Temporal fossa defects: techniques for injecting hyaluronic acid filler and complications after hyaluronic acid filler injection

Margit Lai Wun Juhász, MSc¹ & Ellen S Marmur, MD¹,²
¹Department of Dermatology, Icahn School of Medicine at Mount Sinai, New York, NY, USA
²Marmur Medical, New York, NY, USA

Summary
Facial changes with aging include thinning of the epidermis, loss of skin elasticity, atrophy of muscle, and subcutaneous fat and bony changes, all which result in a loss of volume. As temporal bones become more concave, and the temporalis atrophies and the temporal fat pad decreases, volume loss leads to an undesirable, gaunt appearance. By altering the temporal fossa and upper face with hyaluronic acid filler, those whose specialty is injecting filler can achieve a balanced and more youthful facial structure. Many techniques have been described to inject filler into the fossa including a “fanned” pattern of injections, highly diluted filler injection, and the method we describe using a three-injection approach. Complications of filler in the temporal fossa include bruising, tenderness, swelling, Tyndall effect, overcorrection, and chewing discomfort. Although rare, more serious complications include infection, foreign body granuloma, intravascular necrosis, and blindness due to embolization into the ophthalmic artery. Using reversible hyaluronic acid fillers, hyaluronidase can be used to relieve any discomfort felt by the patient. Injectors must be aware of the complications that may occur and provide treatment readily to avoid morbidities associated with filler injection into this sensitive area.

Keywords: filler, hyaluronic acid, temporal fossa, volume deficit, cosmetic procedure

Introduction
With aging, the body undergoes significant changes that often affect facial structure and shadowing. These changes include thinning of the epidermis, loss of skin elasticity, atrophy of muscle, and subcutaneous fat and bony changes, all which result in a loss of volume.¹,² In the temporal fossa, volume loss leads to an undesirable, gaunt appearance. The temporal bones become more concave, and the temporalis muscle atrophies and the temporal fat pad decreases in size, leading to a prominent appearance of zygomatic arch and temporal fusion line.²,³ By altering the temporal fossa and upper face with filler, dermatologists are able to achieve a balanced and more youthful facial structure.

Anatomy of the temporal fossa
The joining of the squamous temporal bone, the parietal bone, the greater wing of the sphenoid and the frontal bone at a point known as pterion creates the bony structure of the temporal region. The temporal fossa directly overlies the squamous portion of the temporal bone and was bordered inferiorly by the zygomatic arch of the temporal bone. Over these bones lie the peristeum, the temporalis muscle, and the temporal fascia. There are several important vessels situated on the outskirts of the temporal region, including the zygomatico-orbital (medially), middle temporal and the...
superficial temporal arteries (both laterally), all terminal branches of the external carotid artery, and the zygomaticofacial artery (medially), arising distal to the internal carotid artery. Due to anastomoses with the ophthalmic artery, these arteries are of special concern as injecting into these may result in filler emboli and subsequent blindness.\(^5\)\(^7\) By injecting into the central temporal fossa, an anatomical location devoid of important structures, many of these vessels may be avoided.

**Techniques for injecting filler into the temporal fossa**

There are several described techniques that may be used to inject filler into the temporal fossa. A method described by Moradi et al.\(^8\) describes injecting hyaluronic acid filler into the subcutaneous space superficial to or just deep to the superficial temporalis fascia. The injection enters perpendicularly to the skin and is then adjusted to a 45° angle or less to deliver filler volume of 0.05–0.1 mL. A total of 0.3–2.0 mL, dependent on the amount of temporal volume depletion at presentation, is injected into the temporal fossa with subsequent injections happening in a “fanned” pattern.\(^8\)

Another technique using highly diluted hyaluronic acid filler is described by Lambros.\(^9\) The use of highly diluted filler provides a smoother contour once the temporal fossa is filled. The most common dilution tested was 2 mL of hyaluronic acid with 1 mL of 1% lidocaine with epinephrine and 3 mL of normal saline. A single injection of 6 mL was completed, and afterward, gentle pressure was applied to promote the body’s absorption of excess saline. In addition, the author of this study found that inclusion of lidocaine into the diluted filler formulation increased the incidence of lower lid bruising.\(^10\)

