PSN

Aesthetic Department

CE 2.0 ANCC Contact Hours

Avoiding the "Danger Zones" When Injecting Neurotoxins

Connie Brennan, RN, CPSN, CANS, CPC

INTRODUCTION

Aesthetic medicine is a respected and well-accepted field of medicine; it is characterized by minimally invasive techniques and services that utilize injectables, lasers, and other procedures, which require no surgery or general anesthesia. The goals of aesthetic medicine are to maintain a natural and healthy appearance and to assist clients in looking their best. Advancements in aesthetic techniques and technology allow these procedures to be safely and effectively conducted in an office by certified, experienced, and skilled aesthetic medical providers.

> Today, more than any prior generation, our current consensual beauty ideal of both face and body, male and female is generated to a large extent by our exposure to omnipresent advertising by the cosmetic, fashion, and media industries, and most recently by some of our colleagues. (Koblenzer, 2011)

Many regard aesthetic medical treatments as a normal part of their health and beauty regime.

> Our culture is a culture of youth, and as the population ages, and as economic conditions deteriorate, men and women are tending to work longer and to retire at a greater age, thus increasing competition in the workplace. In order to remain competitive, men like women are struggling to look younger, healthier, more physically active, and more consonant with the current ideal of masculine good looks. Thus both men and women are seeking cosmetic improvement in greater numbers than ever before. (Koblenzer, 2011)

This field has seen a 13% increase since 2012 with a total of 9.5 million nonsurgical procedures (ASAPS, 2013). According to the American Society of Aesthetic Plastic Surgeons (ASAPS), the top five nonsurgical cosmetic procedures in 2013 were the following: treatments utilizing Botulinum toxin type A (3,766,148 procedures, up 15.6%), hyaluronic acid dermal fillers (1,872,172 procedures, up 31.5%), laser hair removal (901,571 procedures, up 2%), microdermabrasion (479,865 procedures, down 3.8%), and photorejuvenation (456,613 procedures, up 35.3%) (ASAPS, 2013).

Botulinum neurotoxins, the top cosmetic procedure performed today (ASAPS, 2013), are proteins synthesized by *clostridial* bacteria—isolated, purified, and formulated into specific products in a complex series of steps that are strictly regulated by the governmental agencies in most countries where the products are approved. Neurotoxins are regulated by the Food and Drug Administration (FDA) as biologics. Biologics are required to demonstrate efficacy, safety, and reproducibility in their manufacture before being granted a formal indication. There are currently three commercially available neurotoxins (i.e., Botulinum Toxin Type A) available in the United States (Table 1).

Every aesthetic injectable product has its limitations, and every aging face is unique. Knowledge of how the skin aging influences the position of vulnerable muscle locations, the specific techniques used to safely administer each neurotoxin, what specific "danger zones" to avoid and what to do if complications occur, will ensure that the aesthetic provider is well informed and prepared to safely deliver optimal clinical outcomes.

FACIAL AND MUSCLE ANATOMY

Complete understanding of the anatomical locations of vulnerable muscle structures, as well as how facial aging or previous surgical alterations may change the structure orientation, will aid the aesthetic provider in identifying critical "danger zones" to avoid during the neurotoxin injection process (Seckel, 1994). As descending and thinning skin may make it easier to see these important structures, prior facial surgeries can have the opposite impact,

Connie Brennan, RN, CPSN, CANS, CPC, is currently the Director of Medical Aesthetic Education at the Center for Advanced Aesthetics at Life Time Fitness and President/Founder of Aesthetic Enhancement Solutions, LLC. Connie is a licensed registered nurse in 10 states and has earned advanced certifications in aesthetic injectables, laser resurfacing, skin care, sclerotherapy, and perioperative nursing over the course of 26 years in aesthetic medicine. Connie has worked as an expert alongside the ASPSN task force in creating the first Certified Aesthetic Nurse Specialist (CANS) examination.

The author is a consultant to Allergan, Inc., Galderma Laboratories, L. P., and Nordson Micromedics, Inc., but has not received any funding to write or publish this article.

Address correspondence to Connie Brennan, RN, CPSN, CANS, CPC, 5905 Troy Lane, N, Plymouth, MN 55446 (e-mail: info@conniebrennanRN.com).

