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The Fascias of the Forehead and Temple Aligned—An Anatomic Narrative Review

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Abstract

A thorough understanding of 3-dimensional facial anatomy and its fascial concepts is essential to allow for further development of novel surgical and nonsurgical treatment strategies to increase patient safety and effectiveness. The layered anatomy and its interconnections of the forehead, scalp, and temple is complex and is thus summarized and aligned in a unified nomenclature in this review. The scalp consists of 5 layers, which transition into 8 layers in the forehead and into a total of 13 layers in the temple.

Keywords: Facial anatomy; Fascial layers; Forehead anatomy; Frontalis muscle; Temple anatomy.

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Real-Time Ultrasound Imaging of the Tear Trough: Lessons Learned From Functional Anatomy

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Abstract

Background: The tear trough is one of the most challenging facial regions for soft-tissue filler injections. A thorough understanding of the underlying facial, muscular, and vascular anatomy is crucial to perform safe and effective tear trough injectable treatments.

Objectives: The authors sought to evaluate the location and function of the angular vein in the tear trough in 3 different facial expressions: repose, smiling, and max. orbicularis oculi contraction.

Methods: Twenty study participants with a mean age of 48.3 years and mean BMI of 24.5 kg/m² were investigated via functional ultrasound imaging. The diameter of the angular vein and the velocity and direction of venous blood flow were analyzed in repose, smiling, and during max. orbicularis oculi contraction.

Results: The angular vein was identified in 100% of the cases to travel inside the orbicularis oculi muscle (intra-muscular course) within the tear trough, whereas the angular artery was not identified in this location. The distance between the angular vein and the inferior orbital rim was (lateral to medial): 4.6 mm, 4.5 mm, 3.9 mm, and 3.8 mm. The caudally directed blood flow was in repose 10.2 cm/s and was 7.3 cm/s at max. orbicularis oculi muscle contraction; however, no blood flow was detectable during smiling.

Conclusions: The diameter and the venous blood flow of the angular vein varied between the 3 tested facial expressions. Based on these anatomical findings, the deep injection approach to the tear trough is recommended due to the intramuscular course of the angular vein.

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A Guide to Doppler Ultrasound Analysis of the Face in Cosmetic Medicine. Part 1: Standard Positions

Peter J Velthuis, Oscar Jansen, Leonie W Schelke, Hyoungjin J Moon, Jonathan Kadouch, Benjamin Ascher, Sebastian Cotofana

Abstract

Interest in Doppler ultrasound (DUS) analysis of the face has grown in cosmetic medicine, in particular for injectable fillers. When dealing with complications, DUS has the advantage of easily visualizing the filler and identifying the problem in relation to the patient's anatomy. When working with hyaluronic acid filler, ultrasound-guided injections with hyaluronidase can precisely target the problem. In addition, DUS can be used to study the anatomy of a patient, specifically to prevent intravascular injections. We predict that in a few years' time DUS will become standard equipment in the offices of cosmetic doctors. We discuss the basics of ultrasound imaging of different tissues with the concomitant terminology. With the use of 7 basic DUS probe positions, key anatomic reference points can be easily found. From these, all relevant anatomic structures in the face can be observed and analyzed. With some practice, physicians will ultimately be able to acquire a complete 3-dimensional mental image of a patient's face.

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A Guide to Doppler Ultrasound Analysis of the Face in Cosmetic Medicine. Part 2: Vascular Mapping

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Abstract

Duplex mode ultrasound imaging can detect the course of the main vascular structures in the face, which are known to be subject to variation. Once duplex mapping has been performed, measures can be taken to prevent injection into an artery, thereby avoiding skin necrosis or, worse, vision loss. For this reason, in particular, we predict that in the coming years sonography will become standard equipment in the offices of cosmetic doctors. We discuss the basics of vascular imaging by Doppler ultrasound, both in normal and pathologic situations. Starting from the 7 basic positions for the ultrasound probe, all facial arteries relevant in cosmetic medicine can be found.

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The mobility of the superficial and deep midfacial fat compartments: An ultrasound-based investigation

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Abstract

Background: Understanding the mobility of the midface and the separate contributions of the superficial and deep fat compartments is essential for natural esthetic outcomes following soft tissue filler or fat grafting procedures. A study was designed that used ultrasound imaging to demonstrate in vivo visualization and quantification of distances and movements in the midface.

