COMPLEMENTARY FAT GRAFTING

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SAMUEL M. LAM, MD

Private Practice
Lam Facial Plastic Surgery Center & Hair Restoration Institute
Willow Bend Wellness Center, *Plano, Texas*

MARK J. GLASGOLD, MD

Clinical Associate Professor of Surgery
Robert Wood Johnson Medical School, University of Medicine & Dentistry of New Jersey, *Piscataway, New Jersey*
Private Practice, Glasgold Group Plastic Surgery, *Highland Park, New Jersey*

ROBERT A. GLASGOLD, MD

Clinical Assistant Professor of Surgery
Robert Wood Johnson Medical School, University of Medicine & Dentistry of New Jersey, *Piscataway, New Jersey*
Private Practice, Glasgold Group Plastic Surgery, *Highland Park, New Jersey*

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In memory of my beloved father, Samuel S.O. Lam, M.D., whose courage in the face of adversity has inspired me and all who knew him. He will truly be missed.

S.L.

To Alvin Glasgold, M.D., skilled surgeon, compassionate physician, wise mentor, and loving father.

M.G.
R.G.

Preface

My adoption of autologous fat transfer has proven to be the most significant advance in my evolution as a facial plastic surgeon, which accounts for 100% of my practice. I first appreciated the role that volume loss plays in the aging process from one of Dr. Sidney Coleman's courses on Lipostructure. Once I made this leap in understanding, it became almost inevitable for me to pursue autologous fat grafting. I have witnessed this eye-opening moment in other surgeons at scientific meetings when they perceive for the first time the incredible rejuvenative capacity of fat grafting and embark on their own journey of discovery.

This book arose out of the tremendous interest that my colleagues expressed about learning fat grafting and my desire to produce an introductory, algorithmic approach to what I conceive of as a very straightforward procedure. My understanding of fat grafting has evolved over the past ten years. I began, as many do, with the disappointing experience of filling nasolabial folds and lips. I was then encouraged by my early success in filling cheeks. I learned full-face approaches from Drs. Coleman and Amar who espouse their own unique techniques for fat grafting. The complementary manner in which I combine fat grafting with traditional incisional-based procedures has yielded the most uniform patient success when compared with using either modality alone. I now employ fat grafting in over 90% of my facial rejuvenative cases.

Fat grafting is usually taught with a heavy emphasis on the artistic nature of the procedure. The technical steps of harvesting, processing and injecting fat are relatively easy to master and the hurdle encountered always concerns where to place the fat and how much fat to place. The critical question then arises whether placement and volume can be performed empirically rather than purely aesthetically? The answer is yes and no. I believe that a volumetric foundation can be placed in an empirical manner that is appropriate for almost every aging face patient because facial aging is fairly consistent. However, an aesthetic touch is necessary to refine the result. The application of the volumetric foundation will allow the surgeon to incorporate fat grafting into his or her box of tools comfortably and with few problems and facilitate the development of an aesthetic eye with time.

I would like to thank my brother Robert's and my own patients for allowing us to evolve and to use their photographs to demonstrate the results and techniques shown in this book. The evolution of this technique belongs as much to Robert as to me. He is a terrific and creative surgeon and the development of the ideas for this approach stemmed from a completely collaborative undertaking with him. Mike Nayak, a previous fellow, came up with the term *Complementary Fat Grafting* and his thirst for knowledge pushed me harder than anyone else has. Sam Lam was the force behind this project, completed all the illustrations, did all of the groundwork and through hard work and an iron will got this project completed faster than I would have believed possible.

Mark J. Glasgold, M.D.
Highland Park, New Jersey

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Chapter 1

Aesthetics and Aging: A New Paradigm

Introduction

Many book chapters and scientific papers have been written about the aesthetic evaluation of the aging face, with a plethora of lines and measurements, philosophies, and perspectives to instruct the reader in that analysis. This chapter will not review the past literature but instead will attempt to propose a new way of looking at the maturing face—one that is particularly relevant to the surgical therapies outlined in this book. In a certain respect, the aesthetic surgeon has to unlearn much of his or her education up to this point. Past theories on the aging face have focused solely on facial descent as the primary mechanism for facial aging. Accordingly, a facelift, browlift, and blepharoplasty were used as the principal weapons to combat and reverse the aging process. All of these procedures are contingent upon excision and lifting of redundant, prolapsed, or descended tissue.

A new paradigm has emerged to supplant this established dogma—the face does not descend so much as contract by virtue of volume loss. Two pioneers have led the charge for fat enhancement: Sydney R. Coleman of New York and Roger Amar of France. Coleman has been an eloquent and outspoken proponent of this new thinking. He reasons that the face undergoes soft-tissue and fat loss. Therefore, volume expansion with facial fat grafting is the method by which the aging process can be reversed. Roger Amar, a studious and meticulous individual, has advocated a strict anatomic program for facial rejuvenation known as FAMI (Fat Autograft Muscle Injection), in which fat is infiltrated systematically into the face using the facial muscles as the recipient bed.

A simple simile can be instructive and illuminating when thinking about the aging face in this light. A grape becomes a raisin with loss of volume; in a similar fashion, volume depletion of the aging face manifests as redundant skin. The effect of a facelift can be viewed as transforming the raisin into a pea by removing the redundant "shell" without addressing the volume loss. Therefore, returning the raisin to a grape, or the aged face to a youthful face, requires restoring the volume that is at least in part responsible for these changes.

When we look at the results of our past efforts to rejuvenate the face, we can see that excisional-based surgery has not truly provided all the answers to facial rejuvenation (Fig. 1-1). The hollowed-out eyes that result from removing fat and skin during a blepharoplasty surely are not the ideal of a youthful countenance. At times, a perfectly performed facelift may produce an unnatural surgical result and not a rejuvenated appearance. Clearly, there is more to restoring a natural, more youthful facial appearance than what just lifting can provide (Fig. 1-2).

Figure 1-1A, B: Photograph of a patient who years earlier underwent upper- and lower-eyelid blepharoplasty and a cervicofacial rhytidectomy. Despite the adequate improvement the patient attained with traditional rejuvenative procedures, her aesthetic result could have been significantly enhanced with autologous fat transfer.

Is volume expansion, then, the only method acceptable to rejuvenate the face? Should the experienced plastic surgeon who is adept at browlifting, facelifting, and the like, throw out all that he or she has learned and start over with just filling the face with fat? Certainly, many advocates of full-face fat transfer have shown remarkable clinical results that testify to the potency of fat grafting alone, with longevity that has rivaled traditional lifting procedures.

Although the aging face can be readily addressed in many circumstances with full-face fat transfer, the quantity of fat needed to achieve the intended result can be considerable, exceeding 100 cc during a procedure. Because proper fat infiltration requires multiple tiny passes with the infiltrating cannula to attain a viable, long-lasting result, an individual who has received a sizable amount of fat during a session can suffer from a marked recovery period, characterized by gross, lingering edema and ecchymosis. At times, traditional lifting procedures combined with fat grafting can reduce the amount

Figure 1-2A: This patient, who underwent a cervicofacial rhytidectomy, appreciated the improvement along her jawline and neck contour but did not feel that the result approximated her appearance in youth. **B:** Following fat transfer to the midface and periorbital region, she felt that she appeared more as she did when she was younger.

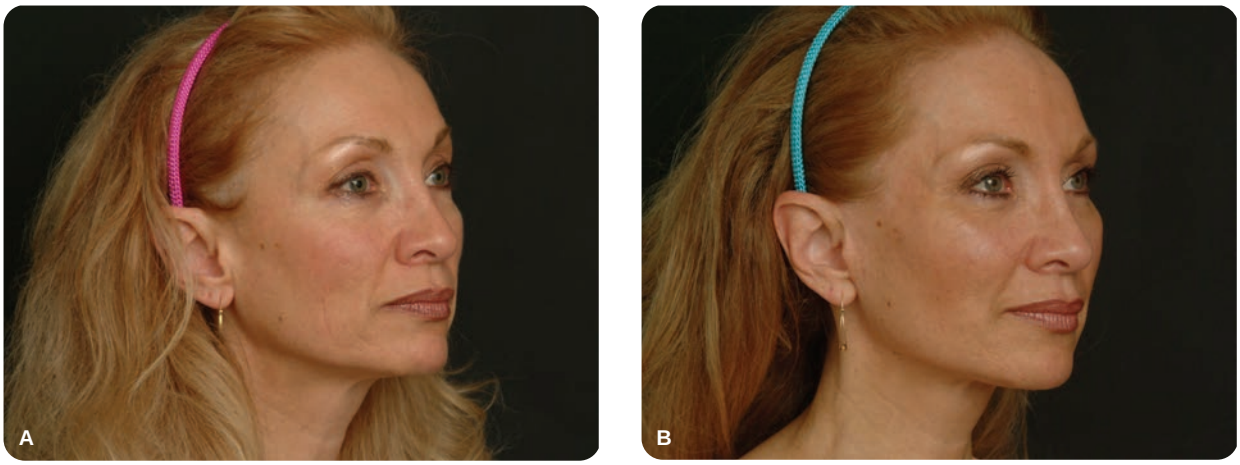


Figure 1-3A, B: Pre- and postoperative views of a patient who underwent facelift to correct the lower face and fat transfer to improve the midface.

of fat needed to arrive at the desired result and thereby limit morbidity without aesthetic compromise (Fig. 1-3). Deciding whether to perform facial fat grafting alone, a lifting procedure, or a combination of the two will be thoroughly discussed in Chapter 2. Implementation of how to perform each type of procedure alone or in combination will then be discussed in Chapter 3. This book will not explain how to perform a facelift, blepharoplasty, or other types of surgical procedures, as sufficient numbers of books have already been written about these topics. The book assumes a prerequisite knowledge on how to perform non fat grafting rejuvenative procedures. The emphasis instead is on fat grafting and how to integrate it into an existing plastic surgical practice. If the surgeon is unfamiliar with other types of rejuvenative procedures and elects only to perform fat grafting, this book will also be useful toward that end.

