A New Paradigm for the Aging Face

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Abstract

This chapter encapsulates the process of facial aging as primarily a result of volumetric involution. In particular, the important concept of framing the eye rather than elevating and excavating is discussed as a principal method of facial rejuvenation. Other concepts like reducing facial transitions and improving facial shape are explored as adjunctive measures to improve the youthfulness of the face. The pros, cons, and limitations of facial fat grafting as a method of facial volumization are detailed, and a hair transplant model of graft take is also used to illustrate longevity of fat grafting. Today, fat grafting and facial fillers are the two principal methods for facial volumization, and restoring volume to the face should be a vital component to an overall strategy for facial rejuvenation.

Introduction

This textbook is dedicated to a thorough understanding of the aging skin that encompasses both basic science and clinical topics. However, the effects of skin aging extend well beyond the inherent microarchitecture of the cutis itself. Concomitant aging processes have a remarkable impact on the appearance of the skin as well, which will be covered in this chapter. An outdated perspective of the aging process for the human face is that the only two components of facial aging include manifest skin changes, e.g., rhytids, textural worsening, solar elastosis, and dyschromias, and gravitational effects, e.g., brow, periorbital, midface, jawline, and neck descent. However, the concept of volume deflation via loss of both soft tissue and bone has increasingly been recognized not only as an ancillary part of the aging process but also as a core facet of aging [1]. Although various components of the aging process will be discussed in this chapter, the central role of volume loss will be elucidated in great detail and the effect that volume loss and volume repletion have on the appearance of the skin will be explored.

Although some fundamental scientific ideas will be evaluated, this chapter is almost entirely of a clinical nature. It discusses how the facial aging process is seen as well as how surgical and nonsurgical interventions are made to ameliorate this condition. Autologous facial fat transfer is the mainstay of therapy for facial rejuvenation followed by other adjunctive measures including rhytidectomy, hair restoration, and skin therapies. Regarding facial fat transfer, some new theories about the observed stem-cell changes to the skin in which scarring, dyschromias, and rhytids diminish over a period of 1–2 years following a fat transfer will also be discussed.

From a surgeon’s perspective, this textbook is principally focused on educating the students and researchers on aging skin, and in this case, the overall aging process related to cutaneous aging. Accordingly, very little will be addressed as far as elaborate technical execution of surgical methods is concerned. Instead, the primary focus will be in alignment with the objectives of this textbook, which are to provide current and comprehensive understandings of the aging process, i.e., to teach the reader to see more than to do.

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As alluded to earlier, the effect of gravity on the facial aging process has been greatly overestimated. What was once thought to be distinctly gravitational has been reconsidered as representing volume deflation. Lambros studied the aging process by superimposing the face of a mature individual over the exact pose of that same individual at 20 years of age [2]. He then evaluated the effects that accounted for periorbital, midface, and jawline aging. His results are nothing short of remarkable: the brow was seen on occasion to descend approximately 1 mm but no further, the lower eyelid-cheek interface did not fall at all, the cheek and nasolabial groove did not descend at all, and the jawline actually went up with aging. This latter observation can be quite confusing without further explanation. The jowl that appears with aging has been thought in the past to represent descent of that part of the jawline. What Lambros discovered was that the entire jawline that was once volumetrically full (by virtue of replete fat, soft tissue, and bone) was actually, at one point, situated below the jowl along its entire length. In other words, the entire jawline recedes superiorly to expose the jowl. In addition, by examining the relative position of nevi to the surrounding anatomic landmarks, he found that nevi do not fall downward, but either do not change position at all or migrate horizontally along muscle pull directions, indicating a volumetric deflation rather than a descent.

With this almost unassailable empiric study, it is hard to argue that gravity is the principal mechanism by which facial aging occurs. Further, simply having patients bring in their own photographs during their youth will help educate both the patient and the surgeon regarding what techniques would be ideal to rejuvenate that patient so that the result will approximate their own youthful mien and avoid the unnatural alteration of identity that can occur through overzealous, traditional, excisional techniques. Lambros states: “The brows do not fall as much as we pick them up” [3]. Accordingly, using old photographs can be an instructive guide to plan surgical intervention.