Methods: A total of 48 midfaces of 24 healthy Caucasian volunteers, all naïve of esthetic procedures, (22 females; 46.85 (9.8) years; 22.83 (3.1) kg/m²) were scanned using 18 MHz ultrasound imaging. Distances between bony landmarks (inferior orbital rim, infraorbital foramen) were used as markers to measure the cranial movement of the superficial (superficial nasolabial and superficial medial cheek fat compartment) and the deep (deep pyriform space, deep medial cheek fat compartment, deep lateral cheek fat compartment) midfacial fat compartments between resting and smiling facial position.

Results: The superficial midfacial fat compartment moved, on average, 3.7 mm ($p < 0.001$) cranially, whereas the deep midfacial fat compartments moved, on average, 0.1 mm ($p > 0.05$) during smiling. No gender differences in mobility were identified ($p > 0.05$).

Conclusion: The results obtained are in line with previous cadaveric investigations and revealed, in a highly statistically significant fashion, that the superficial midfacial fat compartments move in cranial direction whereas the deep fat compartment did not display similar positional changes. These results help to guide facial injectable treatments and to understand why, in the midface, a deep supraperiosteal approach should be favored when augmenting the deep midfacial fat compartments.

Keywords: facial anatomy; facial fat compartments; midface; mobility; ultrasound.

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

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Abstract

Background: Injecting soft tissue fillers into the deep plane of the forehead carries the risk of injection-related visual compromise due to the specific course of the arterial vasculature.

Objectives: The aim of this study was to investigate the 2- and 3-dimensional location of the change of plane of the deep branch of the supratrochlear and supraorbital artery, respectively.

Methods: A total of 50 patients (11 males and 39 females; mean age, 49.76 [13.8] years, mean body mass index, 22.53 [2.6] kg/m²) were investigated with ultrasound imaging. The total thickness and the distance of the arteries from the skin and bone surface were measured with an 18-MHz broadband compact linear array transducer.

Results: The deep branch of the supraorbital artery changed plane from deep to superficial to the frontalis muscle at a mean distance of 13 mm (range, 7.0-19.0 mm) in males and at 14 mm (range, 4.0-24.0 mm) in females and for the deep branch of the supratrochlear artery at a mean distance of 14 mm in males and females (range, 10.0-19.0 in males, 4.0-27.0 in females) when measured from the superior orbital rim.

Conclusions: Based on the ultrasound findings in this study, it seems that the supraperiosteal plane of the upper and lower forehead could be targeted during soft tissue filler injections because the deep branches of both the supraorbital and supratrochlear arteries do not travel within this plane. The superficial plane of the lower forehead, however, should be avoided due to the unpredictability and inconsistent presence of the central and paracentral arteries.

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Ultrasound to Improve the Safety and Efficacy of Lipofilling of the Temples

Jonathan Kadouch¹, Leonie W Schelke¹, Arthur Swift¹

Abstract

Background: Autologous fat is known for a reliable and natural safety profile, but complications do occur-even serious vascular adverse events.

Objectives: The authors sought to examine doppler-ultrasound (DUS) imaging for the harvesting and subsequent facial implantation of autologous fat tissue.

Methods: All patients underwent lipofilling treatment of the temporal fosse of the face. DUS examination was performed for preprocedural vascular mapping and imaging of previously injected (permanent) fillers. In addition, the injection of autologous fat was performed DUS-guided.

Results: Twenty patients (all female; mean age, 57.9 years; range, 35-64 years). DUS examination showed that 16 of the 20 patients (80%) had been injected with resorbable or nonresorbable fillers elsewhere in the past. The temporal artery could be visualized and avoided in all cases. An average of 1.1 cc of autologous fat was injected in the temporal fossa per side. One case of edema and nodules was described, but no other adverse events were reported.

Conclusions: The utilization of DUS can add valuable information to a lipofilling procedure and should be considered an integral part of a safe lipofilling treatment.

