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Aesthetic Department

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Avoiding the "Danger Zones" When Injecting Dermal Fillers and Volume Enhancers

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Aesthetic providers need to be aware of the serious potential complications that can result from occlusion of specific facial arterial and venous structures. This article focuses on the anatomical "danger zones" to avoid during dermal filler and volume enhancer injection procedures. Clinical pearls are provided on how to avoid these "danger zones" and what to do if a rare complication (e.g., skin necrosis or vision loss) does occur.

INTRODUCTION

Aesthetic medicine is a respected and well-accepted field of medicine characterized by minimally invasive techniques and services that utilize injectables, lasers, and other procedures that 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, many regard aesthetic medical treatments as a normal part of their health and beauty regimen. This field has seen a 250% increase in nonsurgical cosmetic procedures since 1997 (American Society of Aesthetic Plastic Surgeons [ASAPS], 2012). According to the ASAPS, the top five nonsurgical cosmetic procedures in 2012 were treatments utilizing Botulinum Toxin Type A, hyaluronic acid (HA) dermal fillers, laser hair removal, microdermabrasion, and chemical peel (ASAPS, 2012). There are currently more than 200 dermal fillers and volume enhancer products available internationally (Glogau, 2012). In the United States, the Food and Drug Administration regulates dermal fillers and volume enhancers as medical devices. Medical devices are required to demonstrate efficacy, safety, and reproducibility in their manufacture before being granted a formal indication. Some parts of the world do not regulate these products as rigorously for market introduction as is required in the United States. There are several different classes of dermal fillers and volume enhancing products. The four chemical/polymeric classes of dermal fillers and volume enhancers commercially available in the United States are HA, calcium hydroxylapatite, poly-L-lactic acid (PLLA), and polymethyl methacrylate (Brennan, 2013). Every aesthetic injectable product has its limitations, and every aging face is unique. Knowing how the skin aging influences the position of arteries, the specific techniques of how to safely administer each dermal filler and volume enhancer, what specific "danger zones" to avoid, and what to do if arterial/venous occlusion occurs, will ensure that the aesthetic provider is well informed and prepared to safely deliver optimal clinical outcomes.

FACIAL ANATOMY

A complete understanding of the anatomical locations of vasculature structures, as well as how facial aging or previous surgical alterations may change the structural orientation, will aid the aesthetic provider in identifying critical "danger zones" to avoid during the dermal filler/volume enhancer injection process. Descending and thinning skin may make it easier to see these important structures. Surgeries can impact the location of these anatomical "danger zones" as well. It is very important to take inventory of prior facial surgeries and the history and location of other soft tissue fillers and volume enhancers during the initial aesthetic consultation (Brennan, 2012). Prior surgeries and dermal filler/volume enhancer injections can alter the client's baseline anatomy and result in unpredictable vascular events (Gilbert, Hui, Meehan, & Waldorf, 2012).

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ANATOMICAL LOCATIONS OF CRITICAL VESSELS—THE "DANGER ZONES"

Certain regions of the face are at a higher risk for complications due to the structures that lie beneath the skin (e.g., vessels or nerves). The most severe potential complication associated with the use of dermal fillers and volume enhancers is arterial/venous occlusion, which leads to ischemia, with subsequent necrosis of the skin and/or vision loss. *These events are considered a medical emergency and must be dealt with immediately.* Arterial occlusion can lead to ulceration, scarring, and even vision loss due to occlusion of the ophthalmic artery (presumably via retrograde flow from the supratrochlear, supraorbital, and dorsal nasal artery; Carle, Roe, Novack, & Boyer, 2014). Arterial/venous occlusion results from direct intra-arterial injection of product, from vascular injury, or by external compression of the blood supply by surrounding filler/volume enhancer material or swelling. Arterial/venous occlusion and necrosis are generally recognized as rare.

