WEBINAR

Facial Filler Danger Zones: Ultrasound Protocol for Safe Injections in the Chin, Forehead, and Marionette Lines

November 2022

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Your Host

Shelley Guenther, CRGS, CRCS

Clinical Marketing Manager

clarius Ultrasound Anywhere

Facial Vascular Danger Zones for Filler Injections

Review > Dermatol Ther. 2020 Nov;33(6):e14285. doi: 10.1111/dth.14285. Epub 2020 Sep 18.

Facial vascular danger zones for filler injections

Uwe Wollina [1], Alberto Goldman [2]

Affiliations + expand

PMID: 32902108 DOI: 10.1111/dth.14285

Abstract

Filler injections are widely used for facial rejuvenation. The technique is safe as long as some precautions are respected. In this review we will focus on vascular anatomy in the upper, middle and lower face. We performed a PUBMED research on "facial danger zones" and "filler injections" and "hyaluronic acid" and "vascular compromise" with a focus on the last decade. This is of particular importance since vascular compromise is one of the most severe adverse events possibly leading to tissue necrosis and in rare cases to loss of vision. We describe the danger zones in these esthetic units and provide recommendations how to avoid severe adverse events. We report on temporal region, glabella and nose, infraorbital region, nasolabial folds and nasal triangle, lips, and chin. Although we focus on hyaluronic acid fillers, our recommendations will also scope other filler types and autologous adipose tissue transfer. We also take a closer look on innovations to improve the safety of facial filler injections. Facial rejuvenation with hyaluronic acid fillers is a popular method. It is safe if the facial danger zones are recognized and proper injection techniques and fillers are used.

Keywords: danger zones; facial rejuvenation; facial vasculature; filler injections; hyaluronidase.

Similar articles

Facial Danger Zones: Techniques to Maximize Safety during Soft-Tissue Filler Injections.
Scheuer JF 3rd, Sieber DA, Pezeshk RA, Gassman AA, Campbell CF, Rohrich RJ.
...2017 May;139(5):1103-1108. doi: 10.1097/PRS.0000000000003309.

"Facial rejuvenation with HA fillers is a popular method. It is safe if the facial danger zones are recognized and proper injection techniques are used."

Wollina U, Goldman A. Facial vascular danger zones for filler injections. Dermatol Ther. 2020 Nov;33(6):e14285. doi: 10.1111/dth.14285. Epub 2020 Sep 18. PMID: 32902108.

Complications of Nonpermanent Facial Fillers: A Systematic Review

"The most severe complications were observed in treatments of nose, glabella, and forehead."

> Plast Reconstr Surg Glob Open. 2021 Oct 22;9(10):e3851.
doi: 10.1097/GOX.0000000000003851. eCollection 2021 Oct.

Complications of Nonpermanent Facial Fillers: A Systematic Review

Carlo M Oranges [1], Davide Brucato [2 3], Dirk J Schaefer [4], Daniel F Kalbermatten [1], Yves Harder [2 3]

Affiliations + expand

PMID: 34703713 PMCID: PMC8542164 DOI: 10.1097/GOX.0000000000003851

Free PMC article

Abstract

Background: A variety of complications after injection of nonpermanent fillers for facial rejuvenation have been reported so far. However, to date, the overall complication rate is still a matter of debate. The aim of this study was to perform a systematic review of literature to assess the type and severity of associated complications following injections in different anatomical regions of the face.

Methods: The entire PubMed/Medline database was screened to identify case reports and clinical studies describing complications that have occurred after injection of nonpermanent fillers in the face. These complications have been reviewed and analyzed according to their occurrence in different anatomical regions of the face.

Results: Forty-six articles including a total of 164 patients reported on a total of 436 complications during the time period between January 2003 and February 2020. The majority of the complications were reported after injections to the nose and the nasolabial fold (n = 230), the forehead and the eyebrows (n = 53), and the glabellar region (n = 36). Out of 436 complications, 163 have been classified as severe or permanent including skin necrosis (n = 46), loss of vision (n = 35), or encephalitis (n = 1), whereas 273 complications were classified as mild or transient, such as local edema (n = 74), skin erythema (n = 69), and filler migration (n = 2). The most severe complications were observed in treatments of nose, glabella, and forehead.

Conclusions: Nonpermanent facial fillers are associated with rare but potentially severe complications. Severity and impact of complications depend on the and eventually require profound knowledge of facial

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Oranges CM, Brucato D, Schaefer DJ, Kalbermatten DF, Harder Y. Complications of Nonpermanent Facial Fillers: A Systematic Review. Plast Reconstr Surg Glob Open. 2021 Oct 22;9(10):e3851. doi: 10.1097/GOX.0000000000003851. PMID: 34703713; PMCID: PMC8542164.

Description of a safe doppler ultrasound-guided technique for hyaluronic acid filler in the face

J Cosmet Dermatol. 2022 Jul;21(7):2783-2787. doi: 10.1111/jocd.14492. Epub 2021 Sep 29.

Description of a safe doppler ultrasound-guided technique for hyaluronic acid filler in the face-A method to avoid adverse vascular events

Paula Stéfany Rocha [1], Thais Almeida Guerra [1], Danilo Augusto Teixeira [1]

Affiliations + expand

PMID: 34587360 DOI: 10.1111/jocd.14492

Abstract

Background: Knowledge of facial anatomy is essential for professionals intending to inject hyaluronic acid (HA) into that region, but due to the considerable anatomical variations in region, it does not guarantee the complete safety of the procedure. Similarly, procedures widely disseminated among professionals, such as aspiration and the use of cannulas, do not ensure total safety against vascular occlusion events caused by the filler.

Objectives: This article describes a technique for injecting hyaluronic acid into the face guided by Doppler ultrasonography (DUS) in order to ensure greater safety against vascular occlusion events secondary to the procedure.

Methods: We describe a Doppler ultrasound-guided filling technique, with an 18 MHZ transducer, consisting of three steps: arterial mapping, real-time ultrasound-guided filling, and assessing the perfusion.

Results: The described technique was performed in 480 patients and can be adopted in the routine of professionals who inject hyaluronic acid, especially in areas at high risk for vascular events. Its use results in greater safety against vascular occlusion events secondary to the procedure, without the need for prior aspiration. We conclude that there is a local vasodilation right after the filling that makes it difficult the possibility of extrinsic compression exerted by the filler on the vessel. Furthermore, the product moves to deep planes even with the bevel facing up (toward the epidermis).

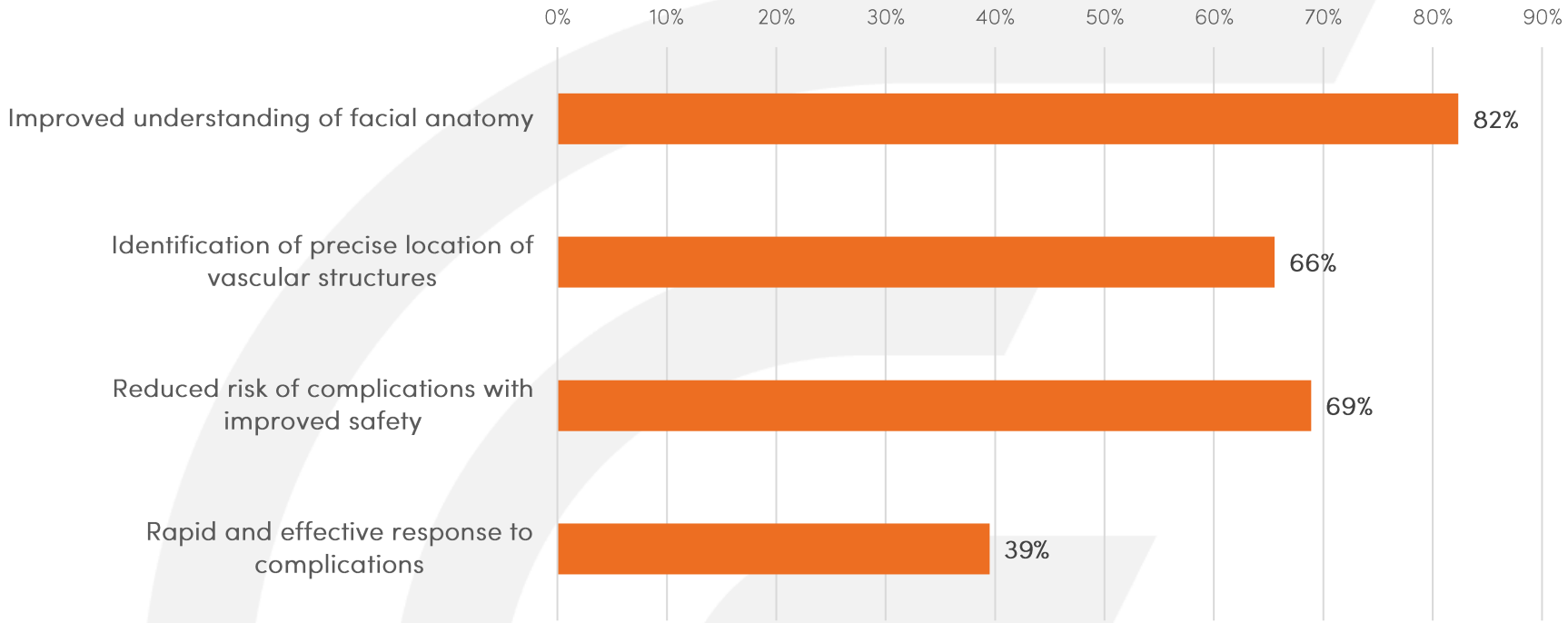
...that in the future the use of Doppler ultrasound-guided filling technique ...form HA injection, to both ensure patient

"We believe that in the future the use of Doppler ultrasound-guided filling technique will be mandatory for professionals who intend to perform HA injection, to both ensure patient safety and provide legal protection for the professional."

