

# 106 Facial Rejuvenation: A Chronology of Procedures

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## Introduction

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The past decade has borne witness to a remarkable increase in the demand for facial rejuvenation [1]. Fueled in part by reality television programming and the associated increase in public familiarity with, and acceptance of, the available procedures, this trend is also a reflection of increasing life expectancies and the entrance of baby boomers into their fifth through seventh decades (40s through 60s) – a period of heightened manifestation of aging face stigmata. Indeed, this cohort, born between 1946 and 1964, [2] is characterized as being the healthiest and wealthiest generation to that time, and among the first to grow up genuinely expecting the world to improve with time [3]. It logically follows that with such optimism comes the desire to maintain a youthful countenance during the good times to come.

While the estimated 80 million boomers are certainly a major driving force in the economy, the marketing dollars spent in pursuit of their spending power have also piqued the interest of other generations. This chapter aims to outline the procedures which are appropriate for the various decades of adult life, beginning when the earliest signs of aging present themselves – in the thirties. It should be emphasized that the following are general guidelines for the respective decades and that major factors such as ultraviolet light exposure and tobacco smoking, along with lesser factors such as diet and exercise, can accelerate the natural aging process. Thus, a heavy smoker who also sunbathes excessively and without UV protection will perhaps be a candidate for all procedures given below in his/her early forties, in contrast to his/her healthier counterparts in the expected decades, addressed below. Additionally, one's genetic construct also certainly influences the period in which the stigmata outlined below become evident.

## Thirties

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Most adults begin to show mild rhytides at rest (without animation) in the glabellar, forehead, and periorbital

regions in the early to mid-thirties. Some patients wish to prevent formation of these dynamic lines prior to their presentation at rest, as they note their appearance in animation in their late twenties and are frequently fearful of permanence, but the majority of patients tend to delay intervention until the persistence of rhytides at rest. The primary treatment modality for these rhytides is neurotoxin, specifically *botulinum toxin type A* (e.g., Botox Cosmetic<sup>®</sup>; Allergan, Inc., Irvine, CA). Botulinum toxin causes a temporary paralysis of the targeted muscle(s) by preventing acetylcholine release from motor nerve endings. The paralysis typically lasts for 3–4 months, with increased durability of effect realized by patients after multiple treatments at regular intervals; some patients are able to extend their treatment intervals to 6 months or more. Muscles most frequently treated in this fashion include the *procerus* and *corrugator supercilii* muscles, for horizontal and vertical glabellar rhytides, respectively; the *frontalis* muscle for horizontal forehead rhytides; and the *orbicularis oculi* muscles for lateral periorbital rhytides, commonly called “crow's feet.” Additional sites for the use of neurotoxins in the later decades are outlined below. The specific US FDA approval for botulinum toxin A for cosmetic purposes is for glabellar lines alone, and Botox Cosmetic has shown an excellent safety profile since its approval in 2002 [4].

For patients who do not wish to receive neurotoxin injections or for whom they are contraindicated, facial resurfacing procedures are also effective in reducing fine rhytides. A variety of modalities are available for this aim, including medium strength chemical peels (e.g., 35% trichloroacetic acid [TCA]) and light-based therapies such as the erbium laser.

In addition to the role of rhytides in portending age, there has been a dramatic increase in appreciation for the role of *volume loss* in the aging face [5]. This volume loss is exhibited in diminishment of skin thickness, subcutaneous adipose volume, and bony volume, as well as in muscular atrophy. The earliest site to yield evidence of this volume loss is the infraorbital region, beginning in the late twenties or early thirties. Here, patients begin to

