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LETTER TO THE EDITOR

WILEY

A foreign body granuloma after dermal filler injection successfully treated with a combination of high-intensity focused ultrasound and quantum molecular resonance technology device

Dermal fillers are commonly used in rejuvenation treatment. However, they are exogenous to the body, and foreign body reactions, including granuloma formation, may occasionally occur after injection. Various treatments have been used for the treatment of foreign body granulomas, including intralesional corticosteroid injection, systemic corticosteroids, and surgical excision. In clinical practice, various off-label treatments have been attempted because there are no standard therapeutic principles. Here, we present a case of a patient with a dermal filler-induced foreign body granuloma who was successfully treated with high-intensity focused ultrasound (HIFU) and a quantum molecular resonance (QMR) technology-based device.

A 52-year-old woman presented with a 4-month history of skin-colored firm nodules with swelling of both cheeks (Figure 1A). She had received polylactic acid filler injection on both cheeks and nasolabial folds 1 year ago and hyaluronic acid filler injection at the same sites 8 months ago. The patient reported that the nodule had formed 4 months prior, and she had received treatment with hyaluronidase injection in the lesional area and systemic antibiotics. Despite treatment, the symptoms persisted.

In our clinic, in addition to systemic corticosteroid therapy, the patient was treated with a combination of HIFU (Ultraformer III (SHURINK), CLASSYS Inc) and a QMR technology-based device (Corage®™, QuanteQ, Seoul, Korea). The treatment area was 5.0 × 5.0 cm^2 on each cheek. After applying topical anesthetic cream, we used an HIFU device with two different transducers (L4-4.5:4 MHz, 4.5 mm focal depth, MF6: 2 MHz, 6.0 mm focal depth). The treatment lines included a total of 30 shots with L4-4.5 (0.9 J per shot) and MF6 (1.5 J per shot), distributing a total of 72 J on each lesion. The QMR device was used with the following parameters: 35 W per 180 s per 2 cycles. A handheld probe with a flattened ceramic surface was used to deliver the resonant energy evenly throughout the treated area (Figure 2). She received eight sessions of treatment at 1-week intervals. After treatment, a marked improvement was observed (Figure 1B). No adverse events were reported, except for mild erythema and pain, which resolved within 24 hours.

Nodule formation is one of the most common adverse events after dermal filler injections. Although early intervention, including resolution with hyaluronidase, vigorous massage, or intralesional steroid injection, can help disrupt the nodules, longstanding refractory nodules with pain and inflammation are most frequently associated with foreign body granulomas.[1,2] These chronic and intractable nodules can persist for months despite such treatment procedures and may become increasingly fibrotic, eventually requiring surgical excision. However, it is usually considered a last resort due to potential scarring.

In a previous report, the authors reported a case of a filler granuloma successfully treated using a bipolar radiofrequency (RF) device.[1] The therapeutic mechanism of RF in an implant nodule has been explained by collagen denaturation within the thermally modified deep tissues and the resulting neocollagenesis. However, previous studies have shown that RF delivery is more diffuse and tends to affect the dermis and the RF waves travel along connective tissue septae into the subdermis.

HIFU uses high-energy ultrasound waves to increase the temperature in the focal zone, inducing tissue destruction and coagulation necrosis. It has also been used for solid tumor ablation, including for prostate cancer and uterine fibroids. As the frequency (f) increases, the wavelength, which is proportional to the length and width of the focus, decreases. In addition, attenuation (α) also increases with frequency based on the power-law relationship $\alpha = \alpha_0 f^n$ (α_0, n: coefficient. n is typically close to 1 for most biological tissues, ranging closer to 2 for tissues with high water content), which results in a low penetration depth.[3] Based on these principles, HIFU for thermal surgery of larger, deep targets are usually operated at low frequencies (500-750 kHz). For dermatologic fields, relatively high frequencies (2-20 MHz) are used to ablate focal and small targets at a relatively shallow tissue layer (the dermis or subcutaneous fat layer). The ability to easily control the focal depth of the treatment zone by choosing the appropriate HIFU frequency is the advantage of the HIFU system. In this case, we used 2-MHz and 4-MHz transducers to treat the shallow and small-sized filler granulomas.