Rocha PS, Guerra TA, Teixeira DA. Description of a safe doppler ultrasound-guided technique for hyaluronic acid filler in the face-A method to avoid adverse vascular events. J Cosmet Dermatol. 2022 Jul;21(7):2783-2787. doi: 10.1111/jocd.14492. Epub 2021 Sep 29. PMID: 34587360.

Poll

What key benefits do you see ultrasound bringing to facial aesthetics?



Your Expert Guest Speaker

Dr. Ines Verner, MD

Aesthetic Dermatology &
Regenerative Medicine

clarius Ultrasound Anywhere

Facial Filler Danger Zones

US Protocol for Safe Injection to Chin, Forehead & Marionette lines

Dr Ines Verner

Verner Clinic
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Diagnostic Ultrasound

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DC-90

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Diagnostic Ultrasound 2022

L20 HD
Ultrasound Technology - Clarius

Hand held

Wireless

Ipad, phone

Unlimited Cloud Storage

Frequency: 8-20 MHz
Max Depth: 4 cm

Visualize vessels up to 0.5mm diameter

ASAPS 2020 Statistics

In total 13.3 million cosmetic minimally invasive procedures

- **Botulinum toxin type A (4.4 million procedures)**
- **Soft tissue fillers (3.4 million procedures) very common ➔**

More complications:

- **Delayed Inflammatory Reactions (DIR)**
- **Vascular Occlusion due to intravascular filler injection ➔**
  - **Tissue necrosis ulceration & scarring**
  - **Vision loss**
- **Anatomy - Variability**
  - **Cadaver courses**
  - **Live by Ultrasound**

Diagnostic US to Prevent Vascular Complications

- Visualize – skin, facia, fat pads, muscles, vessels
- Visualize previous filler
- Map blood vessels in danger zones before filler injection
- Prevent intravascular filler injection & its complications
- Visualize a filler complication
- Assist in complication treatment and follow up

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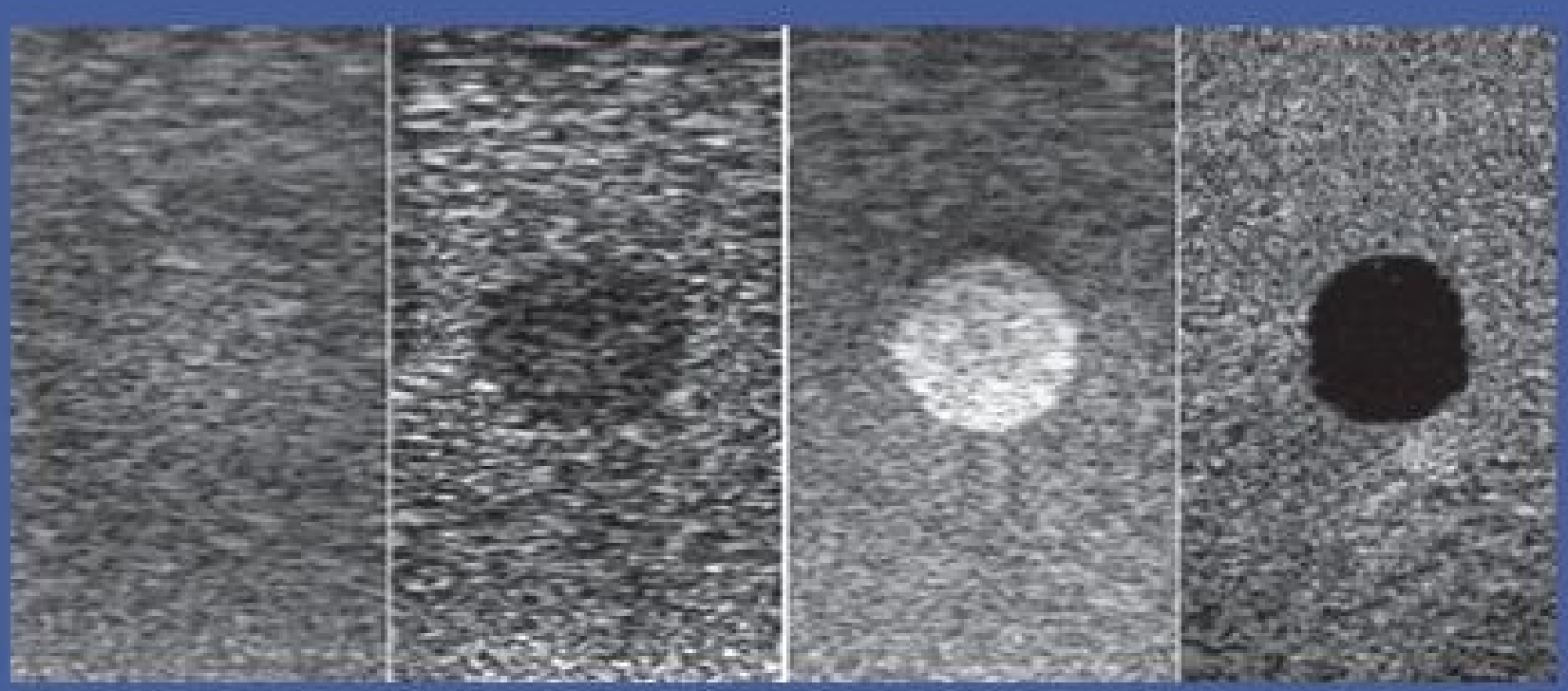
Diagnostic US to Prevent Vascular Complications

- The role of diagnostic ultrasound in Aesthetic Medicine
- Vascular occlusion
- Vascular mapping to prevent intravascular injection
  - Video demos

Ultrasound Imaging

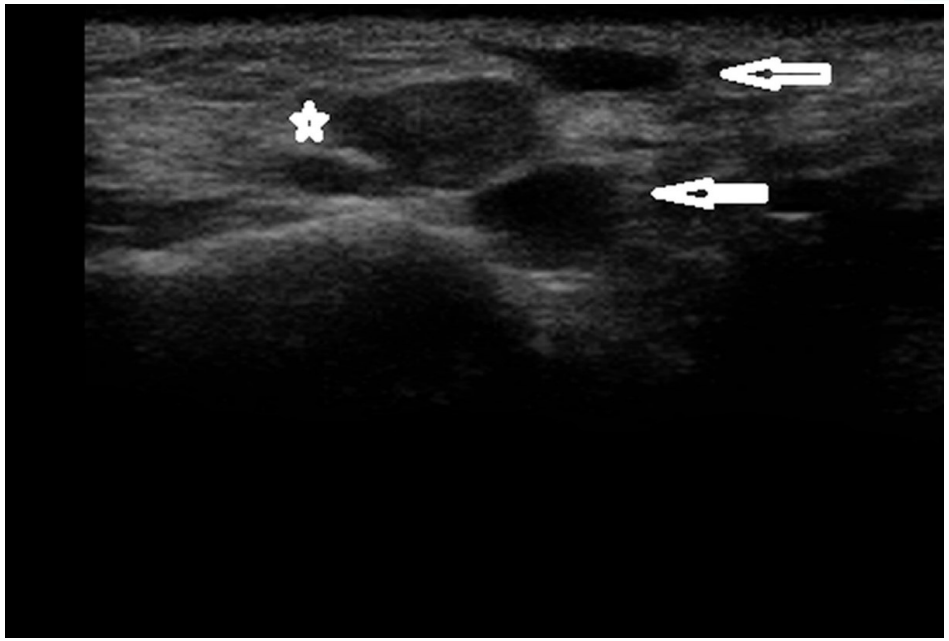


No waves bounce back - fluid

Isoechoic Hypoechoic Hyperechoic Anechoic

Many waves bounce back

US Mapping to Prevent Filler Compications



Multiple deposits of hyaluronic acid filler, two anechoic deposits (black)and one hypoechoic deposit*

Ultrasound to improve the safety of hyaluronic acid filler treatments
Journal of Cosmetic Dermatology, Volume: 17, Issue: 6, Pages: 1019-1024, First published: 06 August 2018, DOI: (10.1111/jocd.12726)

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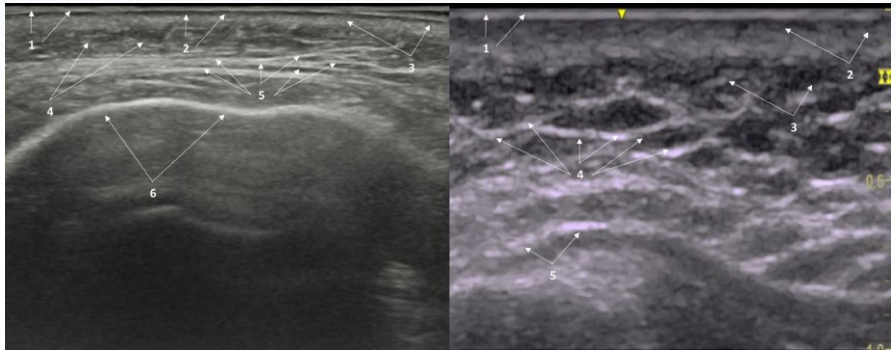
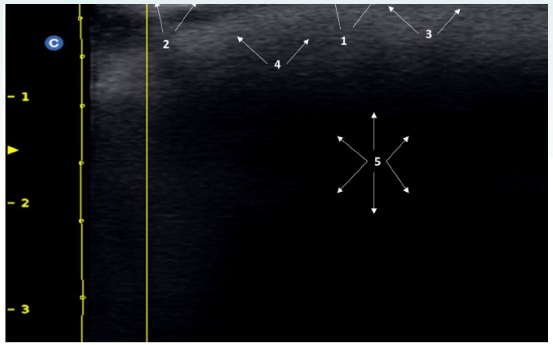
US Patterns of different fillers

