstract

Sensory neural blockade of the face with local anesthetics is an important part of the management of cosmetic procedures, but it is not usually considered a simple approach. The facial sensory innervation is provided mainly by the trigeminal nerve, the largest and the most complex cranial nerve. The peripheral branches of the trigeminal nerve that may be accessible through percutaneous needle techniques are the supraorbital, supratrochlear, nasociliary, infraorbital, and mental branches. In addition to indications for general surgical anesthesia and treatment of painful clinical conditions, the local anesthetic blockade of the trigeminal nerve branches can be used to produce more patient tolerance on painful esthetics procedures, such as facial deep chemical *peelings*, laser, fillers, microneedling, and dermabrasion.

The main purpose of this chapter is to describe the techniques of blockade of the trigeminal nerve branches with local anesthetics by means of practical approaches, including relevant anatomical landmarks, possible complications and unwanted side effects.

Keywords

Neural blockade of the face · Trigeminal nerve · Trigeminal nerve branches block · Supraorbital nerve · Supraorbital nerve block · Supratrochlear nerve · Supratrochlear nerve block · Infraorbital nerve · Infraorbital nerve block · Nasociliary nerve · Nasociliary nerve block · Infratrochlear nerve · Infratrochlear nerve block · Mental nerve · Mental nerve block

Introduction

The local blockade of the trigeminal nerve branches is widely used for surgical procedures, such as excision of malignant skin tumors and blepharoplasty. Furthermore, it can be used clinically, for example, for the treatment of trigeminal neuralgia, cluster headache, and acute cancer pain (Waldman 2015).

With the advancement in cosmetic dermatology, anesthetic blockade of the trigeminal nerve branches became an interesting tool on the management of painful comestical procedures, such as facial deep chemical *peelings*, ablative laser, fillers, microneedling, and dermabrasion.

Depending on the area of the face involved in the cosmetic procedure, we need to block one or more branches of the trigeminal nerve. Thus, procedures in the forehead require blockade of the supraorbital and supratrochlear nerves. Approaches only in the nasal region, such as *peelings*, need blockade of the nasociliary and infraorbital nerves. Procedures involving the periorbital and nasal regions need blockade of the supraorbital, supratrochlear, nasociliary, and infraorbital branches. Approaches only in the perioral region require blockade of the infraorbital and mental nerves.

In behalf of the safety of the procedure, an inquest should be performed, focusing on identifying coagulation disorders and allergies, as well as a minute physical examination of the face. The contraindications to the anesthetic blockade of the face are local infection, vascular tumors, or malignant skin tumors at the local of the injection and important behavioral abnormalities. Coagulopathy is a relative contraindication. Drugs, such as acetylsalicylic acid and warfarin, shouldn't be suspended, but they require a careful local compression after the procedure to avoid hematoma and ecchymosis (Waldman 2015).

Facial Sensory Innervation and Anatomical Landmarks

The sensory innervation of the face is determined mainly by the trigeminal nerve (cranial nerve V), the largest and the most complex cranial nerve. It contains motor and sensory fibers. The nerve carries somatic afferent impulses of touch, pain, thermal sensation, and proprioception from the skin of the face, scalp, oral and nasal mucosa, teeth, paranasal sinuses, muscles of mastication, and temporomandibular joint. Furthermore, visceral efferent fibers reach a variety of muscles of facial expression, some muscles of mastication, and the tensor tympani. The trigeminal nerve also establishes communication with the autonomic nervous system, including the optic, sphenopalatine, ciliary, and submaxillary ganglia and the facial, oculomotor, and glossopharyngeal nerves. Because of the complex structure of the trigeminal nerve, a good understanding of the clinically anatomical landmarks is important to obtaining satisfactory results of neural blockade (Larrabee et al. 2004; Waldman 2015).