show the “tear trough deformity” or “dark circles” beneath the eyes. While commonly attributed to allergic, fatigue, or vascular etiologies, the elimination of these “circles” is most effectively achieved by volume augmentation of the tear trough region, rather than by reversal of the other proposed etiologies. Indeed, many patients who have previously used numerous under-eye “concealers” unsuccessfully in hopes of camouflaging what is perceived as darkly pigmented skin are relieved when volume augmentation is quickly effective. This is because volume loss results in a depression, or concavity, between the convexities of the bony inferior orbital rim and/or lower lid fat pads above and the cheek mass below. The appropriateness of a patient for volume augmentation here may be determined by shining light directly into the “dark circle,” perpendicular to the skin – this will fill the shadow in the tear trough created by overhead light, such as that in a typical examination room. If the resulting appearance is desired by the patient, they are excellent candidates for this procedure; any pigmentary issues are thus excluded as causative. Volume replacement can be performed

with either synthetic materials, such as hyaluronic acid (HA) fillers, or the patient’s own fat cells (▶ *Fig. 106.1*). The specific FDA approval for HA fillers is for “correction of moderate to severe facial wrinkles and folds, such as the nasolabial folds,” and volume restoration in the infraorbital area and others is therefore categorized as “off-label,” though well-accepted in the medical community [6–10].

The next most common site of use for filling materials in the practice in this decade is the lips. Restoration or augmentation of genetically suboptimal fullness in the vermilion of the lips is easily accomplished with synthetic fillers, such as the HA fillers. Certain anatomic norms must be respected, however, if the physician is to achieve a natural result: the upper lip vermilion show should not exceed one half of the lower in vertical height; the upper lip vermilion should be viewed as three separate aesthetic units: central, left, and right, with the lateral units comprising the majority of the horizontal length; and the lower lip vermilion is comprised of two aesthetic units – left and right – with a central sulcus between them.

■ **Figure 106.1**

A 56-year-old patient who requested improvement in the infraorbital region. Patient shown before (*left*) and after (*right*) hyaluronic acid filler augmentation of the tear trough region, using <1.0 cc total for both sides. Patients have been treated in a similar fashion in the authors practices as early as the late twenties, when genetically predisposed to early tear trough deformity



## Forties

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With the progressive thinning of skin comes increased visibility of rhytides at rest. In addition to the periorbital and glabellar regions, lines become more evident in the forehead and perioral regions, as well as the sidewalls of the nose. While neurotoxin is commonly used in the frontalis muscle for horizontal forehead rhytides, less commonly treated muscles include the *orbicularis oris*, for vertical rhytides of the white portions of the lips, and the transverse portion of the *nasalis*, for vertical lines on the sidewalls of the nose (“bunny lines”) [11]. Treatment of the *orbicularis oris* muscle in this fashion is done conservatively, so as not to affect animation or oral intake.

Synthetic fillers may also be used to eliminate fine lines in the skin. In contradistinction to neurotoxins, which are injected into the muscles that cause the rhytides, fillers are placed in the dermis directly beneath the line of depression and typically last from 6 months to 1 year or more. Hyaluronic acid fillers are exceedingly well tolerated in this manner and may also be used in conjunction with neurotoxins for particularly deep rhytides, such as commonly develop in the glabellar region. Examples of HA fillers currently available include Restylane<sup>®</sup> (Q-Med AB, Uppsala, Sweden) and Juvederm Ultra (Allergan Inc., Irvine, CA).

In the areas of fine rhytides at rest not amenable to neurotoxin treatment, or in patients apprehensive about such treatments or otherwise not candidates, chemical peels and laser resurfacing are excellent options. Both types of modalities can be customized to the depth of the patient’s rhytides and the available downtime; those with predominantly fine rhytides or with limited capacity for skin erythema beyond 1-week posttreatment are best treated with a medium-depth peel, such as 35% trichloroacetic acid (TCA) or a medium strength croton oil/phenol peel (e.g., Hetter’s medium-light peel) [12, 13], or an erbium laser set to medium penetration depth [14]. For patients with deeper rhytides at rest and greater capacity for downtime, a deeper chemical peel (e.g., Hetter’s medium-heavy or heavy croton oil/phenol peel) or erbium laser set to deeper penetration will be more effective. Recently, however, physicians have begun to use fractionated carbon dioxide lasers with promising results and significantly diminished downtime and unwanted effects such as scarring and pigmentary changes [15], although the technology remains in its infancy of use and at least one published report of detracting effects exists [16].

