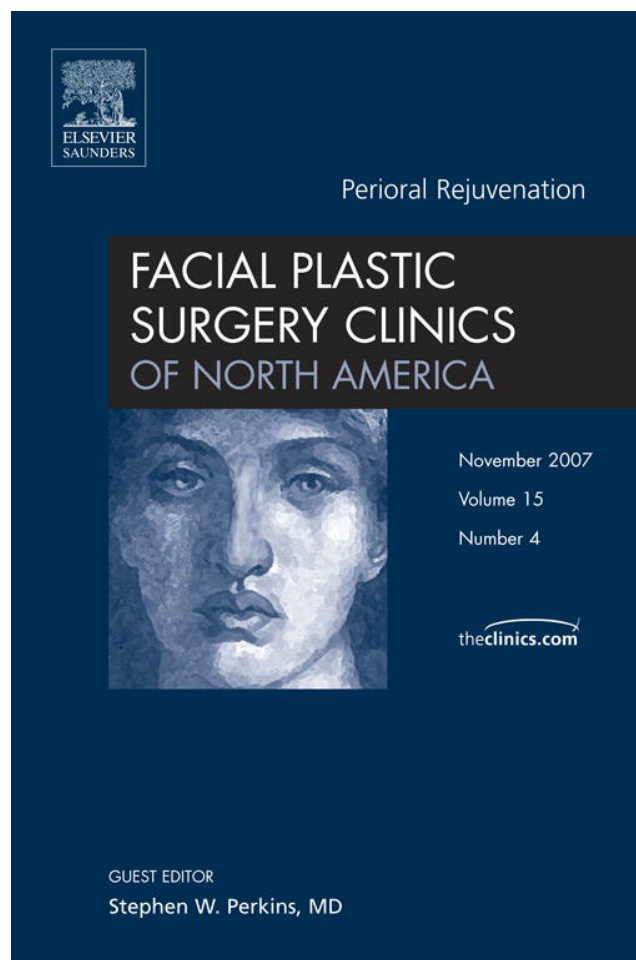


Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article was published in an Elsevier journal. The attached copy is furnished to the author for non-commercial research and education use, including for instruction at the author's institution, sharing with colleagues and providing to institution administration.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Perioral Rejuvenation and Lip Augmentation

M. Jafer Ali, MD^a, Kevin Ende, MD^{a,b}, Corey S. Maas, MD^{a,b,*}

- Perioral facial aging
 - Soft tissue augmentation*
- Biologically active injectables: Botox
- Autologous fat injection
- Collagen fillers
- Hyaluronic acid fillers
 - Restylane*
 - Perlane*
- *Captique*
- *Hyalafom and Hyalafom Plus*
- *Clinical use of hyaluronic acid products in the perioral region*
- Calcium hydroxylapatite (Radiesse)
- *Surgical rejuvenation*
- *Ablative resurfacing*
- References

Perioral facial aging

The process of facial aging generally consists of intrinsic and extrinsic processes. Intrinsically, the most significant changes occur in the dermis where the ground substance, predominantly consisting of glycosaminoglycans and proteoglycans, decreases. The ratio of type I to type III collagen diminishes and elastic fibers, which maintain the pattern of collagen bundles, become thin and fragmented, resulting in an overall reduction in the total amount of collagen. In addition to aging, external processes such as actinic damage may accelerate this decline.

The decreased laxity of the skin, along with habitual repeated contraction of the underlying facial muscles, result in wrinkles or rhytids. In general, the aging process of the face is a process of atrophy.

The lips are the foundation on which the remainder of the perioral region is centered. In the modern aesthetic, full lips provide a youthful healthy appearance. A key external anatomic feature of the lips is the Cupid's bow complex of the upper lip,

formed by two high points of the vermilion joined at a V-shaped depression centrally. The lower lip has no such depression. Lying between the cutaneous and red lip is the white roll which refers to the raised line of skin that separates these structures.

Most of the lip bulk is the orbicularis muscle. This muscle is separated from the vermilion and cutaneous portions of the lip with a fascial layer. In the upper lip, the orbicularis muscle fibers decussate and insert into the contralateral philtral ridge. The lip commissures represent a complex array of lip elevators and depressors and the buccinator muscles.