The trigeminal nerve binds to the lateral side of the pons by motor and sensory roots in an area called cerebellopontine angle. The sensory root expands into the trigeminal ganglion (also called gasserian ganglion, or semilunar ganglion, or Gasser's ganglion) which gives rise to three major divisions of the trigeminal nerve: ophthalmic division (V1), maxillary division (V2), and mandibular division (V3). Each division of the trigeminal nerve corresponds approximately to the three embryologic processes of the face: the frontonasal, the maxillary, and the mandibular processes. The motor root also contains afferent fibers of the muscles of mastication, joins the mandibular division. These roots cross the posterior cranial fossa in a forward and lateral direction, passing by the border of the petrous temporal bone, and reach a recess called Meckel's cave, which is formed by an invagination of the surrounding dura mater into the middle cranial fossa (Gardner et al. 1988; Waldman 2015).

The ophthalmic division of the trigeminal nerve (V1) is divided, nearby the superior orbital fissure, into three nerves: frontal nerve, nasociliary nerve, and lacrimal nerve. These three nerves enter the orbit via the superior orbital fissure where originate its branches. The frontal nerve enters the orbit passing ventrally under the periosteum of the roof of the orbit, and, at an extremely variable point inside the orbit, originates two branches, the supraorbital and the supratrochlear nerves. The supraorbital nerve, laterally situated in relation to the supratrochlear nerve, exits the orbital cavity anteriorly via superior orbital foramen and supplies sensation to the upper eyelid, the forehead, the anterior scalp, and frontal sinus. The supratrochlear nerve, so minor branch, leaves the orbit at a medial extremity of the supraorbital border and aides the innervation of the forehead (inferomedial section) and medial portion of the upper eyelid. The lacrimal nerve provides innervation to the lacrimal gland and the portion of the skin and the conjunctiva of the upper eyelid. At last, the nasociliary nerve is the sensory nerve of the eye. Furthermore, the terminal branches of the nasociliary nerve consist of the infratrochlear nerve and external nasal branches of the anterior ethmoidal nerve. The external nasal branches of the anterior ethmoidal nerve provide cutaneous and mucosal innervation to the apex and ala of the nose and anterior nasal cavity, and the infratrochlear nerve supplies the root of the nose (Gardner et al. 1988; Larrabee et al. 2004; Waldman 2015).

The maxillary division of the trigeminal nerve (V2) passes through the foramen rotundum and enters the pterygopalatine fossa. Crossing the inferior orbital fissure, it enters the orbit, passing along the floor of that structure in the infraorbital groove, and arrives at the face, as the infraorbital nerve, via the infraorbital foramen. Therefore, the infraorbital nerve is considered an extension of the maxillary nerve. When arrives at the face, it originates various branches: the inferior palpebral branch, which innervates the conjunctiva and skin of the lower eyelid; the external nasal branch, which supplies the nasal sidewall; the superior labial branch, which supplies the skin of the cheek and part of the upper lip and oral mucosa; and the anterior superior, middle superior, and posterior superior alveolar nerves, which supply the superior dental arcade as well as the mucosa of the anterior maxillary sinus, the nasal cavity, and the buccal and gingival mucosas. Furthermore, before the maxillary nerve enters the orbit, it originates the zygomatic nerve. The zygomatic nerve crosses the inferior orbital fissure and is divided into two branches: the zygomaticotemporal and zygomaticofacial nerves. These nerves perforate the zygomatic bone and provide sensory innervation to the skin of the temporal and lateral zygomatic regions (Gardner et al. 1988; Waldman 2015).

The mandibular division of the trigeminal nerve (V3) passes through the foramen ovale and arrives at the infratemporal fossa. When the mandibular nerve crosses the skull base, it joins to the motor root of the trigeminal nerve. This combined trunk gives off two divisions, anterior and posterior, and, consequently, originates various branches. The posterior division is mainly sensitive and gives off the auriculotemporal nerve, the lingual nerve, and the inferior alveolar nerve. The auriculotemporal nerve provides innervation to the skin of the external ear (tragus and helix) and temporal region. The lingual nerve supplies sensation to the tongue and buccal mucosa. The inferior alveolar nerve provides sensory innervation to the lower teeth, gingival mucosa, and mandible. The terminal branch of the inferior alveolar nerve, the mental nerve, exits the mandible via the mental foramen at the level of the second molar tooth and provides sensory innervation to the skin of the chin and lower lip as well as to the mucous membrane of the lower lip (Gardner et al. 1988; Waldman 2015).

