Cheek Augmentation and Rejuvenation Using Injectable Calcium Hydroxylapatite (Radiesse®)

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Soft tissue fillers are becoming increasingly important as nonsurgical treatment options for patients seeking to ameliorate the appearance of facial aging. Radiesse®, a calcium hydroxylapatite (CaHA) compound in an aqueous gel carrier, is gaining popularity as a nonsurgical facial contouring agent. We examine the use of CaHA for cheek augmentation, providing an overview of available soft tissue fillers, as well as a description of CaHA, its clinical applications, and injection techniques for facial contouring. Additionally, we discuss which patients and treatment areas are optimal candidates for this longer-lasting soft tissue filler.

Soft tissue fillers continue to be introduced to the medical marketplace for use in facial aesthetics. More than a dozen on-label and off-label filler materials ranging in duration of action from short lived to longer lasting to permanent are already in use by clinicians.[1] Some of the facial fillers, including collagen, hyaluronic acid, and poly-L-lactic acid, have been approved for facial soft tissue augmentation. Other fillers with approved non-cosmetic indications have been adapted for facial aesthetic use. Radiesse® (calcium hydroxylapatite [CaHA]), for example, currently is approved in the United States for vocal fold augmentation, radiographic soft tissue marking, and craniofacial defect correction. Although not approved at this time for facial aesthetics by the US Food and Drug Administration (FDA), CaHA does have clearance status in Europe, Canada, and Latin America for this purpose.[2,3]

CaHA is an injectable implant material that contains uniform CaHA microspheres suspended in an aqueous carboxymethylcellulose gel carrier. Recently, off-label use of CaHA in facial aesthetics has been reported for the correction of deep folds and rhytides in the nasolabial crease, marionette lines/oral commissurae, glabella, and infraorbital rim depression.[4-10] FDA-supervised clinical trials investigating the potential use of CaHA for the correction of soft tissue defects, such as facial lipoatrophy associated with human immunodeficiency virus infection and nasolabial folds, have been completed and are awaiting FDA clearance.

A less-explored application of CaHA is the enhancement of facial arches. Specifically, soft tissue augmentation within the malar and submalar areas using this longer-lasting material may have profound effects on the overall

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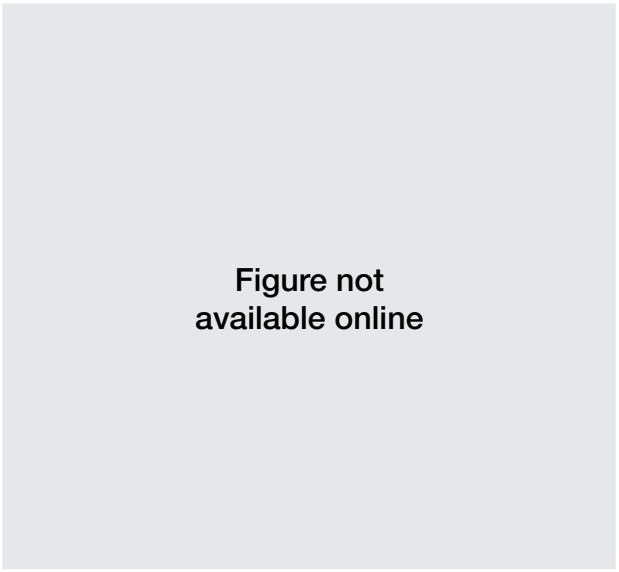

Figure 1. Shading indicates potential areas of calcium hydroxylapatite use. Illustration courtesy of Christie Thompson.

appearance of the aging face. By restoring structural support and fullness to the malar and submalar areas, the shadowing effect typically associated with the aging malar region can be diminished, resulting in a more youthful appearance. Although clinicians often speak of this treatment as cheek augmentation, *cheek rejuvenation* may be a more appropriate term because a younger appearance is achieved posttreatment. We describe our use of CaHA in facial contouring and cheek rejuvenation.

CALCIUM HYDROXYLAPATITE

CaHA is found in nature as the mineral component of human bone. Synthetic CaHA shares the same biocompatibility profile of the natural compound. The compound requires no skin testing, shows no evidence of migration or ossification (when used subdermally), and appears to be relatively long lasting. As Sklar and White[4] observed, these properties are "sought after in an 'ideal' soft tissue filler."