We propose an integrated philosophy that permits the combination of lifting procedures with volume enhancement. Paradigms are merely models for viewing and understanding the world around us. No one paradigm can explain everything. Rather than subscribe to a single paradigm and constrain all of our view through the narrow confines of that model, we would like the reader to be more embracive of all techniques that can be beneficial for a particular patient and to select the combination of techniques that will work based on that patient's particular anatomy and aesthetic desires. Like a painter with many sizes of brushes and a full color palette, the surgeon can be more creative and open when approaching the aging face. At times, full-face fat grafting will work beautifully (Fig. 1-4). Other times, lifting procedures alone will probably suffice. Most often, a judicious combination of both treatment modalities will be superior. As stated, Chapter 2 will guide the reader in a detailed preoperative evaluation of the face to determine which procedures will be best suited for a prospective patient. This chapter is intended only to set forth our paradigm of the aging face, which integrates prior work filtered through a new perspective.

Where should our search begin when looking for the quintessence of ideal, youthful beauty? Should we look at the aging face and think of how to rid it of unsightly wrinkles, sagging tissues, and the like? The answer is an unequivocal no. We should begin by determining what constitutes a youthful countenance so that we can strive toward that ideal. Too often, surgical plans begin and end with how to eliminate the face of "aging" without any clear understanding of youth. That is why a facelift can straighten a jawline but still leave the individual feeling as if he or she appears old. A pulled and stretched face does not necessarily resemble a youthful face or, more precisely, what the individual looked like in the past.

What makes a face appear young, vibrant, and ultimately alluring? When we look at a young face, how do we know that it is a youthful face? Is it just the

Figure 1-4A: Preoperative photograph of a patient with significant global facial volume loss. **B:** Postoperative photograph following full-face fat transfer using a total of 63 cc of fat.

absence of lines and wrinkles? Is it just volume? Observing youthful faces will provide part of the answer. But, without a frame of reference it may still be difficult to delineate the changes that make an older face uniquely distinct from a youthful face. Reviewing photographs of patients when they were younger can elucidate these changes and help to establish the particular goals and plan for rejuvenating them. The remaining part of this chapter will be divided into three sections that describe the fundamental qualities of youth and the evolution of those qualities over time: Volume and Shape, Highlights and Shadows, and Framing the Eye. Viewing the youthful (and aged) face with these proposed principles will not only generate an insightful aesthetic philosophy but in so doing will serve as the underpinning for an effective and systematic surgical plan.

Volume and Shape

Women tend to scrutinize their faces with the absolute, unforgiving lens of a mirror at 8 or 10× magnification. Fine lines, uneven texture, and color become the focus of attention at this level of magnification and at such close inspection; and oftentimes, women present to the plastic surgeon with alarm regarding these fine lines and other minor skin imperfections. Understanding how people view themselves can provide the surgeon the proper eye with which to view and understand their perception of aging. Nevertheless, the fundamental change from youth to age lies not in the minor cutaneous flaws that develop over time but in the overall change in facial volume and shape. How does a casual viewer almost instantaneously perceive that another individual several feet away is 15, 25, 35, 45, or 55 years of age before even a detailed facial analysis has been rendered? The answer lies fundamentally in the perception of that individual's facial volume and shape. How does someone almost immediately know that an individual is 35 years old and not 15 years old? Wrinkles and lines have most likely not developed at this point, unless severe and repeated photodamage has ravaged the skin at an early age. Considering that the sun and other abusive behaviors are not in effect and eliminating any mannerisms or styles of dress that would suggest a person's age, an onlooker usually can still discern the age gap that would define someone as 35 and not 15. Again, the answer lies in the change over time in volume and shape. From 15 to 35 years of age, most individuals experience principally a change only in *volume* due to loss of overall soft tissue, known colloquially as "baby

Figure 1-5A–F: Photographs showing progressive, age-related changes. The individuals featured in the photographs are 24, 36, 41, 48, 56, and 59 years of age, respectively. The volumetric loss of soft tissue that is evident with the aging process initially transforms a face that is replete with "baby fat" (in the twenties) to a leaner, more sculpted appearance (in the thirties), giving way to progressive skeletonization of the face (thereafter), including a hollow orbital rim, prominent zygoma with scant overlying soft tissue, development of a prejowl sulcus, and eventually a full jowl.

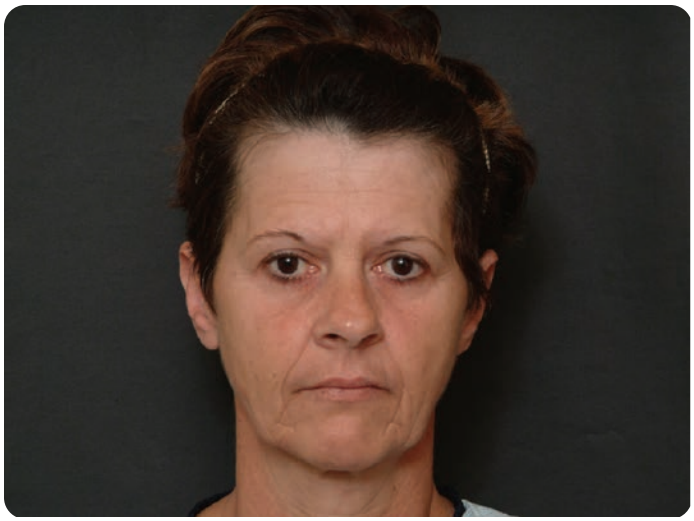


Figure 1-6: The loss of midfacial volume combined with facial tissue descent along the jawline result in a squaring of the face typically associated with aging.

fat" (Fig. 1-5). Most women actually like this change from their twenties into their thirties when they begin to exhibit a leaner, more sculpted appearance. Suggestion that they need facial fat enhancement can be anathema at this point. However, in some very athletically inclined individuals, the volume loss is accelerated and may impart an unhealthy, overly gaunt appearance that may connote the opposite of health—infirmness and aging. In these individuals who seek rejuvenation, any lifting procedure would most likely be premature, unnecessary, and futile in achieving any aesthetic improvement. In such a situation, volume restoration is the primary tool for facial rejuvenation.

From the period of 35 to 45 years of age and beyond, gravitational forces and volume contraction are both at work, depending on the individual. Some individuals experience marked signs of facial tissue descent; others exhibit almost exclusively radial volume contraction of the face. The combination of both forces contributes ultimately to the change in facial shape over time from a youthful heart shape (or triangular shape) to an elongated rectangle (or square shape) (Fig. 1-6). The objective of surgery is to restore both the volume and shape to the face to recreate the ideal heart shape.

Facial fat and soft-tissue loss in the midface plays a significant role in the loss of a youthful heart shaped face. Perioral, chin and prejowl sulcus volume loss combined with jowl formation create a squaring effect on the lower face. This effect on the lower face can be masculinizing. The goal of rejuvenation is defined simply as trying to move that individual's face from a rectangular shape back in time to that of a heart and in so doing move attention away from the lower face back to the eyes (Fig. 1-7) (see the following section, Framing the Eye, for more details). Evaluation of the face (Chapter 2) will help define the precise anatomic attributes that can be improved with selective procedures.

In an effort to strive toward the ideal, heart-shaped face, brow position can play a critical role. A browlift, irrespective of technique, can actually elongate the face and thereby accentuate the rectangular configuration that is both masculinizing and connotes aging. If the brow is truly ptotic and is situated below the orbital rim, then browlifting can help restore youthful vitality and femininity to the eye (Fig. 1-8). However, in most patients, volume enhancement of the brow may better restore the fullness typically seen in the youthful brow (Fig. 1-9). Photographs of the patient at a younger age are crucial to this evaluation. Although this chapter concerns ideal aesthetics, technique has been introduced only as it relates to an understanding of currently proposed aesthetics. The aesthetic objective for facial rejuvenation should be to return the face toward the ideal heart shape, and brow position can be a major determinant in striving to achieve or, conversely, to undermine that standard.