Patient Preparation

The patient is placed supine with the head in neutral position. In this moment, the vital signs should be measured.

Conventional antiseptics, such as 70% ethanol, iodinated compounds, and chlorhexidine can be used to prepare the site, with care taken to avoid spilling solution into the eye. Aqueous solution of chlorhexidine can be applied to the oral mucosa in the neural blockade with intraoral approach.

Anesthesia

Local anesthesia generates a reversible loss of sensation in a portion of the body. Its mechanism of action is to block impulse conduction along nerve axons, decreasing reversibly the rate of depolarization and repolarization of excitable membranes. The local anesthetics act principally by inhibiting sodium influx through sodium-specific ion channels in the neuronal cell membrane (especially voltage-gated sodium channels). Once the influx of sodium is suspended, an action potential can’t be accomplished and so the signal conduction is inhibited (Davies et al. 2014).

The local anesthetic most commonly used is lidocaine. Given its vasodilating action, a small amount of epinephrine can be added to cause vasoconstriction, reducing the bleeding and risk of hematoma and prolonging the anesthesia. In general, about 2–3 mL of the anesthetic solution with 2% lidocaine with or without epinephrine (generally at a dilution 1:200,000–1:400,000) is sufficient for each neural blockade. For patient comfort, use delicate needle (25G–30G). For prolonged analgesia (4–6 h), bupivacaine or ropivacaine, anesthetic drugs of later elimination, can be used (Davies et al. 2014).

Topical anesthesia of the skin with 4% lidocaine, 2.5% lidocaine/2.5% prilocaine or 7% lidocaine/7% tetracaine creams or precooling agents can be used in individuals sensitive to pain, with blenophobia (fear of needles) or psychologically unstable, reducing pain and anxiety produced by administration of local injectable anesthetics. Already in the mucosa, cotton ball soaked with 2% viscous lidocaine or 10% cocaine solution, 4% lidocaine ointment, 20% benzocaine gel, 5% lidocaine patch or cryoanesthesia can be applied (Alster and Lupton 2002; Lathwal et al. 2015).

Finally, after the introduction of the needle and just before the infiltration, it is advisable to pull back the syringe plunger (aspiration) to avoid intravascular injection.

Technique of Blockade of the Supraorbital Nerve

The supraorbital nerve exits the orbital cavity via the superior orbital fissure, along the orbital roof, to emerge through the supraorbital foramen (or superior orbital foramen). It supplies sensation to the upper eyelid, the forehead (supraorbital portion), part of anterior scalp and frontal sinus. The anatomical reference is the superior orbital rim, in the junction of its two thirds lateral and medial third, about 2.5 cm from the midline, where the foramen is easily identified by palpation (Fig. 1). The supraorbital foramen is also named as supraorbital notch, situating on an imaginary

Fig. 1 Supraorbital nerve block

line passing through the pupil when the eye is in the primary position.

The syringe needle is inserted perpendicularly to the skin at the level of the supraorbital notch. It is important to avoid passing through the foramen, which could pin the nerve against the periosteum and cause compressive neuropathy. It is safer to slide the needle medially when the periosteum is contacted and it reaches the foramen, such that its tip abuts the rim of the foramen. To anesthetize the peripheral branches of the nerve, 2–3 mL of local anesthetic (e.g., 2% lidocaine with or without epinephrine) are injected at the reference point. There may be bleeding from the supraorbital artery that accompanies the nerve. After infiltration, a local gentle compression with gauze or cotton should be performed for preventing periorbital hematoma or ecchymosis (Larrabee et al. 2004; Salam 2004; Tomaszewska et al. 2012; Ilhan Alp and Alp 2013; Candido and Day 2014; Davies et al. 2014; Latham and Martin 2014; Waldman 2015).