DOI: 10.1097/PSN.0000000000000064

TABLE 1 Neurotoxins (i.e., Botulinum Toxin Type A) Available for Cosmetic Use in the United States

Name	Nonproprietary Name	Year of Glabellar Line Indication	Year of Other Facial Indication(s)
Botox Cosmetic[a]	Onabotulinumtoxin A	2002	2013 (crow's feet)
Dysport[b]	Abobotulinumtoxin A	2009	
Xeomin[c]	Incobotulinumtoxin A	2011	

[a]Allergan, Inc., Irvine, CA.
[b]Galderma Laboratories, L.P., Ft., Worth, TX.
[c]Merz Pharmaceuticals, LLC, Greensboro, NC.

making the location of these anatomical "danger zones" more difficult to assess. It is very important to take a complete medical history of all prior facial surgeries during the initial aesthetic consultation (Brennan, 2012).

Intimate knowledge of the anatomy of muscles is just as crucial as their relative position on the face. For example, the *origin* of a muscle is the bone, typically proximal, which has greater mass and is more stable during a contraction than a muscle's insertion (Dorland, 2003). The *insertion* of a muscle is the structure it attaches to and tends to be moved by the contraction of the muscle (Dorland, 2003). Most of the muscles of facial expression are not attached to bone—rather they have soft tissue attachments. They tend not to move the body, but rather to move the skin and related structures to facilitate communication (Spencer, 2011). The muscles of facial expression are connected to the overlying skin through the layer known as the superficial muscular aponeurotic system (SMAS). When the underlying muscle contracts, the overlying skin moves with it. The muscles of mastication, such as the masseter and temporalis, have boney attachments and function to move the jaw in a way similar to the muscles elsewhere on the body (Spencer, 2011).

Since the optimal chemodenervation effect with a neurotoxin occurs when the belly of muscle is the target, knowing the origin and insertion point will increase the probability of success of each neurotoxin injection. Similarly, knowledge of the relative thickness of the muscle is critical so the depth of the muscle belly can be approximated.

Remember to think three dimensionally before you inject—the specific location of each facial muscle, the insertion and origin of the muscle being targeted, as well as the relative thickness of each muscle, so accurate triangulation of the target muscle is accomplished with each neurotoxin injection. Injection site accuracy and precision during the injection process will decrease the potential of adverse events.

"DANGER ZONES" ASSOCIATED WITH NEUROTOXIN COMPLICATIONS

Certain regions of the face are at a higher risk for complications due to the structures that lie beneath or surrounding the intended muscles for injection (e.g., deeper, overlapping, or inserting muscles). Adverse events of longer duration that can be serious and are technique-dependent are the following: blepharoptosis, brow ptosis, diplopia, blurred vision or diminished visual acuity, diminished tearing and xerophthalmia with or without keratitis, ectropion (potentially leads to xerophthalmia), lagophthalmus (potentially leads to exposure keratitis), dysphagia, dysarthria, and dysphonia (Benedetto, 2011).

Figures 1a and 1b identify the "danger zones" to be aware of during neurotoxin injections. Key muscles/anatomical locations to avoid (and associated presentation) include the following: frontalis (mid brow ptosis), levator palpebrae (lid ptosis), levator labii superioris alaeque nasi (lip ptosis), zygomaticus (lip ptosis), orbicularis oculi (diplopia), depressor labii inferioris, mentalis, and depressor anguli oris (DAO; lip asymmetry).

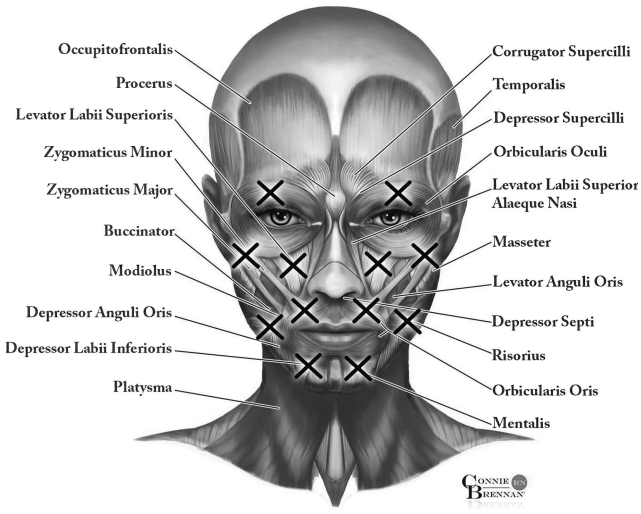
Practical considerations for the aesthetic provider to remember as they prepare to inject neurotoxin into these key muscles/anatomical locations include the following:

