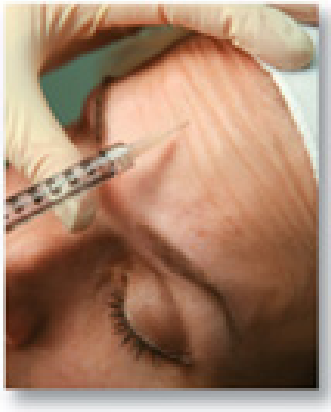
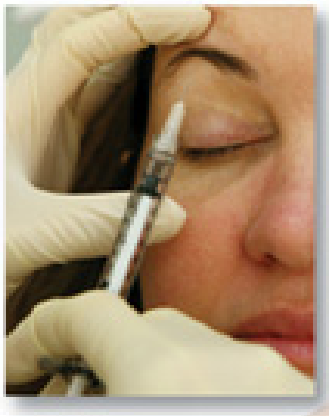
A Practical Guide to

Botulinum Toxin Procedures





Includes online access to videos for every procedure!

Rebecca Small • Dalano Hoang

Foreword by John L. Pfenninger, MD

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Botulinum Toxin Procedures

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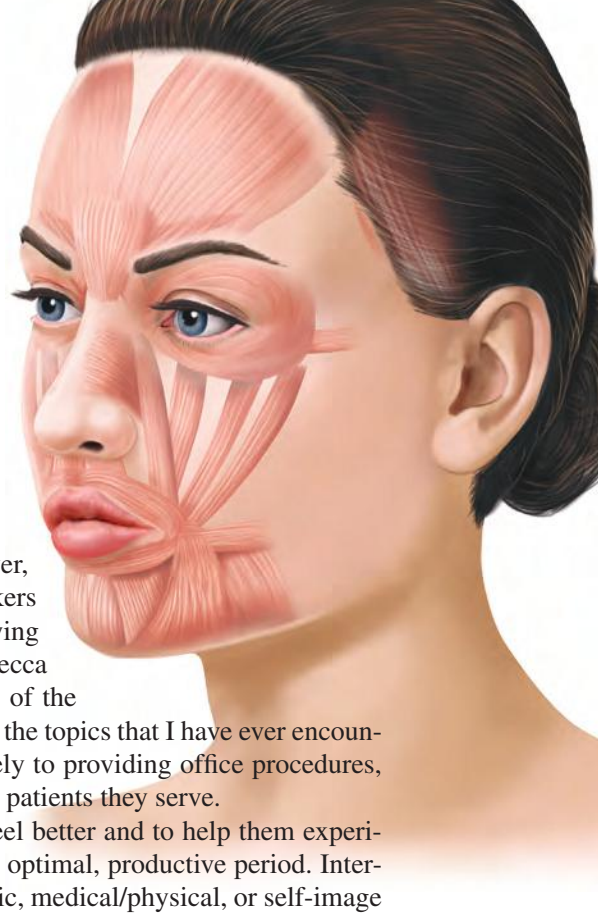
Foreword



As a lecturer, editor, author, and medical reviewer, I have had ample opportunity to evaluate many speakers as well as extensive medical literature. After reviewing this series of books on cosmetic procedures by Rebecca Small, MD, I have concluded that it has to be one of the best and most detailed, yet practical, presentation of the topics that I have ever encountered. As a physician whose practice is limited solely to providing office procedures, I see great value in these texts for clinicians and the patients they serve.

The goal of medical care is to make patients feel better and to help them experience an improved quality of life that extends for an optimal, productive period. Interventions may be directed at the emotional/psychiatric, medical/physical, or self-image areas.

For many physicians, performing medical procedures provides excitement in the practice of medicine. The ability to see what has been accomplished in a concrete way provides the positive feedback we all seek in providing care. Sometimes, it involves removing a tumor. At other times, it may be performing a screening procedure to be sure no disease is present. Maybe it is making patients feel better about their appearance. For whatever reason, the "hands on" practice of medicine is more rewarding for some practitioners.

In the late 1980s and early 1990s, there was resurgence in the interest of performing procedures in primary care. It did not involve hospital procedures but rather those that could be performed in the office. Coincidentally, patients also became interested in less invasive procedures such as laparoscopic cholecystectomy, endometrial ablation, and more. The desire for plastic surgery "extreme makeovers" waned, as technology was developed to provide a gentle, more kind approach to "rejuvenation." Baby boomers were increasing in numbers and wanted to maintain their youthful appearance. This not only improved self-image but it also helped when competing with a younger generation both socially and in the workplace.

These forces then of technological advances, provider interest, and patient desires have led to a huge increase in and demand for "minimally invasive procedures" that has extended to all of medicine. Plastic surgery and aesthetic procedures have indeed been affected by this movement. There have been many new procedures developed in just the last 10–15 years along with constant updates and improvements. As patient demand has soared for these new treatments, physicians have found that there is a

whole new world of procedures they need to incorporate into their practice if they are going to provide the latest in aesthetic services.

Rebecca Small, MD, the editor and author of this series of books on cosmetic procedures, has been at the forefront of the aesthetic procedures movement. She has written extensively and conducted numerous workshops to help others learn the latest techniques. She has the practical experience to know just what the physician needs to develop a practice and provides "the latest and the best" in these books. Using her knowledge of the field, she has selected the topics wisely to include

- A Practical Guide to: Botulinum Toxin Procedures
- A Practical Guide to: Dermal Filler Procedures
- A Practical Guide to: Skin Care Procedures and Products
- A Practical Guide to: Cosmetic Laser Procedures

Dr. Small does not just provide a cursory, quick review of these subjects. Rather, they are an in-depth practical guide to performing these procedures. The emphasis here should be on "practical" and "in depth." There is no extra esoteric waste of words, yet every procedure is explained in a clear, concise, useful format that allows practitioners of all levels of experience to learn and gain from reading these texts.

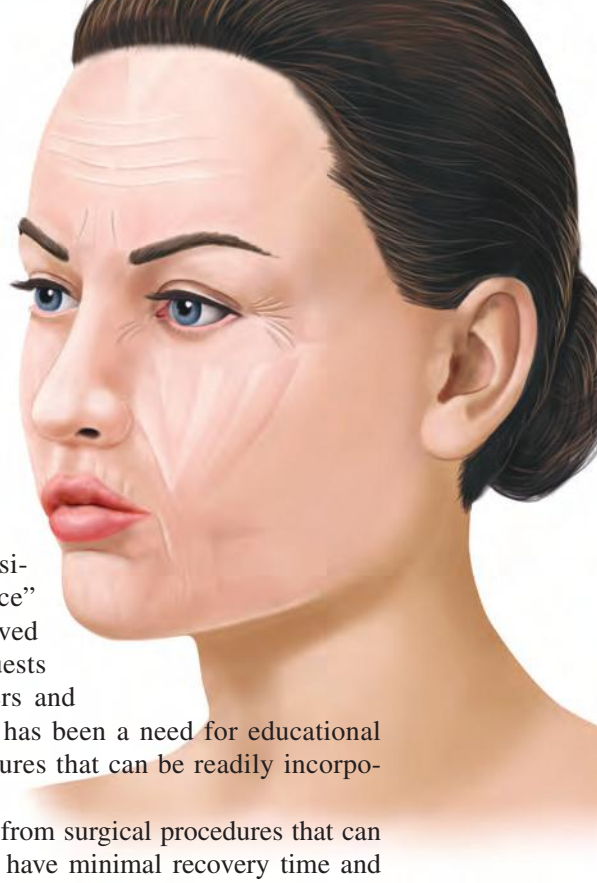
The basic outline of these books consists of the pertinent anatomy, the specific indications and contraindications, specific how to diagram and explanations on performing the procedures, complications and how to deal with them, tables with comparisons and amounts of materials needed, before and after patient instructions as well as consent forms (an immense time-saving feature), sample procedure notes, and a list of supply sources. An extensive updated bibliography is provided in each text for further reading. Photos are abundant depicting the performance of the procedures as well as before and after results. These comprehensive texts are clearly written for the practitioner who wants to "learn everything" about the topics covered. Patients definitely desire these procedures, and Dr. Small has provided the information to meet the physician demand to learn them.

For those interested in aesthetic procedures, these books will be a godsend. Even for those not so interested in performing the procedures described, the reading is easy and interesting and will update the reader on what is currently available so they might better advise their patients.

Dr. Small has truly written a one-of-a-kind series of books on Cosmetic Procedures. It is my prediction that it will be received very well and be most appreciated by all who make use of it.

John L. Pfenninger, MD, FAAFP
Founder and President, The Medical Procedures Center
PC Founder and Senior Consultant, The National Procedures Institute
Clinical Professor of Family Medicine, Michigan State College of Human Medicine

Preface



After the publication of the American Family Physician article "Aesthetic Procedures in Office Practice" (December 2009 Vol. 80 No. 11), I have received an overwhelming amount of inquiries and requests for aesthetic training from primary care providers and residents. The common thread of these inquiries has been a need for educational resources and quality training in aesthetic procedures that can be readily incorporated into office practice.

As the trend in aesthetic medicine shifts away from surgical procedures that can radically alter appearance, toward procedures that have minimal recovery time and offer more subtle enhancements, the number of minimally invasive aesthetic procedures performed continues to increase. These procedures, which include botulinum toxin and dermal filler injections, lasers and light-based technologies, and exfoliation treatments, have become the primary modalities for treatment of facial aging and skin rejuvenation. This aesthetic procedures series is designed to be a truly practical guide for physicians, physician assistants, nurse practitioners, residents in training, and other health care providers interested in aesthetics. It is not comprehensive but is inclusive of current minimally invasive aesthetic procedures that can be readily incorporated into office practice, which directly benefit our patients and achieve good outcomes with a low incidence of side effects.

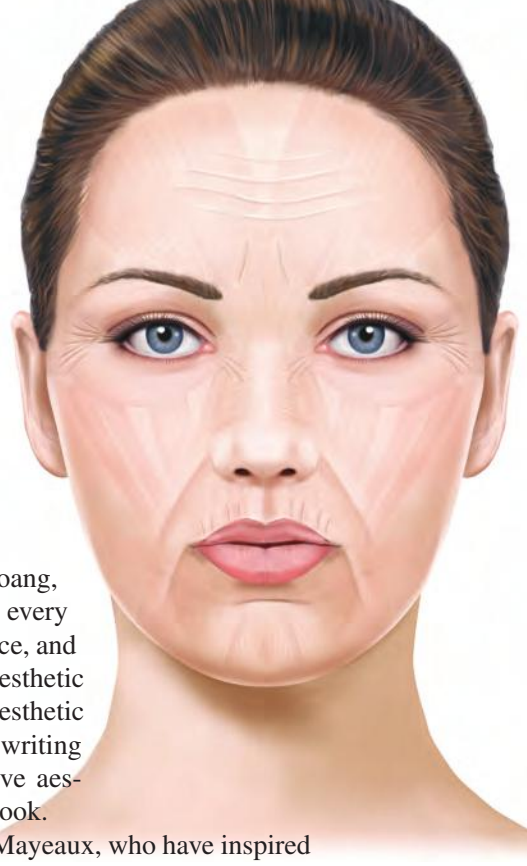
This botulinum toxin injection book is the first in the aesthetic practical guide series and is intended for both novice practitioners learning a new aesthetic procedure, and for more seasoned practitioners seeking advanced procedures. Providers-in-training and teachers can benefit from the step-by-step approach and the online videos of each procedure performed by the author. Also included are suggestions for management of the most commonly encountered issues seen in follow-up visits. Seasoned practitioners may appreciate the concise summary of each procedure's complications and up-to-date suggestions for management, combining aesthetic treatments to maximize outcomes, current product developments, and reimbursement recommendations.