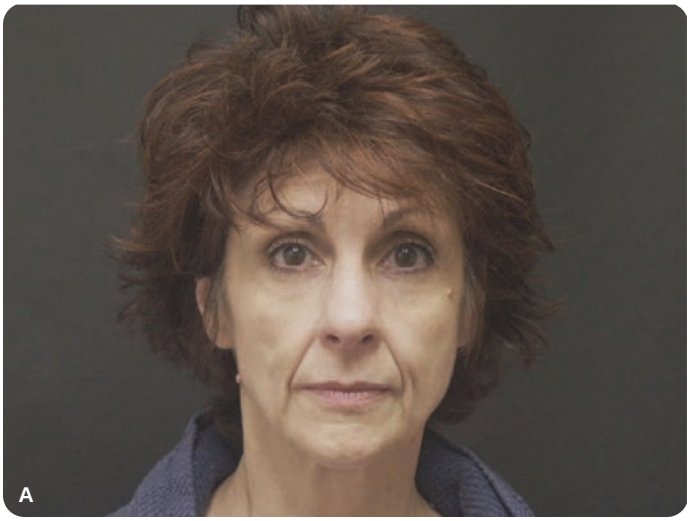
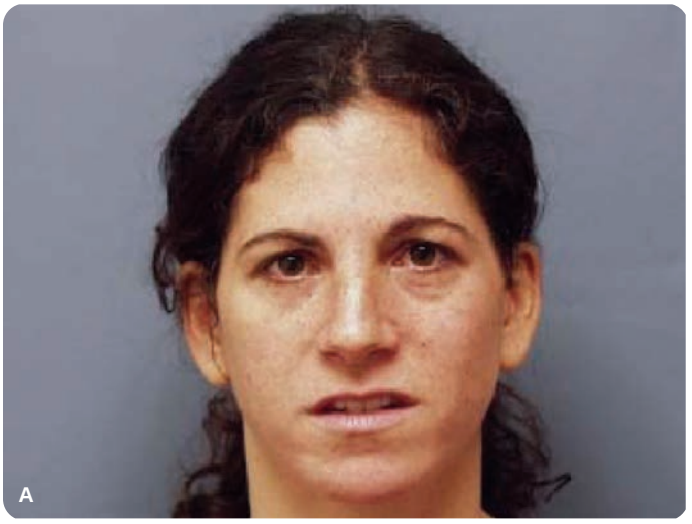


Figure 1-7A, B: Preoperative view of a 56-year-old woman with the typical signs of aging, including soft-tissue depletion and gravitational descent. **C, D:** The patient underwent fat transfer of 27 cc to each cheek and buccal region followed two years later by a facelift and additional fat transfer of 3 cc to her orbital rim and 3 cc to her pre-jowl sulcus. The postoperative photographs show the patient at two years after the second operative procedure.



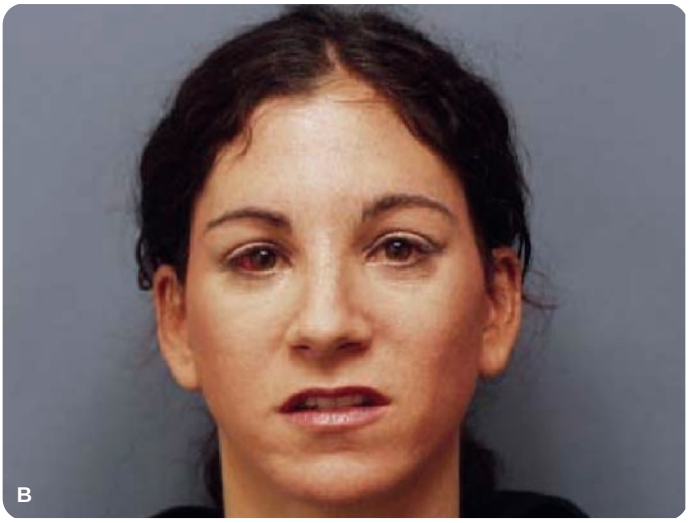


Figure 1-8A: This 30-year-old female exhibits a congenitally ptotic brow. **B:** Following an endoscopic browlift, she demonstrates a more open eye with maintenance of a strong periorbital frame, preserving upper-eyelid fullness and avoiding unfavorable skeletonization of the superior orbital rim.

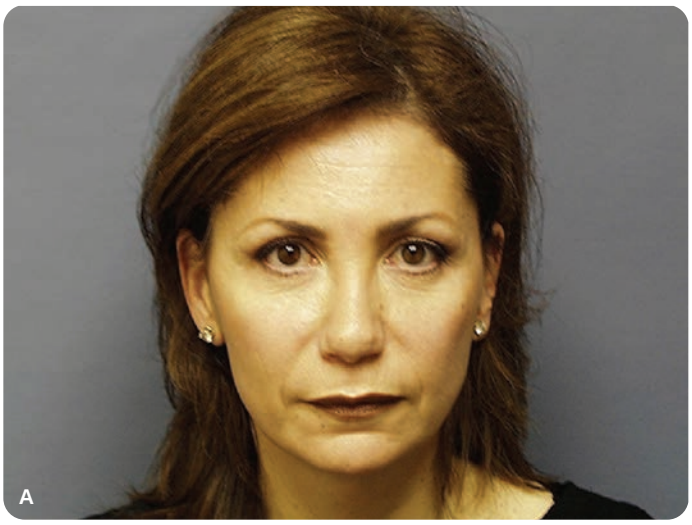
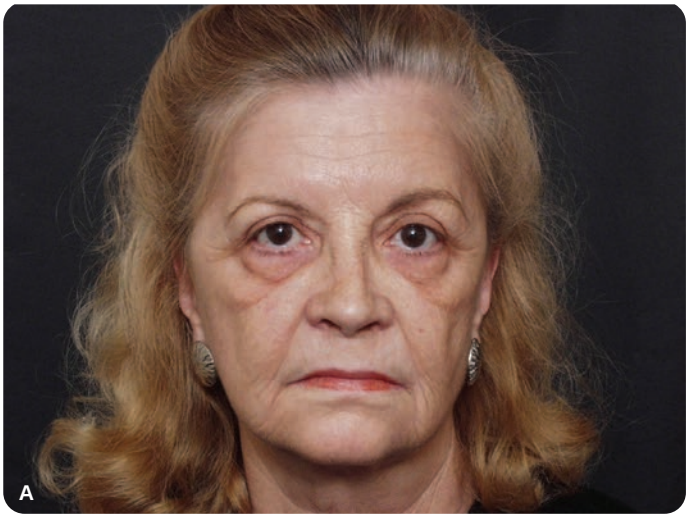


Figure 1-9A, B: Pre- and postoperative views of a woman who underwent browlift and upper-eyelid blepharoplasty. Skeletonization of the brow and upper eyelid from the procedure imparts an unnatural hollowing or aged look.

Highlights and Shadows

The issue of highlights and shadows is intimately related to the previous section discussing volume and shape. As the volume of the face contracts due to soft-tissue loss and the shape of the face elongates due to gravitational descent, the distinguishing highlights of youth give way to the characteristic shadows of senescence. The characteristic highlights of the youthful face are lost as the face deflates. Shadows arise as the tissues fall and are tethered by various retaining ligaments, and concavities emerge from volume loss. Volume restoration combined with or without lifting procedures can reduce the unsightly shadows and recreate desirable highlights (Fig. 1-10).



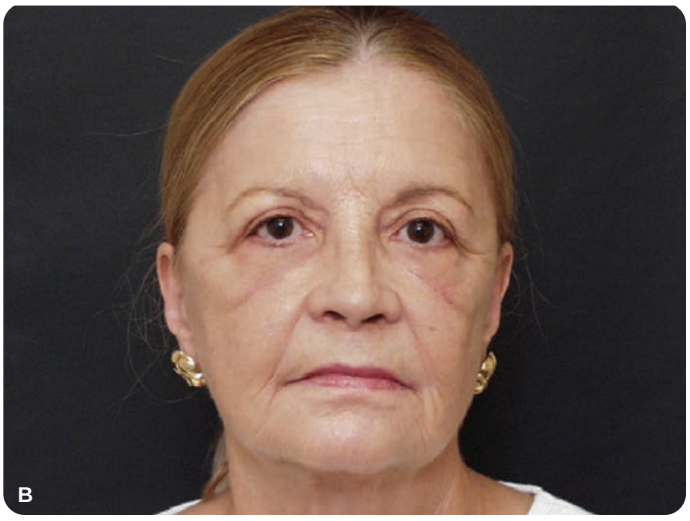


Figure 1-10A: Preoperative view of a woman who underwent a facelift and returned many years later requesting another facelift. The benefit of autologous fat transfer as the preferred method for rejuvenation were reviewed with her. **B:** Postoperative view following fat transfer (a total of 48 cc) to the inferior orbital rim and midface with notable aesthetic improvement.