The aging process of the lips begins with a proliferative phase from birth to pubescence, represented by glandular and muscular hypertrophy resulting in full, youthful appearing lips. After puberty, gradual atrophy of the structures occurs that is influenced by the aging process of not only the skin but also supporting structures such as the teeth, muscle, and bone. Visually, the aging lip is characterized by a decrease in vermilion show, blunting of the

^a Department of Otolaryngology-Head and Neck Surgery, University of California, San Francisco Medical Center, 400 Parnassus, Box 0342, San Francisco, CA 94143, USA

^b The Maas Clinic for Facial Plastic and Aesthetic Surgery, 2400 Clay Street, San Francisco, CA 94115, USA

* Corresponding author.

E-mail address: drmaas@drmaas.com (C.S. Maas).

Cupid's bow, and an attenuated white roll [1]. The repetitive activity of the circular orbicularis muscle itself can also lead to vertical rhytids of the upper and lower lips. These rhytids have been referred to as *smoker's lines* because they are often accentuated in smokers.

Over time, marionette lines may also form. Marionette lines are characterized by vertical lines at the oral commissures, resulting in an expression of sadness. They are the result of muscle hyperactivity; in this case, the depressor angularis oris muscle. The depressor angularis oris muscle finds its origin at the oblique line of the mandible, lateral and inferior to the depressor labii inferioris muscle, where some of its fibers also join the platysma muscle. The muscle then fuses with fibers from the risorius and orbicularis oris muscle at the oral commissures, forming what is called the *modiolus*. In the aging face, contraction of this muscle over time may cause these vertical rhytids, resulting in a sad expression. Extrinsic factors such as actinic damage and smoking may accentuate these lines.

Two additional signs of aging are seen in the area of the mentum, including the mentalis crease and *peau d'orange*. The mentalis muscle finds its origin at the incisor fossa and extends vertically and medially to fuse with the orbicularis oris. Its action is to evert the lower lip. The repetitive action of this muscle over time can lead to a transverse rhytid which is known as a *mentalis crease*, which gives an expression of doubt. *Peau d'orange*, the French term meaning orange skin, describes a condition of dimpling rhytids on the chin resulting from visible attachments of the superficial musculoaponeurotic system (SMAS) with the mentalis muscle, seen through aging thin skin [2].

Finally, one of the more telltale signs of the aging face is the increasingly deep nasolabial folds that are formed by the malar fat overlying the complex of the orbicularis oris, levator labii superioris, and zygomaticus major muscles. Muscular activity and ptosis of skin and the SMAS contribute to their relative severity and depth.

Soft tissue augmentation

Modern soft tissue augmentation dates back to the late 19th century when Neuber [3] first used autologous fat to correct depressed facial defects in patients who had tuberculous osteitis. In the early 1900s, injectable paraffin gained popularity until foreign body granuloma was found to often be the result. Refined injectable silicone was introduced by Dow Corning in 1962 and initially hailed as an ideal dermal implant, with excellent cosmetic results and high use potential. However, severe complications resulting from high-volume injections eventually lead to the U.S. Food and Drug

Administration (FDA) ban of direct liquid silicone injections [4].

Recent decades have seen an exponential increase in filler technologies. Injectable bovine collagen was developed in the 1970s and approved by the FDA in 1981; it has remained the industry criterion standard. With the emergence of liposuction in the late 1970s came a resurgence in interest in fat as a convenient source for tissue augmentation. Further research has led to a myriad of fillers and biologically active agents that make up the current available enhancement products, including Botox, collagen, hyaluronic acid (HA) derivatives, and calcium hydroxylapatite [4].

Biologically active injectables: Botox

Botulinum toxin A, a protein produced by the bacterium *Clostridium botulinum*, is a neurotoxin that interferes with muscle contraction by inhibiting the release of the neurotransmitter acetylcholine at axon terminals. The history of botulinum toxin A, or Botox, is more than 30 years old. It has been used in the treatment of strabismus, cervical dystonia, hemifacial spasm, and, more recently, migraine headache and hyperhidrosis [4].