The Introduction and Foundation Concepts section in this book, provides basic aesthetic medicine concepts essential to successfully performing aesthetic procedures. Each chapter is dedicated to a single botulinum toxin procedure with all relevant anatomy reviewed, including the target muscles and their functions, as well as the muscles to be avoided. Injection points and the injection *safety zones* are highlighted to help the providers perform the procedures more effectively and minimize complications. The

first three chapters, which cover treatment in the upper third of the face for frown lines, horizontal forehead lines, and crow's feet, are ideal for providers getting started with cosmetic botulinum toxin treatments. The remaining chapters of the book cover more advanced cosmetic treatments in the lower face, neck, and axillary hyperhidrosis.

This book is intended to serve as a guide and not a replacement for experience. When learning aesthetic procedural skills, preceptorship with a skilled provider or a formal training course is recommended to minimize undesired outcomes. When getting started with these procedures, providers may consider performing initial treatments on staff and family to get feedback and closely observe the effects of botulinum toxin. Also consider receiving a treatment to gain personal knowledge about botulinum toxin procedures.

Acknowledgments



I have profound gratitude and respect for Dr. Dalano Hoang, my associate editor and husband. He has been with me at every step of the way as the clinic director of our aesthetic practice, and much more. Although he personally does not perform aesthetic procedures, his knowledge of the multiple aspects of aesthetic medicine is extensive and invaluable. His clear, concise writing style combined with my knowledge of minimally invasive aesthetic procedures yielded this straightforward procedure book.

A special thanks to Drs. John L. Pfenninger and E. J. Mayeaux, who have inspired and supported me, and taught me much about educating and writing.

The University of California, San Francisco and the Natividad Medical Center family medicine residents deserve special recognition. Their interest and enthusiasm for aesthetic procedures led me to develop the first family medicine aesthetics training curriculum in 2008. Special recognition is also due to the primary-care providers who participated in my aesthetic courses at the American Academy of Family Physicians' national conferences over the years. Their questions and input further solidified the need for this practical guide series.

I am indebted to my Capitola office staff for their ongoing logistical and administrative support, which made it possible to write this series.

Special acknowledgments are due to those at Wolters Kluwer Health, who made this book series possible, in particular, Kerry Barrett, Sonya Seigafuse, Freddie Patane, Brett MacNaughton, and Doug Smock. It has been a pleasure working with Liana Bauman, the gifted artist who created all of the illustrations for these books.

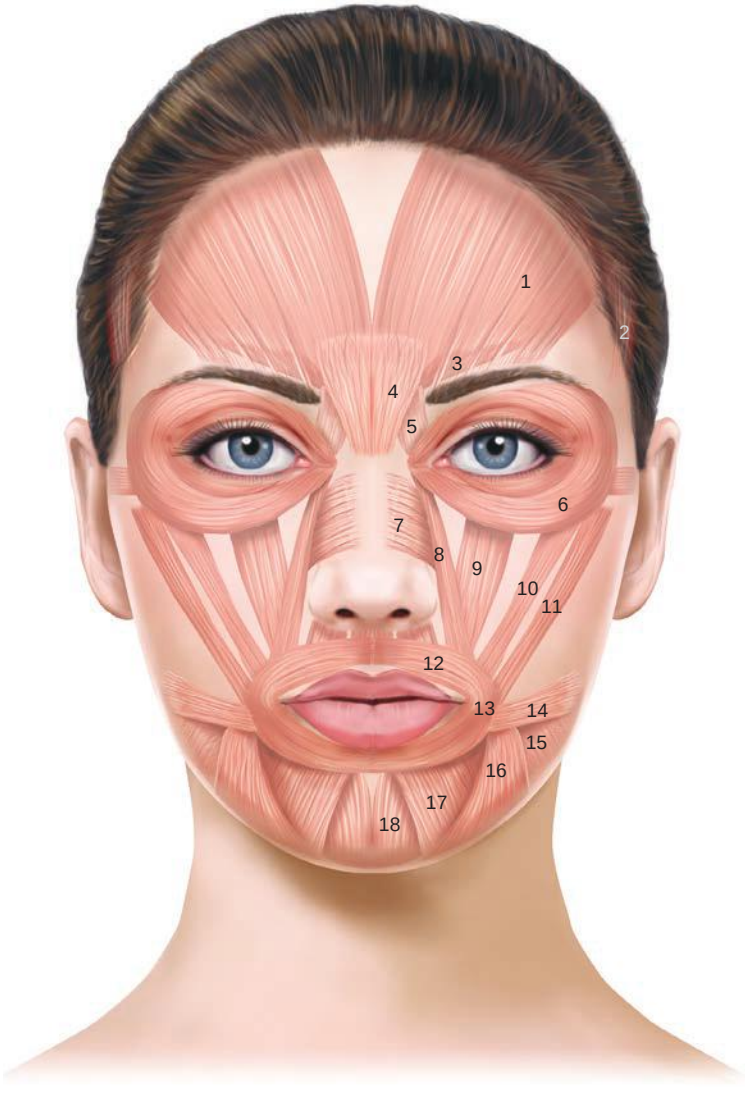
Finally, I would like to dedicate this book to my 5-year-old son, Kaidan Hoang, for the unending hugs and kisses that greeted me no matter how late I got home from working on this project.

Contents

A video clip for every procedure can be found on the book's website.

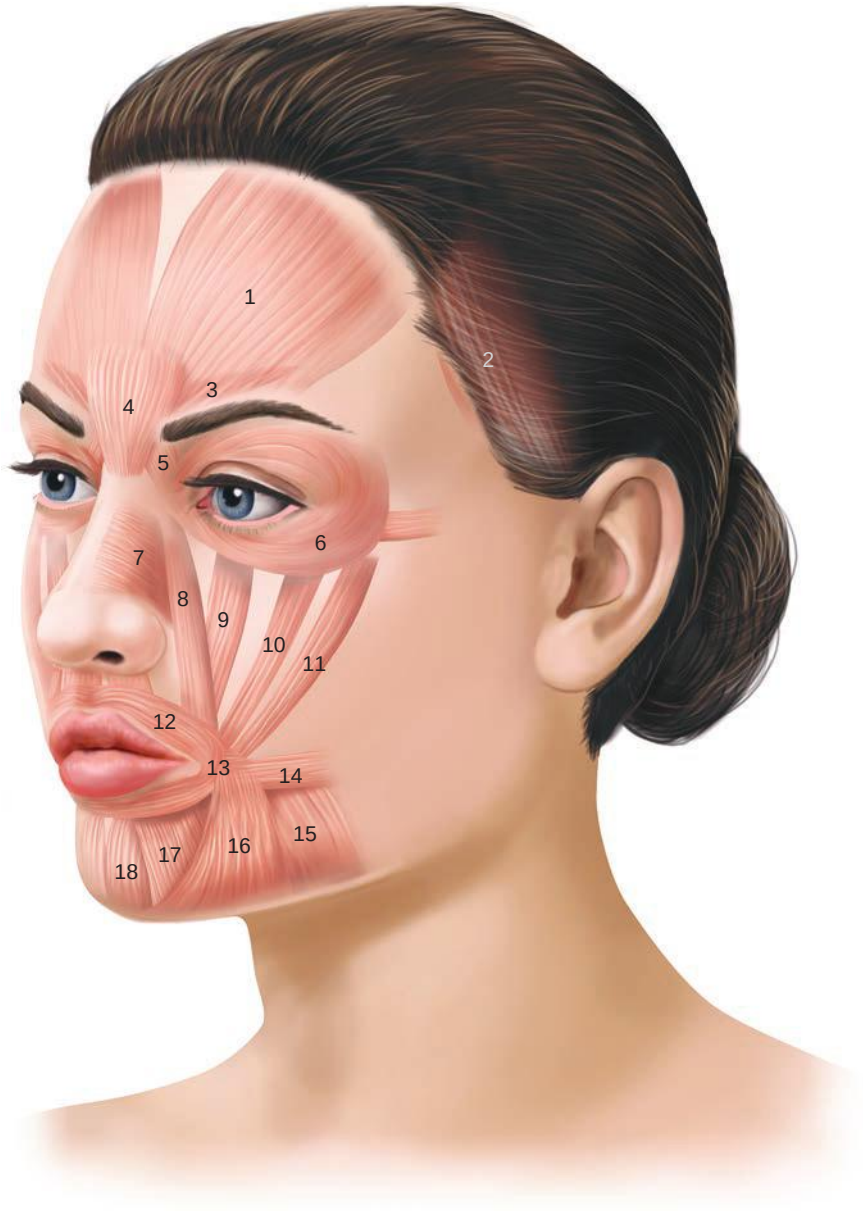
Section 1

Anatomy



1. Frontalis m.
2. Temporalis m.
3. Corrugator supercilii m.
4. Procerus m.
5. Depressor supercilii m.
6. Orbicularis oculi m.
7. Nasalis m.
8. Levator labii superioris alaeque nasi m.
9. Levator labii superioris m.
10. Zygomaticus minor m.
11. Zygomaticus major m.
12. Orbicularis oris m.
13. Modeolus
14. Risorius m.
15. Platysma m.
16. Depressor anguli oris m.
17. Depressor labii inferioris m.
18. Mentalis m.

FIGURE 1 ● Musculature of the face–anterior-posterior. Copyright R. Small, MD.