Figures 1(a) and 1(b) identify the "danger zones" to be aware of during dermal filler and volume enhancer injections. Key vessels to avoid in the cheeks, glabella, nasal ala, and temples include the following (Gilbert et al., 2012):

Cheeks

- Facial artery
- Transverse facial artery
- Buccal branch of the maxillary artery
- Infra-orbital artery
- Zygomatic branch of the lacrimal artery

Glabella (area of highest risk because the vessels are small and do not have a good source of collateral circulation; Glaisch, Cohen, & Goldberg, 2006).

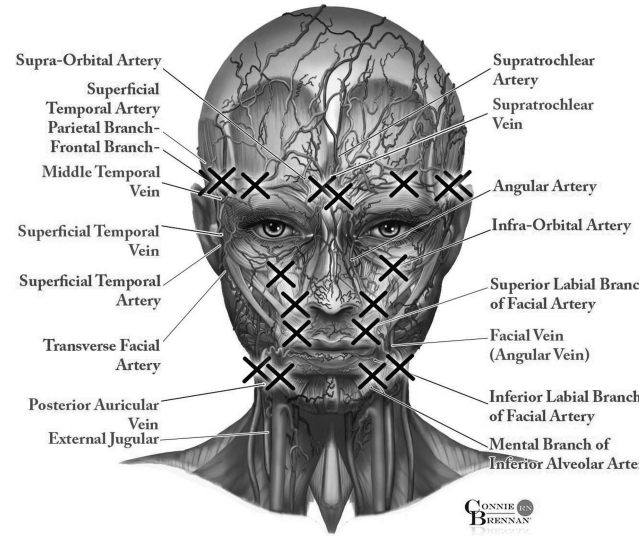
- Supratroclear artery
- Supraorbital artery

Nasal ala

- Dorsal nasal artery
- Angular artery (extension of the facial artery) provides blood to medial cheek, nasal ala and sidewall, and dorsum of the nose. Care should be exercised when injecting near the alar grove because excessive compression with large volumes of material or direct injection into the vessel can lead to nasal ala, nasal tip, nasolabial fold, and upper lip necrosis (Emer & Waldorf, 2011).

Peri-oral

- Superior labial artery
- Inferior labial artery



(a)

(b)

FIGURE 1. (a) The facial arterial/venous system and "danger zones" (black Xs). (b) Model with "danger zones" (black Xs) identified.

Temples

- Superficial temporal artery
- Partial branch of the superficial temporal artery
- Frontal branch of the superficial temporal artery

TYPICAL ASSOCIATED SYMPTOMS OF IMPENDING NECROSIS

The immediate appearance of discoloration postinjection is the typical presentation of vascular ischemia after a filler injection (Hirsch, Lupo, Cohen, & Duffy, 2007). Knowing what clinical symptoms to watch out for will give the aesthetic provider a head start in mitigating skin necrosis should arterial/venous occlusion unfortunately occur. The "tell-tale" signs of arterial/venous occlusion that could lead to skin necrosis include the following:

- Skin blanching
- Dusky (i.e., grayish blue) skin
- Ecchymosis
- Reticulated erythema
- Intense pain in the treated area

TYPICAL ASSOCIATED SYMPTOMS OF IMPENDING VISION LOSS

Approximately 60 cases of retinal artery occlusion have been reported since 1988, and of these, 27 cases have been reported since 2012 (Yanyun et al., 2014). This unfortunate statistic coincides with the significant increase in aesthetic injections in recent years. Symptoms associated with impending vision loss include the following:

- Ocular pain in the affected eye immediately after injection
- Diminished vision
- Ptosis
- Headache
- Dizziness
- Nausea
- Ophthalmoplegia (i.e., extra-ocular muscle palsy)

WHAT TO DO IN THE EVENT OF ARTERIAL/VENOUS OCCLUSION AND IMPENDING NECROSIS?