In addition to fine lines noted above, the face begins to show deepening of the nasolabial folds (from the sides of the nose to the corners of the mouth) and

labiomandibular folds (from the oral commissures toward the jawline, commonly called “marionette lines”) in this decade. Synthetic fillers are excellent remedies for such folds and these areas are among the most commonly treated with HA fillers. Indeed, it was the augmentation of nasolabial folds which served as the basis for FDA approval of HA fillers [9].

In the periorbital region, volume loss becomes evident in the medial infrabrow region, where the convex highlight of youth gives way to a relative concavity and associated shadow. Accompanying this shadow, usually toward the end of the fifth decade, is the accumulation of folds of skin along the upper eyelid lashes, termed dermatochalasis. While traditional aging theory attributes this skin excess to loss of skin elasticity and descent of the brow, current understanding of this presentation recognizes the important role of volume loss, both in the soft tissue (adipose) and the bony orbital rim. Thus, refilling of the infrabrow region restores the youthful convexity and associated highlight to the medial infrabrow area and elevates a finite portion of the infrabrow skin from the lashline (► Fig. 106.2). This reflation of the infrabrow area can create an appearance of brow elevation, as elegantly demonstrated by Coleman [17]. As described below, when infrabrow skin excess exceeds the capacity for elevation by soft tissue augmentation, upper lid blepharoplasty, with excision of redundant skin, may be entertained as an adjunctive procedure or in isolation.

## Fifties

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One of the most important endocrinologic events contributing to the aging face stigmata in women is menopause, for which the average age is fifty-one. The associated decline in circulating body estrogen has been linked to multiple facial cutaneous aging phenomena, including wrinkling, dryness, laxity, and atrophy; it has been demonstrated that some 30% of skin collagen is lost in the first 5 years after menopause, and that the average annual decline over 20 years following menopause is 2.1% [18, 19]. Estrogen replacement, particularly in the form of topical application of *estriol*, a weak estrogen, may ameliorate some of these effects and should be considered as part of a comprehensive skin care regimen in postmenopausal women [20, 21].

In the periocular region, the infrabrow shadow noted above and resulting from volume loss, progresses laterally across the infrabrow region creating an appearance of darkness across the upper eyelid region. In this sixth decade, the deflation of the infrabrow area also results in

■ **Figure 106.2**

Patient at 50 years of age before (*above*) and after (*below*) soft tissue augmentation in the superior orbital rim/infrabrow area using an HA filler. Note the age-associated atrophy in medial infrabrow soft tissue creating concavity with resultant shadowing as well as skin redundancy prior to treatment (*above*), the latter seen best on patient's left side. Note improvement of atrophy and skin redundancy in posttreatment image (*below*) resulting in reduction of upper eyelid show to a more youthful height



greater accumulation of folds of skin near the eyelashes, which prompt visits to the facial cosmetic surgeon for blepharoplasty consultation to a larger extent than during the fifth decade. At this relatively early age, however, the degree of skin laxity is often best treated not by skin excision but by volume restoration in the infrabrow area; refilling the subcutaneous volume in this area results in radial expansion and superior elevation of the skin (▶ *Fig. 106.2*) and, frequently, the overlying brow hair.

Along with the *infraorbital* filling, which is begun in the thirties and forties, such *infrabrow* filling aids in restoring highlights around the eyes, a technique frequently termed “framing the eye” [22]. The reader is encouraged to review covers of beauty and fashion magazines for depictions of society’s “ideal” periorbital constructs: a relatively low eyebrow, full *infrabrow* soft tissue with associated highlight, and a full lower eyelid/cheek interface. It is this anatomy that draws the viewer’s eye toward the iris and pupil. Careful study of these anatomic relationships allows more natural restoration of the youthful visage, as eloquently demonstrated by Coleman [23]. Indeed

without such examination one may be beguiled by the optical illusion that a hollowed *infrabrow* region represents a *descended* brow and thereafter undertake to surgically elevate the brow, all too often creating an unnatural, surprised look [22, 24]. Additionally, the lateral brow descends earlier and to a greater extent than the central or medial brow, and therefore in practice greater emphasis should be placed on lateral browlifting than the more traditional lift, which incorporates all brow components.