Figure 1-11: A 24-year-old woman who displays the convexity and highlights of youth and the absence of concavity and shadowing associated with aging.

The principal highlights that underscore a youthful countenance are found at the lateral brow, cheek, upper lip, and chin (Fig. 1-11). Women often tease their eyebrow hairs, which appears attractive not only as a result of the crafted arched shape but also because the highlight along the lateral brow is rendered more exposed. With age, the cheek mound that frames the eye falls downward and involutes, resulting in a conspicuous double contour that is exacerbated by the presence of the malar septum (Fig. 1-12). The double contour arises from exposed orbital fat (bulge), bony orbital rim (hollow) malar mound (bulge), and malar septum (hollow). The separation of the lower eyelid from the cheek with the appearance of the double contour is a notable stigma of aging, and every effort should be made to reunite these two areas into a confluent, single complex. The double contour should be viewed as a more important area to correct than a deepened nasolabial fold which can be present even in youth. The targeted fashion for addressing all of the highlights and shadows of the face will be presented in Chapters 2 and 3. Restoration of the lower-eyelid and cheek complex as a single unit will provide the requisite lower frame for the eye.

Figure 1-12A: Preoperative view of a patient demonstrating the double contour that arises from volume loss along the inferior orbital rim and the malar septum. **B:** Postoperative appearance following conservative lower-eyelid transconjunctival blepharoplasty as well as midfacial and periorbital fat transfer (a total of 24 cc) to restore a single, unified convexity.

Figure 1-13: Two principal variants of an attractive youthful frame of the eye exist. The young woman in Figure 1-11 demonstrates one type of a youthful frame with a full lower eyelid/cheek and a full upper eyelid/brow. This woman exhibits the other variant of a youthful framed eye with a full lower eyelid/cheek yet a more sculpted upper eyelid/brow.

Although a convex and rounded face is associated with a youthful mien, some gender differences should be underscored. In particular, a full and round anterior cheek is a feminine characteristic. For men who are interested in facial fat grafting, care should be taken not to overfill the anterior cheek, which may render the face less masculine. In contrast, a strong lateral cheek and lateral jawline are more important in creating a more ideal masculine facial shape. Studying patterns of the ideal male face reveals these aforementioned attributes.

Framing the Eye

The eye should be the most captivating feature of the face, and the goal of facial rejuvenation is to bring back the beauty of the eye and attention to it. As discussed, the descended and deflated brow that collapses over the eye renders it looking tired and haggard. The lower eyelid is exposed, and attention is drawn to the unsightly contour deformities of the lower-eyelid fat bulge and the skeletonized and descended cheek. Without a proper frame, the attractiveness of the eye is markedly diminished. Think of a receding hairline: An onlooker's eye is drawn immediately to it. Conversely, a natural, full hairline that serves as a frame for the face goes unnoticed, and the onlooker's gaze is drawn back to the central face.

Should our goal be to restore a full and sensuous upper and lower frame for every eye? Yes and no. The answer lies in a studious evaluation of youthful and beautiful eyes. There exist two principal variants of an attractive, youthful frame for the eye: a full lower-eyelid/cheek complex and a full upper-eyelid/brow complex (Fig. 1-11) or a full lower-eyelid/cheek complex and a sculpted upper-eyelid/brow complex (Fig. 1-13). The first of these variants is encountered more commonly in a youthful face. How about a full upper frame and a hollow lower frame (Fig. 1-14A)? This pattern is rarely observed but can occur when a very prominent bony superior orbital rim exists with relative malar hypoplasia and lower-eyelid hollowing. This variant is unattractive and can be improved with fat transfer to the hollow lower eyelid and cheek to establish improved balance and harmony. A full lower frame should always be a primary goal in facial rejuvenation.

Some surgeons rely on cheek implants to achieve an improved malar contour. However, use of an alloplastic malar implant alone in the aging face can actually worsen infraorbital hollowing and accentuate the absence of a proper lower frame for the eye. Why is this the case? Simply put, the implant cannot reside superior to the infraorbital nerve; therefore, the hollow inferior orbital rim is only accentuated by the

Figure 1-14A: Preoperatively, this patient exhibits a negative-vector eye with a full upper frame (upper eyelid/brow) and a hollow lower frame (lower eyelid/cheek). **B:** Postoperative photograph following fat transfer, which included 3.5 cc along each inferior orbital rim and 7.5 cc to each cheek, creating a balanced frame for the eye and mitigating the appearance of the negative vector.

presence of a greater prominence immediately inferior to it (Chapter 2, Fig. 2-19). Nevertheless, use of an alloplastic implant can be quite effective in combination with fat grafting for individuals such as athletes who lack sufficient body fat for fat grafting. This will be discussed more thoroughly in Chapters 2 and 3.

To better understand the concept of framing the eye, an example of an unframed youthful eye—an exception that proves the rule—is the so-called negative-vector eye. As described in previous literature, a negative-vector eye is one in which the globe rests anterior to the orbital rim, giving the illusion of an unframed eye (Fig. 1-14). Traditional blepharoplasty can exacerbate the appearance of a negative-vector eye by continuing to hollow the frame and thereby exposing the relative anterior position of the globe. Fat transfer can soften the appearance of a negative-vector eye, although only as much as additional fat placement can match the anterior projection of the eye position. The negative-vector eye, whether found in the younger or older patient, is unattractive simply because of the relative lack of a frame for the eye.

Concluding Remarks

Beauty lies in the eye of the beholder, or so the saying goes. This chapter attempts to define a new aesthetic that closely parallels natural patterns of beauty. Hopefully, in so doing, we have challenged the reader to re-evaluate his or her concept of what beauty is and whether surgical options of the past have truly been sufficient to arrive at that aesthetic ideal. However, after finishing this chapter, the reader may choose to reject part or all of the proposed philosophy, and that's just fine. Every surgeon and every patient will have a somewhat different opinion as to what constitutes beauty and what should be done to achieve the optimal result. Fundamentally, the most important harmonious union of opinion must lie between the surgeon and the prospective patient.

Chapter 2

Preoperative Evaluation

Introduction

With the aesthetic concepts outlined in Chapter 1 firmly in mind as a framework, the surgeon can now begin a rigorous preoperative evaluation of a prospective patient. This chapter is divided into two principal sections: preoperative consultation and preoperative analysis. The former reviews in detail the dynamics of an aesthetic consultation as it pertains to fat grafting and/or ancillary methods; the latter undertakes a systematic anatomic analysis of the aging face as it will benefit from fat grafting and/or other techniques.

Fat is not viewed as a universal panacea for the aging face. Instead, this chapter will guide the surgeon in the requisite judgment of when fat will be beneficial and when other rejuvenative techniques may be more applicable. The complementary nature of fat grafting to traditional lifting procedures will be emphasized so that the reader may grasp the role that each type of surgical treatment can play to achieve the optimal aesthetic objective for the patient.

Preoperative Consultation

The goals of an initial preoperative consultation are threefold: (a) to establish what the patient desires as far as aesthetic enhancement, (b) to determine an independent plan based upon a study of the patient's anatomy, and (c) to ensure that the first two objectives are in alignment. This section will deal chiefly with the patient's perspective on fat enhancement, that is, understanding what the patient wants and educating him or her about the benefit of fat enhancement versus other ancillary measures. A study of each component of the face has been reserved for the Preoperative Analysis section (even though technically it constitutes part of the consultation).

An aesthetic consultation should always begin with declaration of the patient's complaint without prodding or prompting from the surgeon. Even if the patient asks for a recommendation, the surgeon should carefully divert the attention back to the patient's unsolicited expression of desire for enhancement. Listening attentively to the patient's words will help guide and structure the surgeon's efforts.

The aging face is a complex and lengthy subject that requires both significant time investment and a commensurate expenditure in thought and energy (for both the surgeon and the patient). Accordingly, starting with what the patient desires can be the most beneficial opening to guide the surgeon in a targeted consultation. If the patient states that

he or she is truly troubled by the deepening nasolabial fold, a conversation about fat enhancement may not be the most fruitful dialogue. Why is this the case? First, we must understand what fat does well and what it does not do so well in our judgment.

Fat should be thought of primarily for volume enhancement of the face. It is not an ideal treatment for facial lines or for lip augmentation, although some practitioners have successfully used it in both of these areas. Our experience has been that treating these areas with fat has not resulted in high patient satisfaction. For the treatment of facial lines, fat transfer can oftentimes subject patients to undergo a more significant procedure with more morbidity, and often an inferior result, than if treated with a more standard filling material. Patients who present to the office desiring correction of only hypoplastic lips or deeper facial lines are offered the range of facial filler products tailored to their specific desires, concerns, and budget. An exhaustive review of current filler products lies beyond the scope of this text and will most likely be either outdated by the time of publication or irrelevant for a certain country where a product is unapproved or unavailable.