In 2002, Allergan earned FDA marketing clearance for Botox Cosmetic for treating glabellar rhytids, and dermatologists and cosmetic surgeons alike have since found numerous other applications. In the perioral region, the use of Botox is limited partly because of the potential for paralysis near the oral cavity and the associated functional problems. Nevertheless, depressed corners of the mouth are one problem that can be corrected with Botox through relaxing the depressor angularis oris. This relaxation results in the unopposed action of the zygomaticus major and minor muscles, leading to favorable elevation of the commissures into a position that is no longer turned down and sad-appearing [4].

Injection focuses on a position along the jawline inferior and slightly lateral to the oral commissure. Injecting too medially or aggressively confers the risk for affecting parts of the depressor labii muscle, which may cause a poor aesthetic (asymmetric elevation of the lateral lip) and potentially unfavorable functional outcome. Perioral rhytids may be effectively improved using conservative doses of botulinum toxin; however, best results are achieved using a combination of Botox (four to five units in upper lip and lower lip, respectively). The injections are placed at the vermilion, with emphasis on symmetry. The authors prefer Cosmodern 1 for fine-line filling to avoid tracts seen with deeper fillers and the blue-line "Tindle effect."

Similar principles apply to the correction of the mentum. Again, injection of the mentalis muscle should be directed near its origin at the mentum to prevent inadvertent paralysis of the more superiorly based depressor labii muscle and unfavorable aesthetic and functional sequelae. This *peau d'orange* appearance is generally treated with five to eight units placed in two or three central injection sites.

Autologous fat injection

Neuber's initial attempt at using autologous fat as filler was found to be unpredictable at best. Sporadic attempts over the next several decades did not show fat to be a particularly reliable filler; that is, until the 1970s when liposuction was popularized and large amounts of adipose tissue were available. The technique of microlipoinjection was then popularized. Microlipoinjection involved using the tumescent technique for fat harvest from the legs, buttocks, hips, or abdomen then purifying the fat cells from serosanguineous debris. A large-bore needle was then used to inject fat into the subcutaneous areas that needed enhanced volume. Overcorrection of 30% to 50% was advised because of the anticipated reabsorption; multiple injections were often required to obtain a desirable result [4].

Lipocytic dermal augmentation was introduced in 1989 and involves the harvest, lysis, and purification of injectable fibrous tissue from oily residue, which is discarded. This filtrate has been shown to have similar longevity to collagen fillers such as zyplast. Slight overcorrection with anticipation of reabsorption is recommended [4].

Biopsies of injected tissues suggest that the mechanism of action of this kind of filler is in stimulating an inflammatory response that is later replaced with fibrotic tissue. No adipocytes were found in biopsy samples [4].

In the perioral region, fat injection may be beneficial for correcting nasolabial and melolabial folds and lips. However, its limited longevity and irregular surface contours have restricted its use in these mobile areas.

Collagen fillers

The role of soft tissue fillers is to restore facial volume. Collagen has been used for more than 2 decades and was one of the first fillers used in the aesthetic setting. Initial laboratory research efforts in the late 1950s led to the discovery that minor molecular modifications of collagen molecules could decrease their antigenicity, paving the way for clinical use. This development ultimately led

to the first FDA-approved collagen filler in 1981: Zyderm [5].

The current FDA-approved bovine collagen derivatives are Zyderm I, Zyderm II, and Zyplast. Zyderm I is a 3.5% bovine collagen with 0.3% lidocaine. It has been used to treat superficial skin lines. In the perioral region, Zyderm I is commonly used for lines around the upper lip. Zyderm II is similar, but has a higher collagen concentration at 6.5%, making it thicker.

Zyplast is similar to Zyderm I, but has the additional feature of a 0.0075% glutaraldehyde additive that cross-links the collagen fibers, making it less accessible to breakdown by collagenase. Zyplast, like Zyderm II, is often used in deeper lines such as the nasolabial fold and vermilion border of the lip to emphasize the white roll. The requirement for skin testing has reduced the market share of these products, especially with the advent of Cosmoderm and HA fillers.