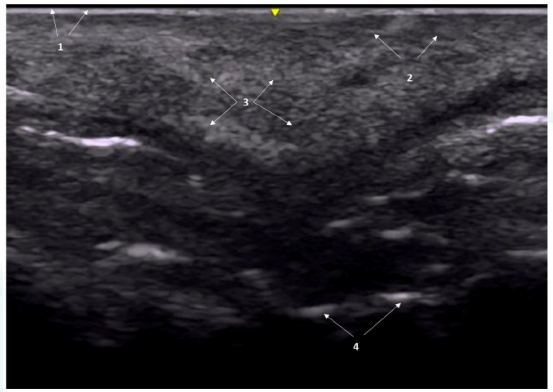


PLLA - hyperechoic/anechoic balance
Predominantly hyperechoic-fibrotic;

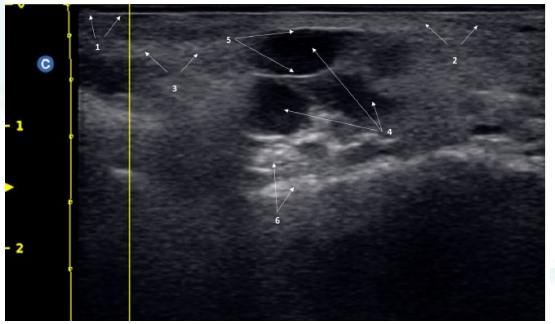
Fine-grain snowfall pattern - liquid silicone.



Coarse-grain snowfall pattern - Calcium hydroxylapatite



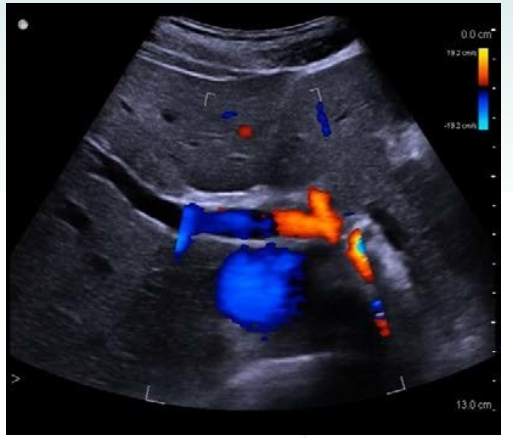
Globular pattern - polyalkylamides polyacrylamides

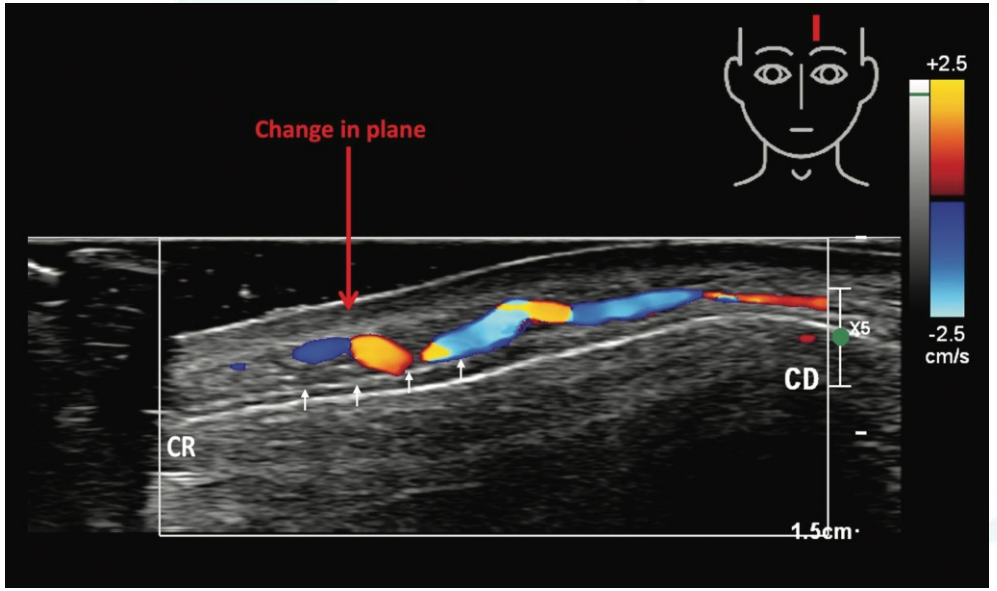


Urdiales-Gálvez F, De cabo-Francés FM, Bové I. Ultrasound patterns of different dermal filler materials used in aesthetics. *J Cosmet Dermatol*. 2021;20: 1541–1548. https://doi.org/10.1111/jocd.14032

Colour Doppler

- Colours indicate the direction of the flow
- Red ➔ Blood flow towards the transducer
- Blue ➔ Blood
  flow going away from the transducer





Longitudinal ultrasound scan of the left forehead showing the course of the **supratrochlear artery** & change of plane to above subfrontalis fascia

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Vascular Mapping by Ultrasound for Filler Injection

- The role of diagnostic ultrasound in Aesthetic Medicine
- **Vascular occlusion**
- Vascular mapping to prevent intravascular injection
  - Video demos

Vascular Occlusion

- The most feared complication of filler injection is vascular occlusion
  - Skin necrosis
  - Scarring
  - Visual compromise➔ blindness
- Injections with microcannulas➔ less often associated with occlusion events than injections with needles but the risk is not 0
- In a cohort of 370 Dermatologists➔ the risk of vascular occlusion appears exceedingly low
- 1 in 6410 syringes via needle
- 1 in 40 882 via microcannula
- **No evidence to support aspiration as a safety measure**

Rates of Vascular Occlusion Associated With Using Needles vs Cannulas for Filler Injection

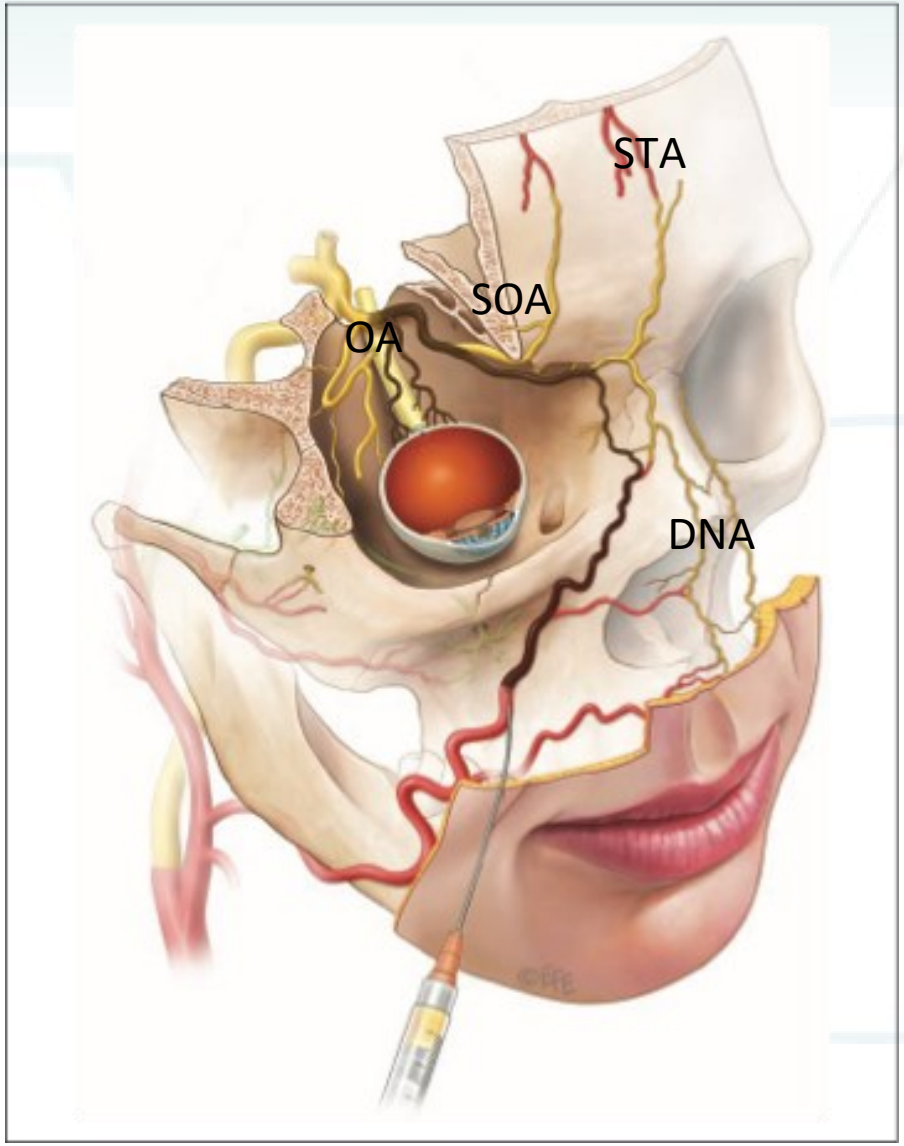
Murad Alam, MD, MSCI, MBA; Rohit Kakar, MD; Jeffrey S. Dover, MD; Vishnu Harikumar, BA; Bianca Y. Kang, BS; Hoi Ting Wan, BS; Emily Poon, PhD; Derek H. Jones, MD