Although digital imaging analysis with morphing capacity has often been used successfully as an educational tool during a typical consultation, we have not found it valuable for fat transfers. It is difficult to image the projected results of volume augmentation that are normally seen with fat grafting. Alternatively, reviewing before-and-after photographs of patients with similar anatomy and aesthetic complaints can be quite instructive during consultation. It is also helpful to review images of the patient looking at their three-quarter oblique and profile views, as volume changes can best be seen on these views, even though a patient generally only examines himself or herself on frontal view in the mirror. Review of these clinical photographs will enlighten a prospective patient about the effects of volume loss and the benefits of volume restoration. Patients are often surprised by what they learn from these views (Fig. 2-1).

After a detailed preoperative facial analysis (discussed separately in the following section), the surgeon should determine if his or her aesthetic goals match those of the patient. Two other important variables that may affect what procedure(s) a patient selects to undergo are budget and recovery time. The latter consideration can be particularly important when discussing fat transfer, as the time to recovery can be greater than the patient expects due to the relatively noninvasive nature of the procedure. The surgeon should discuss openly and frankly the usual time to recovery after fat transfer and what a "typical" patient looks like during that time. The characteristics of the recovery period are detailed in Chapter 4.

Preoperative Analysis

For simplicity, the face is partitioned into three main components—the upper face, the midface, and the lower face—each of which are subdivided into smaller anatomic subunits. The analysis in each anatomic zone pays attention to whether fat alone, an alternative technique, or a combination approach is preferable. This section will help the reader to determine which methods will be the most suitable to achieve the ideal aesthetic principles outlined in Chapter 1 (Fig. 2-2).

Upper Face

Brow

The upper face is an important area concerning the transformation of a patient from looking tired to looking more awake and vibrant. However, many different surgical approaches exist to arrive at this outcome. For the brow and upper-eyelid area, the surgical approaches include the following: (a) raising the brow through a browlift with or without upper blepharoplasty to remove redundant eyelid skin,

Figure 2-1A, B, C: Preoperative view of a patient in her early 50s showing facial volume loss associated with aging. Her periorbital hollowing is much more evident on the profile and three-quarter oblique views. **D:** Postoperative view following fat transfer to the periorbital and midface regions shows aesthetic improvement in those areas.

Figure 2-2: Patient showing panfacial age-related volume loss.

(b) performing an isolated upper-eyelid blepharoplasty, (c) fat enhancement of the brow, and (d) combining fat transfer with upper blepharoplasty. Selection of which procedure(s) is predicated on the patient's anatomy and on what outcome the patient desires. With advancing age, there are several changes seen in the brow/upper-eyelid complex. The brow deflates due to loss of soft-tissue fullness. The loss of volume will result in skeletonization of the superior orbital rim and/or significant descent of the brow. The upper eyelid may demonstrate hooding of the eyelid skin and/or pseudoherniation of eyelid fat.

In our opinion, brow rejuvenation has too frequently relied on lifting procedures and has overlooked the importance of restoring volume. Upper-eyelid rejuvenation has traditionally been approached with aggressive removal of upper-eyelid orbital fat and skin. It is our contention that the overly elevated brow and aggressively sculpted upper-eyelid sulcus do not impart a youthful appearance but instead create either an aged appearance or a surgical look. In women, the increase in the length of the middle third of the face as a result of browlifting accentuates the unattractive rectangular facial appearance associated with aging, and skeletonization of the orbital rim removes the fullness necessary to attractively frame the eye. In men, exposing the orbital rim and upper-eyelid sulcus can give a feminized appearance (Fig. 2-3). We believe that the overuse of browlifting is in part due to surgeons allowing the available techniques to dictate the goals, rather than the aesthetic goals dictating the choice of procedure. Additionally, patients often misunderstand the aging process and request these types of changes. Reviewing a patient's photographs when he or she was young can be instructive for both the patient and surgeon in planning a strategy for creating a more youthful appearance. It is quite common when looking at these photographs to realize that brow descent is dramatically less than the patient believes and that loss of volume in the brow with resulting skin hooding are the most significant changes.

The surgeon should strive not only to meet a patient's aesthetic expectations but also ensure that the result will look natural, not surgical. A mildly ptotic brow that exhibits volume loss can be best addressed with a fat transfer and, if accompanied by dermatochalasis, an upper-eyelid blepharoplasty. Patients with a truly ptotic brow resting below the orbital rim will benefit from a browlift. The browlift violates tissue planes that preclude a concurrent fat transfer to the lateral superior orbital rim.

A sculpted brow/upper-eyelid complex can be seen as an attractive appearance but only if it is associated with a full inferior orbital rim and midface. Some of our patients

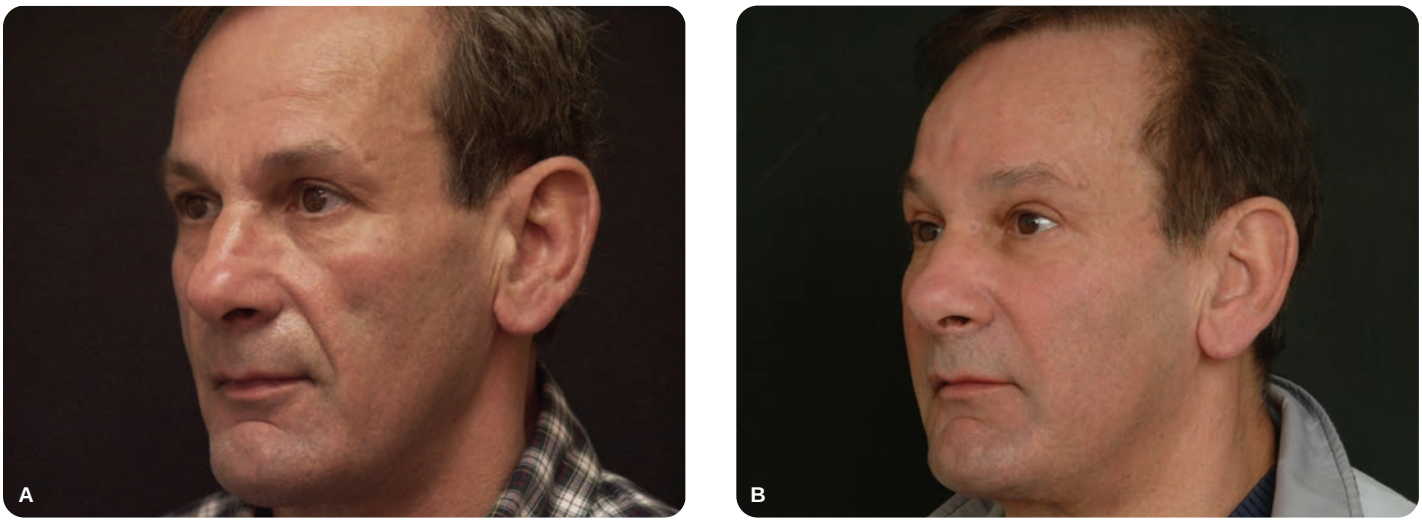


Figure 2-3A: Preoperative view of a male patient who disliked the heaviness of his brow and wanted the effect of a browlift. **B:** The same patient is shown following browlift and a fat transfer to the cheeks. Note that the browlift has a tendency to feminize the patient's face.