Interestingly, traditional textbooks on plastic surgery are perhaps the worst source of information to understand the aging process and what is required to rejuvenate the face. Brows are arbitrarily lifted upward and upper eyelid skin aggressively removed along with upper eyelid fat. Lower eyelids have fat extracted and skin tightened leaving the area hollower and the canthal position unnaturally changed. Instead, the “textbooks” that have the most accurate information on what defines youth are entitled Glamour, Allure, and Vogue and can be purchased at any newsstand. The reader is encouraged to review these exemplars of youthful beauty to understand facial shape, proportion, and what exactly defines youth. In many instances, the very low brows that are robustly full will perhaps shock a complacent surgeon/physician into rethinking the aging process entirely.

Framing the Eye

Traditional reductive surgery, especially in the periorbital region, oftentimes leads to an acceleration of the aging process in which the hollower eyelid and brow are manifestly more so after the procedure (Fig. 1). In short, traditional eyelid and brow surgery can actually render an individual even older in appearance than the desired rejuvenation. A model to understand what in fact happens with the brow is to think of a balloon that deflates, in which the goal is not to excise the hanging and deflated skin but to refill the lost volume (Fig. 2). Now, in selected individuals, a very small degree of skin (1–3 mm) is removed but almost always in conjunction with fat transfer to the brow and upper eyelid for the aforementioned reasons. Performing browlifts was stopped several years ago realizing today that a browlift is rarely, if ever, indicated and can be counterproductive in the ultimate goal of framing the eye with fat. The lower eyelid “eyebag” that appears most oftentimes does not need to be removed, but additional fat is added along the exposed periorbital bony rim. This again represents the opposite strategy of traditional surgery in which
The eyebag is removed and the skin is tightened. A model for the lower eyelid may be informative to understand this concept better: the rocks (eyebag) are covered by high tide (fat along the orbital rim), but when the shoreline recedes (panfacial fat loss), the rocks that were once covered become evident. In a lecture, William Little explained it this way, and his analogy makes quite a bit of sense. In other words, the exposed orbital fat may be thought of as being camouflaged in youth with the presence of fat surrounding it along the orbital rim. A transconjunctival blepharoplasty is performed to remove excessive orbital fat only in about 5% of operative cases but almost always in conjunction with adding fat along the bony orbital rim. Skin resurfacing and botulinum toxin are used to address the cutaneous changes in the lower periorbital region, and no skin is almost ever removed along the lower half of the periorbital frame for fear of changing the lower eyelid and/or canthal position in an unfavorable way.

Another finding that Lambros discovered in his seminal study was that the eyelid shape is more almond configured in youth no matter the race and that in turn becomes increasingly smaller and rounder in shape with age. This narrower eyelid shape of aging is more accentuated via traditional browlifting techniques and aggressive reductive eyelid blepharoplasty, which has been facetiously termed blepharectomy (Fig. 1). Although there is no known method to safely re-enlarge the lateral canthus to resemble the almond shape of youth without risking unpredictable scleral show, fat transfer to the lateral brow can help draw one’s attention to the illusory widening of the eye shape rather than a further narrowing of it. These concepts are very difficult to explain with superlative clarity, and the reader is advised to study young and old (unoperated) eyes in the quest to understand what takes place in nature rather than what happens in the preconceived brain or biased surgical training history that can taint perceptions of the aging process.
Recalibrating Perceptions and Redefining Aging

Most individuals, specifically women, seek microchanges to their face, namely, improvement in the appearance of small folds and creases around their mouth, reduction of the “crepiness” of their upper eyelid, etc. The reason for this desire in change is that women in particular apply makeup at close range so that the small facial flaws take center stage and appear to be the focus for aesthetic improvement. The first goal of the aesthetic surgeon/physician is to recalibrate what may be more important for the patient when evaluating the face for aging and related cosmetic enhancement. Gladwell’s [4] brilliant thesis, Blink, argues that we judge another individual in a blink of an eye. When evaluating the face for aging, it should be understood what programs us to make an almost immediate, visceral response to another person’s attractiveness and aging. It is certainly not the micro skin effects in the perioral region in most cases, but a larger gestalt that is quickly apparent upon first glance.

Before wrinkles and small flaws can be appreciated, the gut response of a bystander judging another individual regarding age and attractiveness at even a relatively far social distance of 10–20 ft should be the measure of how aging is understood. What is the fundamental element, then, if it is not the prescribed traditional vocabulary of wrinkles, folds, and other minor flaws? In a word – geometry. The facial shape of another as being older or younger is recognized almost instantaneously. This concept is further refined in this chapter.