Technique of Blockade of the Supratrochlear Nerve

The supratrochlear nerve leaves the orbit at a medial extremity of the supraorbital border and aides the innervation of the forehead (inferomedial section) and medial portion of the upper eyelid. The nerve exits the orbit between the trochlea and supraorbital foramen. To block the supratrochlear nerve, the needle is directed medially from the supraorbital notch toward the apex of the nose. The needle is inserted just lateral to the junction of the bridge of the nose and the supraorbital ridge and it is advanced medially into the subcutaneous tissue. It is used to block 1–2 mL of anesthetic with or without vasoconstrictor under the superomedial orbital rim. Adequate compression with gauze or cotton must be applied at the injection site because of the loose alveolar tissue of the eyelid, preventing periorbital hematoma and ecchymosis (Larrabee et al. 2004; Salam 2004; Latham and Martin 2014; Waldman 2015).

Technique of Blockade of the Nasociliary Nerve

The terminal branches of the nasociliary nerve consist of the infratrochlear nerve and external nasal branches of the anterior ethmoidal nerve. The external nasal branches of the anterior ethmoidal nerve provide cutaneous and mucosal innervation to the apex and ala of the nose and anterior nasal cavity, and the infratrochlear nerve supplies the root of the nose.

The infratrochlear nerve and external nasal branches of the anterior ethmoidal nerve are blocked below the trochlea and about 1 cm above the medial palpebral ligament (or medial canthal tendon) along the medial wall of the orbit. The needle should be inserted to a depth of 1–1.5 cm, where is the anterior ethmoidal foramen, injecting about 1–2 mL of the anesthetic solution. Terminal branches of the ophthalmic artery and small tributaries of the superior ophthalmic vein can be reached during blockade of the infratrochlear nerve, which may cause retrobulbar hematoma. It is important highlight that the blockade should be accomplished without adrenaline to eliminate any risk of retinal artery spasm (Molliex et al. 1996; Larrabee et al. 2004).

Technique of Blockade of the Infraorbital Nerve

The infraorbital nerve is considered an extension of the maxillary nerve, arriving at the face via the infraorbital foramen. It originates various branches: the inferior palpebral branch, which innervates the conjunctiva and skin of the lower eyelid; the external nasal branch, which supplies the nasal sidewall; the superior labial branch, which supplies the skin of the cheek and part of the upper lip and oral mucosa; and the anterior superior, middle superior, and posterior superior alveolar nerves, which supply the superior dental arcade as well as mucosa of the anterior maxillary sinus, the nasal cavity, and the buccal and gingival mucosas.

There are two techniques for blockade of the infraorbital nerve: intraoral and extraoral approaches.

Intraoral Approach

The infraorbital foramen is palpable as a small depression about 1.5 cm below the inferior orbital rim and approximately 2.5 cm from the midline of the face, being in an imaginary line through the pupil (Fig. 2). Thereby, the foramen is located by the index finger and the upper lip is lifted by the thumb of the same hand. A fine needle is introduced superiorly by the alveolar ridge of the mucosa, just inferior to the infraorbital foramen, and toward the index finger already placed. For patient comfort, topical anesthesia can be performed in the alveolar ridge before infiltration. After careful aspiration, about 2–3 mL of local anesthetic are injected. An adequate pressure over the inferior orbital rim limits dissection of the local anesthetic superiorly into the periorbital region, avoiding hematoma and ecchymosis (Ilhan Alp and Alp 2013; Candido and Day 2014; Davies et al. 2014; Latham and Martin 2014; Waldman 2015).

Fig. 2 Supratroclear nerve block

Extraoral Approach

As mentioned previously, the infraorbital foramen is in an imaginary line through the pupil. It is palpable as a small depression in the infraorbital ridge of the maxillary bone, about 1.5 cm below the inferior orbital rim (Fig. 3). A fine needle is advanced toward the foramen. Once the needle reaches the foramen and the periosteum is contacted, the needle should be slid slightly medially. This maneuver prevents the pinning of the nerve against periosteum and compressive neuropathy. If the needle enters the infraorbital foramen, it should be withdrawn to avoid potentially nerve injury. After careful aspiration, about 2–3 mL of the anesthetic solution is injected into the outer opening of the foramen. Similar to the intraoral approach, gentle compression with

Fig. 3 Infraorbital nerve block: extraoral approach

Fig. 4 Infraorbital nerve block: intraoral approach

gauze or cotton should be performed at the injection site, avoiding dissection of local anesthetic and preventing periorbital hematoma and ecchymosis (Larrabee et al. 2004; Salam 2004; Candido and Day 2014; Latham and Martin 2014; Waldman 2015).