JAMA Dermatol. 2021;157(2):174-180

A Consensus on Minimizing the Risk of Hyaluronic Acid Embolic Visual Loss and Suggestions for Immediate Bedside Management

Greg J. Goodman et al. Aesthetic Surgery Journal 2020, Vol 40(9) 1009–1021

- Fillers may cause blindness if a column of filler is pushed against the arterial blood pressure of the ophthalmic artery and gains access to the central retinal arterial system and/or the ciliary vessels
- **Greatest risk forehead, glabella & nasal dorsum**



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Relative risk for blindness & visual complications

- Low - Jawline and marionette, lateral cheek (lateral to a vertical line through lateral canthus), sub-malar, preauricular, chin augmentation
- Moderate - Lips, perioral region, anterior cheek
- High - Temples, nasolabial folds, peri-orbital, medial cheek
- Very high - Glabella, nose, forehead

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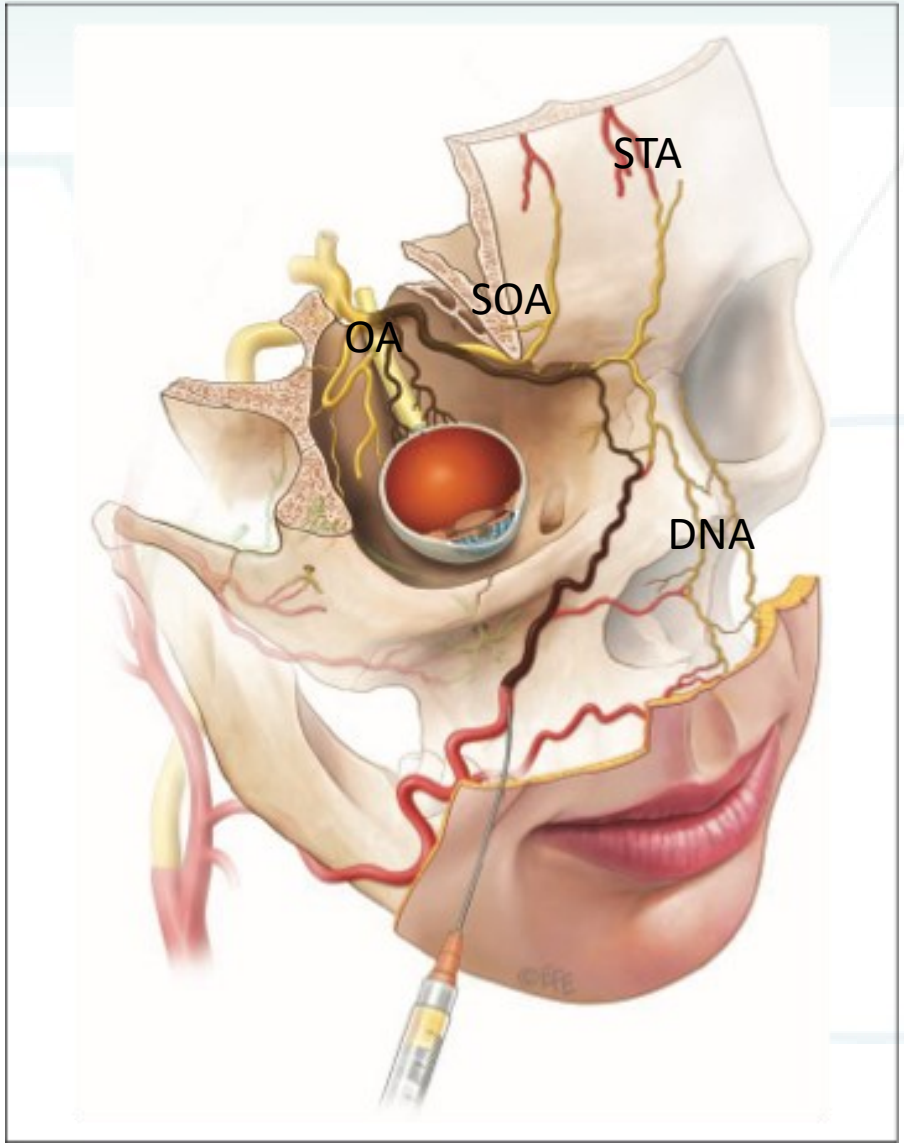
- **Greatest risk forehead, glabella & nasal dorsum**
- Many anatomical variations & anastomoses
  - Retrograde flow from Supratrochlear artery into ophthalmic artery
  - Ophtalmic artery ➔ visual loss, ptosis
  - Retinal artery➔ visual loss
- Estimated at 0.001% (less than 1 in 100,000 injection syringes used), blindness has occurred from filler being injected in a vessel



Vascular Mapping by Ultrasound for Filler Injection

- The role of diagnostic ultrasound in Aesthetic Medicine
- Vascular occlusion
- **Vascular mapping**
- Prevention of intravascular injection
  - Video demos

Ultrasound Mapping to Prevent Filler Complications

- By ultrasound mapping we can visualize the vessels and map their depth and plane
- The newer US transducers can visualize arteries < 0.5mm
  - It is possible to visualize the supratrochlear or the supraorbital artery➔ mean diameters **are 0.71 mm** and **0.8 mm** ± 0.38 mm, respectively

- Injection will be either under or above but not at the same plane
- Move away from the area you see the vessels
- Evaluate filler placement after injection

The Change of Plane of the Supratrochlear and Supraorbital Arteries in the Forehead— An Ultrasound-Based Investigation

Sebastian Cotofana , MD, PhD; Peter J. Velthuis, MD, PhD; Michael Alfertshofer; Konstantin Frank, MD ; Vince Bertucci, MD; Kate Beleznay, MD; Arthur Swift, MD; Diana L. Gavril, MD; Nirusha Lachman, PhD; and Leonie Schelke, MD

Aesthetic Surgery Journal 41(11) 2021

- Frontal hollowing ➔ fillers compensate for volume loss & reshape the bony contour ➔ resulting in a smooth, sym- metric and rounded skin surface
- Thin soft tissue coverage of the forehead ➔ aesthetic improvements are visible ➔ high patient satisfaction
- Techniques to treat frontal hollowing:
  - Perpendicular bolus injection utilizing a needle
  - Fanning cannula technique parallel to the bone surface
  - Place filler into the supraperiosteal plane
  - Studies ➔ perpendicular needle injection is less precise ➔ position the product in all fascial layers including the subdermal plane
-

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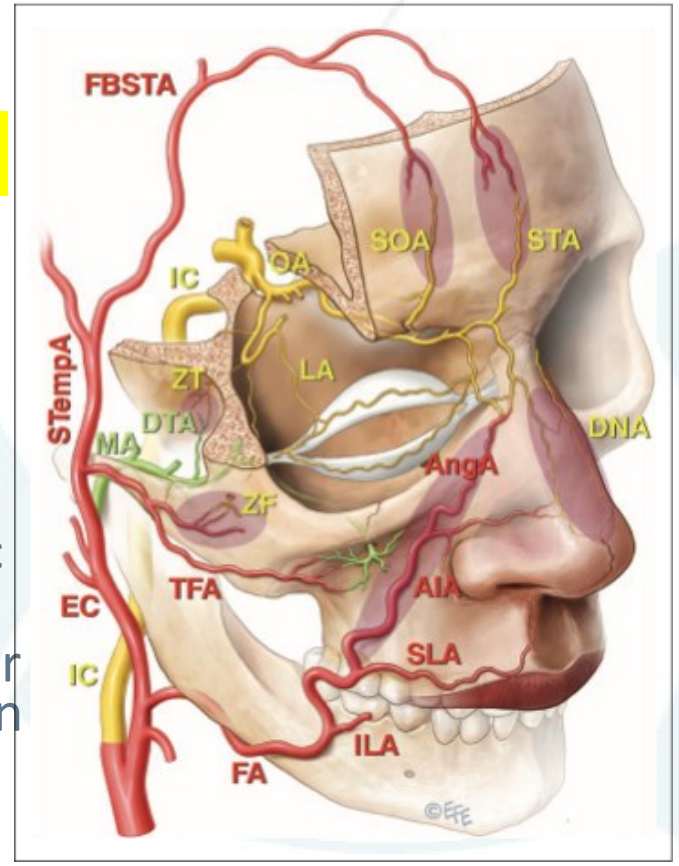
- The rationale to target the supraperiosteal plane
- Aesthetic➔ Smooth appearance & filler not visible
- Safety ➔ The loose areolar tissue of the supraperiosteal plane is free of major arteries and thus safer when targeted with fillers
  - Injection-related visual compromise leading to irreversible blindness following filler injections is related to vascular connections between arteries and ophthalmic artery circulation
  - Supratrochlear and supraorbital arteries can lead to devastating adverse events as these vessels are direct branches of the ophthalmic artery
  - To avoid catastrophic adverse events ➔ recommended that the upper forehead should targeted deep in supraperiosteal plane & injections in the lower forehead should be more superficial ➔ Emerge from foramen & "**change of plane**"



