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Cosmetic

Three-point Method Nerve Block for Relieving Pain of Microbotox Injection in Middle and Upper Face

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Background: With the popularity of microbotox, pain caused by multiple microdroplets and subcutaneous injection of botulinum toxin is increasing. This study presents a new, refined, three-point nerve block technique that provides effective pain relief during minimally invasive injection therapy targeting the middle and upper face.

Methods: Fifty volunteers underwent facial ultrasonography to measure the locations of the supraorbital and infraorbital foramen. Following microdrop Botox injection of the middle and upper face, 100 patients underwent a self-controlled study to analyze whether a three-point nerve block surpasses topical anesthesia for reducing injection pain. The visual analog scale pain score, the time of the three-point method and botulinum toxin injection, and side effects were recorded.

Results: Among the volunteers, the location of the supraorbital and infraorbital foramen showed no statistical difference between the left and right sides. For the 100 patients (13 men, 87 women) who underwent the three-point nerve block, the visual analog scale pain scores on the experimental side were significantly lower than those on the control side, except in the frontotemporal region (2.46 ± 0.50, 2.42 ± 0.47, $P > 0.05$). The duration of the unilateral three-point nerve block was 74.8 ± 5.64 seconds. The total injection time was 189.86 ± 26.79 seconds (range 148–286 s).

Conclusions: The three-point method exerted prominent analgesic effects during middle and upper facial treatments, with benefits including a precise block region, high satisfaction, and simple operation technique. Therefore, clinicians can easily master and apply this method. *(Plast Reconstr Surg Glob Open 2024; 12:e5853; doi: 10.1097/GOX.0000000000005853; Published online 4 June 2024.)*

INTRODUCTION

In recent years, minimally invasive treatments in the field of facial cosmetic surgery have been increasing, and the scope of treatment has expanded. Notably, botulinum toxin type A injection has been the most common aesthetic procedure performed by plastic surgeons since 1999.[1,2] Botox injection for middle and upper facial rejuvenation has become the most popular minimally invasive technique because of its low trauma, low cost, excellent effect, and rapid recovery.[2,3] However, the pain caused during the treatment negatively impacts patients' experience, prolongs the time of therapy, and ultimately reduces the therapeutic effect. The methods for reducing pain more effectively and accurately are constantly being explored by clinicians.

Surface anesthesia, local anesthesia, and nerve block anesthesia are the typical anesthetic methods for minimally invasive middle and upper facial treatments. Surface anesthesia usually does not achieve good anesthetic effects owing to limited drug absorption and shallow anesthesia levels, and some patients are allergic to these drugs. Local anesthesia can better anesthetize local tissues through

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osmosis, but a large injection dose results in swelling and deformation of tissues, increasing the risk of bleeding and reducing the treatment accuracy.[4,5] In the traditional nerve block technique, anesthetics are injected into the peripheral nerve trunk at a single point to anesthetize the area innervated by the nerve by blocking the conduction of nerve impulses, thereby avoiding the swelling and deformation caused by local anesthesia and reducing the amount of anesthetic.[6–8] However, owing to the large variation in cranial exit points, if the injection point is inaccurate, the blocking effect will be greatly reduced, and it is often accompanied by anesthesia of uninvolved areas.[8–11]

Therefore, based on the ultrasonic measurement of the anatomical position of the supraorbital and infraorbital foramens, combined with abundant experience of botulinum toxin injection in the face, we propose a new three-point method for precise middle and upper facial nerve block. This technique combines the nerve block effect with the local infiltration anesthesia effect, exerting an analgesic effect through linear injection of a small amount of anesthetic agent on the initial location of sensory nerve branch in the injection area. This technique provides more accurate anesthesia, fewer adverse reactions, and improved patient satisfaction levels; meanwhile, it is easy for clinicians to operate and master, with a stable effect.

Takeaways

Question: With the popularity of microbotox, pain caused by multiple microdroplets and subcutaneous injection of botulinum toxin is increasing, which urged us to improve the facial nerve block technique.

Findings: This method played a dual role of nerve block and local infiltration anesthesia, exerting an analgesic effect through linear injection of a small amount of anesthetic drugs. Compared with the traditional technique, this method offers a more accurate paralysis of the target area, reducing the discomfort caused by unnecessary numbness and unnecessary anesthesia duration.