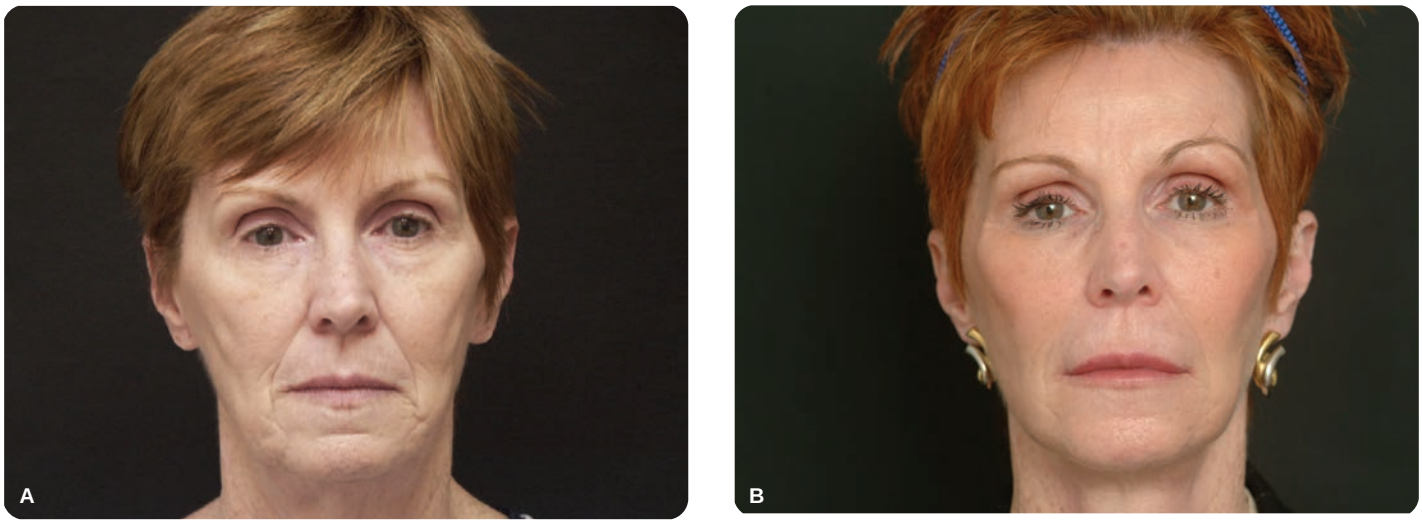


Figure 2-4A: This patient demonstrates a very hollow upper-eyelid sulcus with skeletonization of her superior orbital rim. **B:** Postoperative view following facelift and fat transfer that included placement along her superior orbital rim and upper eyelid in order to de-emphasize the hollow upper-eyelid sulcus. Although she was ultimately quite happy with the result, this photograph shows residual postoperative edema in the right upper-eyelid/brow region, which bothered her even after all other edema had effectively resolved.

desire this appearance even if it is a change from the way they looked when they were younger. In these patients, it is critical to ensure that the inferior orbital rim and midface have adequate fullness either naturally or with fat transfer as part of the surgical plan.

Upper Eyelid

The patient with upper-eyelid hollowing and a deep eyelid sulcus secondary to aging or prior surgery should be carefully approached. Unless the patient explicitly desires correction of this problem, the surgeon should avoid suggesting aggressive fat transfer to the upper-eyelid orbital region as part of the periorbital fat grafting plan (Fig. 2-4). Again, it is important to establish what the patient is displeased with, and in some cases, the hollowed upper eyelid is not an attribute the patient wants corrected. As opposed to fat transfer to the lateral brow (described in Chapter 3 as part of the volumetric foundation), which is technically straightforward and requires little recovery time, fat transfer to the inferior aspect of the superior orbital rim and/or the central upper-eyelid hollow can be technically challenging (described as an advanced technique in Chapter 3) and is associated with a prolonged recovery period of weeks to months during which time the patient often feels that the upper eyelid has an unnatural appearance. Only with patient prompting and explicit preoperative consultation should a surgeon decide to proceed with aggressive fat transfer to address a hollowed upper eyelid.

Temple

A hollowed temple may impart an unhealthy and/or aged appearance and should be evaluated for fat transfer. Temporal fat transfer can be technically challenging (described as an advanced technique in Chapter 3) and should generally only be undertaken once the surgeon has greater experience with fat transfer. Browlift procedures and facelift procedures with extension into the temporal region preclude simultaneous temporal fat transfer.

Midface

The midface is often the most important area for fat transfer because it provides the essential frame for the eye. Of all the facial highlights that accentuate the youthful

Figure 2-5A, B: This patient had a transconjunctival blepharoplasty with fat transfer to the lower eyelid and cheek, achieving the ideal youthful convexity of the lower eyelid/cheek complex.

appearance, it is the highlight of the full lateral cheek that is associated with a beautiful and youthful face. A full cheek is a critical element in creating the ideal heart-shaped face, as described in Chapter 1. The cheek should transition smoothly into the lower eyelid. A youthful countenance does not exhibit separation between these two areas, and the goal for fat transfer should be to reunite the lower eyelid and cheek (Fig. 2-5).

Inferior Orbital Rim

The degree of lower-eyelid fat protrusion should be carefully inspected. Typically, most individuals experience only limited middle and medial fat protrusion. Although any kind of blepharoplasty is appropriate for management of lower-eyelid fat protrusion, a transconjunctival blepharoplasty has proven to be ideal in our hands due to the preservation of tissue planes, which permits concurrent fat transfer and is associated with a minimal incidence of lower-eyelid malposition. Some fat transfer surgeons advocate fat augmentation alone to fill the inferior orbital rim hollow, feeling there is no need for a blepharoplasty. In patients without significant fat protrusion, this is a reasonable approach (Fig. 2-6). In the presence of more than minimal pseudoherniated lower-eyelid fat, the volumes required to establish a confluence between the lower eyelid and cheek without concurrent lower-eyelid blepharoplasty can be considerable and predispose toward contour irregularities. If fat transfer alone is performed in such a patient and a smooth contour is achieved, there is risk that the patient may feel there is too much fullness of his or her lower eyelid, necessitating a second procedure to perform a blepharoplasty to reduce this fullness. Therefore, appropriate fat reduction of the lower eyelid combined with fat transfer to the inferior orbital rim can achieve a predictable attractive appearance to this area (Fig. 2-7). With the goal of maximizing the surgical result and minimizing the need for touch-up procedures, in the presence of visible lower-eyelid fat pseudoherniation, a lower-eyelid transconjunctival blepharoplasty should be combined with fat transfer. The exception to this rule may be the patient with a prominent, negative-vector eye and malar hypoplasia, where periorbital fat removal will accentuate the prominence of the eye and further subtract away an adequate frame for the eye.

The lateral fat pad is managed differently from the medial and central lower-eyelid fat pads. If there is a small amount of herniated lateral fat, it is better not to

Figure 2-6A, B: Preoperative evaluation displays primarily volume loss along the inferior orbital rim without prominent fat pads. **C, D:** Postoperative views following fat transfer to the periorbital and cheek regions. A lower-eyelid blepharoplasty was not performed to avoid further hollowing of her eyes.

remove this fat for risk of exacerbating the lateral rim hollow. Fat transfer alone to the lateral orbital rim can soften or efface the depression between the lateral fat pad and cheek. However, the presence of a prominent lateral fat pad mandates fat removal via blepharoplasty, as isolated fat transfer is often unable to create the desired result (Fig. 2-8). After selective decompression of the lateral fat pocket, fat transfer to the lateral inferior orbital rim can then camouflage the hollow inferior orbital rim below.

The bulging or prominent eye is not an uncommon presentation. Typically, the eye appears prominent owing to inadequate fullness along the inferior orbital rim and anterior cheek, a condition that may arise from congenital, iatrogenic, or age-related etiologies (Fig. 2-9). A strong, projecting brow, particularly in a man, may compensate for a hollow midface. Inadequate projection or fullness of the superior orbital rim alone is less common and creates less of a bulging appearance to the eye. When both the superior and inferior orbital rims are deficient, the prominent appearance of the globe is dramatically accentuated to the point that the patient may appear to have a thyroid ophthalmopathy. Increasing projection of either the superior or inferior orbital rim will ameliorate the prominent-appearing globe, with inferior orbital rim

Figure 2-7A, B: Patient with prominent pseudoherniation of lower-eyelid fat and volume deficiency of her inferior orbital rim and midface. **C, D:** Postoperative photographs following fat transfer to the inferior orbital rim and cheeks in conjunction with transconjunctival lower-eyelid blepharoplasty and upper-eyelid blepharoplasty.

and midface augmentation being significantly more effective toward that end (Fig. 2-10). When both the superior and inferior orbital rims are inadequate, correcting both deficiencies will create the optimal frame for the eye and the most attractive result for the patient (Fig. 2-11).

Tear Trough

For the purposes of this book, we have made a distinction between the tear trough and the bony nasojugal groove. The tear trough is a visible surface depression along the medial inferior orbital rim, often accentuated by lower-eyelid fat herniation superolaterally (Fig. 2-12). The nasojugal groove is defined by the skeletal anatomy as a palpable depression between the medial-inferior orbital rim superolaterally and the nasal sidewall inferomedially. In some patients, the tear trough will overlie and correspond with the bony nasojugal groove. Alternatively, the visible tear trough defect may be cephalad to the bony nasojugal groove. Therefore the fullness above the tear trough is due to a prominent medial-inferior orbital rim and/or pseudoherniated lower eyelid fat. Examination will clarify what will define the superficial contour and will dictate whether fat transfer needs to be performed

Figure 2-8A: Preoperatively, this patient exhibits prominent lower-eyelid fat pads and hollowing along the entire inferior orbital rim. **B:** Postoperative photograph following lower transconjunctival blepharoplasty in which just the medial and central fat pads were selectively reduced. A fat transfer was performed to the entire inferior orbital rim and midface. The lateral orbital rim was addressed with fat transfer alone, without reduction of the lateral fat pad. Both the patient and surgeon were dissatisfied with the aesthetic result along the lateral orbital rim. **C:** Photograph shows the result following revision surgery, during which the lateral fat pad was reduced and additional fat was transferred to the inferior orbital rim.