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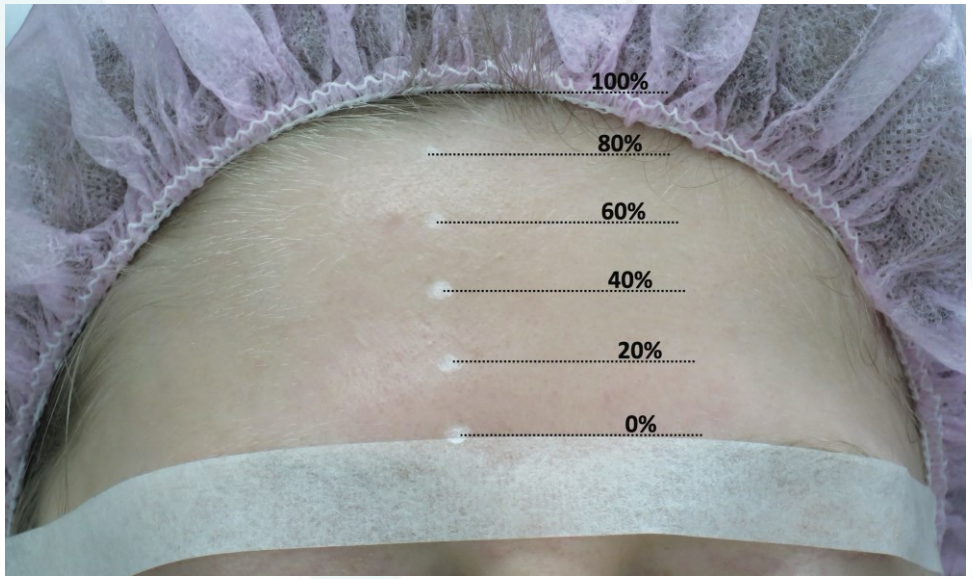
- 50 Patients: 11 males and 39 females
- Age: range, 20-79 years Mean: 49.76
- Mean length of forehead: Males: 74.45 (58.0-85.0 mm) Females: 68.12 (50.0-81.0 mm)
- Soft tissues thickness: Males: 5.34 mm (range, 4.29-6.37 mm), females: 4.94



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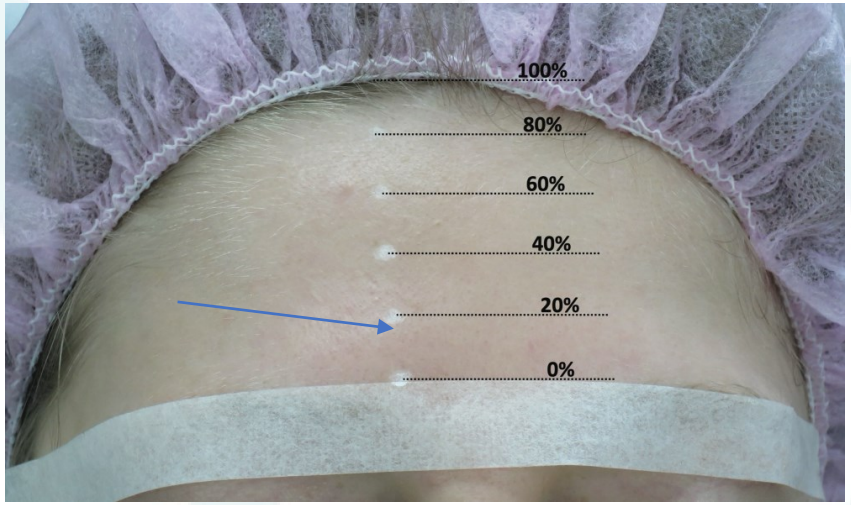
- Change of plane➔
- Supraorbital artery (deep branch) changed its plane from deep to superficial to the frontalis muscle along its cranially directed course from the superior orbital rim
  - Mean distance of 13.32 [2.5] mm (range, 7.0-19.0 mm) in males
  - Mean distance of 14.10 [3.4] mm (range, 4.0-24.0 mm) in females (*P* = 0.311 for gender differences)

This change in plane corresponded to 17.94% and 20.91% of the total forehead length for males and females, respectively

- Supratrochlear artery
- Mean distance of 13.64 in males
- Mean distance of 13.67

This change in plane corresponds to 18.48% and 20.30% [6.2%] of the total forehead length for males and females, respectively.

Both coursing deep to the orbicularis oculi (orbital part) muscle after emerging from their respective foramen/notch & not within the supraperiosteal plane



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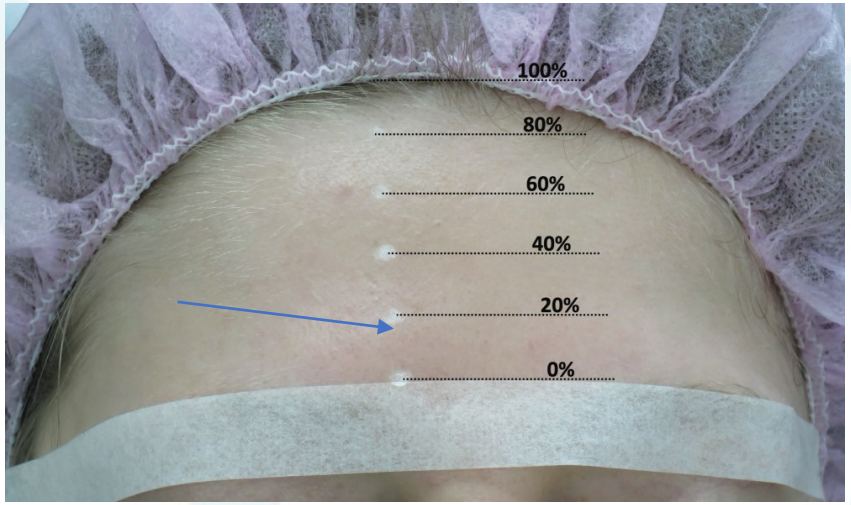
- Fillers can be administered into the supraperiosteal plane in the lower forehead with a certain degree of safety
- Ultrasound measurements showed that the mean overall distance between the deep branch of the supraorbital/ supratrochlear artery and the periosteum was 2.2- 2.5 mm
- Large- diameter blunt-tip cannula (eg, 22G) can be inserted into the supraperiosteal layer of the lateral lower forehead to treat age-related bony changes that result in visible skin surface changes
- The superficial plane of the lower forehead should, however, be avoided due to the unpredictability and inconsistent pres- ence of the central and paracentral arteries
- The supraperiosteal plane should be avoided at the site where the artery exits from its respective foramen/notch.



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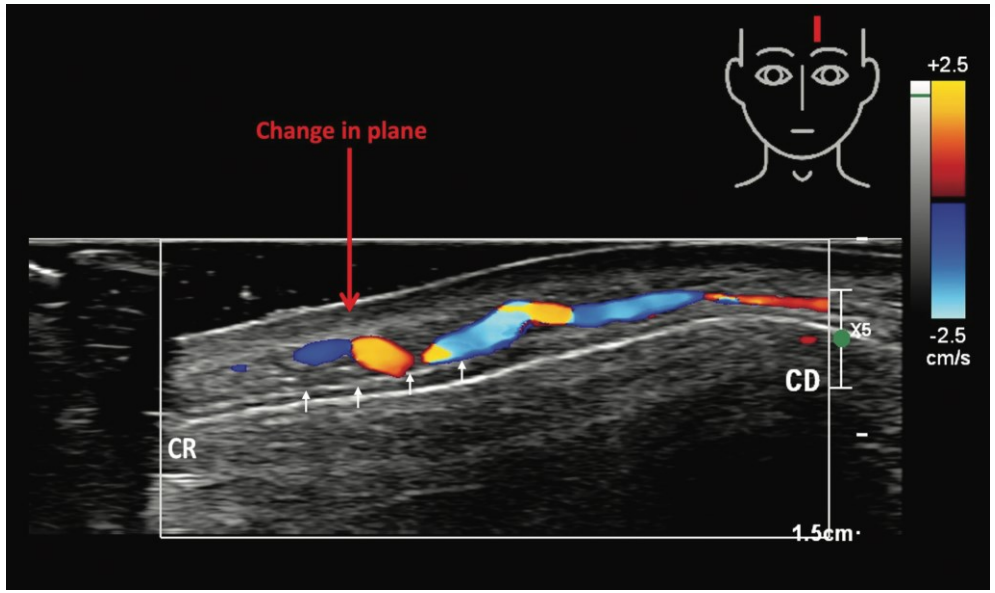
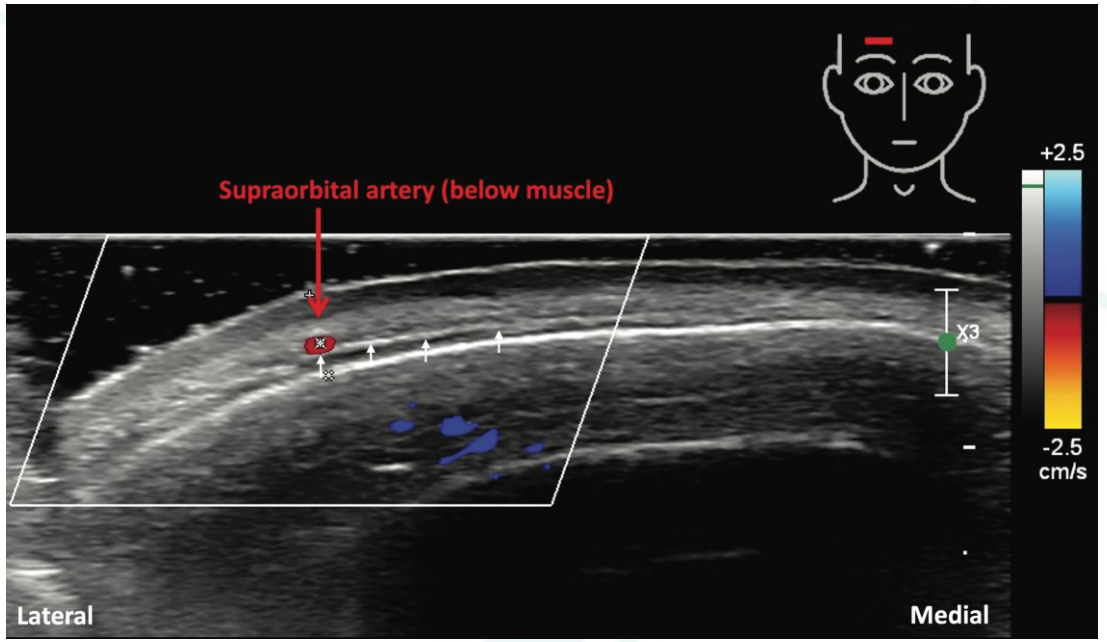