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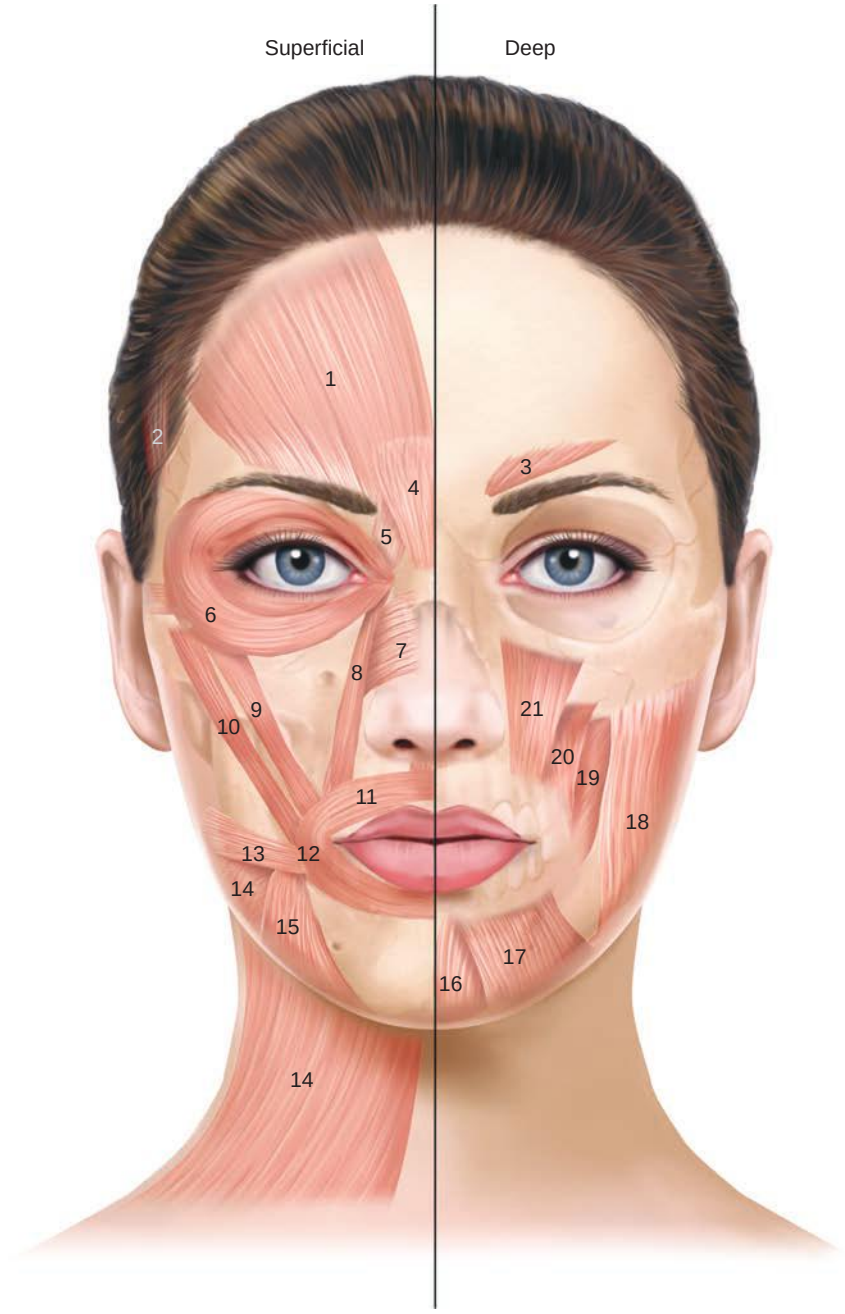
13. Modeolus
14. Risorius m.
15. Platysma m.
16. Depressor anguli oris m.
17. Depressor labii inferioris m.
18. Mentalis m.

FIGURE 2 ● Musculature of the face–oblique. Copyright R. Small, MD.



1. Frontalis m.
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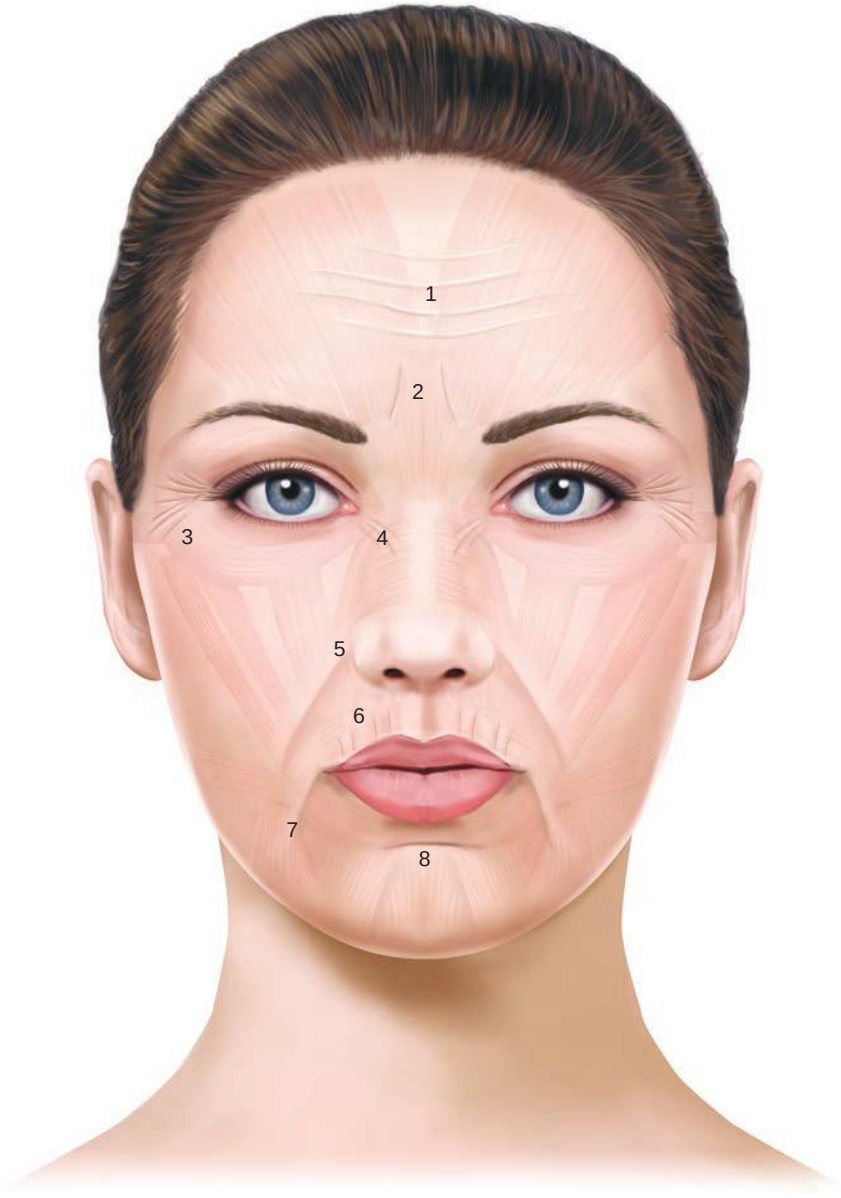
3. Corrugator supercilii m.
4. Procerus m.
5. Depressor supercilii m.
6. Orbicularis oculi m.
7. Nasalis m.
8. Levator labii superioris alaeque nasi m.
9. Zygomaticus minor m.
10. Zygomaticus major m.
11. Orbicularis oris m.
12. Modeulus
13. Risorius m.
14. Platysma m.
15. Depressor anguli oris m.
16. Mentalis m.
17. Depressor labii inferioris m.
18. Masseter m.
19. Buccinator m.
20. Levator anguli oris m.
21. Levator labii superioris m.

FIGURE 3 ● Superficial and deep musculature of the face. Copyright R. Small, MD.



1. Horizontal forehead lines
   (Frontalis m.)
2. Frown lines
   (Glabellar complex m.)
3. Crow's feet
   (Orbicularis oculi m.)
4. Bunny lines
   (Nasalis m.)
5. Nasolabial folds
   (Levator labii superioris alaeque nasi m.)
6. Radial lip lines
   (Orbicularis oris m.)
7. Marionette lines
   (Depressor anguli oris m.)
8. Chin line
   (Mentalis m.)

FIGURE 4 ● Wrinkles and folds of the face–anterior-posterior (contributing muscle). Copyright R. Small, MD.

1. Horizontal forehead lines
   (Frontalis m.)
2. Frown lines
   (Glabellar complex m.)
3. Crow's feet
   (Orbicularis oculi m.)
4. Bunny lines
   (Nasalis m.)
5. Nasolabial folds
   (Levator labii superioris alequae nasi m.)
6. Radial lip lines
   (Orbicularis oris m.)
7. Marionette lines
   (Depressor anguli oris m.)
8. Chin line
   (Mentalis m.)

FIGURE 5 ● Wrinkles and folds of the face–oblique (contributing muscle). Copyright R. Small, MD.