Figure 2-9A: This patient exhibits a negative-vector eye, with the appearance of a prominent and bulging globe. **B:** Postoperative photograph is shown after placement of fat in the midface, including the superior orbital rim in order to effectively frame the eye and to reduce the appearance of ocular prominence.

Figure 2-10A, B: This patient has a strong superior orbital rim and a negative-vector eye with significant midfacial volume deficiency. In contrast to the patient in Figure 2-9, the presence of a strong superior orbital rim renders his eye less prominent in appearance. His midfacial volume deficiency was addressed with a fat transfer to the inferior orbital rim and cheek in order to balance the prominent superior orbital rim and thereby complete the frame to the eye and yield improved facial harmony and balance.

Figure 2-11A, B: Preoperatively, this patient has inadequate projection of both the inferior and superior orbital rims in combination with flattening of the midface. The patient's eyes appear prominent, similar to a patient with thyroid ophthalmopathy. **C, D:** Fat transfer to the superior and inferior orbital rim and midface creates the optimal frame for the eye.

Figure 2-12A, B: Pre- and post-treatment views of isolated augmentation of the tear trough without concurrent lower-eyelid blepharoplasty.

with or without a concurrent lower-eyelid blepharoplasty (Fig. 2-13). The bony nasojugal groove is augmented with fat as part of the standard volumetric foundation for the midface. If there is a prominent tear trough, the surgeon can place additional fat more superficially to efface it during the refinement phase discussed in Chapter 3.

Lateral Cheek

The highlight of the full lateral cheek prominence is an important feature of the youthful face. Therefore, lateral cheek enhancement is a critical area for rejuvenation (Fig. 2-14). The lateral cheek corresponds with the palpable zygomatic arch. Evaluation of the degree of volume deficiency during the preoperative evaluation can influence whether only a standard amount of fat is placed into the cheek (during the volumetric

Figure 2-13A: A patient with pseudoherniated fat and a visible tear trough preoperatively. **B:** The patient is shown following fat transfer to the inferior orbital rim, nasojugal groove, and tear trough in conjunction with transconjunctival lower blepharoplasty in which medial and central fat was removed.

Figure 2-14A: This patient exhibits marked volume deficiency in her midface, creating an imbalance in which her lower face appears wider than her midface. **B:** Fat transfer to her midface corrected the volume deficiency, recreating improved upper and lower facial balance.

foundation phase discussed in Chapter 3) or additional fat is transferred (during the refinement phase addressed in Chapter 3). Patients may exhibit a well-defined bony foundation with adequate zygoma-to-zygoma width yet still benefit from volume augmentation of the lateral cheek. These individuals tend to be thin and athletic and who manifest a skeletonized zygoma for which fat transfer can provide softening and contouring both over and adjacent to the bony zygoma (Fig. 2-15).

Anterior Cheek

The aging anterior cheek is a complex structure that is characterized by a linear malar depression corresponding with the malar septum and loss of anterior projection (Fig. 2-16). The presence of a malar mound should be noted and is visible as a distinct

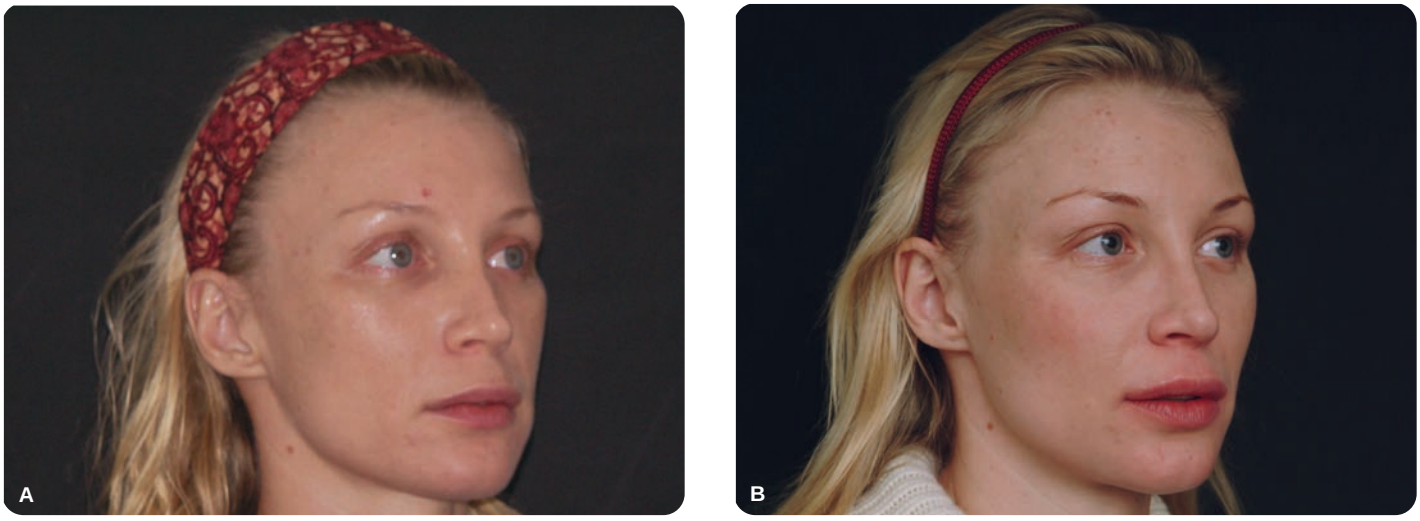


Figure 2-15A: This patient has a good underlying bone structure, with adequate width at the level of the zygoma. She is athletic and has lost volume throughout her face, resulting in skeletonization of her zygoma. **B:** Following fat transfer to the midface and periorbital regions, her facial appearance has been softened, eliminating the gaunt appearance and re-establishing the triangular/heart shape associated with a youthful face.

Figure 2-16 Characteristic age-related changes in the anterior cheek include development of a malar depression, malar mound, and decreased anterior projection. These features of the facial surface anatomy are effectively demonstrated using the Vectra 3D System (Canfield Scientific, Fairfield, NJ). **A:** Pre-operative contour image created by the Vectra 3D System. **B:** Post-operative fat transfer contour image created by the Vectra 3D System.

superolateral protuberance. The treatment goal is to recreate a single convex contour, which is a hallmark of a youthful cheek (Fig. 2-17). Fat grafting should be concentrated in the hollowed areas, primarily along and inferomedial to the malar septum. In the presence of a malar mound, fat placement should be performed with the goal of avoiding the protuberance of the malar mound so as not to worsen the condition. The degree of anterior cheek hollowing should dictate the amount of fat placed whether it be the basic volumes advocated for a volumetric foundation or additional fat during a second refinement pass (discussed in Chapter 3). The aesthetic objectives pertaining to the anterior cheek are gender specific. Whereas a full, round anterior cheek creates an attractive female face, the same outcome in a male may feminize the face and create a dissatisfied patient. As such, the volumes injected into the anterior cheek of male patients should tend toward the more conservative side.

Figure 2-17A: Preoperatively, this patient displays characteristic midfacial volume loss associated with aging, with a malar depression and loss of the uniform uninterrupted convexity from the lower eyelid to the cheek. **B:** Following midfacial fat transfer, the single convexity is re-established, removing a clear delineation between the lower eyelid and cheek.

Figure 2-18A: An athletic patient with a gaunt face and minimal available donor fat. **B:** Photograph showing malar augmentation with an alloplastic implant in combination with fat transfer to the inferior orbital rim, buccal, and submalar regions.

The thin, athletic individual who has little body fat presents a unique challenge in the approach to fat transfer. As can be expected, the more gaunt the face of a patient, the potentially more limited donor fat that will be available for harvest. Preoperative evaluation of possible donor sites for fat harvesting may be important in the thin individual and in whom an alloplastic implant may be required. These patients may need to be considered for an alloplastic malar implant in combination with fat transfer (Fig. 2-18). This strategy will reduce the volumes required in the anterior cheek and direct fat placement to areas not amenable to augmentation with implants. When malar implants are used, the superior extent of augmentation is limited by the infraorbital nerve, which can lead to an accentuated hollowing of the inferior orbital rim necessitating the use of fat transfer to correct this problem (Fig. 2-19).

As mentioned earlier, the presence of a malar mound should be noted during initial patient evaluation. The malar mound, a triangular-shaped fullness, is demarcated superiorly by the lateral-inferior orbital rim depression and inferomedially by the malar depression overlying the malar septum (Fig. 2-20). Patients may refer to the malar mound when they are talking about their "bags." In the preoperative evaluation, it is critical that the physician make the distinction between the malar mound and protruding orbital fat and even on occasion the bony edge of the nasojugal groove. There are several variations in the malar mound that can be discerned from patient history and physical examination and that are important in determining the appropriate treatment, which we have classified as follows:

Grade 0:	No malar mound present
Grade I:	Malar mound without swelling
Grade II:	Malar mound with fluctuating edema with normal overlying skin
Grade III:	Malar mound with fluctuating edema and a skin fold (festoon)

The hallmark of a Grade I malar mound is fullness without intermittent swelling or skin changes. A history of variable edema is the first important distinction to make and when present is referred to as a Grade II malar mound. The swelling is often

Figure 2-19A, B: This patient presents 8 years after malar implantation and lower-eyelid blepharoplasty. She desired correction of the hollowing along the inferior orbital rim that she noted had worsened with age. **C, D:** She is shown following fat transfer to the inferior orbital rim and cheek to restore a uniform convexity and to eliminate the step-off above the cheek implant.