Meaning: The three-point method exerted prominent analgesic effects during middle and upper facial treatments, with benefits including a precise block region, high satisfaction, and simple operation.

PATIENTS AND METHODS

This study was performed in compliance with the ethical principles of the World Medical Association Declaration of Helsinki. The study was approved by the ethics committee of the Plastic Surgery Hospital of the Chinese Academy of Medical Sciences, and written informed consent was obtained from all participants. The IBM SPSS, version 24.0 was used for all statistical analyses. Comparison of the means was performed through paired Student *t* test, and statistical significance was considered at *P* values of less than 0.05.

Ultrasonic Measurement of the Supraorbital and Infraorbital Foramen

This study included 50 patients who underwent facial ultrasonography at the Plastic Surgery Hospital of the Chinese Academy of Medical Sciences from August to October 2020. Facial marking tape was pasted on the median line of the frontal region, vertical line of the outer canthus, and horizontal line of the lower naso-alar margin on both sides (Fig. 1). The ultrasound device used in this study was a GE LOGIQ E9 (General Electric Healthcare Company) with a probe frequency of 15 MHz. An experienced sonographer measured and recorded the distance between the supraorbital foramen and median line of the frontal region, the infraorbital foramen and vertical line of the outer canthus, and the infraorbital foramen and lower naso-alar margin (Fig. 2).

Self-control Study of Three-point Method Facial Nerve Block Technique

Three-point Method

A 25-mm-long 30G needle with a 1-mL screw syringe was used with 1% lidocaine anesthetic. For the glabellar insertion point, after disinfection, the needle was inserted at the midpoint of the bilateral supraorbital margin, inserted vertically into the subcutaneous layer to inject a skin mound, and then injected obliquely along the subcutaneous fat layer to the right side until the tip reached the farthest position. While the needle was advanced and withdrawn, the anesthetic was slowly injected, with a higher injection volume at the distal end (0.1 mL); the unilateral injection dose was 0.25–0.3 mL. The needle was then withdrawn to the insertion point, the needle tip was embedded in the skin, and the needle direction was adjusted. The anesthetic was injected to the left using the same method. The supratrochlear and supraorbital nerves were blocked to anesthetize the pain in the frontal region, glabella, and upper eyelid, as they were involved in the injection track. For the left/right cheek insertion point, the needle was inserted at the intersection of the vertical line of the outer canthus and the parallel line 0.5 cm under the lacrimal groove. The needle was slowly advanced along a parallel line 0.5 cm under the lacrimal groove until the tip reached the farthest position, and the anesthetic was injected into the deep fat layer. The unilateral injection dose was 0.25–0.3 mL. The anesthetic was injected slowly while the needle was advanced and withdrawn, blocking the lower eyelid and nasal branches of the infraorbital nerve and anesthetizing the ipsilateral lower eyelid and nasal dorsum (Fig. 3). [**See Video (online),** which shows the technique of anesthesia and injection.]

Self-control Study Design

This prospective randomized controlled study included 100 patients (men: 13, women: 87) who received microdrop Botox technique of the middle and upper face[12] at our hospital from May 2021 to December 2022. Exclusion criteria were hypersensitivity to local anesthetics or Botox, infection, or inflammation in the injection area, history of facial surgery in the past 6 months, scar constitution, pregnancy or lactation, and noncompliance with treatment.