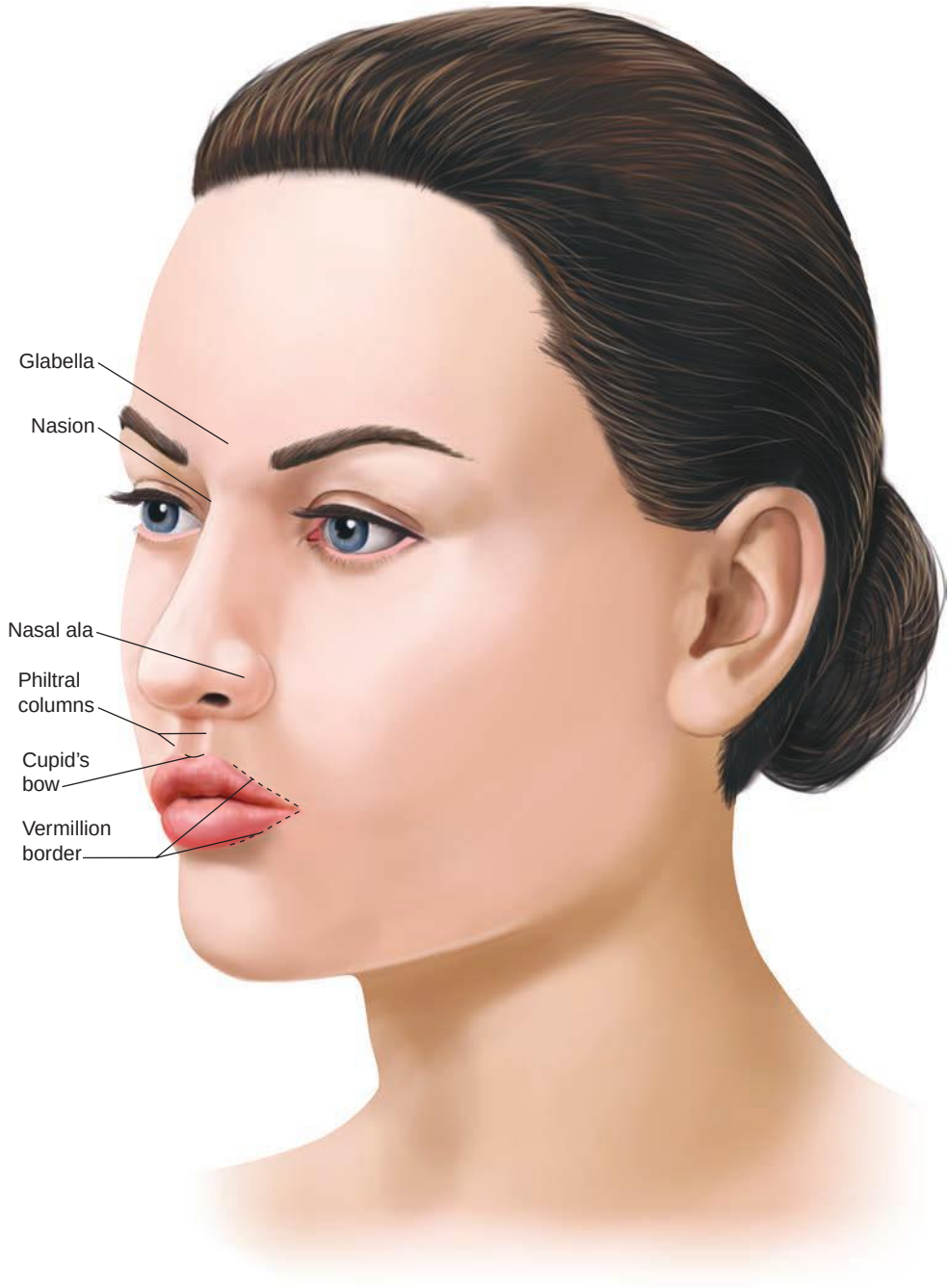


FIGURE 6 ● Surface anatomy of the face. Copyright R. Small, MD.

FIGURE 7 ● Functional anatomy of the face. Copyright R. Small, MD.

TABLE 1

EXPRESSION LINES	MUSCLES	ACTIONS
Frown lines	Corrugator supercilii	Eyebrows drawn medially
	Procerus and depressor supercilii	Medial eyebrow depressors
Horizontal forehead lines	Frontalis	Eyebrow levator
Crow's feet	Lateral orbicularis oculi	Lateral eyebrow depressor
Eyebrow lift	Superior lateral orbicularis oculi	Superior lateral eyebrow depressor
Bunny lines	Nasalis	Nasal sidewalls drawn medially
Radial lip lines	Orbicularis oris	Lip puckering
Marionette lines	Depressor anguli oris	Corner of mouth depressor
Nasolabial folds	Levator labii superioris alaeque nasi	Central lip levator
Chin line	Mentalis	Chin puckering and lower lip levator

Key:
Orange—depressor muscles Purple—levator muscles Gray—sphincteric muscles

Section 2

Introduction and Foundation Concepts

Administering botulinum toxin injections is an essential skill for physicians and qualified healthcare providers who wish to incorporate aesthetic medicine into their practice. According to statistics from the American Society of Plastic Surgeons, since its approval for cosmetic use by the U.S. Food and Drug Administration (FDA), botulinum toxin has become the most commonly performed minimally invasive cosmetic procedure, with over 3 million treatments performed annually. To successfully perform botulinum toxin procedures, an understanding of relevant anatomy and an appreciation for facial aesthetics, in addition to injection skill, are necessary to achieve desirable results.

Skin Aging

Wrinkling is a prominent feature of skin aging. Skin naturally thins and loses volume over time as dermal collagen, hyaluronic acid, and elastin gradually diminish. This process of dermal atrophy is accelerated and compounded by sun exposure and other extrinsic factors such as smoking. Hyperdynamic facial musculature also contributes to formation of visible lines and wrinkles. Initially, lines and wrinkles are seen only during active facial expression such as frowning, laughing, or smiling and are referred to as dynamic lines (Fig. 1A). Over time, dynamic lines become permanently etched into skin resulting in static lines (Fig. 2B), which are present at rest.

A

B

FIGURE 1 Younger patient demonstrating dynamic frown lines seen with glabellar complex muscle contraction **(A)** and lack of static lines at rest **(B)**. Copyright R. Small, MD.

FIGURE 2 Older patient demonstrating dynamic frown lines seen with glabellar complex muscle contraction **(A)** and static lines at rest **(B)**. Copyright R. Small, MD.

Skin laxity, redistribution of facial fat, and biometric changes such as bone resorption, contribute to skin folds and facial contour changes. In addition, aged skin exhibits dyschromia such as mottled pigmentation, vascular ectasias such as telangiectasias and cherry angiomas, and undergoes benign and malignant degenerative changes.

Botulinum Toxin Indications (Year Approved)

- Botulinum toxin is FDA approved for the temporary treatment of moderate to severe dynamic glabellar frown lines in adults aged 18–65 years (2002).
- Botulinum toxin is FDA approved for the temporary treatment of primary axillary hyperhidrosis (2004).
- Other FDA approved indications include blepharospasm (1989), strabismus (1989), cranial nerve VII disorders (1989), cervical dystonia (2000), upper limb spasticity (2010), prophylaxsis for chronic migraine (2010).
- Other off-label cosmetic uses include reduction of wrinkles in the upper and lower face, neck, and chest; lifting of facial areas; and correction of facial asymmetries.

Mechanism of Action

Botulinum toxin is a neurotoxin protein derived from the *Clostridium botulinum* bacterium. When small quantities of botulinum toxin are injected into target muscles,

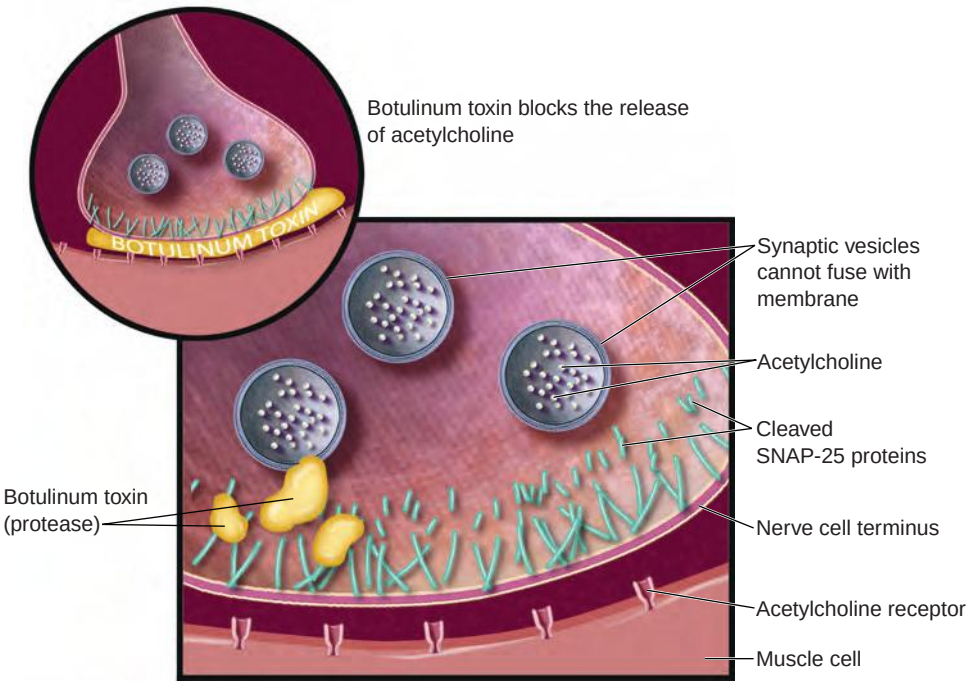


FIGURE 3 ● Botulinum toxin inhibits the release of acetylcholine at the neuromuscular junction. Copyright R. Small, MD.

localized chemical denervation occurs due to inhibition of acetylcholine release at the neuromuscular junction (Fig. 3). This temporarily reduces muscle contractions and smooths skin wrinkles in the treatment area.

Basic and Advanced Procedures

Basic. Areas of hyperdynamic muscles in the upper third of the face (frown lines, crow's feet and horizontal forehead lines) yield the most predictable results with the greatest efficacy, and fewest reported side-effects when treated with botulinum toxin. These areas are ideal for providers getting started with cosmetic botulinum toxin injections and are referred to as basic treatment areas (Table 1) in this book.

Advanced. Botulinum toxin treatments in the lower face are considered advanced procedures (Table 1). This is a highly functional region and, in addition to facial expression, lower face muscles serve essential functions of mastication and elocution. Treated muscles in the lower face must retain partial functionality which requires more practiced injection skill with precise placement of small doses of toxin. Botulinum toxin treatment of neck bands, hyperhidrosis and all facial areas other than the basic treatment areas, are considered advanced procedures in this book. These procedures have a greater risk of complications, and it is advisable for novice injectors to gain skill and confidence with basic procedures before proceeding to advanced botulinum toxin procedures.

Patient Selection

Patients with dynamic wrinkles that have minimal to no static component (Fig. 1) demonstrate the most dramatic improvements with botulinum toxin treatments. Results for

TABLE 1

Basic and Advanced Botulinum Toxin Treatment Areas

Expression Lines		
Common Name	**Medical Name**	**Muscles**
Basic		
Frown lines	Glabellar rhytids	Glabellar complex: corrugator supercilii, procerus, and depressor supercilii
Horizontal forehead lines	Frontalis rhytids	Frontalis
Crow's feet	Lateral canthal rhytids	Lateral orbital orbicularis oculi
Advanced		
Lower eyelid wrinkles	Infraocular rhytids	Inferior preseptal orbicularis oculi
Eyebrow lift	Reduction of ptotic eyebrows and dermatochalasis	Superior lateral orbital orbicularis oculi
Bunny lines	Nasal rhytids	Nasalis
Lip lines (smoker's or lipstick lines)	Perioral rhytids	Orbicularis oris
Marionette lines	Melomental folds	Depressor anguli oris
Downturned corners of the mouth	Depressed oral commissures	Depressor anguli oris
Nasolabial folds	Melolabial folds	Levator labii superioris alaeque nasi
Gummy smile	Gingival show	Levator labii superioris alaeque nasi
Chin line	Mental crease or labiomental crease	Mentalis
Chin puckering	Mentalis contraction	Mentalis
Neck bands	Platysmal bands	Platysma

patients with static wrinkles (Fig. 2) are slower and cumulative, and may require two to three consecutive treatments for significant improvements. Deep static lines may not fully respond to botulinum toxin treatment alone and may require combination treatment with dermal fillers or resurfacing procedures to achieve optimal results. Severe static wrinkles and laxity, commonly seen in patients aged 65 years or older, may require surgical intervention. Discussion regarding realistic expectations and results during the evaluation and consultation process is essential.