In the lower periorbital region, the tear trough deformity described above becomes more prominent, while the lower lid fat pads become more protuberant as well. Although the latter is partially due to weakening of the lower eyelid retaining structures, it is the same atrophy that causes the tear trough deformity to manifest that also results in uncovering of the *infraorbital* fat pads. Pseudo-herniation of the lower eyelid fat pads may necessitate surgical removal, via lower eyelid blepharoplasty, particularly if they cannot be recovered by volume restoration in the tear trough and inferior orbital rim regions. Techniques for addressing lower eyelid fat pseudo-herniation

include *transconjunctival* and *transcutaneous* blepharoplasty. The practice employs predominantly the transconjunctival approach, so as to limit the possibility of weakening the lower eyelid support mechanisms, which may result in lid retraction and scleral show [25]. Regardless of the chosen approach, it is recommended that blepharoplasty be done in conjunction with infraorbital volume restoration, either by formal lipotransfer or simply by lower lid fat *transposition* [26], to both increase the longevity of the result and to create a more youthful eyelid–cheek interface, which is one of convexity.

Another anatomic site of volume loss is the lips. Frequently overtreated at the patient’s unwitting request, a conservative restoration of more youthful volume in the lip vermilion is an important aspect of facial rejuvenation. Here again, both synthetic fillers and autologous fat are excellent options. As noted above for patients in their thirties, the aesthetic norms should be respected in order to prevent an unnatural appearance. In addition to restoration of vermilion volume, however, patients in their fifties frequently begin to benefit from restoration of the philtral ridges and the white rolls, including the central “cupid’s bow” of the upper lip.

Many patients begin to note an interruption of their mandibular jawline with “jowls” in their late forties or early fifties. While frequently attributed entirely to gravity-induced descent of the cheek and loss of cutaneous elasticity, jowling is also partially a function of subcutaneous atrophy in the cheek, with resultant hanging of the deflated tissue inferiorly under the influence of gravity; inverting the head readily demonstrates the effect of gravitational pull, with redirection of the deflated soft tissue superiorly toward the infraorbital area. Thus, gravity is not primarily causative, but rather simply determines the direction in which the deflated, atrophic cheek tissue hangs. Reinflation of the anterior cheek with fat or synthetic fillers aids in the reduction of jowling along the mandibular border. However, the primary benefit of volume augmentation in the anterior and lateral cheek is in restoring the convexities of youth, which have typically become replaced by concavities in this decade (► Fig. 106.3).

Bony loss is also thought to contribute to jowling: atrophy of the mandible anterior to the jowl leads to the formation of the *prejowl sulcus*, creating a superomedial indentation in the overlying soft tissue, which exacerbates

■ **Figure 106.3**

A 51-year-old woman who underwent fat transfer to the midface to complement facelifting, shown before (*left*) and 2 months postoperatively (*right*). Notable is the improvement in the cheek fullness seen in both the near and far cheek, and the associated improvement in continuity of the lid–cheek interface; neither benefit is likely with facelifting alone





the appearance of jowling [27, 28]. Bony loss also occurs in the lateral mandibular region and thus, when combined with augmentation of the prejowl sulcus, volume restoration of this postjowl region may effectively postpone surgical elevation of the jowl (► *Fig. 106.4*).