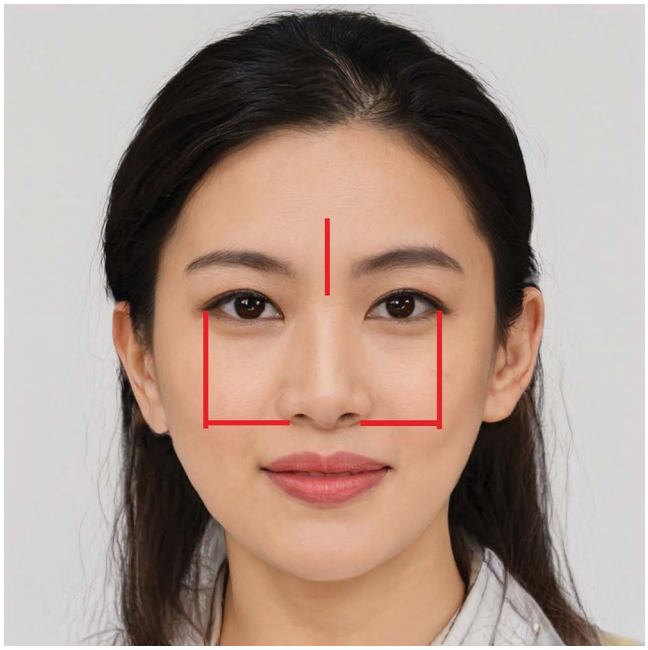


Fig. 1. Photograph showing facial marking tape: median line of frontal, vertical line of the outer canthus, horizontal line of the lower naso-alar marginal. Original photograph used with permission of Generated Media Inc.

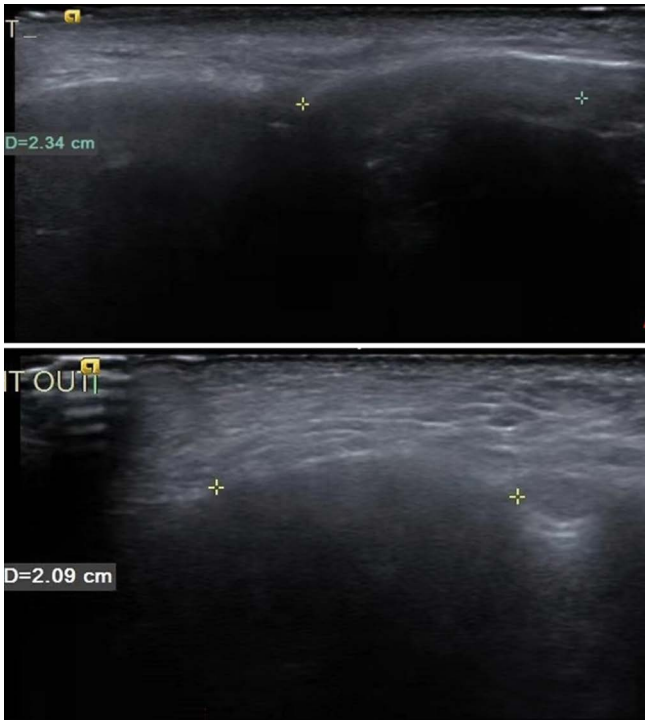


Fig. 2. Ultrasonic measurement in a 25-year-old woman.

Patients were allocated to each group by using a closed black bag of cards marked "LR+3NV" or "LC," the first representing the right side being selected as the experimental side (local refrigeration + three-point nerve block), and the second representing the right side being selected as the control side (lidocaine cream was externally applied for 30 minutes). The left side was automatically selected for the other group. Botulinum toxin was injected 3 minutes after blocker injection; the microdrop Botox technique of the middle and upper face is shown in Figure 4 and Video 1 (online). All injections were administered by a single experienced practitioner. The visual analogue scale (VAS) pain scores were obtained and recorded for the seven injection sites, including forehead lines, glabellar wrinkles, repositioning the eyebrows, crow's feet lines, lower eyelid wrinkles, inner canthus wrinkles, and nasal dorsum wrinkles, and the differences between the data of two sides were compared. The injection time of the three-point method, the time of botulinum toxin injection, and side effects were recorded.

RESULTS

Ultrasonic Location Measurement of Supraorbital and Infraorbital Foramens

Among the 50 patients with the average age of 34.1 ± 8.3 years (100 sides, age: 25–50 year, men: 22, women: 28), the distances between the right and left supraorbital foramens and median line of the frontal region were 2.20 ± 0.37 and 2.21 ± 0.33 cm, respectively. The paired sample *t* test showed no statistical difference between the left and right sides ($P = 0.582$). The distances between the right and left infraorbital foramens and the vertical line of the outer canthus were 1.98 ± 0.29 and 1.97 ± 0.31 cm, respectively, with no statistical difference between the left and right side ($P = 0.831$). The distances between the right and left infraorbital foramens and the lower naso-alar margin were 1.89 ± 0.25 and 1.92 ± 0.23 cm, respectively, with no statistical difference between the left and right sides ($P = 0.291$).