Technique of Blockade of the Zygomatic Nerve

Before the maxillary nerve enters the orbit, it originates the zygomatic nerve. The zygomatic nerve crosses the inferior orbital fissure and is divided into two branches: the zygomaticotemporal and zygomaticofacial nerves. These nerves perforate the zygomatic bone and provide sensory innervation to the skin of the temporal and lateral zygomatic regions. The zygomaticotemporal and zygomaticofacial branches arrive at the face via a small foramen in the zygomatic bone at the junction of the lateral and inferior orbital rim. Infiltrative anesthesia at this site will block these nerves. After gentle aspiration, about 2–3 mL of local anesthetic is injected. An adequate pressure over the lateral and inferior orbital rim limits dissection of the local anesthetic superiorly into the periorbital region, avoiding hematoma and ecchymosis (Larrabee et al. 2004; Davies et al. 2014).

Technique of Blockade of the Mental Nerve

The terminal branch of the inferior alveolar nerve, the mental nerve, exits the mandible via the mental foramen and provides sensory innervation to the skin of the chin and lower lip as well as to the mucous membrane of the lower lip.

As in the infraorbital nerve block technique, there are two techniques for blocking the mental nerve: intraoral (Fig. 4) and extraoral (Fig. 5) approaches.

Intraoral Approach

The mental foramen is located in an area approximately 2 cm from the midline in a plane parallel with the supraorbital and infraorbital foramina and between the superior and inferior borders of mandible. Careful palpation of the jaw allows its location and generates a "sensation of shock" after a little nerve compression in the mental foramen area. The lower lip is pulled downward and a fine needle is advanced perpendicularly in the alveolar ridge of the mucosa, just superior to the mental foramen. For patient comfort, topical anesthesia

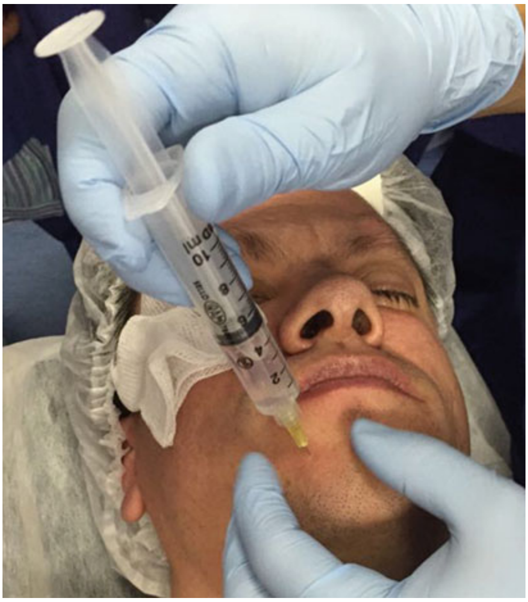

Fig. 5 Mental nerve block: extraoral approach

Fig. 6 Mental nerve block: intraoral approach

can be applied in the alveolar ridge before infiltration (Fig. 6). After careful aspiration, about 2–3 mL of anesthetic solution are injected (Candido and Day 2014; Davies et al. 2014; Latham and Martin 2014; Waldman 2015).

Extraoral Approach

The mental foramen is located in a plane parallel with the supraorbital and infraorbital foramina, in about 2 cm from the midline. Because of the acute angle at which the mental nerve exits the mental foramen, the local palpation generates a "sensation of shock" after a little nerve compression in the mental foramen area. A fine needle is advanced toward the mental foramen using a slight medial approach, as noted earlier for supraorbital and infraorbital nerve blocks, and about 2–3 mL of anesthetic solution are injected after preventive aspiration. As the nerve is susceptible to compression, it isn't advisable to enter the needle into the mandibular canal in order to avoid neuropathy by pinning the nerve against periosteum or increment of pressure during injection (Candido and Day 2014; Salam 2004; Latham and Martin 2014; Waldman 2015).