Fig. 2 This 46-year-old woman appears to require traditional eyelid surgery. However, with closer inspection she exhibits a hollow eye deformity due to volume loss that also involves the entire face. She is shown (a) before fat transfer, (b) 1 week after fat transfer, (c) 1 month after, (d) 3 months after, (e) 1 year after, and (f) 1.5 years following a single session of fat grafting.
The shape of the face of a baby, a young child, a teenager, and an individual in his/her early 20s is round owing to the abundance of so-called baby fat despite overall body weight or habitus. The ongoing volume loss of the face is a continuous process that begins from infancy forward. An individual in his/her early 20s has proportionately less fat in the face than a child or a baby. Accordingly, this process continues for the remainder of one’s life. Most women in fact who are dreadfully afraid of looking fat oftentimes when they pass 35 years of age look retrospectively at their youth and in the majority of cases prefer the look of their face in their early 30s than in their 20s due to the slimming effect that further soft-tissue loss affords them. However, passing through the early 30s into the mid to late 30s, a slight fatigue and aging become more apparent as they mature passing through the narrow window of full-framed youth to thinner 30-something youth to now slight aging with further volume loss.

These volume changes can be redefined more precisely with geometric terminology in broad strokes. From infancy to early 20s, the predominant facial shape is round. With a slight slimming effect that occurs in the early 30s and loss of fat in the buccal area among other areas, the face transforms into a triangle with the apices in the anterior cheek and chin. In the intervening mid to late 20s, a hybrid shape is observed somewhere between a circle and a triangle, i.e., a less circular circle or a slightly widened triangle. Keep in mind that these geometric assumptions are not meant to describe each and every individual person, as variances occur owing to gender, race, genetics, weight, and environmental insults like sun exposure, smoking, etc.

As volume loss progresses from mid 30s into the early 40s, the face assumes a more masculine appearance whether the individual is a man or a woman. The eyes and the cheeks flatten, and the padding of the anterior chin starts to dissipate exposing the underlying malar and chin bone protuberances. With volume loss across the expanse of the jawline minus the jowl region, the apices of a new geometry shift toward the appearance of a square: the malar bone and the jowl become the new apices of this square. The flattening effect of the face further accentuates the masculine contour along with the exposed bone, which is a masculinizing attribute. Many male models are chosen for their flatter anterior cheek profile, as they look more chiseled and attractive for these masculine hallmarks. It has been noticed that even very young male models are chosen for this attribute of greater bone exposure than their female counterparts.

As metabolism slows in the late 30s and beyond, weight gain is oftentimes more prevalent at this juncture. The mid to late 40s and thereafter exposes the curious mixture of weight gain and soft-tissue volume loss further unbalancing the face. The soft tissue of the periorbital region, upper anterior cheek, and anterior chin continues to dissipate in the face of weight gain that becomes more pronounced in the lower anterior cheek and the jowl region along with neck adiposity. The dominance of the lower face and ongoing recession of the upper face with marked depressions running superomedially down inferolaterally in the anterior cheek transform the face into the shape of an upside triangle. These progressive changes become even more apparent with further aging of the 50s and beyond as the lower face dominates with concurrent volume loss of the periorbital region and midface.

Beyond Geometry: Understanding Transitions and Highlights

Is gross geometry then the only perception of aging? Obviously not, as the neck does suffer from gravitational forces with the exposure of loosening platysma. There are also readily apparent signs of cutaneous damage with the onset of rhytids, dyschromias, etc. However, what can be more important than both neck descent and skin changes is what could be termed microgeometry. The aforementioned geometry in the previous section can be smoothly presented with minimal transitions or with multiple abrupt demarcations. Take for example an overweight child or young adult versus an overweight 50 years something. If they are both replete with fat, how does the brain determine their aging even before a
wrinkle or a hanging neck is perceived? The answer lies in the fact that an overweight youth is uniformly convex and uniformly round. An overweight person past 35 years of age or so will exhibit areas of marked hollowness that become even more pronounced alongside pockets of excessive weight gain in the lower cheek, jowl, and neck area. These abrupts in gross geometry further accentuate perception of aging. That is how it is possible to tell if someone is young and simply full with their natural baby fat, someone overweight and young, and someone overweight and older.