CaHA consists of microspheres (25–45 µm) carried in a gel that consists of glycerin, sterile water, and sodium carboxymethylcellulose. A preclinical study demonstrated that the gel is phagocytosed over 4 to 12 weeks, leaving only the microspheres.[11] These CaHA microspheres do not migrate and do not calcify.[12] Instead, microspheres remain in place to act as a scaffold that promotes soft tissue formation within the tissue where the CaHA is placed. For example, when injected into the dermis, the CaHA microspheres support in-growth of fibroblasts that lay down a collagenous extracellular matrix over time. As matrix is deposited, the implant becomes integrated into the surrounding soft tissue, which provides for its longer-lasting effects.[12] Implant material palpability diminishes over time as the CaHA is integrated into the surrounding soft tissue. CaHA microspheres are not permanent; the particles slowly are broken down into calcium and phosphate ions via the body's normal metabolic processes.[12]

Longevity

In our practice, the duration of action of CaHA as a facial filler within motile areas of the face, including nasolabial folds and marionette lines, generally has ranged from 12 to 18 months, resulting in an average duration of 14 to 15 months. Longer-lasting results (18–24 months) can be expected, however, in areas of relative stasis, including those areas overlying bony prominences without concomitant muscle activity such as areas superficial to the zygomatic arch, infraorbital rim, mentum, and dorsal nose. It is important to consider that the longevity of correction is dependent on multiple factors, including the area in which the material is placed, the age of the treated patient, his/her ability to synthesize new soft tissue, and his/her rate of metabolism.

GUIDELINES FOR EFFECTIVE USE OF CaHA AS A SOFT TISSUE FILLER

Facial areas and uses where CaHA may provide superior and long-lasting results include one or more of the following, depending on the patient's current condition and past medical history: general malar and submalar augmentation and contouring, infraorbital rim, nasal dorsum and tip, nasolabial folds (mesolabial), infracommissural folds, marionette lines and prejowl sulcus, chin contouring and mental crease, acne scars and depressions, deep glabellar furrows, lateral brow, and soft tissue deformities arising from lipoatrophy associated with human immunodeficiency virus infection and other conditions (Figure 1).

In contrast, areas where CaHA injection generally is not recommended include the lip mucosa, tear trough/nasojugal groove, and temple. Historical use of CaHA within the lip mucosa has demonstrated a propensity to develop nongranulomatous nodules of aggregated material because of the repeated motion of the orbicularis oris muscle in a small percentage (about 10%) of patients. Reports have shown that these nodules, which may persist for weeks to months, effectively can be reduced with massage or conservative steroid injection. Excision of nodules from the lip mucosa is a rare event.[1] Further, the thin nature of the skin and soft tissue overlying the tear trough and temple areas combined with the opacity of CaHA precludes use of this compound because of the potential for product visualization following injection and surface irregularities.

General Injection Technique Considerations

Many clinicians in aesthetic medicine are well versed in injecting materials such as collagen and hyaluronic acid into facial soft tissues for the correction of superficial folds or rhytides. These materials typically flow easily during injection, are placed within the superficial to mid dermis, and tend to be forgiving. If nodularity or surface irregularity occurs, massage is used to smooth the area; in rare cases, enzymatic digestion is required.

CaHA is safe and biocompatible, with no reports of allergic reactions or granuloma formation attributable to the product. However, some important technique considerations should be made when injecting the material into the dermis. In contrast to collagen-based or hyaluronic acid–based fillers, CaHA augmentation results are best when the compound is injected into the deep dermis or dermal-subcutaneous border in multiple fine linear threads in a fanning motion averaging 0.05 mL for each thread. Because of the scaffolding effect of CaHA, threads laid within the tissue in multiple planes using a cross-hatching pattern will provide the best structural support for future tissue in-growth and provide optimal and lasting correction.

Care should be taken to ensure that placement of the material is not too superficial or too deep. Superficial placement may result in visualization of the product or visible surface irregularities, whereas placement too deep (within the deep subcutaneous space) will result in a markedly shorter duration of results because tissue in-growth will be limited. In instances where surface irregularities are seen subsequent to injection, the material effectively can be massaged and molded to provide the desired outcome.

Volumetric correction with CaHA may require that the patient progressively be brought to full augmentation. Overcorrection is not necessary or recommended. For optimal and long-lasting results, a second touch-up procedure is warranted. Recent evidence suggests that the gel carrier of CaHA resorbs at a slightly faster pace than the pace at which tissue in-growth occurs.[12] It is the experience of the authors that performing a touch-up injection at approximately 8 to 12 weeks following initial injection optimizes longevity and provides a safe mechanism to reach full correction.