Self-control Study of Three-point Method Facial Nerve Block

Table 1 presents the main results. A total of 100 patients (13 men, 87 women) were included in the study; the mean age of the patients was 40.5 ± 7.6 years (range, 26–60 years). The VAS pain scores on the experimental side and control sides, respectively, were as follows: forehead region (0.76 ± 0.41 versus 1.85 ± 0.39; $P < 0.001$), frontotemporal region (2.46 ± 0.50 versus 2.42 ± 0.47; $P > 0.05$), glabellar region (0.53 ± 0.32 versus 1.78 ± 0.47; $P < 0.001$), eyebrow region (1.02 ± 0.32 versus 2.15 ± 0.30; $P < 0.001$), crow's feet region (1.41 ± 0.23 versus 2.32 ± 0.26; $P < 0.001$), eyelid fine region (0.44 ± 0.17 versus 1.92 ± 0.22; $P < 0.001$), inner canthus region (0.91 ± 0.36 versus 1.78 ± 0.45; $P < 0.001$), and nasal dorsal region (0.98 ± 0.39 versus 2.04 ± 0.55; $P < 0.001$). The unilateral duration of three-point method was 74.8 ± 5.64 seconds, the duration of unilateral supraorbital and supratrochlear nerve block was 54.83 ± 4.83 seconds, and the duration of unilateral suborbital foramen nerve block was 19.97 ± 2.55 seconds. The total injection time of microdrop Botox injections to the middle and upper face was 189.86 ± 26.79 seconds (range 148–286 s). The analgesic effect satisfaction rate of the experimental side was

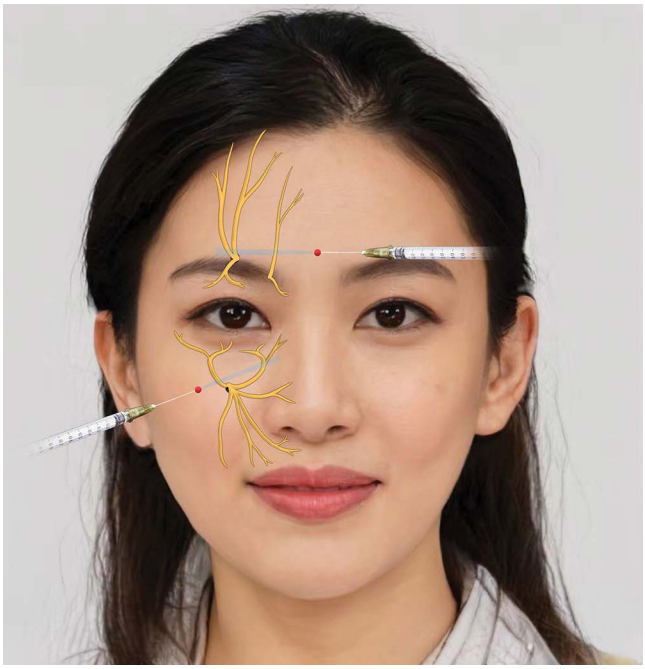


Fig. 3. Schematic diagram of nerve anatomy pathway and injection route. Original photograph used with permission of Generated Media Inc.

96% (96 of 100), which was higher than the 71% (71 of 100) of the control side, and three patients experienced nerve block injection-site pain (n = 1) or hemorrhage (n = 2) and recovered within a week.