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Increased risk of late-onset, immune-mediated, adverse reactions related to dermal fillers in patients bearing HLA-B*08 and DRB1*03 haplotypes

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Abstract

Even though manufacturers claim that the dermal fillers are nontoxic and nonimmunogenic, adverse events may occur. Clinically and histologically, most of the late onset adverse events present as an inflammatory response. To assess whether HLA polymorphisms are associated with late-onset inflammatory adverse events related to dermal fillers. A total of 211 patients were included, of whom 129 experienced late-onset inflammatory adverse events to different fillers (Inflammation group) and 82 who did not (Reference group). Patients completed a standardized questionnaire and provided a blood sample or oral swap for HLA testing. The study population consisted of 188 (89%) women and 23 (11%) men. The two study groups were similar in the distributions of filler type, location of injecting, allergy, autoimmune disease, gender, age, ethnicity, and smoking status. Of the 211 patients in the sample, 25 had the combination of HLA subtype-B*08 and HLA subtype-DRB1*03. This was 16.3% of the inflammatory group and 4.9% of the reference group. This combination of HLA subtypes was associated with an almost 4-fold increase in the odds of developing immune mediated adverse events (odds ratio = 3.79, 95% CI 1.25-11.48). Genetic polymorphisms such as HLA combinations may identify patients at risk of developing late onset immune mediated adverse events to dermal fillers.

Keywords: HLA; adverse reaction; cosmetic dermatology; dermal filler; haplotypes; immunogenetics; late-onset reaction.

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Nomenclature proposal for the sonographic description and reporting of soft tissue fillers

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Abstract

Background: There is a steady increase in publications about the use of ultrasound and filler treatments, written by physicians from different specialties. The terminology used to describe the ultrasound images of fillers is not uniform, making the different articles difficult to compare. Standardization of the descriptions based on their basic sonographic parameters is recommendable.

Aims: The purpose of this study is to propose a nomenclature for the sonographic description and reporting of cosmetic fillers.

Methods: An assessment of articles indexed for MEDLINE/PubMed and Embed electronic database was conducted; in total of 39 articles could be included.

Results: All articles were investigated for their sonographic descriptions of soft tissue fillers. Ten parameters used for describing and monitoring soft tissue fillers were distinguished.

Conclusion: The proposed sonographic descriptions for cosmetic fillers may contribute to a better standardization and understanding fillers ultrasound images in the reports or literature.

Keywords: fillers; nomenclature; review; ultrasound.

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Early ultrasound for diagnosis and treatment of vascular adverse events with hyaluronic acid fillers

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Abstract

Background: Hyaluronic acid fillers are known for a reliable safety profile, but complications do occur, even serious vascular adverse events .

Objective: to improve the treatment outcome after an vascular adverse event safety of hyaluronic acid filler treatments **METHODS:** duplex / ultrasound is used to detect the hyaluronic acid filler causing the intra-arterial obstruction **RESULTS:** If treated in time, one single treatment of ultrasound guided injections of hyaluronidase into the filler deposit will prevent skin necrosis.

Conclusion: As the use of duplex / ultrasound adds extra essential information, its use may become an integral part of the prevention and treatment of injection adverse events.

Keywords: hyaluronic acid filler; ultrasound; vascular adverse event.

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Intralesional Laser Treatment for Dermal Filler Complications

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Abstract

Background: For complications caused by filler treatments, in general, two treatment regimens are advised: systemic drugs and surgical removal of the material. Another possible treatment option would be removal of the material by intralesional laser treatment.

Methods: Two hundred forty-two patients with complications caused by fillers were treated with intralesional laser treatment.

Results: In the majority of patients, an improvement was achieved (92 percent), in 9 percent the complication was resolved, and in 3 percent it was not improved (unknown in the rest).

Conclusion: Considering the large number of patients treated until now and the efficacy and good safety profile of this treatment, the authors plead that intralesional laser treatment may be considered as a treatment option before surgery.

Clinical question/level of evidence: Therapeutic, IV.

Ultrasound to improve the safety of hyaluronic acid filler treatments

Leonie W Schelke¹, Tom S Decates¹, Peter J Velthuis¹

Abstract

Background: Hyaluronic acid fillers are known for a reliable safety profile, but complications do occur, even serious vascular adverse events.

Objective: To improve the safety of hyaluronic acid filler treatments.

Methods: Ultrasound is used to image hyaluronic acid fillers.