Treatment Goals

Botulinum toxin treatments are directed at specifically targeted muscles or regions of muscles to focally inhibit contraction and achieve intended effects such as smoothing the skin or elevating facial areas. An optimal result yields a pleasing aesthetic effect with minimal to no functional impairment in the treatment area and, lack of other undesired effects and complications.

The degree of muscle inhibition achieved with botulinum toxin in a given treatment area is determined by patient preference and the need to preserve functionality

in the treated muscles. For example, some patients may desire complete inhibition of the glabellar complex muscles with botulinum toxin treatment of frown lines, whereas others may desire partial muscle inhibition with retention of some ability to frown. A greater degree of muscle inhibition is typically sought for treatments in the upper third of the face than in the lower face. In the lower face, partial muscle inhibition is the desired result as the treated muscles must still be able to perform essential functions, such as eating, drinking, and speaking. Treatment goals listed in the following chapters are based on common patient preferences and considerations of muscle functionality in the treatment areas.

Products

C. botulinum bacteria produce eight serotypes of botulinum toxin proteins (A, B, Cα, Cβ, D, E, F, and G). Botulinum toxin serotype A is the most potent and is used for cosmetic indications. The FDA currently approve two botulinum toxin serotype A products for the treatment of the glabellar complex muscles that form frown lines: onabotulinumtoxinA (OBTX) (Botox® manufactured by Allergan, Inc, Irvine, CA) and abobotulinumtoxinA (Dysport® manufactured by Medicis Pharmaceutical Corp, Scottsdale, AZ), both of which were formerly known as botulinum toxin type A. OBTX and abobotulinumtoxinA vary in formulation, diffusion capability, onset of action, efficacy, and complications and are not interchangeable. All references to OBTX in this book refer specifically to Botox.

Alternative Therapies

Botulinum toxin is the only treatment for dynamic wrinkles currently approved by the FDA. Other treatments for static wrinkles include chemical peels; microdermabrasion; topical products such as retinoids, nonablative lasers for soft-tissue coagulation and tightening such as infrared and radiofrequency; nonablative lasers for collagen remodeling such as 1320-nm, 1540-nm, and Q-switched lasers; ablative and fractional ablative lasers such as erbium and carbon dioxide lasers; and operative procedures such as dermabrasion and plastic surgery.

Contraindications

- Pregnancy or nursing
- Active infection in the treatment area (e.g., herpes simplex, pustular acne, cellulitis)
- Hypertrophic or keloidal scarring
- Bleeding abnormality (e.g., thrombocytopenia, anticoagulant use)
- Impaired healing (e.g., due to immunosuppression)
- Skin atrophy (e.g., chronic oral steroid use, genetic syndromes such as Ehlers-Danlos syndrome)
- Active dermatoses in the treatment area (e.g., psoriasis, eczema)
- Sensitivity or allergy to constituents of botulinum toxin (including botulinum toxin serotype A, human albumin, lactose, or sodium succinate)
- Milk allergy with abobotulinumtoxinA products
- Gross motor weakness in the treatment area (e.g., due to polio, Bell's palsy)
- Neuromuscular disorder including, but not limited to amyotrophic lateral sclerosis, myasthenia gravis, Lambert-Eaton syndrome, and myopathies

- Inability to actively contract muscles in the treatment area prior to treatment
- Periocular or ocular surgery within the previous 6 months (e.g., laser-assisted in situ keratomileusis, blepharoplasty)
- Medications that inhibit neuromuscular signaling and may potentiate botulinum toxin effects (e.g., aminoglycosides, penicillamine, quinine, calcium channel blockers)
- Uncontrolled systemic condition
- Occupation requiring uncompromised facial expression (e.g., actors, singers)
- Unrealistic expectations or body dysmorphic disorder

Advantages

- Technically straightforward with short treatment time
- Safe and effective, particularly in the upper third of the face
- High patient satisfaction

Disadvantage

- Short duration of action relative to other cosmetic procedures, although effects may be cumulative over time with recurring treatments

Equipment (Fig. 4)

- Botox reconstitution
  - Botox Cosmetic 100-unit vial
  - 5.0-mL syringe
  - 0.9% nonpreserved sterile saline 10-mL vial
  - 18-gauge, 0.5-inch needle
- Botox treatment
  - Reconstituted Botox Cosmetic (100 units/4 mL)
  - 1-mL Becton-Dickinson Luer-Lok™ tip syringe

FIGURE 4 ● Equipment for botulinum toxin treatments. Copyright R. Small, MD.

- 30-gauge, 1-inch needle
- 30-gauge, 0.5-inch needle
- 32-gauge, 0.5-inch needle
- 3 × 3-inch nonwoven gauze
- Hand-held mirror (for consultation)
- Nonsterile gloves
- Alcohol pads
- Ice pack
- Bottle opener (for removing metal cap of the botulinum toxin vial for aspiration of fluid at the bottom of the vial)
- Hemostat (for loosening tight Luer-Lok connections)
- Soft, white eyeliner pencil or surgical pen (for marking injection points)

Reconstitution Method

Botox Cosmetic is supplied as a powder, typically in vials of 50 or 100 units. For reconstitution, non-preserved saline is recommended by the manufacturer and the author. Preserved saline is used for reconstitution by some providers because it may reduce discomfort with injection. There is no standardized volume for reconstitution. Botox efficacy is based on the number of units injected rather than the dilution. However, greater dilution volumes (of 10 mL or more) can increase diffusion and in turn the risk of complications.

The author's reconstitution method, using a 100-unit vial of Botox, is outlined as follows:

- Using an 18-gauge needle with a 5.0-mL syringe draw up 4.0 mL of 0.9% nonpreserved sterile saline.
- Insert the needle at a 45-degree angle into a 100-unit Botox vial and inject saline slowly, maintaining upward plunger pressure so that the diluent runs down the sides of the vial.
- Gently swirl the reconstituted Botox vial and record the date and time of reconstitution on the vial.
- Reconstitution of Botox powder using 4 mL of saline results in a concentration of 100 units of botulinum toxin per 4 mL (100 units/4 mL).

Reconstitution Concentrations and Dosing

Small volumes of reconstituted botulinum toxin solution are injected for cosmetic facial and neck treatments and a 1.0-mL syringe is used for injections. Providers must be aware of the exact dose associated with each 0.1-mL increment on the syringe for accurate dosing of botulinum toxin.

- With the earlier Botox reconstitution concentration of 100 units/4 mL:
  - 4.0 mL of reconstituted Botox has 100 units
  - 1.0 mL of reconstituted Botox has 25 units
  - 0.1 mL of reconstituted Botox has 2.5 units
- A table for conversion of botulinum toxin dose (in units) to injection volume (in mL) for Botox reconstituted at 100 units/4 mL is given in the appendix (Appendix 1, Table 1)

- Common reconstitution volumes used with a 100-unit vial of Botox and the resulting dose per 0.1 mL are shown below:

Saline Volume Added to 100-Unit Vial of Botox (mL)	Resulting Botulinum Toxin Dose Per 0.1 mL of Reconstituted Solution (Units)
1.0	10
2.0	5
2.5	4
4.0	2.5

Handling and Storage

Botox is shipped frozen, on dry ice. Before and after reconstitution it may be stored in the refrigerator at a temperature of 2–8°C (35.6–46.4°F) for up to 24–36 months based on the vial size. While the manufacturer recommends using Botox within 24 hours of reconstitution, the American Society for Plastic Surgery Botox Consensus Panel recommends using Botox within 6 weeks after reconstitution and notes no loss of potency during that time.

Anatomy

- Musculature of the face–anterior-posterior (Anatomy section, Fig. 1)
- Musculature of the face–oblique (Anatomy section, Fig. 2)
- Superficial and deep musculature of the face (Botulinum Toxin Anatomy section; Fig. 3)
- Wrinkles and folds of the face–anterior-posterior (Anatomy section, Fig. 4)
- Wrinkles and folds of the face–oblique (Anatomy section, Fig. 5)
- Surface anatomy of the face (Anatomy section, Fig. 6)
- Functional anatomy (Anatomy section, Fig. 7)

Understanding the facial anatomy in the treatment areas is necessary before performing botulinum toxin procedures (Anatomy section; Figs. 1–7). Most facial muscles have soft-tissue attachments to the skin through the superficial muscular aponeurotic system. When a muscle contracts, the overlying skin moves with it causing wrinkles (also called "rhytids") to form perpendicular to the direction of the muscle contraction. This allows for a diverse array of subtle facial expressions and functions.

Aesthetic Consultation

Review the patient's complete history, including medications, allergies, medical history including conditions contraindicating treatment, cosmetic history including minimally invasive aesthetic procedures and plastic surgeries as well as satisfaction with results and any side effects, and social history including occupations in which facial expression cannot be compromised.

Examine the areas of concern and, with the patient holding a mirror, have the patient prioritize the areas. Note any asymmetries, such as uneven eyebrow height, document in the chart and photograph. Discuss treatment options, number of recommended

treatments, anticipated results, realistic expectations, and procedure cost. Review risks of complications associated with the procedure. Formulate a cosmetic treatment plan and record in the chart along with a consent form signed by the patient. It is advisable to use photographic documentation (referred to as photodocumentation) with aesthetic procedures and take dynamic and static photographs before botulinum toxin treatment and approximately 2 weeks posttreatment to demonstrate results.

When discussing botulinum toxin or other injection treatments, it can be helpful to use nonmedical or "patient friendly" terminology to reduce patient anxiety. Examples of terms used include the following:

Medical Terms	Patient-Friendly Terms
• Toxin	• Natural purified protein
• Paralyzes	• Relaxes
• Pain	• Discomfort

Preprocedure Checklist

- Perform an aesthetic consultation and obtain informed consent.
- Take pretreatment photographs with the patient actively contracting the muscles in the intended treatment area and with the muscles at rest.
- Document and discuss any notable asymmetries before treatment.
- Minimize bruising by discontinuation of aspirin, vitamin E, St. John's wort, and other similar-action dietary supplements including: ginkgo, evening primrose oil, garlic, feverfew, and ginseng for 2 weeks. Discontinue other nonsteroidal anti-inflammatory medications and alcohol consumption 2 days before treatment.
- For hyperhidrosis treatment, discontinue antiperspirant use 24 hours before treatment and see Hyperhidrosis chapter for other preprocedure steps.
- For the procedure, position the patient comfortably in a reclined position at about 65 degrees.
- Identify the *safety zone* for treatment, which is the recommended region within which injections are administered. Confining treatments to the safety zone area can maximize efficacy and minimize side effects.
- Locate the target muscles for botulinum toxin injection, which are located within the safety zone, by instructing the patient to contract the relevant muscles using particular facial expressions as outlined in each chapter.
- Identify the botulinum toxin injection points and OBTX starting doses from the overview figure, which accompanies each chapter.
- Instruct the patient to close their eyes during the procedure.
- Cleanse the treatment areas with alcohol prior to injection and allow alcohol to dry.