Alternatives to the bovine collagen fillers were developed more recently that use bioengineered human collagen. These fillers are known as CosmoDerm I, CosmoDerm II, and CosmoPlast and mirror their bovine counterparts in composition. CosmoDerm I is a 3.5% collagen mixture, CosmoDerm II is a 6.5% solution, and CosmoPlast has the glutaraldehyde additive that allows the cross-linking seen with Zyplast. All of these products also contain 0.3% lidocaine. The major advantage to these products over their bovine counterparts is that, because of their human origin, allergy testing is not necessary for patients before injection [6].

Collagen is often applied using a layering-type technique in conjunction with other products. Because collagen products are typically premixed with lidocaine, a topical anesthetic is usually sufficient for anesthesia. If other products are used in conjunction with the collagen product, using the collagen/lidocaine mixture first for anesthesia is wise. The collagen and lidocaine may also help decrease bruising.

Collagen is often used to enhance the lips. Injections are typically given in the vertical vermilion border and the white roll. The white roll is an accessible place to inject because it is essentially a potential space. After adequate local anesthesia is applied, injection is performed with a 30-gauge needle. The space is entered laterally and injection is performed slowly. Because of the potential space medially, the needle does not need to be advanced initially. Slow injection allows the collagen to flow medially through the potential space. Occasionally, particularly in patients who have actinic damage or scarring, a disruption of this "natural tunnel" may occur. In these cases, the needle is removed and reinserted in the white roll just medial to the area in

which resistance was encountered. Injections are typically performed in this manner in four quadrants, approaching laterally in the upper and lower lip. If the lip is to be further treated with other fillers, such as HA, the collagen can be used as a supporting framework. After the collagen injection, some of the vertical lines at the commissures, or marionette lines, may in fact dissipate because of the increased volume at the lip borders. These lines may be further treated with a combination of Botox and a collagen filler such as CosmoDerm [6].

Injection of the nasolabial fold can actually be considered correction of two separate issues. The depth of the fold itself is caused by volume loss, whereas the overlying skin creases are rhytids from the muscular contractions of smiling. Volume is best corrected with a cross-linked collagen filler or alternative. The improvement in volume, however, does not help to dissipate the rhytids; these should be addressed separately. For these types of superficial rhytids, CosmoDerm can again be used and injected directly into the area [6].

Hyaluronic acid fillers

First isolated more than 70 years ago, HA is a highly hydrophilic glycosaminoglycan polymer that is naturally occurring. Common sources for HA purification include rooster combs, umbilical cord, vitreous humor, tendons, skin, and bacterial cultures. An average-sized human is composed of approximately 15 g of HA, which is found mostly in the extracellular matrix of connective tissue and serves as the ground substance of dermis, fascia, and other tissues. An estimated one third of the human body's HA is turned over daily. The naturally occurring molecule is easily broken down by the enzyme hyaluronidase. Therefore, chemical modification through cross-linking these molecules is necessary to produce an effective filler. Cross-linking provides increased surface area and, therefore, decreased surface area for degradation to take place [4].

The hydrophilic nature of HA is the key to its clinical usefulness; 1 g of HA can bind 6 L of water. This feature allows for its unique ability to maintain the hydration of the intracellular matrix in which cells are organized and thereby maintain tissue volume and support for surrounding tissues. HA is also unique because it is not species- or tissue-specific, giving it essentially no antigenic specificity. Therefore, it has a very low risk for allergic response in clinical use. The HA products currently available vary in the source through which they are purified and, more importantly, the size of the molecules. This property, in particular, gives each product its unique characteristics. HA products have been

characterized as the "cement" that hold the collagen "bricks" together [7,8].

Restylane

Restylane was introduced in 1996 as the first non-animal stabilized HA. Restylane is derived from the fermentation of *Streptococcus* species. The molecules are cross-linked by the addition of 1,4-butanediol diglycidyl ether. Restylane has an HA concentration of 20 mg/mL with a particle size of 400 μ m, making it somewhat more viscous than some of its animal-derived counterparts. In 2003, it was approved by the FDA for correction of moderate to severe facial wrinkles and folds [7].