Once accumulation of jowls has progressed to a point unwelcome to the patient and if deemed too pronounced to be addressed by volume restoration alone, or if lipotransfer is otherwise not an option, facelifting becomes a viable remedy. There are many variations of this procedure, and a complete review of the techniques is beyond the scope of this chapter [29]. Most methods, however, rely on elevation of a skin flap, suture suspension of the underlying superficial musculoaponeurotic system (SMAS) in a superoposterior direction, redraping and trimming of excess skin, and suturing the cut skin edges. Facelifting addresses primarily the lower third of the face, from the nasal ala to the jawline and jowl; improvement is expected in the labiomandibular fold and jowl, as well as platysmal banding. Importantly, however, facelifting does *not* appreciably efface the nasolabial fold. Liposuction of the jowls, while unlikely to independently give a satisfactory result, is a useful adjunct to the above mentioned

techniques and is frequently performed in conjunction with cervical liposuction.

For patients with more advanced platysmal banding and interplatysmal (midline neck) fat accumulation, directly addressing the neck through a submental incision – *submentoplasty* – is beneficial. In this procedure the neck skin is elevated in the subcutaneous plane, the interplatysmal neck fat – which is poorly responsive to liposuction – is excised sharply with scissors, and the medial platysmal edges are sutured together at the midline, from the immediate submental region to the level of the hyoid bone. A notch is then frequently created in the platysmal edges at this level to further define the cervicomentale angle. Excess skin may also be removed by advancing the skin flap anteriorly and excising the redundant skin prior to closure of the submental incision.

Finally, an often overlooked feature of the aging face is that of ptosis of the nasal tip. Typically manifesting in the late fifties and sixties, this presentation results from weakening of the fibrocartilaginous support of the nasal tip, allowing the lower lateral nasal cartilages to become more inferiorly directed. This is effectively corrected by placement of a cartilaginous graft, usually harvested from the nasal septum and placed in the columella, and is termed

#### ► **Figure 106.4**

A 64-year-old woman who requested fat transfer for facial rejuvenation, which was performed in the pre and postjowl regions, as well as the midface and superior orbital rim/infrabrow area; lower lid transconjunctival blepharoplasty was also performed. Note the atrophic pre and postjowl regions prior to treatment (*left*), as well as upper eyelid dermatochalasis and lower eyelid pseudoherniation. Significant improvement was evident along the jawline at the 1-month postoperative visit (*right*), with a straightening effect without the employment of facelifting. Also notable is improvement in upper eyelid skin redundancy via volume restoration alone, and improvement in midfacial contour achieved with combination of blepharoplasty and lipoaugmentation; the mentum was augmented as well



a *columellar strut graft*. Rhinoplasty surgeons often also employ this grafting technique in the younger rhinoplasty patient as a preventative measure.

## Sixties

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In addition to the regions of volume loss noted above in earlier decades, patients in their seventh decade show more advanced volume loss in the temporal regions, with a resultant stepoff lateral to the lateral orbital rim. Likewise, atrophy on the inferior aspect of the zygomatic arch, in the submalar region, becomes more evident, along with that of buccal region. Left uncorrected, these areas represent subtle cues of aging, which are often overlooked by cosmetic specialists unfamiliar with volume restoration. Periorbital, labial/perioral, and mandibular atrophy also become more pronounced in this decade and can be restored in conjunction with the perizygomatic and buccal areas.

Facelifting is beneficial for most patients in their seventh decade, and progression of neck laxity is such that necklifting (submentoplasty) is usually performed in conjunction with nearly all facelifts in this age group, or can be performed in isolation for those patients who have previously undergone facelifting alone and have maintained their mandibular line.

If the patient has not sought a facial resurfacing procedure in earlier decades, they will usually be candidates by their sixties, with most patients having progressed to a Glogau classification of III–IV (advanced to severe) [30]. Resurfacing at these stages frequently requires a deeper chemical peel, such as a croton oil/phenol peel, or a deeper laser resurfacing procedure [31–34].