Anesthesia

Anesthesia is typically not required for botulinum toxin treatments. If necessary, ice or a topical anesthetic may be used before injections (e.g., benzocaine, lidocaine, tetracaine).

Pretreat the anesthetic injection sites with a topical anesthetic such as benzocaine 20% : lidocaine 6% : tetracaine 4% (BLT) for 15–20 minutes prior to treatment.

Commonly used topical anesthetic products include:

- L-M-X (lidocaine 4%–5%)*
- EMLA (lidocaine 2.5% : prilocaine 2.5%)**
- BLT (benzocaine 20% : lidocaine 6% : tetracaine 4%)***

* Over-the-counter product ** Prescription ***Compounded by a pharmacy
See Appendix 6, Supply Sources.

BLT is one of the most potent and fast acting topical anesthetics and is preferred for use by the author. It is applied in-office, with a maximum dose of 1/2 gm applied topically for 15 minutes. Effects are enhanced for certain topical anesthetics by occluding the product under plastic wrap once applied to the skin. Occlusion under plastic wrap is not necessary with BLT due to its potency.

Botulinum Toxin Dosing

- Each chapter has an overview figure of botulinum toxin injection points and recommended starting doses for a given treatment area using OBTX.
- Summary tables of starting doses for all treatment areas are provided in the appendix for OBTX (Appendix 1, Table 2a) and abobotulinumtoxinA (Appendix 1, Table 2b).

General Injection Techniques

- Insert the needle into the area of maximal muscle contraction, which is typically visible as a "hill" or "ridge" of muscle.
- The target for axillary hyperhidrosis is sweat glands located in the dermis. The targets for all other botulinum toxin treatments described in this book are muscles. In some facial areas, where the skin is thin and muscles are superficially located, subdermal injection adequately delivers botulinum toxin to the target muscle. In other areas deeper intramuscular injection is required.
- Depth of botulinum toxin injection is site specific and is either:
  - intradermal, visible as a wheal with dimpled skin (e.g., treatment of axillary hyperhidrosis);
  - subdermal, visible as a wheal without dimpled skin (e.g., treatment of crows feet); or
  - intramuscular, visible as a subtle wheal without dimpled skin or as mild edema in the injection area (e.g., treatment of frown lines).
- Botulinum toxin is typically injected as the needle is withdrawn and should flow very easily with minimal plunger pressure. If resistance is encountered, fully withdraw the needle and reinsert.
- Avoid intravascular injection. Intravascular injection is apparent when the surrounding skin blanches during injection. If this occurs, withdraw the needle partially from the blanched site, reposition, and inject.
- Avoid hitting the periosteum, particularly with frontalis muscle treatments, as this is painful and dulls the needle.
- After injecting, the site may be compressed to reduce discomfort and bleeding. When treating around the eye, compression is directed away from the eye.
- If bleeding occurs, achieve hemostasis before proceeding to subsequent injection points.
- Avoid vigorous massage of the area after treatment to minimize undesired dispersion of botulinum toxin to adjacent muscles.

- Changing needles after six or more injections maintains a sharp needle and minimizes discomfort.

Aftercare

On the day of treatment, instruct the patient to avoid lying down for 4 hours immediately after treatment, manipulating the treated area (e.g., a facial or massage), and activities that can cause facial flushing (e.g., application of heat to the face, alcohol consumption, exercising, and tanning) to reduce the likelihood of product migration and risk of side effects. If bruising or swelling occurs, a soft ice pack may be applied for 10–15 minutes to each bruise site, every 1–2 hours until it is improved.

Results and Follow-Up

- Treated muscles typically demonstrate partial reduction in function 2–3 days after botulinum toxin treatment, with maximal reduction 1–2 weeks after treatment. Effects are most noticeable for treatment of dynamic lines. Static lines are slower to respond, typically requiring two to three consecutive treatments and may need to be combined with other minimally invasive aesthetic procedures such as dermal fillers or resurfacing procedures to achieve optimal results.
- If desired reduction of muscle function is not achieved in the treatment area, a touch-up procedure may be performed 2 weeks after the initial treatment. The botulinum toxin touch-up dose varies according to the degree of movement remaining in the target muscles and the treatment area (see individual chapters for recommended touch-up doses). Reassess the treatment area 2 weeks after the touch-up procedure. Document and include photographs at each visit.
- Results of botulinum toxin treatments in the lower face are subtle, relative to the dramatic changes seen in the upper third of the face. Patients may be able to appreciate pre- and posttreatment improvements in dynamic lines of the lower face if they are schooled in how to make these assessments with animation. In addition to a pleasing aesthetic effect, a desirable result in the lower face also has minimal to no functional impairment of the mouth.
- Muscle function in the treatment area gradually returns 2–5 months after treatment, based on the dose of botulinum toxin used, treatment area and the patient's physiology. Subsequent treatments are recommended when muscles in the treated area begin to contract, prior to facial lines returning to their pretreatment appearance.

Learning the Techniques

- Marking the safety zone with a soft, white eyeliner pencil or surgical marker before treatment can help with locating the target muscles for treatment and marking the injection points can help with needle placement.
- It is advisable to start with conservative botulinum toxin doses; each chapter has recommended starting doses for a given treatment area.
- Consider performing initial treatments on staff and family to get feedback and to closely observe the effects of botulinum toxin.
- Touch-up procedures may be performed 2 weeks after initial treatment if necessary.
- Consider receiving a treatment to gain personal knowledge about botulinum toxin procedures.

Complications

Complications and side effects can be categorized into injection-related or botulinum toxin–related issues. Botulinum toxin–related complications listed below may be associated with treatment of the face and the neck. Complications associated with treatment of specific areas, as well as suggestions for management, are discussed in their respective chapters.

General Injection-Related Complications

- Pain
- Bruising
- Erythema
- Edema
- Tenderness
- Headache
- Infection
- Numbness or dysesthesia
- Anxiety
- Vasovagal episode and loss of consciousness

Pain with botulinum toxin injections is minimal as small-gauge needles are used for treatment. If necessary, injection pain can be reduced using ice, or topical anesthetics. Pretreatment anesthesia, especially with topical anesthetics, can prolong treatment times.

Bruising is commonly seen with botulinum toxin injections, particularly with treatment of crow's feet.. Bruises can range in size from pinpoint needle insertion marks to quarter-sized ecchymoses or, rarely, hematomas. The time for resolution of a bruise depends on the patients' physiology and the size of the bruise, where larger bruises can be visible for up to 1–2 weeks. Prevention of bruising is preferable and several suggestions for bruise prevention are listed in the Preprocedure Checklist above. Immediate application of ice and pressure to a bruise can minimize bruise formation. Bruises can be camouflaged after treatment with makeup.

Erythema and **edema** are seen with almost all injections and usually resolve within a few hours after treatment. Firm compression of injection sites, particularly on the forehead, can effectively reduce edema. Icing is not typically necessary for these issues.

Headaches can occur with upper face injections and usually resolve within a few days after treatment without medication. There are reports of idiosyncratic severe headaches lasting 2–4 weeks. Nonsteroidal anti-inflammatory medications are usually adequate for management of headaches.

Infection is rare with botulinum toxin injections but can occur with any procedure that breaches the skin. The most common etiologies are bacterial or reactivation of herpes simplex. Prolonged **pain, tenderness,** and **erythema,** of more than a few days' duration can signal infection and necessitates evaluation, with infection-specific treatment.

Numbness or **dysesthesia** in the treatment area is extremely rare and could result from nerve injury with injections.

Anxiety with injection procedures is common. Most patients have mild procedural anxiety, which can be reduced by ensuring that injection equipment is not visible during treatment and can be managed with breathing techniques. Rarely, patients with more severe anxiety may require preprocedural medications (e.g., tramadol 50 mg, 1 tablet 30 minutes prior to procedure). Vasovagal episodes associated with severe anxiety are possible, and it is advisable for offices to have emergency protocols when performing injection procedures.

Botulinum Toxin–Related Complications

- Localized burning or stinging pain during injection
- Blepharoptosis (droopy eyelid)
- Eyebrow ptosis (droopy eyebrow)
- Ectropion of the lower eyelid (eyelid margin eversion)
- Lagophthalmos (incomplete eyelid closure)
- Xerophthalmia (dry eyes)
- Epiphora (excess tearing)
- Diplopia (double vision)
- Impaired blink reflex
- Photophobia (light sensitivity)
- Globe trauma
- Infraorbital festooning (worsening of eye bags)
- Lip ptosis with resultant smile asymmetry
- Oral incompetence with resultant drooling and impaired speaking, eating, or drinking
- Cheek flaccidity
- Dysarthria (difficulty articulating)
- Dysphagia (difficulty swallowing), necessitating nasogastric tube placement in severe cases
- Hoarseness
- Neck weakness
- Facial asymmetry, alteration, or poor aesthetic result
- Inadequate reduction of wrinkles or lack of intended effect in the treatment area
- Worsening wrinkles in areas adjacent to the treatment area
- Weakening muscles adjacent to the treatment area
- Autoantibodies against botulinum toxin. Autoantibodies may be present or develop after injection, rendering treatments ineffective (1–2% of patients treated for cosmetic indications per Allergan)
- Extremely rare, immediate hypersensitivity reaction with signs of urticaria, edema, and a remote possibility of anaphylaxis
- Case reports of severe side effects due to distant spread from the site of injection have been reported with large doses of botulinum toxin, including: generalized muscle weakness, urinary incontinence, respiratory difficulties, and death due to respiratory compromise. These complications have been reported in patients hours to weeks after receiving large doses of botulinum toxin for noncosmetic indications (e.g., 300 units in the calf muscles). They have not been reported with cosmetic use of botulinum toxin at the labeled dose of 20 units (for glabellar lines) or 100 units (for primary axillary hyperhidrosis).

Some complications can be improved with botulinum toxin treatment of muscles that antagonize the affected muscles. However, for most complications, there are no corrective treatments and they spontaneously resolve as botulinum toxin effects diminish.

Utilizing precise injection technique into targeted muscles and minimizing diffusion of botulinum toxin with low reconstitution volumes, reduce involvement of adjacent muscles and decrease the likelihood of undesired effects and complications.

Botulinum Toxin Treatments in Multiple Facial Areas

Botulinum toxin treatments in the upper third of the face can be safely and easily combined with treatment in the lower face during a given visit.

Concomitant botulinum toxin treatment of multiple areas in the upper face may be performed; however, this can decrease expressivity. Some patients may, therefore, prefer to space out treatments in the upper face. For example, two areas may be treated together, such as the crow's feet and frown, and 1–2 months later, treatment of the forehead and an eyebrow lift may be performed.