No skin tests are required before using Restylane, and a commercially available hyaluronidase may be used to dissolve the HA if necessary. Adverse outcomes have been reported in approximately 5% of patients, including bruising, swelling, bumpiness, asymmetry, and erythema. Restylane is typically injected with a 30-gauge needle that is distributed in prepackaged form [7].

Perlane

Perlane is essentially identical to Restylane in its composition and manufacture. The major difference between the products is that, although Restylane contains an average of 100,000 gel beads per milliliter, Perlane contains only 8000 because it is thicker material. As a result, Perlane has a significantly decreased surface area and, therefore, is less disposed to breakdown by hyaluronidase. This feature may account for the anecdotal reports of increased longevity of this product, although this has not been confirmed [7].

Because of its increased size, a 27-gauge needle is required for injection, which may cause increased patient discomfort. It is designed for correcting deeper cutaneous depressions and folds and for facial contouring. It may also be used in lip augmentation in conjunction with Restylane, which may be more appropriate for vermilion borders to provide definition [7].

Captique

Captique is another bacterial biofermented HA product that was approved in 2004 by the FDA for correction of moderate to severe wrinkle around the nose and mouth. It has an intermediate concentration between Restylane and Hyalaform, making it a more flexible product to use [7].

Hyaliform and Hyaliform Plus

Hyaliform and Hyaliform Plus are HA products purified from rooster combs then cross-linked chemically by divinyl sulfone. Both are clear gels and, like other HA products, have essentially no

antigenicity. They have been used with favorable results to correct facial wrinkles, folds, and grooves, and as lip volumizer, and are stable up to 4 months.

Hyaliform Plus is similar to Hyaliform except for a larger particle size requiring a 27-gauge needle for injection [7].

Clinical use of hyaluronic acid products in the perioral region

With the multiple filler products available, it is helpful to have a sense of which product should be used in which situation. For example, Hyaliform and Captique may be used for natural-appearing correction of nasolabial folds or to increase lip volume filling, but are generally not recommended because of their short duration of effect. Less viscous collagen agents, such as Zyplast or Cosmoderm, may be more appropriate for the superficial dermis. Layering of superficial and deep fillers may yield the best result. Furthermore, unlike collagen injections that lose volume over just a few weeks, HA products are hygroscopic and may increase correction 10% to 15% after injection [7].

Nasolabial folds

If using only HA products for correcting nasolabial folds, a combination of deep injections of Perlane and superficial layering with Restylane may be

adequate. Deep furrows can also be treated with Hyaliform Plus or Captique. Alternatively, Hyaliform layered with superficial Captique or Captique alone are alternatives [7].

In any case, serial puncture or linear threading techniques can be used. It is important to stretch and compress skin to visualize fold, and to inject medial to the fold to avoid further cheek ptosis. The needle should be beveled up and injected during withdrawal to decrease the risk for intravascular injection.

Lips

When injecting the lips with HA fillers, physicians must consider the three injectable components: (1) vermilion border or white roll, (2) wet-dry junction of the red lip, and (3) dental arcade that provides volume throughout the mucosa to the superior lip. As a rule of thumb, the upper lip should be approximately 75% to 80% the volume of the lower lip and the central lower lip should protrude slightly beyond the upper lip.

Restylane or various collagen products can be injected into the vermilion border to emphasize contour of lip and white roll. Various HA products, such as Perlane, may be used for the mucosa of the lips. It is injected into the submucosa to define shape and restore lost volume of lip mucosa.



Fig. 1. Preoperative view (*left*). Postoperative view 13 months after subnasal lip lift (*right*). The red:white lip ratio has been improved. The vertical red lip height is increased, and the vermilion border is undisturbed.



Fig. 2. Lip lift: intraoperative view. A bullhorn- or seagull-shaped excision was performed on one third of the cutaneous upper lip. This pattern closely resembles the vermilion lip border.

Patients should be forewarned that all HA products may result in nodule formation. Lip injections can also be painful and perioral nerve block should be strongly considered before treatment.