The authors of this article use a technique that involves injecting diluted filler at three sites within the temporal region. A commercial syringe with hyaluronic acid is diluted with a 0.2–0.4 mL swish of normal saline or lidocaine with epinephrine and placed into a second syringe with a ½ to 1 inch, 25- to 30-gauge needle. The first injection is at the center of the deepest concavity in the temporal fossa (approximately 1.5–2.5 cm lateral to the lateral canthus; however, this point should be determined by palpation). This injection should be made perpendicularly down to the hub, after which the needle is gently pulled back to check for the presence of blood (if there is blood, it is a sign that the needle may be in a blood vessel). 0.1–0.4 mL of diluted filler is slowly injected and observed for the rise of skin to full correction. If there is no rise, then consider that the filler may be tracking elsewhere through the facial planes (however, this is a very unlikely eventuality as the temporal fossa is hollow and enclosed within bony processes). For tracking to the infraorbital areas to occur, a large volume of filler must be used and must be injected at very high pressure. The second injection occurs superior or posterior to the first site in an effort to correct any remaining defect. The last injection is placed in the lateral forehead (these authors suggest hyaluronic acid with a 0.4–2 mL swish); the bolus is injected at a 45° to 90° angle and massaged to spread. It is important that this last injection is made to avoid the supraorbital vessels and structures that exit through the supraorbital foramen. This last injection not only fills in remaining defects in the temporal fossa and creates a smoother filler contour, and it also provides a lateral brow lift (Figs 1 and 2, Table 1).

**Blindness**

Blindness after filler injection occurs due to retinal artery occlusion. As it is impossible to inject into the retinal artery, the filler enters ocular circulation by retrograde arterial flow after intra-arterial injection into a branch or anastomoses of the ophthalmic artery. The accepted theory for retrograde arterial flow is that the intravascular injection pressure is greater than intra-arterial pressure during intra-arterial injection causing the filler to move proximal to the central retina. When the intravascular injection pressure is released, the material then moves distal to the central retinal artery and blocks the blood supply causing the immediate symptoms of blurring or loss of vision (Fig 3).\(^5\)\(^12\)

On ophthalmologic examination, the retina is diffusely white with a cherry-red spot at the macula, vascular attenuation, and “boxcarring” (segmentation) of the blood column.\(^7\)

In the temporal fossa, it is especially important to avoid intra-arterial injection into the superficial temporal artery, a branch of the external carotid artery. The superficial temporal artery passes over the posterior zygomatic process (of the temporal bone); the frontal branch anastomoses with the supraorbital artery, a branch of the internal carotid artery. These anastomoses allow for embolization into the ophthalmic artery.\(^7\)

To avoid this complication, it is important that the filler injection stays deep to the temporal fascia at the preperiosteal level.\(^6\)\(^12\)
To our knowledge, there have been no reports of blindness with temporal fossa filling using hyaluronic acid. However, there have been cases with calcium hydroxylapatite injections into the facial regions and silicone filler injections into the temporal regions. In one reported case, the patient presented with painful visual loss of the right eye and a headache 2 h after injection into the temporal region. It was presumed that the silicone embolized into the ophthalmic artery through the anastomotic system described above. To manage retinal artery occlusion, an ophthalmology consult should be requested immediately, and the ophthalmologist may perform an ocular massage or anterior chamber paracentesis to manage the situation. In addition, oral acetazolamide 500 mg may be prescribed to decrease the production of aqueous humor, therefore decreasing intraocular pressure until the embolization is resolved.

**Intravascular necrosis**

Intravascular necrosis after filler injection occurs due to accidental intra-arterial injection causing embolization. By disturbing the skin angiosome (a three-dimensional network of vessels that all can be affected by blockage at only one...
point in the network), full-thickness necrosis and scarring may occur. Risk factors for intravascular necrosis include the injection of a large bolus at a single site, deep injection, and the use of a sharp needle.

Intravascular necrosis may present in many various forms. Intense pain immediately on injection may be masked by the lidocaine in the filler injectant. However, soon after injecting, there may be signs of blanching, a reticulated skin pattern, or purple-red mottling due to hemorrhagic blistering (which may last up to 72 h). Necrosis, eschar, and scarring will occur from 48 h until 7 days after injection.