The lower face is a highly functional region, responsible for speaking, eating, and drinking. Excessive weakening of the muscles in this region can result in significant complications from functional impairment and it is advisable to use caution when treating multiple areas in the lower face and the neck. A conservative approach is to rotate treatment areas every 3–4 months such that only one area is treated with botulinum toxin at any give time. For example, if botulinum toxin treatment of upper lip lines and mental crease are desired, then the orbicularis oris muscle may be treated initially, followed by treatment of the mentalis muscle 3 months later once the upper lip botulinum toxin effect has resolved.

New Products and Current Developments

IncobotulinumtoxinA (Xeomin® manufactured by Merz Pharmaceuticals, Greensboro, NC), and PurTox® (manufactured by Mentor Corporation, Santa Barbara, CA) are new injectable botulinum toxin products currently undergoing FDA approval for cosmetic use in the United States.

RT001 or ReVance (ReVance Therapeutics, Newark, CA) is a physician-applied topical botulinum toxin under investigation for cosmetic applications including treatment of the crow's feet and axillary hyperhidrosis.

Reimbursement and Financial Considerations

Cosmetic botulinum toxin treatments are not covered by insurance. Fees for botulinum toxin injections are usually based on the number of units used, or on the treatment site. Prices vary widely according to community pricing in different geographic regions and range from $10–$25 per unit or $250–$500 per site. The Current Procedural Terminology (CPT) designation for botulinum toxin procedures of the face is chemodenervation of muscles innervated by the facial nerve (CPT code 64612).

Combining Aesthetic Treatments

Facial aging is a multifaceted process involving not only the formation of facial lines and wrinkles but also contour changes, skin laxity, formation of dyschromic and vascular lesions, undesired hair growth, as well as benign and malignant degenerative changes. Achieving optimal rejuvenation results often requires a combination of treatments to address these different aspects of facial aging. Botulinum toxin can be easily combined with other minimally invasive aesthetic procedures such as dermal fillers to treat static lines and volume loss; lasers and intense pulsed light for hair reduction, skin resurfacing, and treatment of benign pigmented and vascular lesion; exfoliation procedures like microdermabrasion and chemical peels; and topical skin care products.

Minimally invasive aesthetic procedures like botulinum toxin offer patients a means to enhance their appearance in a subtle, natural way and maintain a healthy youthful appearance. From the provider's perspective, these procedures can be readily incorporated into practice to provide office-based aesthetic care.

Section 3

Treatment Areas

Chapter 1

Frown Lines

FIGURE 1 ● Frown lines before **(A)** and 1 month after **(B)** botulinum toxin treatment of the glabellar complex, with active frowning. Copyright R. Small, MD.

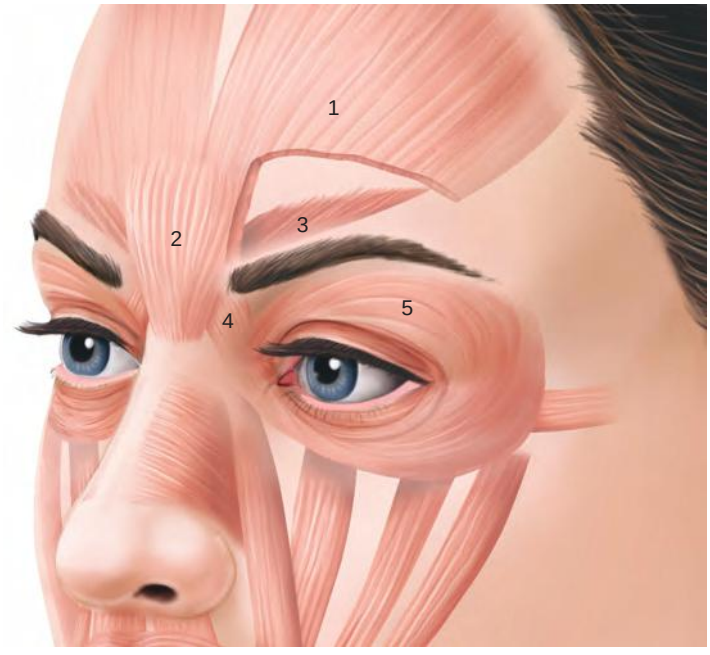
Dynamic frown lines result from contraction of glabellar complex muscles. These lines convey irritation, frustration, or anger and reduction of frown lines is one of the most common cosmetic complaints. Botulinum toxin treatment of the glabellar complex reduces frown lines by inhibiting contraction of these muscles and smoothing the overlying skin.

Indications

- Frown lines
- Medial eyebrow elevation

Anatomy

- **Wrinkles.** Frown lines, or glabellar rhytids, are vertical lines between the medial eyebrows (see Anatomy section, Figs. 4 and 5).
- **Muscles targeted**. Botulinum toxin frown line treatment targets the glabellar complex depressor muscles, which include the corrugator supercilii, procerus, and depressor supercilii (see Anatomy section, Figs. 1 and 2). The corrugator



1. Frontalis m.
2. Procerus m.
3. Corrugator supercilii m.
4. Depressor supercilii m.
5. Orbicularis oculi m.

FIGURE 2 ● Glabellar complex detailed anatomy. Copyright R. Small, MD.

and depressor supercilii muscles lie beneath the frontalis and procerus muscles (Fig. 2).

- **Muscle functions.** Contraction of the glabellar complex muscles draws the eyebrows medially and inferiorly (see Anatomy section; Fig. 7 and Table 1).
- **Muscles avoided.** The portion of the frontalis muscle which is lateral to the corrugator muscles is avoided with treatment of the glabellar complex.

Patient Assessment

- **Dynamic** (with muscle contraction) and **static** (at rest) **frown lines** are assessed.
- **Concomitant frontalis and glabellar complex muscle contraction** with frowning (Fig. 3) are assessed. Patients who use both these muscle groups when frowning may require treatment of the frontalis in addition to treatment of the glabellar complex muscles to smooth frown lines.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- "Frown like you're mad"
- "Concentrate"

FIGURE 3 Frontalis and glabellar complex muscle contraction with frowning. Copyright R. Small, MD.

Treatment Goals

- Complete inhibition of glabellar complex muscles.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts, Reconstitution Method section).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women: 20 units of OBTX
- Men: 25 units of OBTX

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 1-inch needle

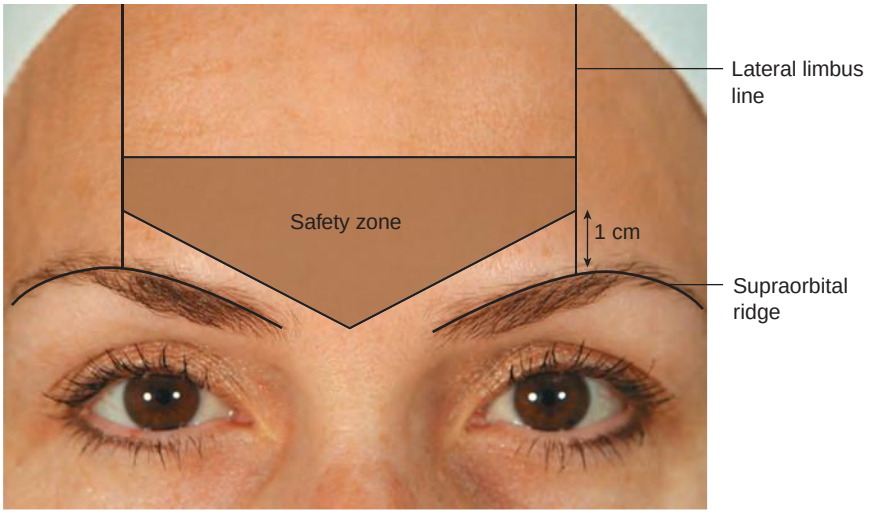


FIGURE 4 ● Frown line safety zone for botulinum toxin treatments. Copyright R. Small, MD.

Procedure Overview

- Place injections within the frown line safety zone (Fig. 4). The safety zone is at least 1 cm above the supraorbital ridge at the lateral limbus line, and extends inferiorly to a point approximately 1 cm below the glabellar prominence. It is bounded by vertical lines extending from the lateral limbi to the hairline.
- An overview of injection points and OBTX doses for treatment of frown lines is shown in Figure 5.
- Botulinum toxin is injected intramuscularly for treatment of frown lines.
- Injecting inferior to the safety zone, less than 1 cm above the supraorbital ridge at the lateral limbus line, increases the risk of blepharoptosis (droopy upper eyelid).

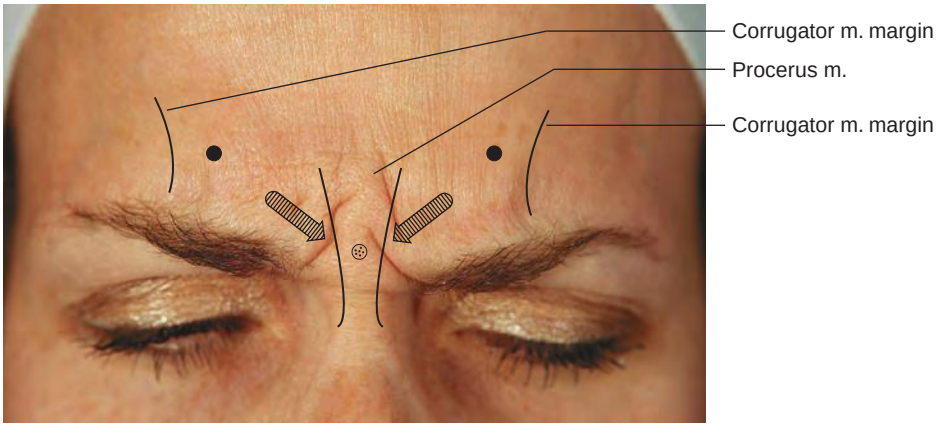


FIGURE 5 ● Overview of botulinum toxin injection points and doses for treatment of frown lines. Copyright R. Small, MD.

- Injecting lateral to the safety zone may involve the frontalis muscle, resulting in eyebrow ptosis (droopy eyebrow).

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the frown line safety zone (Fig. 4).
3. Locate the glabellar complex muscles and identify the lateral margins of the corrugators that lie within the safety zone by instructing the patient to contract the muscles, using one of the facial expressions above.
4. Identify the injection points (Fig. 5).
5. Ice for anesthesia (optional).
6. Prepare injection sites with alcohol and allow to dry.
7. The provider is positioned on the same side that is to be injected.
8. While the glabellar complex muscles are contracted, insert the needle 1–2 cm above the supraorbital ridge at the lateral margin of the corrugator muscle within the safety zone. Angle the needle towards the procerus muscle and insert to half the needle length (Fig. 6). Inject 2.5 units of OBTX with gentle, even plunger pressure as the needle is slowly withdrawn.