Marionette lines and vertical rhytids

Although some physicians use HA products such as Restylane and Perlane for vertical lip rhytids, the authors prefer to avoid the risks by using CosmoDerm or some combination therapy using Botox. Marionette lines may also be corrected with HA products through serial puncture. The corner of the mouth should be elevated during injection to raise sagging tissue. Filling these lines involves injecting an HA product into the rhytid and medial triangle from the lateral lower lip skin and vermilion to the modiolus. Care should be taken not to inject too superficially, which may result in persistent beading. Most side effects are minor and transient, including pain and mild bruising. If the material is injected intravascularly, tissue necrosis may occur [7].

HA products may also be used in numerous other corrective applications in the perioral region, including the mentalis crease, and for depressed scars.

Calcium hydroxylapatite (Radiesse)

Radiesse is currently approved by the FDA for the correction of moderate to severe facial wrinkles



Fig. 3. Intraoperative view of lip lift procedure (*right*). Elevation has been performed over the orbicularis muscle. Excised portion of cutaneous upper lip (*left*).

and folds and for HIV-associated lipoatrophy. It is composed of a suspension of calcium hydroxylapatite (CaHA) in sodium carboxymethylcellulose, glycerin, and water. The CaHA microspheres are identical in chemical composition to those found in bone and teeth. It is biocompatible and degraded naturally by the body's immune system by phagocytosis [9].

Radiesse is supplied in ready-to-use 1.3-mL and 0.3-mL syringes and a 27-gauge needle. A nice feature of this product is that it has a long 3-year shelf-life if the package remains unopened. It does not require refrigeration [9].

After Radiesse is injected into human tissues, the carrier component degrades within 6 months. However, the CaHA microspheres remain and serve as a scaffolding for collagen deposition. Therefore, Radiesse is considered a long-term correction [9].

Injection of Radiesse is performed in the immediate subdermis. If injected more superficially, the product may be visible and result in nodularity of the skin. Deeper injections require more product for the desired effect and may increase inadvertent injection intravascularly.

Correction is performed by first obtaining adequate anesthesia. Regional blocks and topical anesthetic are preferable to injection to limit the amount of distortion in the treated area. Injection is performed using a fanning technique in a cross-hatch pattern during withdrawal of the syringe. Overcorrection is not necessary with this product, with the final result proportionate to postinjection results. Immediately after injection, Radiesse is malleable for a short period in which it can be molded and sculpted as necessary.

In the injection of nasolabial folds, typically 0.6 to 1.0 mL are required per side. The injection is performed in a fanning motion axially while slowly

increasing the angle. Injection is subdermal only. Residual superficial lines must be addressed with other fillers, such as intradermal Radiesse.

Oral commissures can be addressed successfully with Radiesse. A similar axial fanning motion is used in these wrinkles. A cross-hatched pattern can be used just below the level of the vermilion to restore volume and lift the commissures. Marionette lines are more challenging to address with Radiesse alone and typically require more of a combination approach using an intradermal filler for more superficial lines.

Surgical rejuvenation

Injectable fillers are often inappropriately used in isolation to increase the vertical height of the vermilion. Providers must understand that volume enhancement not only increases the vertical height of the lip vermilion but also increases lip volume circumferentially. Attempts to significantly increase vertical lip height with fillers alone project the lip proportionally in the anterior plan and result in the now often seen "duck lip."



Fig. 4. Subnasal lip lift: immediate postoperative view. The single layer suture line falls within the alar grooves bilaterally and along the nasal sill.



Fig. 5. Deep perioral rhytids (*top*). Postprocedure view 8 months after perioral chemical resurfacing with Baker's phenol solution (*bottom*).



Fig. 6. Mild perioral rhytids (*left*). Postprocedure view 8 months after perioral chemical resurfacing with Litton's solution (*right*).



Fig. 7. Deep perioral rhytids (*left*). Postprocedure view 7 months after perioral chemical resurfacing with phenol (*right*).



Fig. 8. Moderate perioral rhytids (*left*). Postprocedure view 1 month after perioral chemical resurfacing with phenol (*right*).

Surgical options are available for improving the red:white lip ratio with or without the use of injectable fillers. Among these are direct vermillion advancement, V-Y advancement, and the subnasal lip lift.