The young person even when very thin will still maintain a soft-tissue padding that is relatively uniform unless they are so thin that they look emaciated. An older individual will show abrupt transition points as the underlying bone is exposed and retaining ligaments exacerbate transition points. In short, a young face exhibits relative uniformity, whereas an older face displays signs of obvious transitions between various facial regions despite weight, neck descent, and signs of skin aging.

With that respect, another word to introduce in perception is convexity. The reader is reminded that in daily life, most situations involve the play of overhead lighting. Indoors, top-down lighting is the norm, and even outdoors, the sun shines from a relatively high vantage point. Flash photography, on the other hand, tends to wash out facial features that can improve one’s appearance. Daily life is not so kind. With overhead lighting, everyone can look a bit worse. The more pointed the light source from above, the worse that facial features can appear. The well-known “mug shot” look of celebrities caught after a bad night of partying reflects as much their torrid state as the harsh overcast lighting. With all of that in mind, two attributes of the aging process become sharply defined in relief with standard overhead lighting: the appearance of unwelcome facial transition zones (previously discussed) and the presence/absence of light convexity. The flatter the face with aging, the less is the light bounce that the face transmits back to the viewer. Relative convexity of the lateral brow, upper cheek, and chin with reflected light bounce back to the viewer is the hallmark of a youthful face. Softening abrupt transitions and creating facial convexity are two major objectives of facial fat transfer. Interestingly, when it comes to the appearance of skin, more light on the skin will make it look brighter and thereby more youthful. Other effects of fat transfer on the skin will be discussed next.

Stem-Cell Changes and Other Cutaneous Manifestations Following Fat Transfer

Although skin resurfacing techniques and botulinum toxin remain the gold standards for addressing the signs of aging skin, there has been a consensus among fat-transfer surgeons that favorable skin changes can occur down the road following fat transfer [5]. Wrinkles, scars, pores, texture, and other pathologies have been noted to diminish in areas overlying transplanted fat. These cutaneous effects, if they manifest, require months if not a year or more to start to show up. Personal findings noted the reduction of acne scarring after a year or more as well as scar reductions in areas that failed to be corrected with conventional scar revision surgery. Reports have claimed improvement in conditions such as radiation damage, chronic ulceration, breast capsular contracture, and damaged vocal cords. Thoughts include that transplanted fat cells may contain adipocyte-derived stem cells or preadipocytes that can repair surrounding tissues and perhaps even transform into bone, cartilage, muscle, blood vessels, nerves, and skin [6]. Thinking and research on these purported claims are still in their nascent phase, but the clinical evidence is difficult to deny.
Long-Term Outcomes Using a Hair Transplant Model

A major drawback that has been expressed regarding transplanted fat is its equivocal longevity. Simply put, this problem was not observed. With proper hand harvesting using gentle negative pressure, centrifugation to purify the fat cells, and atraumatic cannula injection techniques using microdroplet technique, transplanted fat holds remarkably well. It is with rare exception that an additional session is required to attain the optimal results. However, to understand the nature of this longevity, the evolution of fat grafting results over the first 2 years and beyond must be understood.

A critical study [7] documents the evolution of a fat grafting result over the first 18 months using three-dimensional computer VECTRA modeling. Using this method, the author quantified the volume a fat-transfer result would have preoperatively and at points measured at 3 months and every 3 months thereafter for the first year and a half. What they found was that the fat-transfer results at 3 months in many cases had the same volume as preoperatively, i.e., there was no appreciable volumetric gain. However, at 6 months the result started to increase in volume and steadily did so in each recorded interval, i.e., every 3 months. The obvious question then is: why should this happen? Why would the result apparently evaporate at 3 months and then steadily increase thereafter. Hair transplant surgery using follicular-based grafts is very similar to a fat transfer for the following reasons. First, they both rely on free grafts, i.e., no direct microvascular attachment, just freely transplanted with surrounding blood supply creeping in over time. Second, both types of grafts are relatively small and numerous (tiny parcels of fat the size of 1/50th of a cubic centimeter compared with tiny hair grafts containing one to four hairs). Third, they are both transplanted into the same general body region, i.e., the head. Finally, albeit least importantly, they are both performed for cosmetic purposes.