FIGURE 6 Lateral corrugator muscle botulinum toxin injection technique. Copyright R. Small, MD.

FIGURE 7 ● Medial corrugator muscle botulinum toxin injection technique. Copyright R. Small, MD.

9. The second injection point is placed deep in the body of the corrugator muscle, approximately 1 cm medial and inferior to the first injection point, closer to the eyebrow (Fig. 7). Angle the needle towards the procerus muscle and insert to the hub. Inject 5 units of OBTX as the needle is slowly withdrawn.
10. Repeat the above injections for the contralateral side of the face.
11. The third injection point is in the procerus muscle. Reposition to stand in front of the patient. While the glabellar complex muscles are contracted, approach inferiorly, direct the needle towards the glabella, insert to half the needle length, and inject 2.5–5 units of OBTX (Fig. 8).
12. Compress the injection sites firmly, directing pressure away from the eye.

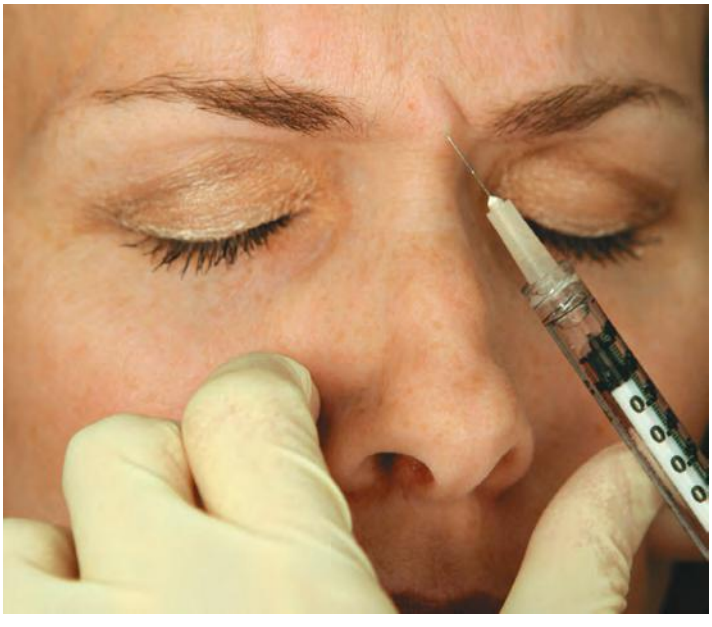


FIGURE 8 ● Procerus muscle botulinum toxin injection technique. Copyright R. Small, MD.

Results

- Reduction of dynamic frown lines is typically seen 3 days after botulinum toxin treatment, with maximal reduction at 1–2 weeks (Figs. 1A and 1B).

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns 3–4 months after botulinum toxin treatment.
- Subsequent frown line treatments with botulinum toxin may be performed when the glabellar complex muscles begin to contract, prior to lines returning to their pretreatment appearance.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of frown lines. If persistent frown lines are present, evaluate for the following common causes:

- **Glabellar muscle contraction.** Patients may have greater muscle mass than anticipated in the treatment area and additional botulinum toxin may be required to achieve desired results. Persistent muscle contraction can be corrected with a touch-up procedure using 5–10 units of OBTX, depending on the degree of glabellar muscle activity present.
- **Broad glabellar complex musculature.** If the lateral margins of the corrugators extend outside the safety zone lines these portions of the corrugators will not receive treatment. These untreated portions of the corrugators retain function and may cause medial frown lines. Treating these active lateral portions of the corrugators is not advisable because of the risks of blepharoptosis and eyebrow ptosis.
- **Frontalis muscle contraction with frowning.** In some patients, frontalis muscle contraction contributes to frown line formation and botulinum toxin treatment of the frontalis may be required to achieve optimal frown line reduction.
- **Static lines.** Patients with superficial static lines that do not have an underlying depression may require several consecutive botulinum toxin treatments for results to be seen. Patients with deep static lines that have an underlying depression often benefit from combining botulinum toxin with dermal fillers (see Combining Aesthetic Treatments below).

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts, Complications)
- Blepharoptosis (droopy eyelid)
- Eyebrow ptosis (droopy eyebrow)

Blepharoptosis is a temporary complication that can occur with botulinum toxin treatment of the glabellar complex muscles, particularly if toxin is injected too close to the supraorbital ridge at the lateral limbus line. Figure 9 shows a patient 3 weeks after botulinum toxin treatment (not by the author) to glabellar complex muscles with a profound right-sided blepharoptosis and mild right eyebrow ptosis. Blepharoptosis is typically seen as a 2–3-mm lowering of the affected eyelid, which is most marked at the end of the day with muscle fatigue. It is infrequent (1–5%), almost always unilateral, and usually resolves spontaneously within 6 weeks.

FIGURE 9 ● Right blepharoptosis. Copyright R. Small, MD.

Blepharoptosis results from migration of botulinum toxin through the orbital septum fascia to the levator palpebrae superioris muscle in the upper eyelid. Some of the levator palpebrae superioris muscle fibers pass up through the orbital septum to attach on the supraorbital ridge at the lateral limbus, and botulinum toxin can migrate into the levator palpebrae superioris at this point.

A

B

FIGURE 10 ● Deep static frown line before **(A)** and 1 month after **(B)** combination treatment with botulinum toxin in the glabellar complex and dermal filler in the frown line. Copyright R. Small, MD.

Blepharoptosis can be treated using over-the-counter alpha-adrenergic eye drops, such as naphazoline/pheniramine (e.g., Naphcon-A, one drop four times per day in the affected eye) or with prescription apraclonidine 0.5% solution (e.g., Iopidine, one to two drops three times per day). Both of these medications cause contraction of Mueller's muscle, an adrenergic levator muscle of the upper eyelid, resulting in elevation of the upper eyelid. Iopidine is reserved for refractory cases and should be used with caution as it can exacerbate or unmask underlying glaucoma.

- **Eyebrow ptosis** can result from relaxation of the lateral frontalis muscle, if botulinum toxin is injected lateral to the lateral limbus lines.

Combining Aesthetic Treatments and Maximizing Results

- **Deep static frown lines** associated with an underlying depression usually respond to a combination of botulinum toxin and dermal filler treatments. Figure 10 shows a deep static frown line before (Fig. 10A) and 1 month after (Fig. 10B) combination treatment with botulinum toxin in the glabellar complex and dermal filler treatment of the volume deficit.

Pricing

Charges for botulinum toxin treatment of frown lines range from $200–$500 per treatment or $10–$25 per unit of OBTX.

Chapter 2

Horizontal Forehead Lines

FIGURE 1 ● Horizontal forehead lines before **(A)** and 1 month after **(B)** botulinum toxin treatment of the frontalis muscle, with eyebrow elevation. Copyright R. Small, MD.

Dynamic horizontal forehead lines result from contraction of the frontalis muscle. Botulinum toxin treatment of the frontalis reduces forehead lines by inhibiting muscle contraction and smoothing the overlying skin. Frontalis muscle contraction also affects eyebrow shape and height, and certain botulinum toxin injection techniques in this area can result in lateral eyebrow elevation.

Indications

- Horizontal forehead lines
- Lateral eyebrow elevation

Anatomy

- **Wrinkles.** Horizontal forehead lines, or frontalis rhytids, course across the forehead (see Anatomy section, Figs. 4 and 5).
- **Eyebrow position and shape.** In women, high arched eyebrows are usually desired. In men, a flat eyebrow shape is usually preferable (see Eyebrow Lift chapter, Figs. 2A and 2B).
- **Muscles targeted.** Botulinum toxin horizontal forehead line treatment targets the broad frontalis muscle, which spans the forehead attaching laterally at the temporal fusion lines (see Anatomy section, Figs. 1 and 2).

FIGURE 2 ● Dermatochalasis of the upper eyelid is a contraindication to horizontal forehead line treatment. Copyright R. Small, MD.

- **Muscle functions.** Frontalis muscle fibers are oriented vertically and contraction of this levator muscle raises the eyebrows. The inferior 2-cm portion has the most significant effect on eyebrow height and shape (see Anatomy section, Fig. 7 and Table 1).

Patient Assessment

- **Dynamic** (with muscle contraction) and **static** (at rest) **horizontal forehead lines** are assessed.
- **Dynamic and static eyebrow shape** is assessed.
- **Eyebrow ptosis** (low-set, droopy eyebrows) and **upper eyelid dermatochalasis** (skin laxity or redundancy) are assessed with the frontalis muscle at rest. Figure 2 shows a patient with significant upper eyelid dermatochalasis. Patients with these conditions often have horizontal forehead lines as frontalis muscle contraction is compensatory to elevate low set eyebrows and reduce upper eyelid skin laxity. While treatment with botulinum toxin will improve forehead lines, it can worsen these other conditions and, when getting started with botulinum toxin injections, it is advisable to avoid treatment in patients with dermatochalasis and eyebrow ptosis. As experience is gained with injection placement and dosing in this area, providers may choose to treat patients with these more challenging presentations.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- "Raise your eyebrows up like you're surprised"
- "Lift up your forehead"

Treatment Goals

- Complete inhibition of the medial frontalis muscle to reduce horizontal forehead lines with partial inhibition of the lateral frontalis muscle in order to maintain a desirable eyebrow shape.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts section, Reconstitution Method)
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women: 15–22.5 units of OBTX
- Men: 20–25 units of OBTX

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Overview

- Place injections within the horizontal forehead line safety zone (Fig. 3). The safety zone is bounded by vertical lines at the lateral limbi and includes the area 2 cm above the supraorbital ridge to the hairline, as well as a small area lateral to the vertical lines approximately 2 cm inferior to the hairline. Confining treatment to the safety zone minimizes the risk of eyebrow ptosis and preserves eyebrow shape and height.

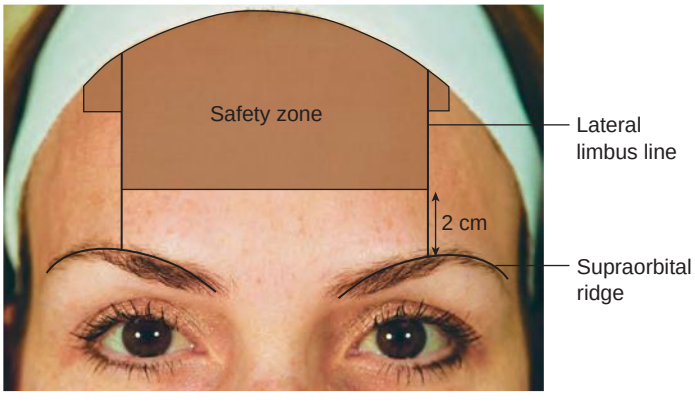


FIGURE 3 ● Horizontal forehead line safety zone for botulinum toxin treatments. Copyright R. Small, MD.