Longitudinal ultrasound scan of the left forehead showing the course of the **supratrochlear artery** & change of plane to above subfrontalis fascia



Transverse ultrasound scan of the right lower forehead showing the **supraorbital artery deep to the frontalis** muscle @subfrontalis fascia.

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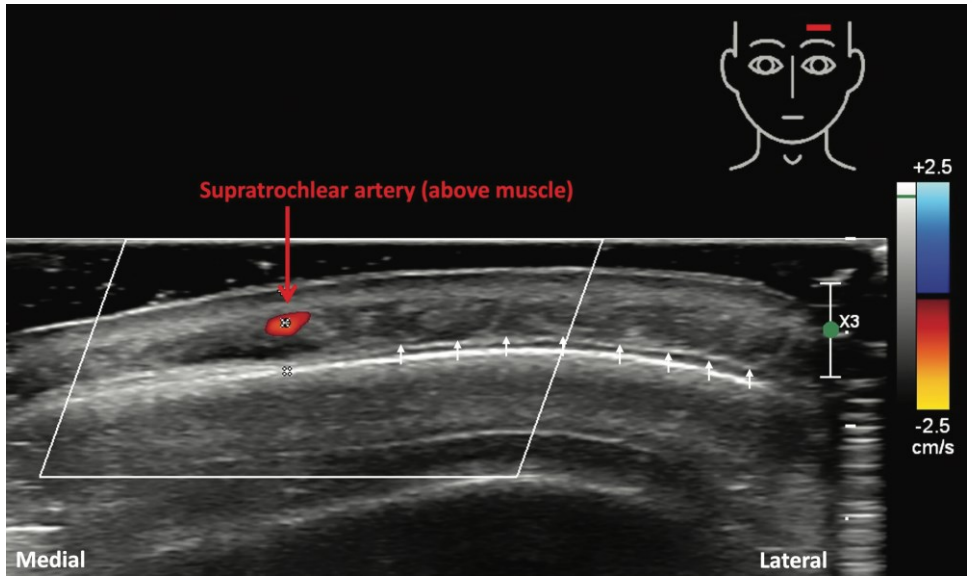
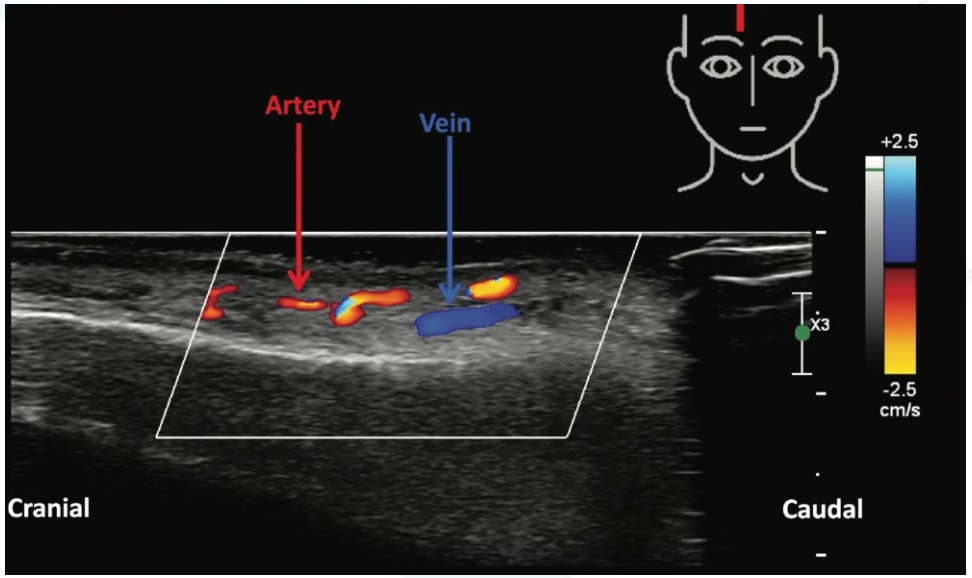


Transverse ultrasound scan of the left upper forehead showing the supratrochlear artery superficial to the frontalis muscle



Longitudinal ultrasound scan of the right forehead showing the plethora of arteries and veins within the superficial fatty layer ➔ **above the muscle.**

Vascular Mapping – Forehead Video

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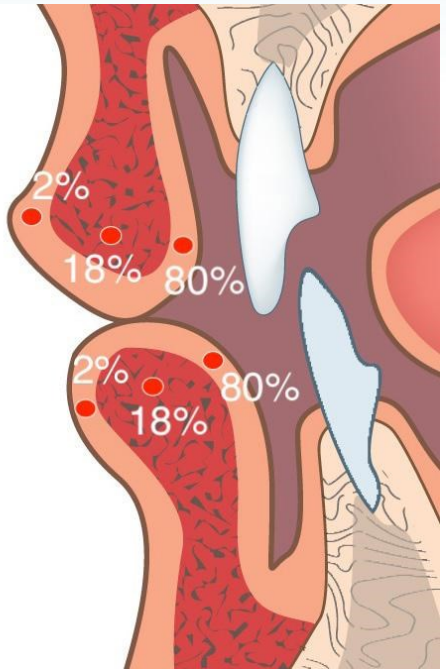
Labial Arteries – Anatomical variability



- 78% Submucosal
- 20% Intramuscular
- 2% Subcutaneous

Mapping of the Marionette Lines

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Managing Complications of Submental Artery Involvement after Hyaluronic Acid Filler Injection in Chin Region

Martha Fang, Sp. KK, M. Kes* Eqram Rahman, MS, MSc, PhD† Krishan Mohan Kapoor, MS, MCh, DNB

Plast Reconstr Surg Glob Open 2018

Juvederm Voluma, 27 G needle in the supraperiosteal plane.
Chin apex - in midline using 1.4 ml & 0.6 ml laterally
Aspiration
Slowly and with minimal pressure
Immediately after completing the filler injections, **blanching of skin** on the right side of chin and upper neck areas was noted
Excessive pain on the chin spreading to the mandible and gingival area immediately
Severe pain during swallowing
10 min after injections - livedo reticularis/skin mottling was beginning to show around the blanched skin patch extending from the mental crease to the upper cervical area

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postinjection picture taken 15 minutes after filler injection in the chin. skin discoloration and demarcation of the ischemic area visible in chin and neck.

The decision to dissolve the HA filler material with high-dose pulsed hyaluronidase was taken immediately.
1,000 U of hyaluronidase was injected using a 30 G needle at chin and neck area
Within minutes, reperfusion was noted in most of the involved area
After 60 minutes, some patches of mottling were still seen in affect- ed area along with persistence of painful swallowing and a further 1,000 U of hyaluronidase was injected using a 27 G cannula
After 6 hours
After 24 hours again
The patient was also put on oral Cefixime 200mg twice daily and acetylsalicylic acid 75mg once daily along with topical Mupirocin ointment for 5 days.

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Five days post-hyaluronidase, with skin changes like pustules and crusting around the mental crease, extending to the chin apex.