Results: Before a filler treatment is performed with ultrasound, previous filler treatments can be brought in to sight and vascular mapping can be performed. In case of adverse events, the filler and the surrounding tissues are visible. Dislocation, abscesses, and vascular adverse events can be seen. Under ultrasound guidance, hyaluronidase can be injected directly into the filler deposit.

Conclusion: Ultrasound examination can be an important tool to improve the safety of hyaluronic acid filler treatments.

Keywords: complications; cosmetic dermatology; filler; hyaluronic acid; safety; ultrasound.

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Ultrasound to improve the safety of hyaluronic acid filler treatments

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Conclusion: Ultrasound examination can be an important tool to improve the safety of hyaluronic acid filler treatments.

Keywords: complications; cosmetic dermatology; filler; hyaluronic acid; safety; ultrasound.

Polyalkylimide: A Nonstable Filler Over Time

Leonie W Schelke¹, Peter J Velthuis¹, Marijke R van Dijk²

Abstract

Background: Polyalkylimide hydrogel is supposed to be a permanent, biocompatible implant. However, years after subcutaneous implantation clinical complications are seen.

Objective: To increase the understanding of the changes that occur over time in this subdermal implanted filler.

Materials and methods: The extruded filler material of 34 patients was evaluated by histologic examination.

Results: In most patients who had cosmetic disturbances but no complaints, histology showed no immune cells in or around the filler material. In patients with an acute inflammatory response, giant cell invasion was seen in and around the filler material. Patients with chronic complaints showed a neutrophilic cell influx in the extruded filler. In all patients, degeneration and calcification of the material was noted. The polyalkylimide hydrogel changed over time, both macroscopically and microscopically. As in most of the patients no immune response was seen around the filler material, this may indicate that the material is biocompatible.

Conclusion: The authors conclude that a dermal filler should not be judged solely on its biocompatible characteristics but also on the degradation process over time in the human body.

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Use of ultrasound to provide overall information on facial fillers and surrounding tissue

Leonie W Schelke¹, Helga J Van Den Elzen, P P M Erkamp, H A M Neumann

Abstract

Background: Information on fillers and their behavior over time in the different layers of tissue is limited. Ultrasound may be used to visualize these fillers and their surrounding tissue to broaden knowledge.

Objective: To evaluate the use of ultrasound as a diagnostic and research tool to obtain information on facial fillers and their behavior in human tissue.

Methods and materials: Patients with a history of facial filler treatment were examined using ultrasound in an outpatient setting.

Results: Seventy-two patients were examined. Hydrophilic fillers were echo visible, whereas tissue-generating fillers, permanent and resorbable, could be detected according to their tissue-generating reaction within the tissue. Filler characteristics such as longevity and reaction within the tissue and complications such as migration and granulomas could be visualized.

Conclusion: The use of ultrasound may provide information to broaden our knowledge of facial fillers and may improve the performance and safety of filler treatments. The authors have indicated no significant interest with commercial supporters.

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Complications after treatment with polyalkylimide

Leonie W Schelke¹, Helga J van den Elzen, Marijke Canninga, Martino H A Neumann

Abstract

Background: Polyalkylimide is a nonresorbable, biocompatible polymeric filler that has been used for several years to treat soft tissue deficits. The literature has shown a minor complication rate. We noticed that complications typically appear several years after injection.

Objective: To evaluate the complications reported after treatment with polyalkylimide.

Methods and materials: We describe a retrospective evaluation, reported by members and candidate members of the Dutch Society of Cosmetic Medicine, of complications after use of polyalkylimide.

Results: In total, 3,196 patients were treated, and 4,738 treatments were performed, from which 154 complications (patient complication rate 4.8%, treatment complication rate 3.3%) were reported. The most common complication was inflammation; other complications were hardening, migration, and accumulation of the product. In some patients, skin biopsy followed by histologic examination was performed.

Conclusion: Treatments with polyalkylimide have been reported to give rise to complications years after treatment. Even though the study described is a retrospective evaluation, we consider an overall complication rate of 4.8%, the severity of the complications, and the difficulty in treating them too high a risk for a cosmetic treatment. The Dutch Society of Cosmetic Medicine advises against the use of polyalkylimide.