Direct vermillion advancement has been widely used and reported. The procedure improves vertical lip height but attenuates the lip roll and results in a typically white scar along the red:white lip border. The authors do not use this procedure in cosmetic patients. The V-Y advancement procedure uses bilateral intraoral incisions. Some authors have reported success with this procedure; however, in the authors' experience, results are unpredictable.

The subnasal lip lift, which is the authors' strong preference, provides predictable increase in the vertical height of the red lip, preserves the delicate anatomy at the lip border, and improves the red:white lip ratio in a predictable fashion (**Fig. 1**).

The procedure may be performed under local anesthesia. The marked incision begins at the alar crease and traverses the vestibule of the nose within the nasal sill following the subcolumellar-lip border bilaterally. With proper judgment, one third to one half of the lip skin is excised in this bullhorn shape (**Figs. 2 and 3**). The wounds are closed with simple interrupted 5 or 6-0 nylon or Prolene sutures. One or two subcutaneous sutures may be

used to reduce tension. No muscle is excised and hemostasis should be meticulous (**Fig. 4**).

In the authors' experience, this procedure is suitable for all age ranges, but patients must accept transient scar redness and upper dental show for a period of weeks during recovery.

Ablative resurfacing

Ablative resurfacing is defined as wounding the skin to levels of the dermis. The tools available to do this include peeling agents, dermabrasion, and various laser treatments. During the healing process, the dermis produces smoother, firmer, rejuvenated skin.

Several peeling agents are available and their use is largely dictated by the depth of penetration desired. For example, 88% phenol alone may be used for medium-depth resurfacing, and is the main ingredient of Baker-Gordon peeling solution. Alternatively, Jessner's solution in combination with 35% trichloroacetic acid creates a maximum-depth peel while maintaining a good safety profile. Treatment of the perioral area with peel solutions requires special attention to the transition area between the facial skin and the lip, which is often inadequately peeled. Treatment of this area is facilitated by stretching out the vermillion borders

and flattening them to provide even distribution over vertical rhytids along the lip (Figs. 5–8) [9].

Dermabrasion is another ablative resurfacing technique, which mechanically removes the epidermis and dermis, usually with a diamond-powered fraise. It is ideally performed in the operating room because of exposure. During the procedure, one must remember that entering the subcutaneous plane must always be avoided [9].

More recently, laser technology has allowed ablative resurfacing to be performed in a more controlled fashion. The carbon dioxide laser is most commonly used. Protective eyewear and fire precautions must be strictly adhered to when using this modality. Lasers use thermal energy to dermabrade the skin, and therefore cautery is an added benefit [9].

References

- [1] Maloney BP. Aesthetic surgery of the lip. In: Papel ID, editor. Facial plastic and reconstructive surgery. 2nd edition. New York: Thieme Medical Publishers; 2002. p. 344–52.
- [2] Loos BM, Maas CS. Relevant anatomy for botulinum toxin facial rejuvenation. *Facial Plast Surg Clin North Am* 2003;11(4):439–44.
- [3] Neuber F. Fat translation. *Chir Kongr Verhandl Dsch Gesellch Chir* 1893;20:66–8.
- [4] Monhian N, Ahn MS, Maas CS. Injectable and implantable materials for facial wrinkles. In: Ira D. Papel, editor. Facial plastic and reconstructive surgery. 2nd edition. New York: Thieme Medical Publishers; 2002. p. 247–61.
- [5] Klein A. Filling substances: collagen. In: Narins R, editor. *Cosmetic surgery: an interdisciplinary approach*. New York: Marcel Dekker; 2001. p. 193–210.
- [6] Rostan E. Collagen fillers. *Facial Plast Surg Clin North Am* 2007;15(1):55–62.
- [7] Monheit GD. Hyaluronic acid filler. *Facial Plast Surg Clin North Am* 2007;15(1):77–84.
- [8] Ahn MS. Calcium hydroxylapatite: Radiesse. *Facial Plast Surg Clin North Am* 2007;15(1):85–90.
- [9] Roy D. Ablative facial resurfacing. *Dermatol Clin* 2005;23:549–59.