Hyaluronic Acid Filler Longevity and Localization: Magnetic Resonance Imaging Evidence

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Summary: Hyaluronic acid is the most commonly used facial dermal filler in aesthetic medicine. Identification of placement, longevity, and localization of hyaluronic acid fillers are becoming increasingly important. This article proposes a practical approach to monitoring the location and longevity of hyaluronic acid, using magnetic resonance imaging. (*Plast. Reconstr. Surg.* 147: 50e, 2021.)
CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, V.

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There are approximately nine publications regarding magnetic resonance imaging of dermal fillers.[1–9] There are no articles specific to magnetic resonance imaging of hyaluronic acid. In 2017, 2.69 million patients underwent filler treatments. The most commonly used product was hyaluronic acid.[10]

Hyaluronic acid is a biodegradable glycosaminoglycan naturally found in the extracellular matrix of the dermis and functions to maintain structure and function of the skin.[11] Hyaluronic acid fillers are regarded as medium-term fillers, designed to last between 3 and 12 months.[4]

As a hydrophilic protein, hyaluronic acid attracts water and maintains hydration wherever it is injected or naturally resides.[12] This study investigates the viability of magnetic resonance imaging to correctly identify the anatomical location, distribution, longevity, and complications, for potential further management.

PATIENTS AND METHODS

The single investigator is a dual-trained radiologist and aesthetic physician, who reported the magnetic resonance imaging scans of 14 patients, over a period of approximately 16 months. Nine referrals were obtained from aesthetic physicians, one was obtained from a plastic surgeon, and four were self-referred. Twelve magnetic resonance imaging scans were obtained by one technician, and two were obtained by other technicians. Two patients were given contrast. One magnetic resonance imaging scan was obtained on a 1.5-T Signa Explorer (GE Healthcare, Chicago, Ill.), one magnetic resonance imaging was obtained on a 3-T Skyra (Siemens, Munich, Germany), and the other 12 were obtained on the 3-T Pioneer (GE Healthcare).

ANATOMY

The signal of hyaluronic acid closely follows water signal because of its composition and its hydrophilic nature.[12] Fat and filler can be easily identified as separate entities.

Cross-sectional magnetic resonance imaging can easily identify the superficial musculoaponeurotic system, a critical structure to the aesthetic physician.[13] This has been rarely described on magnetic resonance imaging (Fig. 1). Anatomical localization of hyaluronic acid using magnetic resonance imaging was easily achievable by the radiologist.

RESULTS

Ten of the 14 patients denied any hyaluronic acid facial injections for more than 2 years at the time of the magnetic resonance imaging. All 10 had hyaluronic acid magnetic resonance imaging signal. Five patients denied any hyaluronic acid treatment in specific locations for more than 6 years; all had significant magnetic resonance imaging hyaluronic acid signal in those areas. One patient denied treatment with hyaluronic acid in the orbital region for over 12 years, which showed significant persistent periorbital hyaluronic acid. The most common clinical referral

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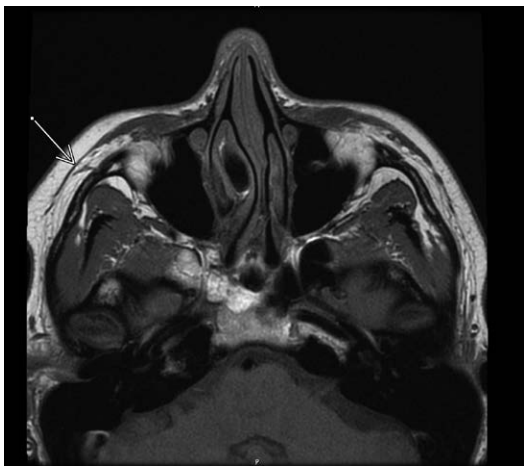

Fig. 1. Axial T1-weighted sequence 3-T magnetic resonance imaging scan obtained using the GE Pioneer. *Arrow* indicates the superficial musculoaponeurotic system.

was longstanding "puffiness" in a specific area, questioning the presence of hyaluronic acid, edema, or fat as a cause. One patient had significant undereye swelling directly after injection, which demonstrated postseptal hyaluronic acid in the right orbit. The signal of hyaluronic acid is similar to fluid signal but can be distinguished from other products, edema, or fluid collections.[4] Some imaging examples of longevity, placement, and potential migration are given.

CASE REPORTS

Case 1

A 54-year-old woman had multiple hyaluronic acid injections in the lips, tear troughs, and cheeks using Restylane (Galderma, Lausanne, Switzerland) and Juvéderm Ultra (Allergan, Inc., Dublin, Ireland). She denied any hyaluronic acid injections for over 2 years. Magnetic resonance imaging demonstrated residual hyaluronic acid signal in the cheeks, tear troughs, and lips. Potential misplacement or migration of hyaluronic acid was seen above the mucosal component of the upper lip, overlying the orbicularis oris (Fig. 2).

Case 2

A 37-year-old woman had bilateral hyaluronic acid bolus injections (product unknown) into the piriform fossae or nasolabial folds 6 years previously. Magnetic resonance imaging demonstrated hyaluronic acid deep within the nasolabial fat pads, tracking laterally and inferiorly (Fig. 3).