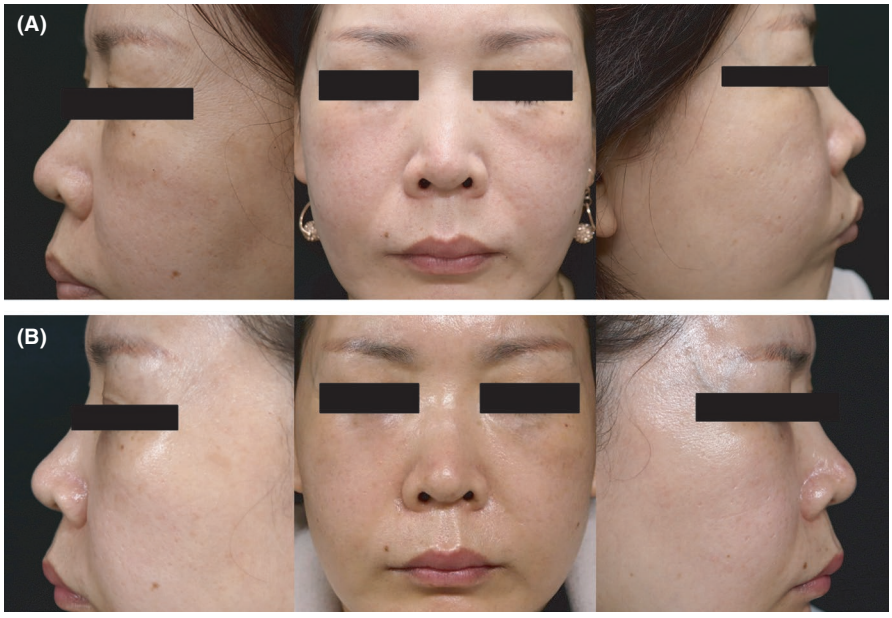

FIGURE 1 Clinical presentation 8 months after dermal filler injection on both cheeks. (A) Initial presentation. Skin-colored firm nodules with swelling on the face, especially in both lower eyelids. (B) Marked improvement of the lesional area after eight sessions of treatments

FIGURE 2 The CORAGE® TM medical device and flattened-surface ceramic prove

Compared to RF, HIFU is sharply focused and shows the highest neocollagenesis and neoelastogenesis in the deep reticular dermis. This indicates that HIFU has an effect on deep tissue and focal regions, whereas RF tends to affect diffuse regions and is less effective than HIFU in the deep reticular dermis.[4] Therefore, we speculated that HIFU could lead to a similar but more advantageous effect compared to RF in inducing thermal ablation of firm nodules without damaging the epidermis by focused collagen denaturation and neocollagenesis in our patient with a filler granuloma.

To maximize the therapeutic effects, we also included a QMR technology device (CORAGE®TM). It generates complex resonance waves, including more than 16 frequencies from 4 MHz to 64 MHz, to produce an electric field therapeutic zone. It has been proven that the radiation of the QMR device induces molecular resonance energy that affects the molecular bonds, resulting in cellular regeneration at the molecular level.[5] QMR devices reportedly decrease the number of inflammatory cells and upregulate the expression of vascular endothelial growth factor, resulting in wound healing.[6] Based on these findings, we expected that by collagen denaturation resulting in neocollagenesis, this device could ameliorate inflammation and accelerate the wound healing process of HIFU-induced necrotic areas. Finally, QMR technology has also shown an anti-edema effect,[6] which would be particularly beneficial in patients with filler granulomas because a filler granuloma is often accompanied by generalized edema at the site of filler injection. In this case, the patient also showed markedly decreased facial swelling.

To the best of our knowledge, this is the first reported case of a foreign body granuloma induced by dermal fillers successfully treated with a combination therapy using HIFU and a QMR technology-based device. We suggest that this combination therapy is an effective and safe treatment for nodular lesions. Further studies are required to determine the optimal treatment parameters.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare. This work has not been presented prior to this submission.

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