Irregularity in the skin surface with initial results appears to be associated primarily with technique and inversely may be proportional to experience with injecting the product. Consequently, the novice CaHA injector should perform several basic injections into areas that tend to be more forgiving (eg, nasolabial folds, marionette lines). With experience, more advanced facial contouring techniques can be accomplished.

Other areas (eg, malar/submalar, infraorbital rim, prejowl sulcus, chin) may be added to the clinician's treatment options as his/her comfort and competence increase. Although CaHA is not for use in all facial areas, when used appropriately, the compound provides a safe and unique option for clinicians seeking a nonsurgical facial-contouring material that provides patient satisfaction and longer-lasting results.

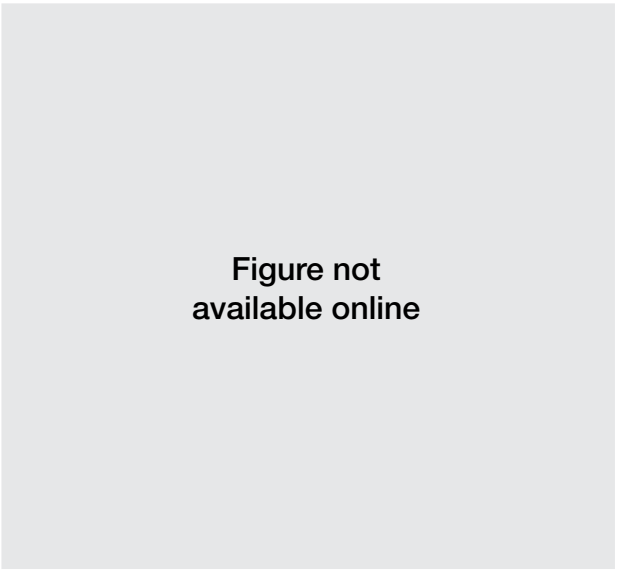

Figure 2. Triangle of beauty associated with a youthful appearance. Illustration courtesy of Christie Thompson.

FACIAL CONTOURING AND REJUVENATION WITH CaHA

Enhancement of the malar eminence is one of the most challenging areas for nonsurgical intervention because available filler options historically have not met the demands for structural support or longevity of correction. However, with the advent of longer-lasting filler materials, nonsurgical malar augmentation can achieve excellent and enduring results. Correct application of a durable soft tissue filler that provides structural lift can restore facial balance to the much-valued inverted triangle of beauty associated with a youthful appearance (Figure 2). This triangle of beauty contrasts to the U-shaped trapezoidal or rectangular outline commonly seen in aged individuals as a result of bone mass loss, soft tissue atrophy, and skin laxity. The rationale for using filler materials in facial contouring lies in 3 tissue dynamics at work: filling, pulling, and lifting. Consequently, the well-executed use of a facial filler in the cheek does more than augment—it creates a rejuvenating effect.

Cheek augmentation should be planned in the context of the entire face, not just the area overlying the malar eminence. When performing facial contouring (eg, augmentation of many areas including the cheek, nasolabial folds, and marionette lines), clinicians should treat the

malar area first because augmentation of the cheek also affects other areas of the face. In particular, cheek augmentation should precede any treatment of the nasolabial folds and zygomatic/suborbital rim. Because of its pervasive effect on the face, cheek augmentation tends to lessen the amount of excess skin in both of these areas by augmenting the underlying bony structure and providing a lift effect. As a result, less volume of material is required to provide full correction in the subsequent areas.

Planning Cheek Augmentation Treatment

When planning treatment of cheek augmentation, clinicians need to be mindful of several considerations. Initial focus should be placed on expanding the entire space, not on simply filling the depressed areas. This larger focus is the distinction between cheek augmentation and other more isolated treatment protocols. In addition, shadowing along the central malar ridge arises from soft tissue deficiencies throughout the area. Concentrating on the malar ridge in clinical isolation does not optimally address the issue of diffuse soft tissue deficiencies. Moreover, permanent solid material implants possess a rigidity that prevents their accommodating volume deficiency as the patient continues to age. On the other hand, long-lasting but nonpermanent fillers allow for a smoother transition between implanted areas and surrounding tissue. Finally, more soft tissue filler may be required as the product is metabolized over time. Ease of administration of this soft tissue filler makes the addition of the product at a later date less problematic for the patient and clinician and allows for the restoration of facial contours as the face continues to age.