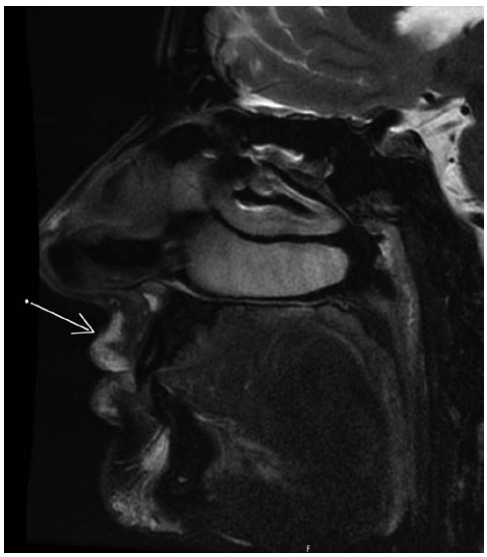

Fig. 2. A sagittal T2-weighted fat saturation 3-T magnetic resonance imaging scan obtained using a GE Pioneer magnetic resonance imaging scanner. *Arrow* indicates the hyaluronic acid signal overlying the orbicularis oris.

Case 3

A 52-year-old woman had 3 ml of Teosyal (Teoxane SA, Geneva, Switzerland) administered, approximately 2 years previously, with a 22-gauge cannula to the malar fat pads. The technique attempted was in the supraperiosteal plane. Extensive magnetic resonance imaging hyaluronic acid signal was seen in the supraperiosteal deep malar fat, tracking along the supraperiosteal

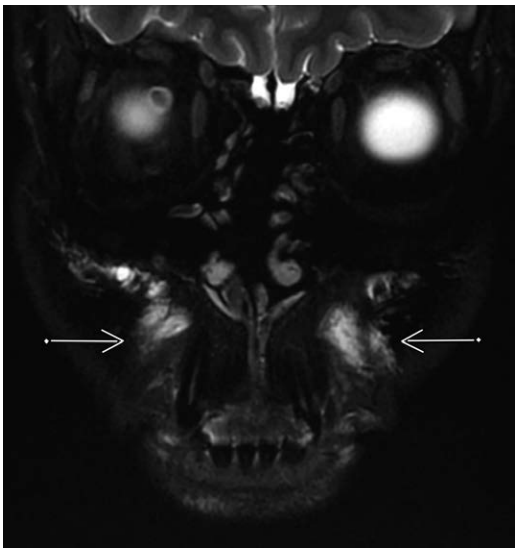

Fig. 3. Coronal T2-weighted fat saturation 3-T magnetic resonance imaging scan obtained using a GE Pioneer magnetic resonance imaging. *Arrow* indicates the hyaluronic acid signal within the nasolabial fat pads.

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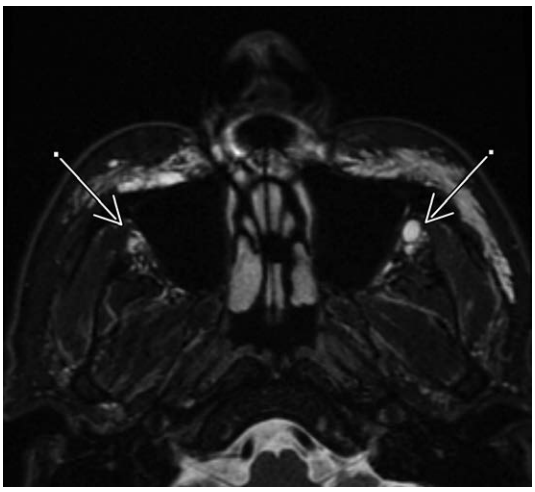

Fig. 4. Axial T2-weighted fat saturation 3-T magnetic resonance imaging scan obtained using a GE Pioneer magnetic resonance imaging scanner. *Arrows* indicate the hyaluronic acid signal overlying the lateral wall of the maxillary sinus.

plane, adjacent to the lateral wall of the maxillary sinus deep and posteriorly (Fig. 4).

DISCUSSION

Satisfactory high-resolution imaging was achieved within 25 minutes and 30 minutes with contrast administration, using a proposed "face" protocol. Such a short scan time can render magnetic resonance imaging economically viable, with the field of view to be adjusted to the region of interest of the face. The suggested magnetic resonance imaging face protocol is as follows:

1. Sagittal T2-weighted fat saturation 3 mm.
2. Sagittal T1-weighted 3 mm.
3. Axial T2-weighted fat saturation 2 mm (Flex, General Electric/Dixon, Siemens).
4. Axial T1-weighted 2 mm.
5. Axial diffusion-weighted imaging b1000 4 mm.
6. Coronal T2-weighted fat saturation face 3 mm.
7. Postcontrast sagittal T1-weighted fat saturation three-dimensional volume (face).
8. Postcontrast sagittal T1-weighted fat 3 mm (Flex, General Electric/Dixon, Siemens) (for orbits).