Frontalis:

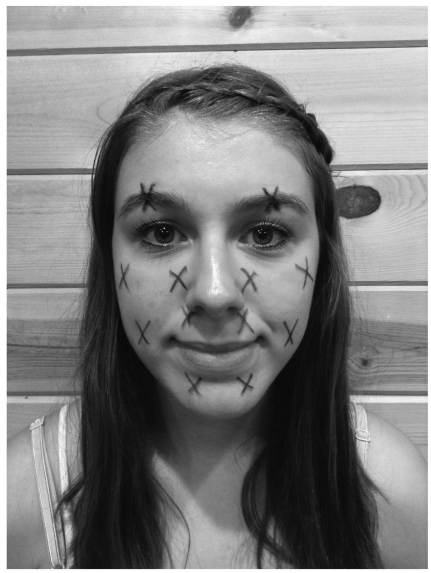
- Considered an elevator muscle of the upper face
- Associated with mid brow ptosis
- Caution must be used to not weaken the frontalis too close to the eyebrows. As a general principle, injections should always be at least 1 cm above the eyebrow, so muscle fibers of the frontalis will remain functional and hold the eyebrows up. (Spencer, 2011)

Levator palpebrae:

- Associated with lid ptosis
- Occurs when diffusion of a significant amount of toxin to the levator palpebrae during glabellar injections
- Instruct the patient to contract their muscle, hold, or "gently pinch" the corrugator supercilii muscle with your thumb and finger and inject 1 cm above the orbital rim. Place the thumb of the noninjecting hand on the superior orbital rim to avoid a potential diffusion of the neurotoxin into the levator palpebral muscle.



(a)



(b)

FIGURE 1. (a). The facial muscles and "danger zones" (black Xs). (b) Model with "danger zones" (black Xs) identified. (Used with permission.)

Levator labii superioris alaeque nasi:

- Associated with lip ptosis, asymmetry, speaking difficulty
- Injection points on nasalis during "bunny line" injections should be superficial and in a wheal formation. Do not inject laterally down the nasal sidewalls.

Zygomaticus:

- Associated with lip ptosis, asymmetry, smile impairment (due to imbalance of the lip elevators and cheek ptosis)
- Injection points should remain in the orbicularis oculi for crow's feet injections; be careful not to massage lower injection point in case of diffusion into the zygomaticus.

Depressor labii inferioris, DAO, and mentalis:

- Associated with asymmetry, dysfunctional mouth, ptosis of the lower lip, and difficulties with eating or drinking
- Avoid being too high, too close to the corner of the mouth, too medial, or too close to the lower lip with injection points

TYPICAL PRESENTATIONS OF NEUROTOXIN-RELATED ADVERSE EVENTS

Within 1–3 days postneurotoxin treatment session, the client may become aware of an adverse event (AE) associated with their neurotoxin injections and they will quickly alert the aesthetic provider that "something is not right." The typical presentations of neurotoxin AEs, as a function of the anatomical locations, include the following:

Mid brow ptosis:

- Feeling of heaviness
- Looking tired
- Difficulty putting eye make up on

Eyelid ptosis:

- Eyelid(s) feel(s) heavy or may not open at all
- Iris of eye partially covered

Lip drop:

- "Crooked" smile
- Upper teeth less visible
- Potential functional impairment of lip—sipping may be difficult
- Looks like client "had a stroke"
- Difficulty with articulation

Lower lip asymmetry:

- "Crooked" smile
- Lower lip looks uneven
- Sipping through a straw may lead to spills/drooling
- Difficulty with speech and suction

WHAT TO DO IN THE EVENT OF AN AE ASSOCIATED WITH A NEUROTOXIN

The gradual appearance of ptosis postinjection is the most frequent presentation of a neurotoxin injection AE. The practical options that the aesthetic provider has in the event of a neurotoxin AE are limited and include the following:

- Let the neurotoxin wear away—typically 2–3 months for a neurotoxin's effect to diminish

- Adjust adjacent musculature to attain symmetry or treat the opposing musculature if possible, especially in the case of ptosis

Many experts anecdotally state that aesthetic providers just learning to perform neurotoxin injections in the upper face have approximately a 4% incidence of inducing ptosis, which with practice falls to 0.5% (Bauman, 2009).