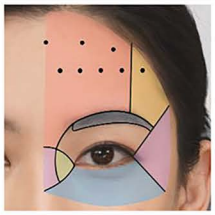
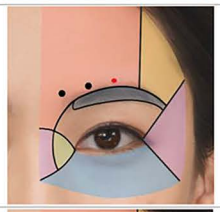
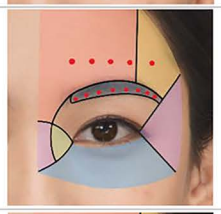
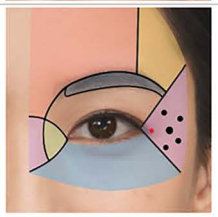
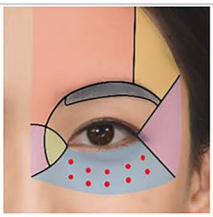
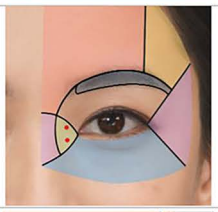
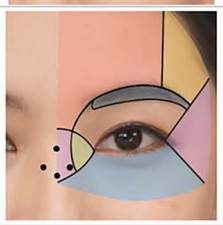
DISCUSSION

Botulinum toxin is used for middle and upper facial wrinkles including forehead lines, glabellar wrinkles, repositioning of the eyebrows, crow's feet lines, lower eyelid wrinkles, inner canthus wrinkles, and nasal dorsum wrinkles. With improvements in living standards, the requirements of beauty enthusiasts for botulinum toxin treatment are increasing, with demands for less trauma, more natural therapeutic effects, more comfortable treatment experiences, shorter recovery times, and pain relief.

The middle and upper facial muscles usually cooperate and antagonize each other, and injection of botulinum toxin into the wrinkle area enhances the compensatory effect of the surrounding muscles. Therefore, the injection scope should be properly expanded to adjust muscle balance.[13] To improve the therapeutic effect, some experts proposed the microbotox technique, which increases the number of injection sites and reduces the injection dosage at each site.[14–16] Multiple microdroplet injections can achieve uniform drug injection, personalized drug distribution, and more accurate and natural effects. Han et al[13] recommended that botulinum toxin injections should be administered in the dermis for periocular wrinkles to control drug dispersion and reduce injection difficulty. Intradermal injection can also reduce the sebaceous and sweat gland secretions, shrink pores, relax the surface fibers of facial muscles more effectively, and reduce fine wrinkles as well.[13,14] To improve the wrinkle removal effect of botulinum toxin, we adopted multi-point and microdrop injection combined with partial point intradermal injection[12]; this technique increases the pain and discomfort during the treatment process, which urged us to improve the facial nerve block technique (Fig. 5).

The supraorbital, supratrochlear, and infraorbital nerves are the main sensory nerves in the middle and upper face injection area.[7] Their cranial exit positions and nerve emergence routes vary greatly between individuals, and clinical localization methods are diverse.[8,9,17] Anatomical variations also bring challenges to surgical operations; for instance, maxillofacial doctors have found an accessory infraorbital foramen on the medial side of the infraorbital foramen, with a probability of approximately 18.2% or even higher, and the accessory branch of the infraorbital nerve mostly provides sensory innervation to the lower eyelid and nasal dorsum. The presence of the accessory infraorbital foramen may lead to the failure of the infraorbital nerve block.[10,18] To develop a new nerve block technique, it is important to understand its anatomical location and pathway. The authors first used high-frequency ultrasound to locate the supraorbital and infraorbital foramens. High-frequency ultrasound overcomes the ethical limitations of traditional anatomical research and the radiation hazards associated with computed tomography examinations. It is painless, noninvasive, convenient, safe, and has high application value in aesthetic surgery.[19,20] The lateral inferior direction of the infraorbital foramen in the cheek was chosen as the insertion point, which is convenient for the three-point method nerve block. Therefore, we measured the distance between the infraorbital foramen and vertical line of the outer canthus and the distance between the infraorbital foramen and lower nasal-alar margin, guiding the insertion point position during the operation.

The middle and upper face three-point nerve block technique presented in this study is based on anatomy, considering that the supraorbital foramen, supratrochlear notch, and infraorbital foramen have great anatomical variation, and that the nerves exiting the cranium are radially distributed in the regional skin and subcutaneous muscles. The technique adopts a linear injection, in which the blocker is injected into the pathway of the target nerves. The needle path of the upper face passed through the supraorbital and supratrochlear nerves with an exact blocking effect and few injuries. The needle path in the middle face passed above the supraorbital foramen, accurately blocking the lower palpebral and nasal branches of the infraorbital nerve, retaining the sensation of the upper lip and areas innervated by the buccal branches, and avoiding the discomfort for patients caused by excessive anesthetized regions. Meanwhile, the technique greatly reduces the complications of nerve foramen injection, such as intravascular injection and blood vessel injury, resulting in ecchymosis or hematoma, and nerve injury resulting in paresthesia. The technique uses a 25-mm needle to inject the drug up to 35 mm in length, which can fully cover the nerve branches. Only three insertion points, the glabella insertion point and left/right cheek insertion points, could guarantee nerve block effect in the middle and upper face. We recognize that pain is