Ultrasound is an alternative imaging modality for imaging of dermal fillers; however, the limitations include that fact that it has less depth resolution, it is operator dependent, and it is a real-time modality, with images that are difficult to interpret after the fact. Ultrasound is particularly useful for clinically apparent focal nodules and recent injections, beyond the resolution of magnetic resonance imaging. The appearance of hyaluronic acid changes over time, and it is more difficult to identify once integrated. Magnetic resonance imaging provides a satisfying "snapshot" of the entire face.

The main limitations of this study are the small cohort and limited clinical notes on the product and placement at the time of injection. The potential migration of hyaluronic acid and unexpected longevity are well highlighted. All patients in this group were treated with a view to use magnetic resonance imaging as a "cognitive roadmap" for dissolving hyaluronic acid with hyaluronidase. For example, one had the postseptal hyaluronic acid dissolved under sonographic guidance (to avoid the globe), and the repeated magnetic resonance imaging scan showed almost complete resolution of the postseptal hyaluronic acid.

Certain patients demonstrated magnetic resonance imaging evidence of hyaluronic acid well over 6 years after injection (e.g., the nasolabial fat compartment filler possibly from migration attributable to the longevity or possibly related to technique). It is unclear as to the cause for persistent hyaluronic acid in various locations; however, this study raises concerns regarding long-term management of hyaluronic acid. Magnetic resonance imaging is helpful in situations that cannot be resolved clinically. If overfilling, persistence, or migration is confirmed with magnetic resonance imaging and hyaluronic acid is determined to be the culprit, a simple injection of hyaluronidase can reverse the unwanted outcome.[14] More extensive, larger cohorts on these specific issues are required.

CONCLUSIONS

Magnetic resonance imaging can become a potential monitor of longevity, localization, and possible migration of hyaluronic acid, with an efficient protocol proposed in this article. All patients who had denied treatment with hyaluronic acid for over 2 years demonstrated magnetic resonance imaging evidence of hyaluronic acid. One patient had significant hyaluronic acid 12 years after treatment. This study raises awareness of the unexpected longevity of hyaluronic acid and recognizes the need for a larger cohort study.

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REFERENCES

1. Jeong KH, Gwak MJ, Moon SK, Lee SJ, Shin MK. Efficacy and durability of hyaluronic acid fillers for malar enhancement: A prospective, randomized, split-face clinical controlled trial. *J Cosmet Laser Ther.* 2018;20:184–188.
2. Kadouch JA, Tutein Nolthenius CJ, Kadouch DJ, van der Woude HJ, Karim RB, Hoekzema R. Complications after facial injections with permanent fillers: Important limitations and considerations of MRI evaluation. *Aesthet Surg J.* 2014;34:913–923.
3. Di Girolamo M, Mattei M, Signore A, Grippaudo FR. MRI in the evaluation of facial dermal fillers in normal and complicated cases. *Eur Radiol.* 2015;25:1431–1442.
4. Tal S, Maresky HS, Bryan T, et al. MRI in detecting facial cosmetic injectable fillers. *Head Face Med.* 2016;12:27.
5. Kadouch JA, Tutein Nolthenius CJ, Kadouch DJ, van der Woude HJ, Karim RB, Hoekzema R. Complications after facial injections with permanent fillers: Important limitations and considerations of MRI evaluation. *Aesthet Surg J.* 2014;34:913–923.
6. Tal S, Maresky HS, Bryan T, et al. MRI in detecting facial cosmetic injectable fillers. *Head Face Med.* 2016;12:27.
7. Luiz Ferreira Costa A, Caliento R, Liberato da Rocha GB, et al. Magnetic resonance imaging appearance of foreign-body granulomatous reactions to dermal cosmetic fillers. *Imaging Sci Dent.* 2017;47:281–284.
8. Di Girolamo M, Mattei M, Signore A, Romana Grippaudo F. MRI in the evaluation of facial dermal fillers in normal and complicated cases. *Eur Radiol.* 2015;25:1431–1442
9. Becker M, Balagué N, Montet X, Calmy A, Salomon D, Toutous-Trellu L; LIPO and Metabolism Group. Hyaluronic acid filler in HIV-associated facial lipoatrophy: Evaluation of tissue distribution and morphology with MRI. *Dermatology* 2015;230:367–374.
10. American Society of Plastic Surgeons. 2017 plastic surgery statistics. Available at: https://www.plasticsurgery.org/documents/News/Statistics/2017/plastic-surgery-statistics-report-2017.pdf. Accessed August 7, 2019.
11. Beasley KL, Weiss MA, Weiss RA. Hyaluronic acid fillers: A comprehensive review. *Facial Plast Surg.* 2009;25:86–94.
12. Murthy R, Roos JCP, Goldberg RA. Periocular hyaluronic acid fillers: applications, implications, complications. *Curr Opin Ophthalmol.* 2019;30:395–400.
13. Mendelson B, Wong CH. Anatomy of the aging face. *Plast Surg.* 2013;6:79
14. Lemperle G, Duffy DM. Treatment options for dermal filler complications. *Aesthet Surg J.* 2006;26:356–364.

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