In the event of arterial/venous occlusion and impending necrosis, the goal is to quickly promote increased blood flow to the affected area. Treatment options include the following (Carruthers, Glogau, Blitzer, & The Facial Aesthetics Consensus Group Faculty, 2008; Cohen, 2008; and Schanz, Shippert, Ulmer, Rassner, & Fierlbeck, 2002):

- No ice
- Warm compresses (immediately)
- Massage or tap the area to facilitate vasodilation and dispersion of material
- Aspirin (80 mg)
- Topical nitro paste (vasodilator—Nitro-BID; Fougera, Melville, NY)
- Hyaluronidase (only if using HA)
- Corticosteroids (anti-inflammatory/immunomodulator—Medrol Dose Pack; Pfizer Pharmaceuticals, New York, NY)
- If ischemia is not reversed and necrosis is unresponsive, contact a plastic or reconstructive surgeon—subcutaneous injections of low-molecular-weight heparin may be helpful
- Antibiotics
- Antivirals (if impending necrosis is around the mouth)
- Hyperbaric oxygen for 1 month may be required
- Multiple laser treatments at 3-month postinjection intervals may be necessary

WHAT TO DO IN THE EVENT OF IMPENDING VISION LOSS?

Vision loss is typically irreversible and potentially devastating. The best strategy for prevention is avoiding the "danger zones," especially in the glabellar, forehead, and upper nasal labial fold areas. *If vision loss is suspected, the client must make an emergency visit to an ophthalmologist.* Maintain area as if vascular compromise is the issue until ophthalmologist is available.

PRACTICAL TIPS WHEN INJECTING NEAR "DANGER ZONES"

While rare, vascular occlusion and subsequent necrosis and/or vision loss can occur after injecting a dermal filler or volume enhancer; when it does, prompt medical attention is critical to prevent the potential of scarring. Sudden pain and/or blanching are warning signs of vascular occlusion, ischemia, and impending necrosis. It can also present as painless, patchy erythema, or an expanding violaceous reticulated patch (Emer & Waldorf, 2011). Actions that decrease the potential of complications of this nature from occurring include the following:

- Aspirate before injecting
- Inject in a retrograde fashion
- Inject small aliquots of filler/volumizer at a time (too fast, too much, or too deep = trouble); a good rate to consider is less than 0.3 ml/min
- Avoid using anesthesia near a vascular bundle that may induce vascular spasm, such as those containing epinephrine; also avoid using epinephrine so that the cause of blanching can be determined quickly (Emer & Waldorf, 2011)
- Use the smallest gauge needle possible to slow the flow of product
- Pinch/tent the skin to provide more space between superficial branches of main arteries and to move away from underlying vasculature (Emer & Waldorf, 2011)

- Use a reversible product—HA (i.e., hyaluronidase will quickly break down HA fillers and volume enhancers; Brennan, 2013); a reversible product will provide a larger margin of error
- Manually occlude the origin of important vessels with the nondominant finger (Emer & Waldorf, 2011)
- If using a nonreversible product (e.g., calcium hydroxylapatite, poly-L-lactic acid, and polymethyl methacrylate), be mindful of the viscosity as one will have fewer options should the product increase pressure around a vessel; this can be mitigated by using smaller aliquots of nonreversible product, and the viscosity can be lowered by premixing with lidocaine solution or extruding through a small-gauge needle
- Inject in a more medial and superficial plane (Emer & Waldorf, 2011)
- Assess pain during the injection
- Keep a watchful eye on the area of injection (i.e., look for blanching)

CONCLUSION

It is imperative that aesthetic providers injecting dermal fillers and volume enhancers carefully consider the location of the injection, especially in the "danger zones." Sound knowledge of facial anatomy, especially the key arterial and venous structures that are vulnerable to occlusion, and knowing how aging affects the location of these anatomical structures, is half the battle in preventing necrosis and potential vision loss with dermal fillers and volume enhancers. Knowledge of the "tell-tale" signs of impending necrosis and vision loss, and the steps necessary to minimize damage that can occur, will ensure that the aesthetic provider is adequately prepared to quickly respond if these rare and potentially devastating adverse events occur. And finally, consistently exercising practical "arterial/venous occlusion prevention tips" whenever an aesthetic provider injects a dermal filler or volume enhancer in close proximity to a "danger zone" will ensure client safety and satisfaction.

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