Complications and Unwanted Side Effects

Complications and unwanted side effects are rare but can include local bacterial infection, postprocedure dysesthesias, facial asymmetry, activation of herpes simplex and herpes zoster, retinal artery spasm, ecchymosis or hematomas, local anesthetic toxicity, and injection-induced compressive neuropathy. Although generally not harmful, they are quite upsetting to the patient. Therefore, the patient must be forewarned of these possible consequences before the procedure (Davies et al. 2014; Waldman 2015).

Conclusion

With recent trends focusing on less aggressive cosmetic procedures, advances in anesthesia are required to avoid the need for local injectable anesthetics and intravenous sedation. Although there are several topical anesthetic agents that are effective in reducing the pain associated with moderately painful cutaneous procedures, most are limited by a necessarily prolonged preoperative application time in order to achieve deep dermal anesthesia. Continuing advances in the understanding of the physiology of pain will produce new topical anesthetics with rapid onset, prolonged duration, and minimal side effects so that improve consequently the management of these patients.

Take Home Messages

- The sensory innervation of the face is determined mainly by the trigeminal nerve (cranial nerve V), the largest cranial nerve.
- Depending on the area of the face involved in the cosmetic procedure, we need to block one or more branches of the trigeminal nerve.
- The imaginary line passing through the pupil when the eye is in the primary position is an important anatomical reference for the blockade of the trigeminal nerve branches.
- The neural blockade of the face is a safe, effective, and simple approach. Although the complications and unwanted side effects are rare, they are quite upsetting to the patient and therefore the patient should be forewarned of them.
- Recent trends focusing on less aggressive cosmetic procedures, advances in anesthesia are required to avoid the need for local injectable anesthetics and intravenous sedation.
- Continuing advances in the understanding of the physiology of pain will produce new topical anesthetics with rapid onset.

References

Alster TS, Lupton JR. Evaluation of a novel topical anesthetic agent for cutaneous laser resurfacing: a randomized comparison study. Dermatol Surg. 2002;28(11):1004–6.

Candido KD, Day M. Nerve blocks of the head and neck. In: Benzon HT, Rathmell JP, Wu CL, Turk DC, Argoff CE, Hurley RW, editors. Practical management of pain. 5th ed. Philadelphia: Elsevier; 2014. p. 697–715.

Davies T, Karanovic S, Shergill B. Essential regional nerve blocks for the dermatologist: part 1. Clin Exp Dermatol. 2014;39(7):777–84. https://doi.org/10.1111/ced.12427.

Gardner E, Gray DJ, O'Rahilly R. Anatomia: estudo regional do corpo humano. 4th ed. Rio de Janeiro: Guanabara Koogan; 1988. p. 618–61.

Ilhan Alp S, Alp R. Supraorbital and infraorbital nerve blockade in migraine patients: results of 6-month clinical follow-up. Eur Rev Med Pharmacol Sci. 2013;17(13):1778–81.

Larrabee WF, Makielski KH, Henderson JL. Surgical anatomy of the face. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2004.

Latham JL, Martin SN. Infiltrative anesthesia in office practice. Am Fam Physician. 2014;89(12):956–62.

Lathwal G, Pandit IK, Gugnani N, Gupta M. Efficacy of different precooling agents and topical anesthetics on the pain perception during intraoral injection: a comparative clinical study. Int J Clin Pediatr Dent. 2015;8(2):119–22.

Molliex S, Navez M, Baylot D, Prades JM, Elkhoury Z, Auboyer C. Regional anaesthesia for outpatient nasal surgery. Br J Anaesth. 1996 Jan;76(1):151–3.

Salam GA. Regional anesthesia for office procedures: part I. Head and neck surgeries. Am Fam Physician. 2004;69(3):585–90.

Tomaszewska A, Kwiatkowska B, Jankauskas R. The localization of the supraorbital notch or foramen is crucial for headache and supraorbital neuralgia avoiding and treatment. Anat Rec. 2012;295(9):1494–503. https://doi.org/10.1002/ar.22534.

Waldman SD. Supraorbital nerve block. Supratrochlear nerve block. Infraorbital nerve block. Mental nerve block. In: Waldman SD, editor. Atlas of interventional pain management. 4th ed. Philadelphia: Elsevier; 2015. p. 55–74.