On day 7 recovery was seen without scarring
Only redness & hyperpigmentation

Cadaveric dissection, demonstrating the course of the submental artery and its branches and its relationship (shown by an arrow) to chin injection points

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The submental artery is the largest branch of the facial artery in the neck with an average diameter of 1.69mm

Origin to the submental artery behind or at the **superior edge of submandibular gland**

The submental artery runs anteromedially below the mandible and then runs **superficial to the mylohyoid muscle**
The superficial terminal branch **anastomoses with the inferior labial artery**
The deep branch passes between the muscle and the bone, supplies the lip and periosteum of the mandible, **and anastomoses with the inferior labial and mental arteries**
(From Inferior Alveolar Artery – Maxillary Artery)

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Mapping of the Chin

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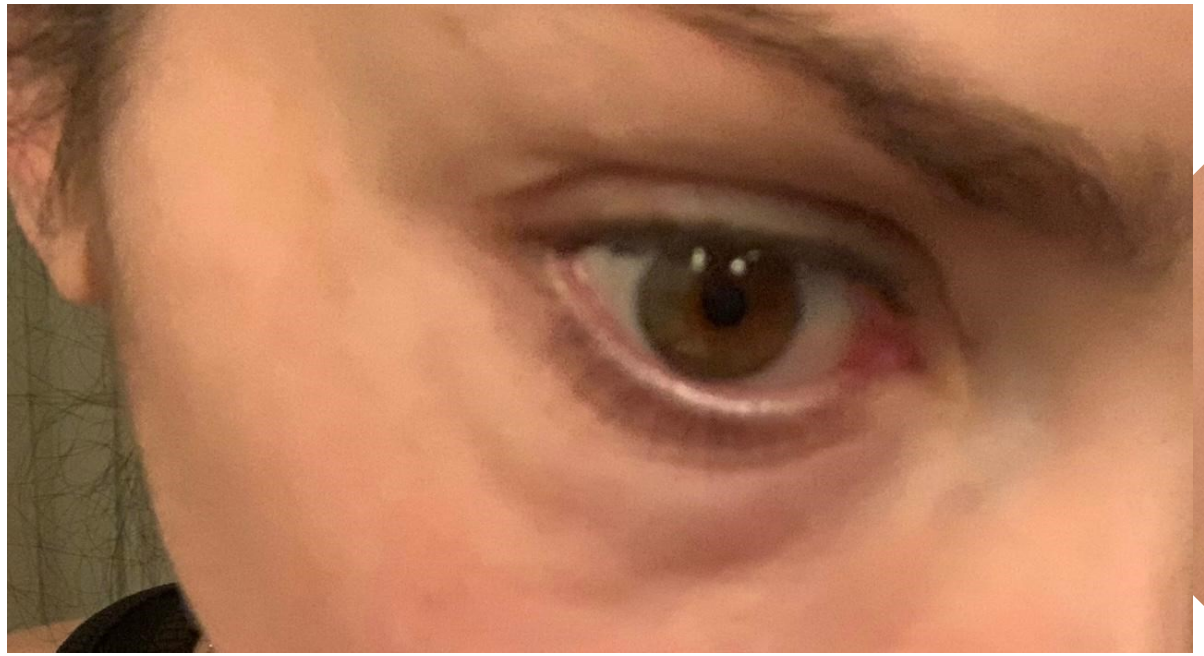
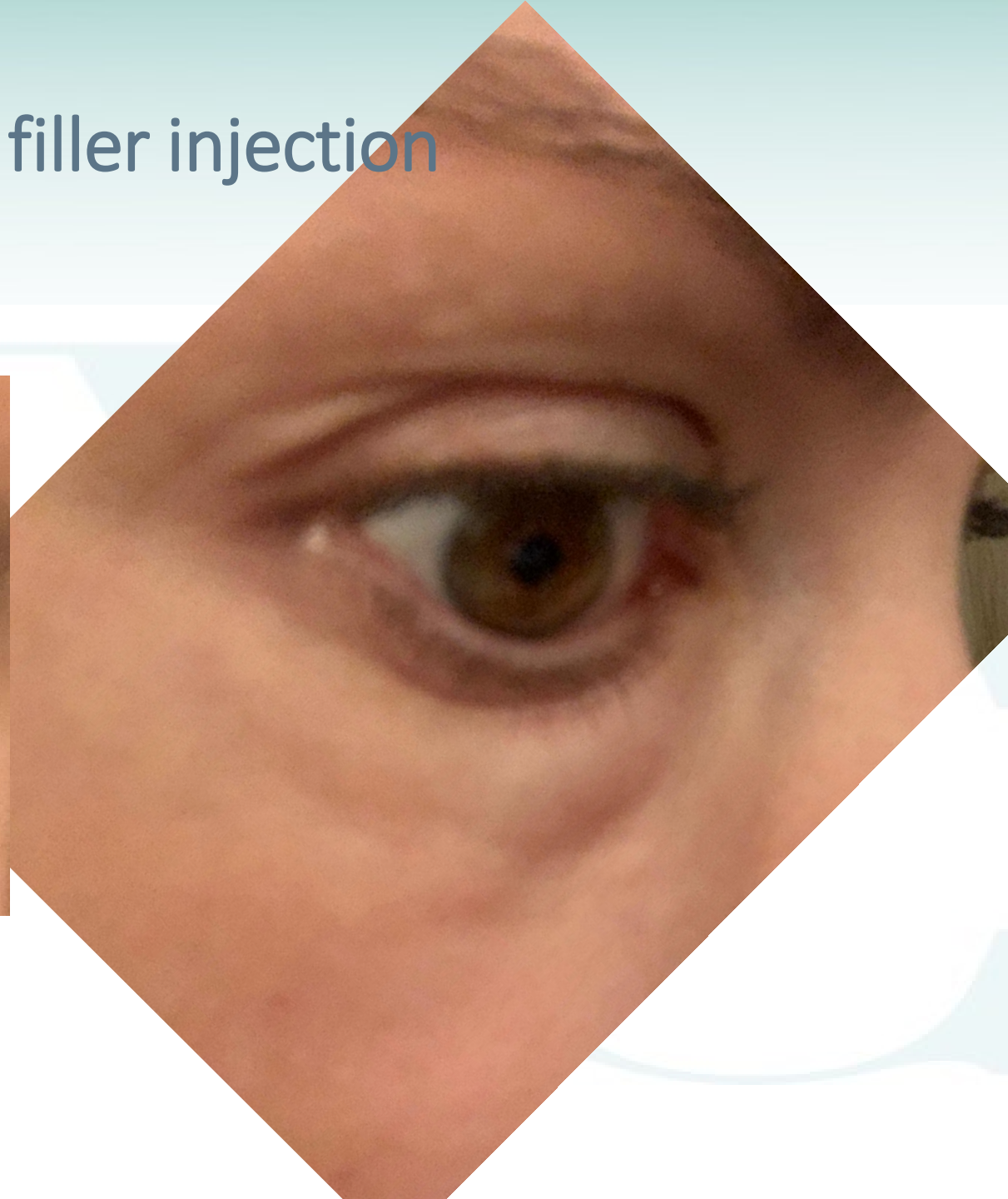
A Consensus on Minimizing the Risk of Hyaluronic Acid Embolic Visual Loss and Suggestions for Immediate Bedside Management
Greg J. Goodman et al. Aesthetic Surgery Journal 2020, Vol 40(9) 1009–1021

- **Understand the safest depth of injection in any given area**
- Inject VERY slowly and with low extrusion pressure
- Cannulae are safer needles in certain areas including the brow and lateral and anterior cheek. They are not considered safer for nasal injection
- Smaller gauge cannulae (less than 25 gauge) may behave somewhat like needles in terms of their ability to pierce blood vessels
- Consider directing the needle/cannula perpendicular to primary axial vessels in the anatomical region to reduce the likelihood of vessel cannulation
- Move the needle in the chosen plane at all times when injecting
- **There is currently no evidence to support aspiration as a safety measure.**