For a smoother look and more natural feel, filler should be placed at the junction of the deep dermis and the subcutaneous tissue. To provide for more structural support over bony prominences, material also can be deposited within the subcutaneous space along the bony prominence. Importantly, injected material should not be placed above the orbital rim. The clinician should be mindful that cheek augmentation is best accomplished by including enhancement of the nasolabial folds as necessary and only after treatment of the malar areas, and treating one side of the face completely before moving to the other because patients may require different volumes of product to correct facial asymmetry.

Anesthetic Prior to Injection of CaHA

Prior to injection of CaHA, anesthetic considerations must be addressed. In our practice, we often follow a regimen used by Zide[5] that involves administration of an infraorbital nerve block to make patients comfortable during injection (Figure 3). We have found that only a small amount of anesthetic (0.2–0.3 mL/side) followed by massage is necessary to prevent distortion of the area to be treated.

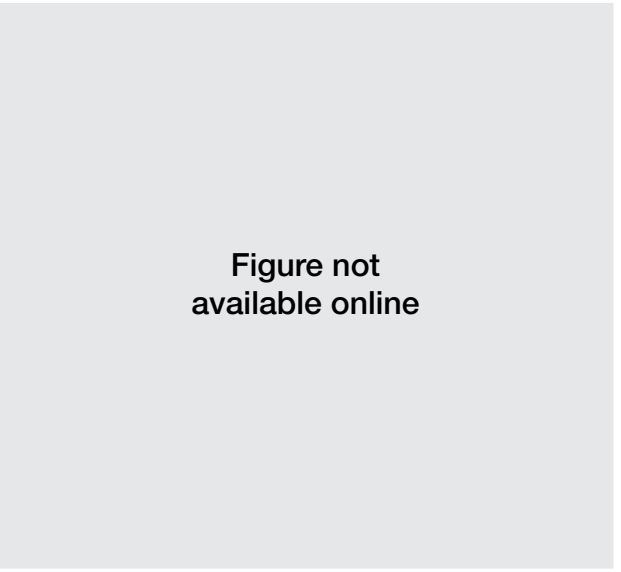

Figure 3. Infraorbital nerve block. Illustration courtesy of Christie Thompson.

In addition to the infraorbital nerve block, 0.1 to 0.3 mL of local anesthetic also may be administered via direct tissue infiltration (avoiding tissue distortion as much as possible) to any areas where injections may take place outside of the infraorbital anesthesia during the course of treatment. This will ensure patient comfort throughout the facial contouring procedure. Administration of minute amounts of CaHA in these areas helps complete restoration of the facial aesthetic triangle described earlier. Other clinicians may prefer to use topical anesthetics and direct skin cooling prior to injecting the less sensitive areas of the mid and lateral cheek not anesthetized by the infraorbital block.

Injection of the Malar and Zygomatic Regions

Cheek augmentation most often begins in the malar region of the face (Figure 4). When planning the treatment procedure, the clinician should approach the area from below and proceed upward with injection into the malar soft tissue. A 27-gauge 1.25-in needle is the needle of choice for this particular procedure because multiple linear threads are placed 3-dimensionally in a fanning motion across the malar eminence. Cross-hatching of material in multiple planes and depths is essential for optimal structural support. The threading pattern into the malar area approximates the shape of an inverted right triangle.

After the product has been fanned into the malar area, the clinician should laterally approach the area perpendicular to the first injection. The same fanning technique

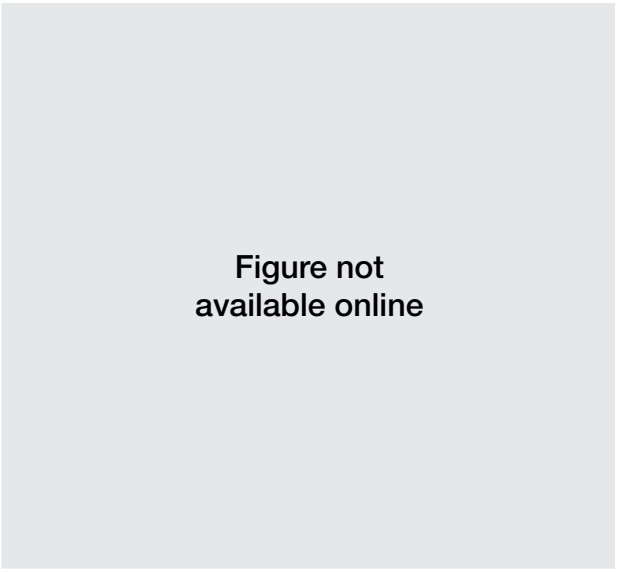

Figure 4. Cheek augmentation areas. Illustration courtesy of Christie Thompson.

is used a second time to crosshatch with 3 or 4 threads of product within a triangulated shape. Again, deposition of material should never extend above the inferior orbital rim.