Injection region	Schematic diagram of injection points	The Injection Points	Analgesic Mechanism of Three-point method
Forehead lines		The first row at the most obvious forehead lines at an interval of 1.0–1.5cm, 5 points on each side; One row was injected 1cm below the hairline, with 5 points on both sides; Subcutaneous injection.	The sensory branches of the supraorbital nerve and supratrochlear nerve were blocked. The range of blocks were mainly in the middle frontal region and the lateral frontal region.
Glabellar wrinkles		A unilateral 3-point in the frown muscle. Subcutaneous injections are administered to the two medial points, intradermal injections are administered at the outermost point.	Blocked the sensory branch of the supratrochlear nerve region + local infiltration anesthesia of glabella and brows.
Repositioning the eyebrows		Brow lowering: injecting about 4-5 points on each side 0.5cm above the eyebrow peak on both sides, intracutaneous injection. Brow lifting: injecting about 8 points on each side of the eyebrow, intradermal injection.	The brow lowering points rely on the blocked frontal sensory branches of the supraorbital and supratrochlear nerve. The brow lifting points rely on the local infiltration anesthesia + nerve block.
Crow's feet lines		Conventional "five-sites" injection method, the injection volume of central point was about 4-5U, obvious pain. An intradermal injection site close to the lateral canthus is added.	Blocking the outer canthus region of the lower eyelid branch of the infraorbital nerve.
Lower eyelid wrinkles		Intradermal injections are administered at a total of 10 points in two above and below the infraorbital border. One or two points can be added to the outer canthus.	The lower eyelid injection area relied on the blocking of the lower eyelid branch of the infraorbital nerve, and the medial side of the lower eyelid relied on local infiltration anesthesia.
Inner canthus wrinkles		2 points were injected above and below the medial side of inner canthus, intradermal injection	Blocking the inner canthus and the lateral nasal branchs of the lower eyelid branch of the infraorbital nerve.
Nasal dorsum wrinkles		4-6 points were injected in nasal dorsum wrinkles region, subcutaneous injection.	Blocking the lateral nasal branch of the infraorbital nerve.

● subcutaneous injection ● Intradermal injection

Fig. 4. The microdrop Botox technique of the middle and upper face and analgesic mechanism of the three-point method.

Table 1. The Self-control Three-point Method Nerve Block of VAS Pain Score

Injection Region	Experimental Side	Control Side	*P*
Forehead	0.76±0.41	1.85±0.39	0.000
Frontotemporal	2.46±0.50	2.42±0.47	0.529
Glabellar	0.53±0.32	1.78±0.47	0.000
Eyebrows	1.02±0.32	2.15±0.30	0.000
Crow's feet	1.41±0.23	2.32±0.26	0.000
Lower eyelid	0.44±0.17	1.92±0.22	0.000
Inner canthus	0.91±0.36	1.78±0.45	0.000
Nasal dorsum	0.98±0.39	2.04±0.55	0.000

inevitable in the injection process, especially in the nerve roots, so we reduce pain via slow and small injections.