PRACTICAL STEPS TO BE MINDFUL OF WHEN INJECTING NEUROTOXINS IN OR NEAR "DANGER ZONES"

Practical steps to be mindful of when injecting near "danger zones" include the following:

- In the upper face, keep injection at least 1 cm above the mid brow and orbital rim to avoid brow ptosis.
- In the orbicularis oculi (i.e., crow's feet area), keep the injection approximately 1 cm lateral to the orbital rim to avoid unwanted weakening of the muscles of ocular motion, which are inside the orbital rim (Spencer, 2011).
- If the medial palpebral orbicularis oculi is weakened as the result of the unintended diffusion of the neurotoxin, a diminution in the action of the lacrimal pump can occur, causing epiphora (excessive tearing). Diplopia also can result if the medial rectus is weakened by a neurotoxin (Benedetto, 2011).
- In the DAO, keep the injection point 1 cm away from the corner of the mouth.
- Be attentive to appropriate placement.
- Be aware of the dosage and dilute the neurotoxin appropriately.
- Avoid massaging areas that are prone to diffusion of the neurotoxin.
- Botulinum toxin-induced lid ptosis can manifest within 48 hr or as late as a week after injections, and can last for weeks. It typically resolves within 2–6 weeks. Apraclonidine 0.5% (Iopidine, Alcon Labs, Fort Worth, TX), naphazoline (Naphcon-A, Alcon Labs), and phenylephrine 2.5% (Mydfrin 2.5%, Alcon Labs) are alpha-adrenergic agonist ophthalmic eye drops that may be used to correct eyelid ptosis as a result of a botulinum toxin injection. The alpha-adrenergic agonist effect stimulates Müller's muscle to help elevate the ptotic eyelid. Typical dosage is two drops, two to three times a day, until the ptosis is resolved (Wesley & Jones, 2013).

Vigorous massage to the area after the injection of a neurotoxin can cause it to spread and diffuse beyond the targeted area and produce the same untoward adverse results, even if the dosing is appropriate and the injection technique is flawless (Benedetto, 2011).

CONCLUSIONS

It is imperative that aesthetic providers injecting neurotoxins carefully consider the location of each injection, especially in the "danger zones." Sound knowledge of facial and muscle anatomy, especially the key areas that are prone to neurotoxin diffusion, and knowing how aging affects the location of these anatomical structures, is half of the battle in preventing eyelid ptosis, brow ptosis, and facial asymmetry with neurotoxins. Knowledge of the steps necessary to minimize eyelid ptosis and facial asymmetry will ensure that the aesthetic provider is adequately prepared to quickly respond if these rare but noticeable adverse events occur. And finally, consistently exercising practical "neurotoxin injection tips," whenever an aesthetic provider injects a neurotoxin in close proximity to a "danger zone," will ensure client safety and satisfaction.

REFERENCES

ASAPS. (2013). *2013 cosmetic surgery national data bank statistics.* Retrieved September 23, 2014, from https://s3.amazonaws.com/asaps/assets/stats/2013/ASAPS-2013-Stats.pdf

Bauman, L. (2009). In Bauman, L. (Ed.), *Cosmetic Dermatology.* (2nd ed., p. 188). New York: McGraw Hill.

Benedetto, A. (2011). Cosmetic uses of botulinum toxin a in the mid face and appendix 5. In Benedetto, A. (Ed.), *Botulinum toxins in clinical aesthetic practice* (2nd ed., pp. 101–139, 276). London: Informa Healthcare.

Brennan, C. (2012). Art of the aesthetic consultation. *Plastic Surgical Nursing, 32*(1), 12–16; quiz 17–18.

Wesley, N. & Jones, D. (2013). Glabella. In Carruthers, A. & Carruthers, J. (Eds.), *Botulinum Toxin.* (3rd ed., p. 83). Philadelphia, PA: Saunders Elsevier.

Dorland, W. (2003). *Dorland's illustrated medical dictionary.* 30th ed. Philadelphia, PA: W. B. Saunders Company.

Koblenzer, C. (2011). Prologue: The search for beauty, historical, cultural, and psychodynamic trends. In Benedetto, A. (Ed.), *Botulinum toxins in clinical aesthetic practice* (2nd ed., p. xi). London: Informa Healthcare.

Seckel, B. (1994). *Facial danger zones—avoiding nerve injury in facial plastic surgery.* St. Louis: Quality Medical Publishing, Inc.

Spencer, J. (2011). Facial anatomy and the use of botulinum toxin. In Benedetto, A. (Ed.), *Botulinum toxins in clinical aesthetic practice* (2nd ed., pp. 15–23). London: Informa Healthcare.