By combining four studies, a total of 60 patients received temporal fossa filler injection. Of the 60 patients, 67% experienced tenderness, 62% experienced bruising, and 7% experienced chewing discomfort.

| Table 1 Estimating total adverse effects in patients receiving temporal fossa filler injection |
|-----------------------------------------------|--------------------------------------------------|
| Adverse Event (as report by the patient or physician) | Number of patients (%) |
| n = 60 | |
| Tenderness | 40 (67) |
| Bruising | 37 (62) |
| Chewing discomfort | 4 (7) |

Figure 2 Temporal volume loss treatment using these authors’ techniques as described in this paper. Photographs taken before and after treatment using filler for this woman show a marked improvement in temporal volume loss. Given the Merz-validated temple scale (as described in Figure 1), the subject improved from a 3 (severe volume loss) to a 0 (no volume loss) with one treatment session.

Figure 3 Schematic of proposed mechanism for retrograde arterial flow causing central retinal artery occlusion and blindness. Intravascular injection pressure is greater than intra-arterial pressure causing the injectate to move proximal to the central retinal artery. Once injection pressure is released, the injectate will move distal to the central retinal artery causing occlusion of the blood supply and subsequently blurring of vision or even vision loss.
important to recognize intravascular necrosis as soon as possible and reverse the hyaluronic acid filler with hyaluronidase if possible.\textsuperscript{17}

**Biofilm causing infection**

Some bacteria, such as \textit{Staphylococcus epidermidis},\textsuperscript{18} secrete an extracellular, protective, and adhesive coat of protein that allows the aggregation of microorganisms and allows these organisms to adhere to a surface. These bacteria are implicated in infectious processes such as urinary tract infections, upper respiratory infections, middle ear infections, dental plaques, gingivitis, and infected prosthetic devices; in some cases, these infections may progress to endocarditis.\textsuperscript{19,20}

Biofilms can even exist on the inside of needles that are used to inject filler.\textsuperscript{21} Infections after filler injection are more common with long-acting, hydrophilic fillers. Although rare, infections often present as persistent, erythematous, tender nodules weeks after filler injection; uncommonly, these infections may present as an abscess or sinus. Unfortunately, these infections are often culture negative and therefore mistaken as an allergic reaction; misdiagnosis allows the infections to persist for months. The infections often resolve with the use of broad-spectrum antibiotics. Steroids, however, may worsen the condition due to immunosuppression.\textsuperscript{21}

**Foreign body granoma**

Sometimes the filler injectant (silicon, collagen, hyaluronic acid with or without acrylic gel, poly-methacrylate, poly-L-lactic acid, hydroxyapatite, polyalkylamide) will induce a reaction in the surrounding connective tissue. This reaction causes the deposition of collagen, phagocytosis of filler material, and the creation of a granuloma with histiocytes and multinucleated giant cells in the dermis within 5–15 months after filler injection. Foreign body granulomas present as single to multiple nodules and sometimes can present as drastically as diffuse facial swelling and redness. The differential diagnosis is vast and includes conditions such as erysipelas, allergic contact dermatitis, facial edema with eosinophilia, orofacial granulomatosis, as well as sarcoidosis.\textsuperscript{22}

Fortunately, although they are esthetically unappealing, most granulomas are asymptomatic. However, some granulomas may present with mild discomfort, local pain, edema, ecchymosis, erythema, and ulceration.\textsuperscript{22} There are many treatment choices for foreign body granulomas including antihistamines, systemic corticosteroids, local tacrolimus, minocycline, retinoids, allopurinol, 5\% imiquimod, or surgical removal.\textsuperscript{22,23}

**Conclusions**

As we age, the temporal fossa erodes giving the face an unappealing gaunt and intense appearance. Filling the temporal region with hyaluronic acid will give the face a more youthful look, and additionally a lateral brow lift. There are many techniques that may be used to inject filler into the fossa including a “fanned” pattern of injections, highly diluted filler injection, and the method we described using a three-injection approach. Complications of filler in the temporal fossa include bruising, tenderness, swelling, Tyndall effect, overcorrection, and chewing discomfort. Using reversible hyaluronic acid fillers, hyaluronidase can be used to relieve any discomfort felt by the patient. Although rare, more serious complications include infection, foreign body granuloma, intravascular necrosis, and blindness due to embolization into the ophthalmic artery. Dermatologists must be aware of the complications that may occur and provide treatment readily to avoid morbidities associated with filler injection into the temporal fossa.

**References**


11 Merz Temples Volume Scale. Reproduced with permission from Merz Pharmaceuticals, GmbH. Copyright 2014 Merz Pharmaceuticals, GmbH.