Finally, multiple strands of the product are extended laterally along the zygoma, using the fanning technique, to accentuate its natural prominence. A second pass of injection to create a cross-hatch usually is not required for the zygoma. As is the case with the malar region, injection should not extend beyond the inferior orbital rim.

While injecting CaHA, the clinician must be mindful of 2 important considerations. First, during cheek augmentation, the needle should not be completely removed during the fanning process. Second, only small volumes of CaHA are required during each thread deposition, typically 0.05 mL for each pass. Following injection, the implanted material easily can be massaged and molded to provide the desired end result. After the malar and submalar areas have been treated, the clinician should massage all the implanted areas to eliminate any possible palpable filler material. Typical volumes required for facial contouring of the above-mentioned areas range from 1.4 to 2.0 mL (0.7–1.0 mL per malar area).

The complete sequence of injection is repeated for the other side of the face. In some cases, preexisting cheek asymmetry may be present. In cases of asymmetry, more facial filler may be required unilaterally to achieve symmetry. In addition, any remaining depression in the submalar area may be filled as complementary correction, followed by extension along the zygoma to provide more support and to accentuate the underlying bony eminence in the area.

Posttreatment Care and Adverse Events

The typical course for posttreatment care involves application of ice over the injection areas to reduce and limit tissue edema. Patient follow-up visits typically are scheduled 8 to 12 weeks after treatment to document any adverse events and provide touch-up injections as necessary.

Adverse events associated with injection of CaHA into the malar and submalar areas include those typically associated with other filler materials, including but not limited to edema, ecchymosis, temporary pain that persists for a few minutes, and tissue soreness the first few days following injection. Patients taking blood thinners may experience more bruising and swelling than usual. In our practice, patients have not experienced or reported severe adverse events such as granulomatous reactions or extravasation of material.

Summary of Cheek Augmentation

Many patients who demonstrate the typical signs of aging, including atrophy of the malar zone, often request correction of only the prominent nasolabial folds. We believe that patients may be better served by being counseled on all aspects of facial aging, including cheek atrophy. Cheek augmentation has the effect of providing facial rejuvenation to the patient and also softening the nasolabial folds. Although some additional injection of soft tissue filler into the nasolabial folds may be appropriate after cheek augmentation, the volume typically required is much less because of the effects already induced through treatment of the malar area.

Results

Restoring more youthful anatomic features through cheek augmentation not only reduces the shadowing effect that aging exerts in this area but also rebalances midface proportions and reduces skin surplus from the nasolabial and suborbital regions. For these reasons, we have found that cheek augmentation is most comprehensive when it involves the full extent of the malar region, extending laterally toward the temple initially, followed by treatment of the nasolabial folds as necessary. This comprehensive approach restores the appearance of the triangle of beauty.

Figure 5 shows a 64-year-old white woman before and after treatment with CaHA for cheek augmentation. The posttreatment photograph was taken at 2 weeks. This patient demonstrates the rejuvenation that comprehensive cheek augmentation can elicit. Her results also support our position that cheek augmentation is a more efficacious treatment strategy compared with treatment of isolated areas of the face, such as the nasolabial folds or zygoma.