The study proved that the three-point nerve block technique was significantly less painful on the experimental side than on the control side when botulinum toxin was applied for middle and upper face wrinkles. However, when injecting into the forehead lines, there was no significant difference between the experimental and control sides in pain scores in the frontotemporal region (2.46±0.50, 2.38±0.46; $P > 0.05$), and most patients indicated that the pain in the frontotemporal region was significantly more intense than that in the median frontal region. This is because the supraorbital nerve innervates the median frontal and lateral frontal regions, and sensory innervations in the frontotemporal region are mainly by the zygomaticotemporal nerve. The pain of injection in the glabellar wrinkles and eyebrow-lifting regions was relatively intense. The three-point method had a dual mechanism of nerve block and local infiltration anesthesia in these two regions, which further improved the analgesic effect. We found that the two most lateral points in the outer canthus exerted no obvious blocking effect, possibly because the sensation in this area was intersectionally innervated by the lower eyelid branch of the infraorbital and zygomatic nerves. Unexpectedly, the three-point method exerted an excellent nerve blocking effect on the region of dorsal nasal wrinkles, and the blocking mechanism of the infratrochlear nerve and nasal branch of the infraorbital nerve should be further explored.[21] Patients who received the three-point block method reported no numbness in the pinna nasi and upper lip, thus not experiencing the numbness and discomfort caused by the traditional infraorbital nerve block, which anesthetizes the branches of the upper lip and pinna nasi simultaneously.

The middle and upper face three-point nerve block technique proposed in this study has the following key advantages: (1) The volume of anesthetic used in the three-point injection method was 1–1.2 mL, which was much less than that of the traditional nerve block method,[22] thereby avoiding tissue swelling and deformation and reducing the influence on subsequent treatment. (2) A precise nerve block effect led to an accurate anesthesia of the target treatment area, thereby reducing the discomfort caused by unnecessary numbness. (3) No epinephrine was added to shorten the duration of facial numbness and improve patient comfort. If it is necessary to increase the duration of anesthesia, epinephrine can be added to provide flexibility.[23] (4) The injection time of the three-point method is much less than topical anesthesia, and is suitable for patients with lidocaine cream allergy.

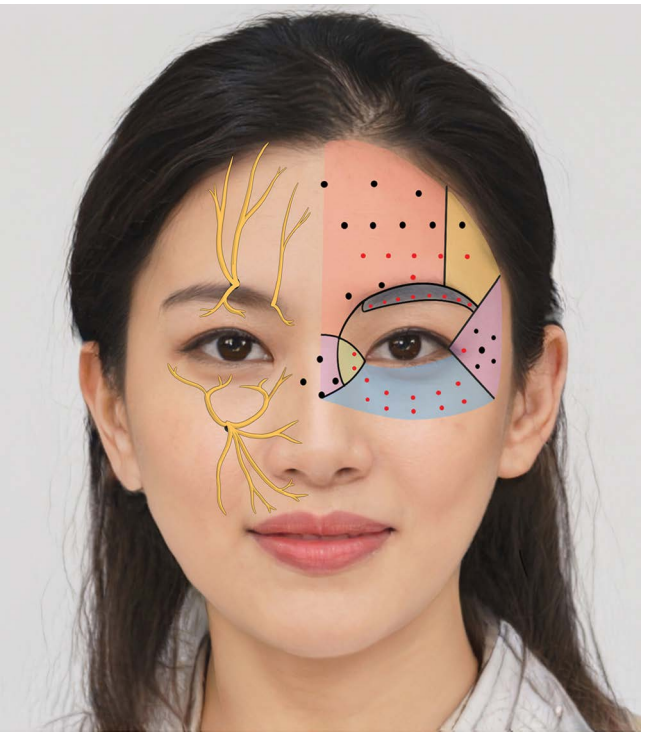


Fig. 5. Schematic diagram of microdrop Botox injection point and nerve route. Original photograph used with permission of Generated Media Inc.

Modern plastic surgery is not only a repair and reconstruction science, but it evolved into a multi-dimensional discipline: for instance, it includes perfecting perioperative evaluation indexes,[24] exacting healing score,[25] personalizing therapy protocol, and improving treatment experience. This method improves treatment comfort via significant analgesic effect and can be applied to the treatment of wounds and flap complications.[26]

CONCLUSIONS

This method exerts a significant analgesic effect on middle and upper face injection treatment, providing an accurate block region and obtaining a high degree of patient satisfaction. The technique is easy to perform, its effect is stable and timesaving, and the clinician can easily master the application. This method is suitable for a variety of minimally invasive treatments of the middle and upper face, such as radiofrequency, laser, and injection therapies, and can even be used to alleviate intraoperative and postoperative pain from middle and upper face surgery.

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DISCLOSURES

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PATIENT CONSENT

The patient provided written consent for the use of her image.

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