Lower eyelid 4 months after HA filler injection





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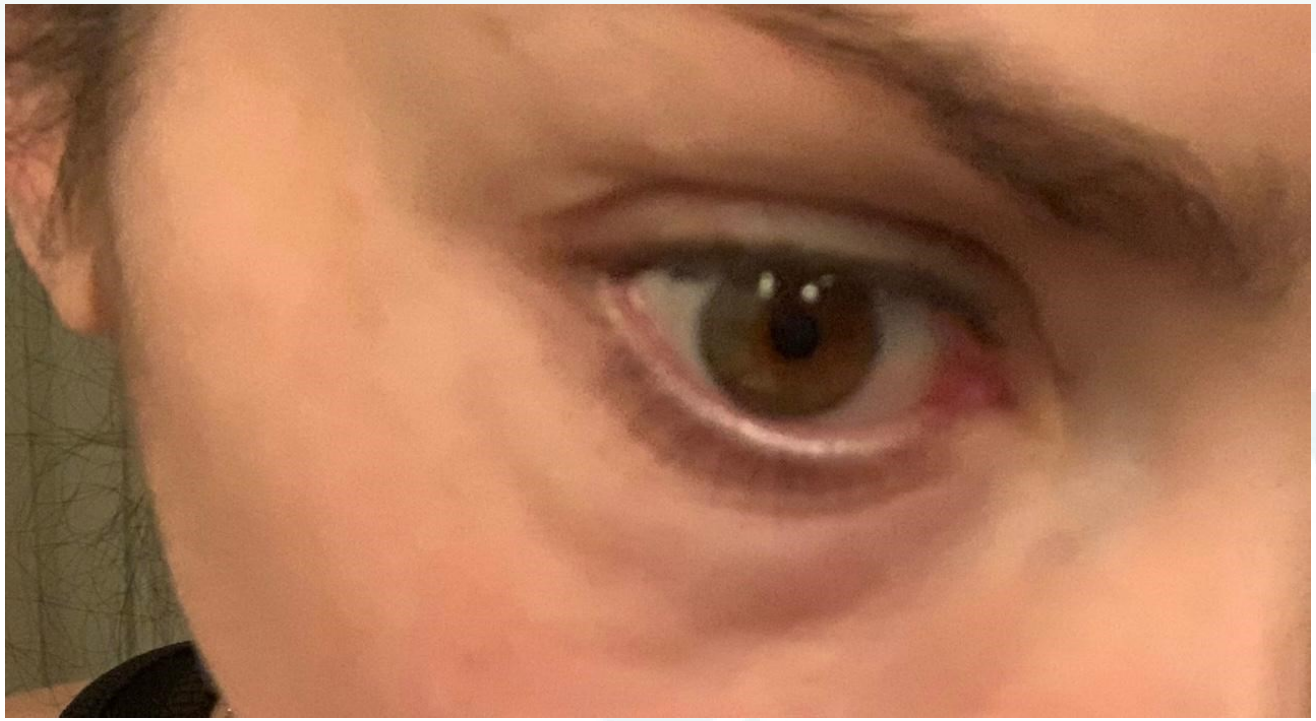
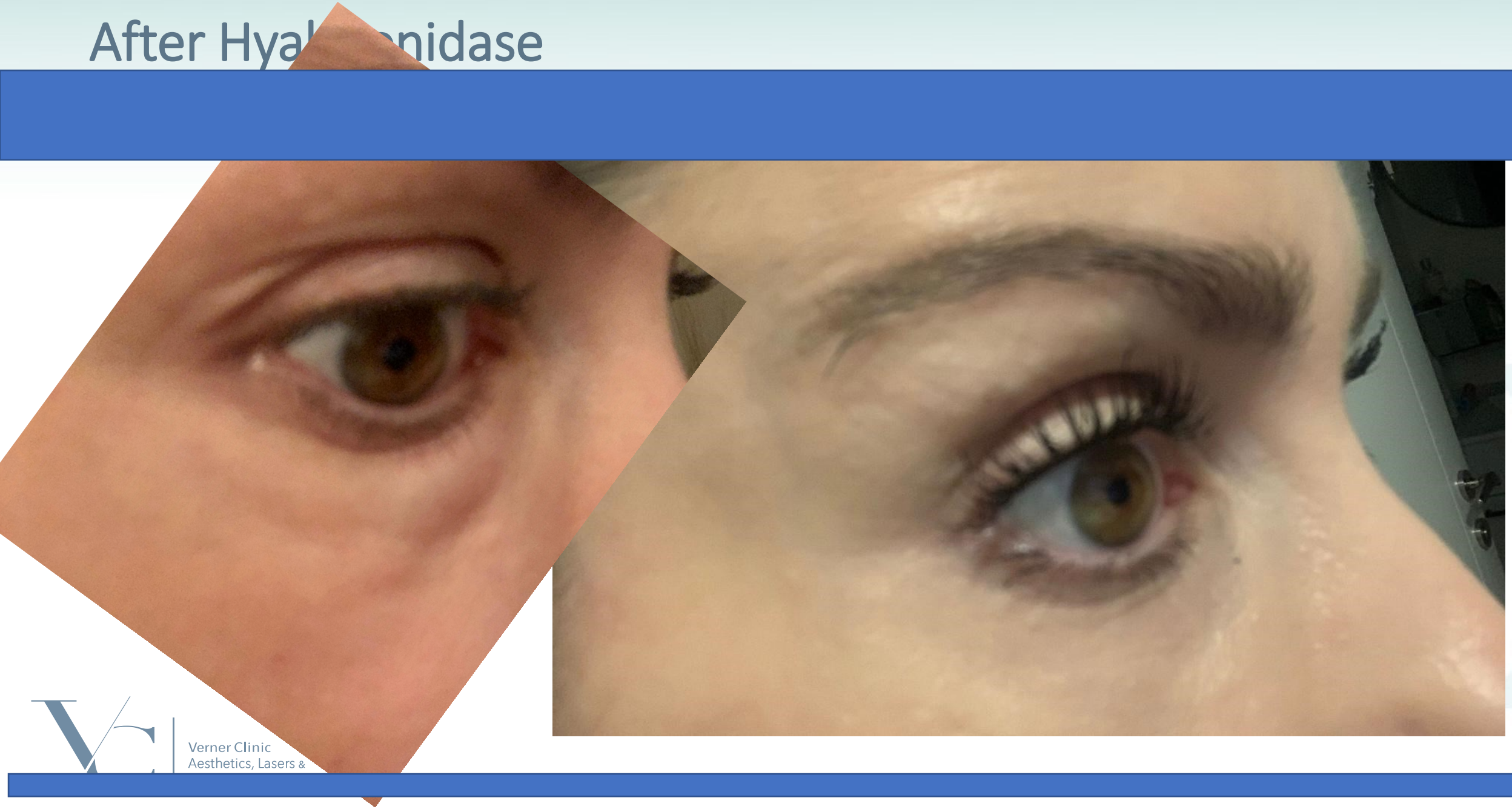
Ultrasound Image



After Hyaluronidase



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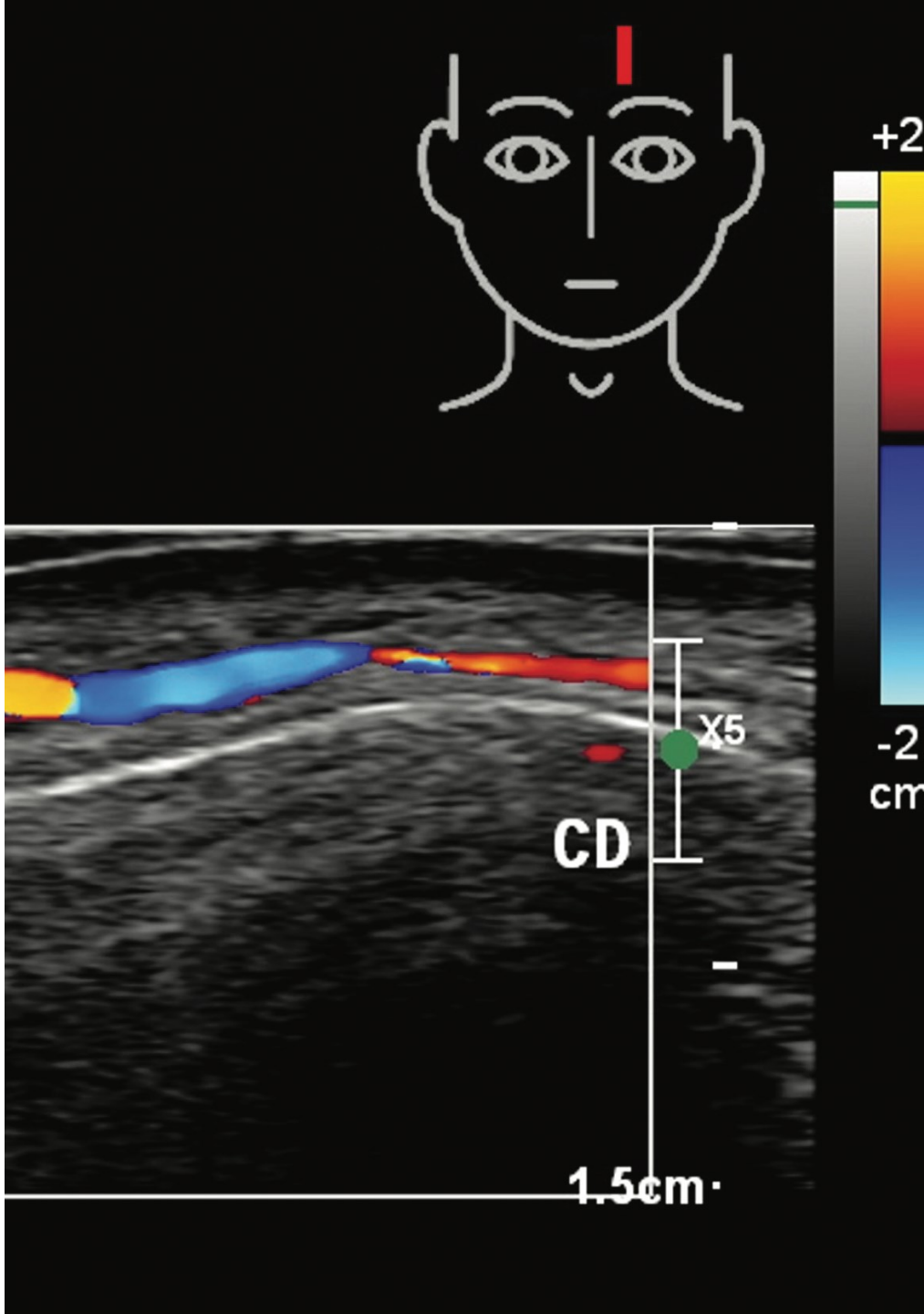
Facial Filler Danger Zones
US Protocol for Safe
Injection to Chin, Forehead
& Marionette lines

- Forehead – Map the Supratrochlear and Supraorbital Arteries
- Marionette lines – Map the Inferior Labial Artery
- Chin - Map the Submental Artery



Facial Filler Danger Zones
US Protocol for Safe Injection to Chin, Forehead & Marionette lines

- Anatomy is important ➔ danger zones
- Huge variability between patients
- By Vascular Mapping of danger zones before injection we can visualize the individual anatomy
- Prevent intravascular filler injection & its complications

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Thank you very much for your attention

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Live Demonstration

Shelley Guenther

Clinical Marketing Manager

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Questions?

Dr. Ines Verner

Shelley Guenther

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Thank you!