Blepharoptosis, or descent of the upper eyelid margin over the iris and even the pupil of the eye, may become apparent in this decade and is addressed by a variety of suspensory procedures [35]. Dermatochalasis, or laxity of the upper eyelid skin, may begin as early as the fourth decade, but may progress to the point of obscuring the patient's visual fields by the sixties, thus becoming of greater functional concern than of cosmetic significance alone, and is addressed by upper lid blepharoplasty. As noted above, volume loss in the infra-brow region, as well as loss of bony orbital rim, contributes to the deflation of the infra-brow skin, exacerbating the accumulation of skin resulting from loss of elasticity, or *elastosis*; volume restoration to the infra-brow region to complement upper eyelid blepharoplasty is therefore routinely recommended. Correction of lower eyelid skin redundancy may also become warranted during this decade and can

be addressed with either a resurfacing procedure such as a chemical peel or laser resurfacing, or with surgical excision via lower eyelid transcutaneous blepharoplasty or skin pinch; caution must be exercised in lower lid skin excision, however, so as not to cause lower lid retraction and scleral show, or even lagophthalmos [36].

The brow of the seventh decade is more likely to show modest descent in the middle and medial portions in addition to the lateral descent noted above during the fifties. Thus, while many patients at this point benefit from lateral browlifting in conjunction with lipotransfer to the infra-brow region, patients in their later sixties may also require conservative elevation of the more medial components, as in endoscopic, coronal, or trichophytic browlifting; the emphasis nonetheless remains on lateral brow elevation.

## Seventies and Beyond

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The eighth decade and beyond are manifested by a continuation of the processes noted in the above sections: gradual progression of subcutaneous volume loss, depletion of skin thickness with associated progression of facial rhytides, and elastosis with resultant skin laxity. Patients who have undergone facelifting or browlifting in their fifties or sixties may wish to undergo a repeat procedure to restraighten the jawline and resuspend their brows, respectively; blepharoplasty may be successfully repeated as well. The typical facelift should be expected to provide a youthful jawline and neck for approximately 7–10 years, although the associated skin removal is permanent, the fibrosis that occurs between the elevated SMAS and the redraped skin flap is permanent, and some surgeons use permanent sutures for elevation of the SMAS. Patients are informed that the aging process continues following surgical rejuvenation, with associated continued decline in skin thickness and elasticity, but that they will always display a more youthful countenance following such endeavors than if no such procedure had been undergone. Similar longevity is to be generally expected with other surgical results, including those of volume replacement with lipotransfer.

## Future Directions

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Much excitement surrounds the seemingly limitless potential for growth factors in the rejuvenative efforts for the aging face. Adipose tissue has been shown to provide the richest source of growth factors in the body, by mass, and such fat-derived growth factors have been successfully encouraged

in vitro to develop into nerves and blood vessels. It is hoped that, provided the proper biochemical milieu, adipose-derived growth factors will develop into these and other tissues in vivo. With associated improvement in nutrient supply to the skin, fat, muscle, and bone of the face, it may be possible to achieve more durable maintenance of the youthful facial glow. Anecdotally, this has been noted in the practice and others in the months and years following autologous fat transfer to the face as a general improvement in the texture of the facial skin [37, 38]. A novel skin analysis system (Visia<sup>®</sup>, Canfield Imaging Systems, Fair-field, NJ) may provide important documentation of this effect, which might ultimately allow physicians to offer volume restoration and modest cutaneous resurfacing with a single procedure.

## Conclusion

Appreciation for the causative factors in the phenotype of the aging face is rapidly evolving. Along with this enhanced understanding come novel techniques for rejuvenation in each decade of age, each more natural and durable than its predecessors, but balanced by the public's yearning for limited downtime and maximum safety. Such procedures are unlikely to wane in widespread societal acceptance, though modest fluctuations in adoption may occur with cyclical economic phenomena; it will be interesting indeed to evaluate the effects of the recession of 2008–2009 on the various cosmetic procedures. While the specific procedures sought will undoubtedly also undergo transformation, what seems constant is the quest for improved self-esteem that accompanies what the public regards as quick and effortless solutions provided by cosmetic procedures [39]. Also constant is the duty of the physician to ensure that motivating factors are healthy and recommended remedies are appropriate for the patient's state of facial aging, whatever the chronologic age.

## Cross-references

- A New Paradigm for the Aging Face
- Cosmetic Surgery in the Elderly

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