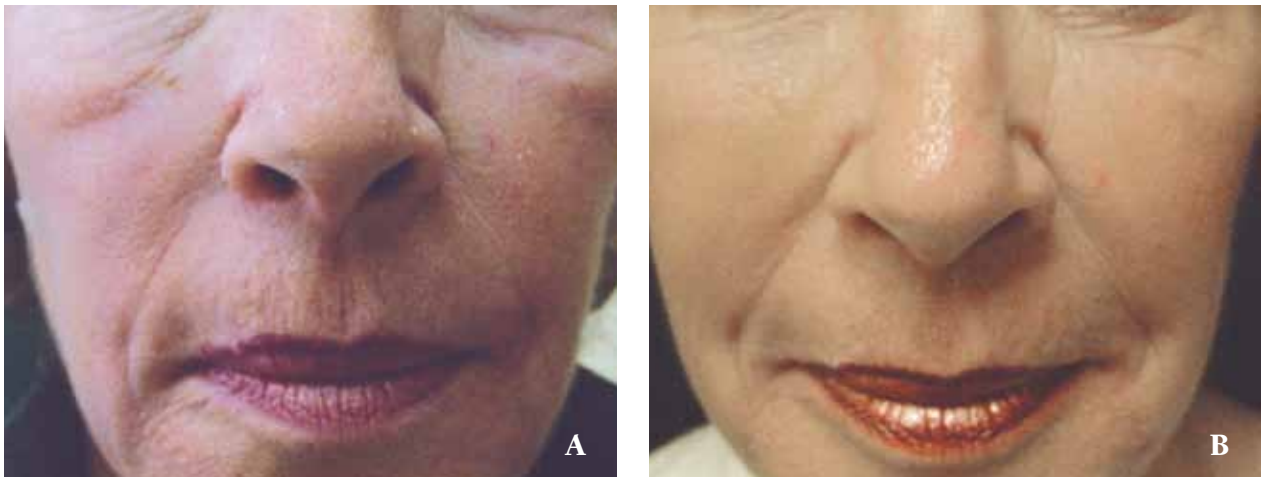

Figure 5. Cheek augmentation in a 64-year-old white woman pretreatment (A) and 2 weeks posttreatment (B).

COMMENT

One rapidly evolving area of aesthetic (procedural) dermatology is nonsurgical soft tissue augmentation with facial fillers. CaHA offers considerable benefit to patients with certain needs, though the product is not intended for every patient and every application. However, CaHA is a tool that should be included in the aesthetic physician's cosmetic armamentarium. The compound complements existing tools and products rather than substitutes and/or replaces products. Because CaHA enhances structural support, the compound is appropriate for correcting soft tissue deficiencies in which the skin has lost some of its elasticity and fullness. Overlaying more superficially placed dermal fillers after facial recontouring with CaHA (Radiesse) can enhance results and allow for more discreet fine-line correction when indicated.

In our experience, patients for whom CaHA is inappropriate are those seeking lip or lower periocular augmentation, those with active infections at the site, and those with unrealistic expectations of treatment outcome. Injections in the lower lid area and the tear trough area, such as injections in the lips, may cause problems and should be avoided by novice injectors as well as other physicians not well versed in injection in these areas. Other considerations that warrant scrutiny before selecting CaHA are preexisting long-term filler materials or preexisting allergic reactions at the site to be treated.

CaHA is particularly attractive for facial recontouring applications because the product has both tissue-expanding and fibroblast-inducing properties. These properties elicit a triple effect—filling, lifting, and pulling—compared with a facial filler. As a result, in addition to cheek augmentation, panfacial rejuvenation occurs posttreatment. Moreover, CaHA has a favorable longevity profile. Our experience with CaHA for cheek augmentation has led to uniformly positive outcomes in the patients we have treated.

REFERENCES

1. Jansen DA, Graivier MH. Soft tissue substitutes in perioral augmentation. *Semin Plast Surg.* 2003;17:181-197.
2. Belafsky PC, Postma GN. Vocal fold augmentation with calcium hydroxylapatite. *Otolaryngol Head Neck Surg.* 2004;131:351-354.
3. Rosen CA, Thekdi AA. Vocal fold augmentation with injectable calcium hydroxylapatite: short-term results. *J Voice.* 2004;18:387-391.
4. Sklar JA, White SM. Radiance FN: a new soft tissue filler. *Dermatol Surg.* 2004;30:764-768.
5. Zide BM. Radiance: a short-term experience. *Aesthetic Surg J.* 2003;23:495-499.
6. Busso M. Cosmetic procedure: soft tissue augmentation with Radiance FN. *Aesthetic Trends Technol*. Summer 2003;2:11-13.
7. Wilson F. Cosmetic dermatology. Radiance fills nasolabial folds, defects, and facial lines—even around the lips. *Dermatol Times.* 2004;25(suppl 2).
8. Jesitus J. Radiesse effective intermediate filler. *Cosmet Surg Times.* August 2004;Special Report:14, 17.
9. Meszaros L. Collagen alternative for facial soft tissue augmentation offers good results. *Cosmet Surg Times.* July 2003;Special Report.
10. Nataloni R. Facial filler study shows less is more. *Dermatol Times.* November 2003;24.
11. Mayer, R, Lightfoot M, Jung I. Preliminary evaluation of calcium hydroxylapatite as a transurethral bulking agent for stress urinary incontinence. *Urology.* 2001;57:434-438.
12. Marmur ES, Phelps R, Goldberg DJ. Clinical, histologic and electron microscopic findings after injection of a calcium hydroxylapatite filler. *J Cosmet Laser Ther.* 2004;6:223-226. ■