Walter Unger’s book, Hair Transplantation [8], explains how transplanted hair grafts attain their blood supply over time. During the first few days, nutrients from the surrounding tissue enter the graft through a process known as plasmatic imbibition. Thereafter, a tenuous blood supply maintains graft viability through a process known as primary and secondary inosculation. It is not until 6 months following a hair transplant that formal neovascularization is fully attained. This time period also correlates with clinical onset of substantive hair growth. From experience, except for occasional examples of significant hair growth at 3–4 months, in most cases pronounced clinical growth is generally evident starting approximately 6 months following hair transplant surgery. Hair grafts then continue to grow at variable rates for the first 18 months.

Not surprisingly, a similar progress in the evolution of a fat grafting result was clinically observed. The only difference would be that hair grafts typically fall out after the first few weeks, whereas a fat grafting result can persist for the first 6 weeks or so owing to the presence of edema since fat grafting is contingent upon soft-tissue volume, whereas a hair transplant result obviously is not. Like a hair transplant, a process of vascular inosculation maintains the fat graft alive, which does not become clinically apparent until typically 6 months following the procedure at which time neovascularization has been established with ongoing growth of a result in the majority of cases for the first 18 months or so just like a hair transplant.

The longevity of a hair transplant and fat grafting result is also correlative. An individual who undergoes a hair transplant will retain the transplanted grafts but suffer ongoing hair loss in susceptible hairs that have not been transplanted. Similarly, once the fat grafting attains a mature blood supply, the grafts survive but ongoing volume loss of nontransplanted fat occurs with ineluctable aging. Generally, a fat transfer may require a minor touch-up procedure 3–4 years later in someone with a genetic predisposition toward more accelerated aging but will not require anything further for 5–10 years in most individuals.

It has been speculated that fat grafting has been so roundly condemned in the past with regard to longevity due to several reasons. First, poor technique can compromise longevity with speculated errors
including traumatic donor harvesting, inadequate or excessive processing, and improper infiltration techniques. Second, physicians may not sufficiently follow clinical results over time or understand the nature of a transplant result. More specifically, the 3-month interval that often presents a clinical situation that is quite unimpressive and may discourage surgeons from continuing, since the result appears to have dissipated. Conversely, filling a patient repeatedly during these time intervals of volume descent may lead to an uncorrectable overfilling when the fat grafting result attains maturity 2 years later.

Some of the stem-cell changes that have been proposed for fat transfer have also been observed clinically when hair transplanted into regions of scarring alopecia can actually heal the damaged and cicatricial skin. Obviously, the effect that a transplanted hair graft has on surrounding tissues may arise through a recognized stem-cell process. The pilosebaceous unit is considered the source for skin regeneration with stem cells understood to reside in the bulge region of the hair shaft. In addition, the long-standing premise of modern hair transplant surgery that transplanted hairs fully retain the native characteristics of their donor region is being recently challenged [9]. For example, hairs grafted from the occiput into the eyebrow region have shown a retardation of hair growth rate to match that of native eyebrow hairs. In addition, hairs transplanted from the body to the scalp in individuals who have depleted their occipital donor hair have been shown to start growing more rapidly and become finer in caliber over time. These profound clinical observations reveal how little is known about the nature of a transplanted graft and skin and hair changes in general.

**Conclusion**

The landscape of understanding facial aging is constantly a shifting terrain. Most of the traditional thinking that dominated perception of aging (i.e., gravity and wrinkles) this past century has been recently upended by distilling the concept of aging through the primary mechanism of soft-tissue (and bony) volume depletion. The juncture between dermatologic and surgical worlds to restore the aging face has become more apparent than ever. The novel concepts of stem-cell changes that can manifest following fat transfer push this idea to an even greater measure. Ongoing clinical and basic science research will ensure that more natural results are attained for facial rejuvenation that also more closely parallel the true nature of facial aging with possible derivative benefits to the understanding and treatment of the aging skin.

**Cross-References**

- [Cosmetic Surgery in the Elderly](#)
- [Facial Rejuvenation: A Chronology of Procedures](#)

**References**

3. Lambros V. Lecture at Cedars-Sinai Medical Center. Los Angeles, October 26, 2008.
5. Having spoken to well-respected and experienced fat transfer surgeons over the years, the consensus is that these surgeons have clinically observed cutaneous benefits that have been thought to be related to fat transplant beyond what would have been observed through any other more direct skin therapy.