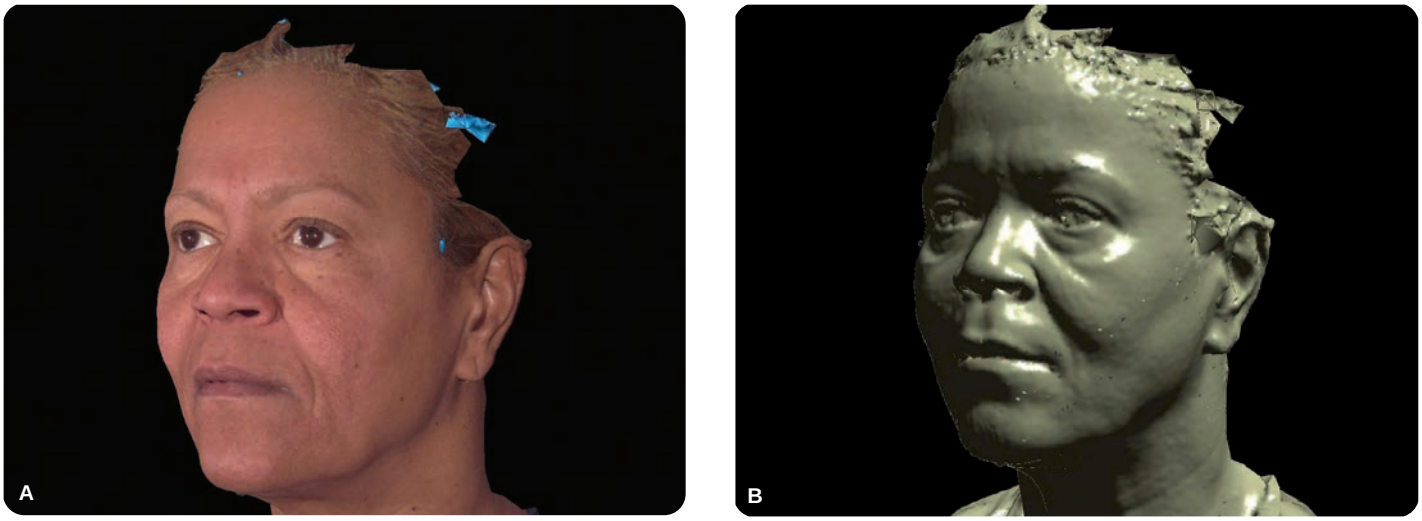


Figure 2-20A: The photograph shows a patient with a Grade 1 malar mound characterized by abnormal malar fullness without intermittent swelling or skin changes. **B:** Contour image created by the Vectra 3D System, displaying the true surface anatomy.

Figure 2-21A: This patient exhibits a Grade III malar mound characterized by fluctuating edema and a skin fold (festoon). **B:** The same patient is shown following fat transfer to the midface and direct excision of skin fold as well as facelift and browlift.

exacerbated by salt or alcohol intake, smoking, and hormonal variation and frequently is a familial trait. This is a critical point because fat transfer may worsen the swelling and transform a Grade II into a Grade III malar mound. A Grade III malar mound is characterized by a skin fold or festoon demarcated inferiorly by the malar septum (Fig. 2-21). The fold may be associated with skin texture changes and exhibit variable swelling. Treatment of a Grade III malar mound with fat transfer alone may result in worsening of the condition. In these patients, we often recommend excision of the redundant or festooned skin. Further discussion of the significance and treatment of the malar mound complex can be found in Chapter 3, page 70.

Buccal

Situated immediately inferolateral to the anterior cheek lies the buccal region. This inframalar hollow should be thought of as a continuation of the anterior cheek so as to achieve a uniform augmentation across the entire anterior face. Many women are reluctant about filling the early buccal hollowing that occurs starting in their mid 30s as they feel that the buccal hollow favorably accentuates the appearance of a high cheekbone. They do not desire the rounder, more youthful appearance of a full buccal region. It is important to acknowledge and respect these desires. Nevertheless, we find that as the cheek is augmented with fat grafting, it becomes important to add some volume in the buccal region to prevent the appearance of relative buccal hollowing. In the patient who exhibits marked buccal hollowing, volumetric restoration of this region provides significant rejuvenative capacity to the overall face (Fig. 2-22). As with the anterior and lateral cheek, a standard amount of volume can be infiltrated into the buccal area, with additional fat placed as judged necessary during a separate refinement phase (discussed in Chapter 3). Preoperative judgment as to the quantity required in the buccal area will come with experience. If a concurrent deep-plane facelift is planned in which the buccal skin will be undermined, then fat infiltration of the buccal region should not be performed. Accordingly, the surgeon should calculate whether the patient will be better served with buccal fat enhancement along with a limited superficial musculoaponeurotic system (SMAS) facelift or simply plan on fat infiltration alone to this area.

Precanine Fossa/Nasolabial Fold

The precanine fossa corresponds to the depression that lies immediately lateral to the pyriform aperture and generally corresponds with the superior limit of the

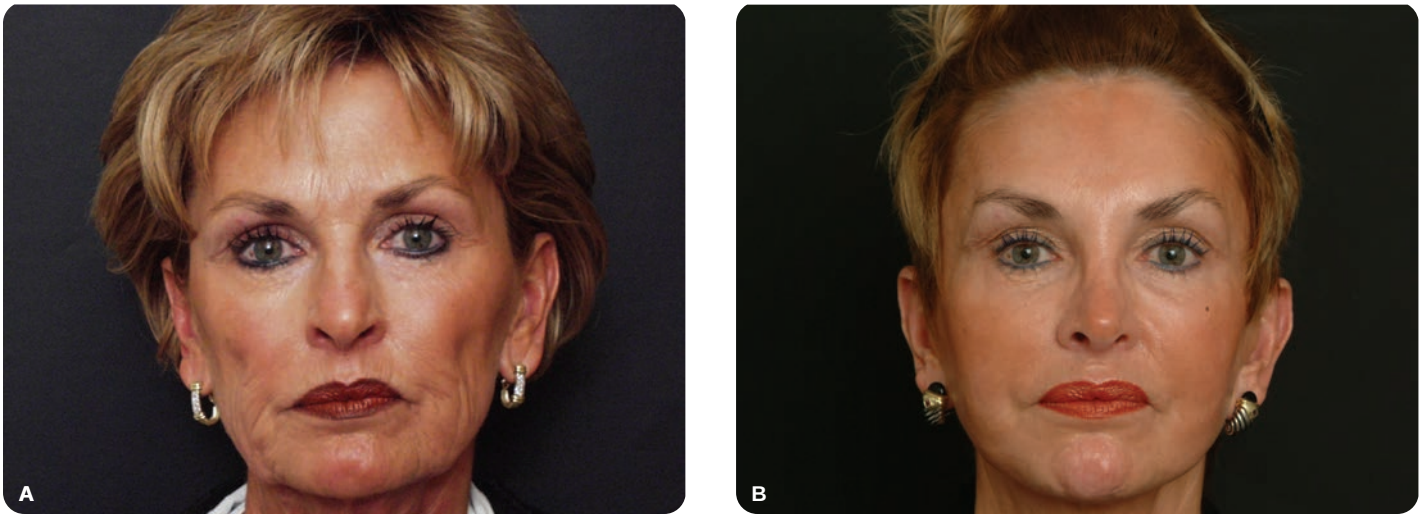


Figure 2-22A: This patient exhibits significant buccal hollowing preoperatively. **B:** The patient is seen 3 years following fat transfer, including the buccal region, and facelift.

nasolabial fold (Fig. 2-23). The nasolabial fold denotes the cutaneous depression that extends from the nasal ala running in an inferolateral direction toward the oral commissure. Placement of fat into these areas can serve to soften the transition from the augmented cheek to the upper lip. However, as stated, the surgeon should educate the patient that softening of the nasolabial fold with fat infiltration is of limited benefit in effacing the line. If the patient is interested only in effacement of the nasolabial fold, an alternative soft-tissue filler will provide a more targeted and efficacious solution to his or her concern. If the patient is planning for fat infiltration and is also concerned about the nasolabial line, the surgeon should typically encourage the patient to complete fat infiltration and determine what additional filling may be needed with an injectable filling material to achieve the desired result at a later date.

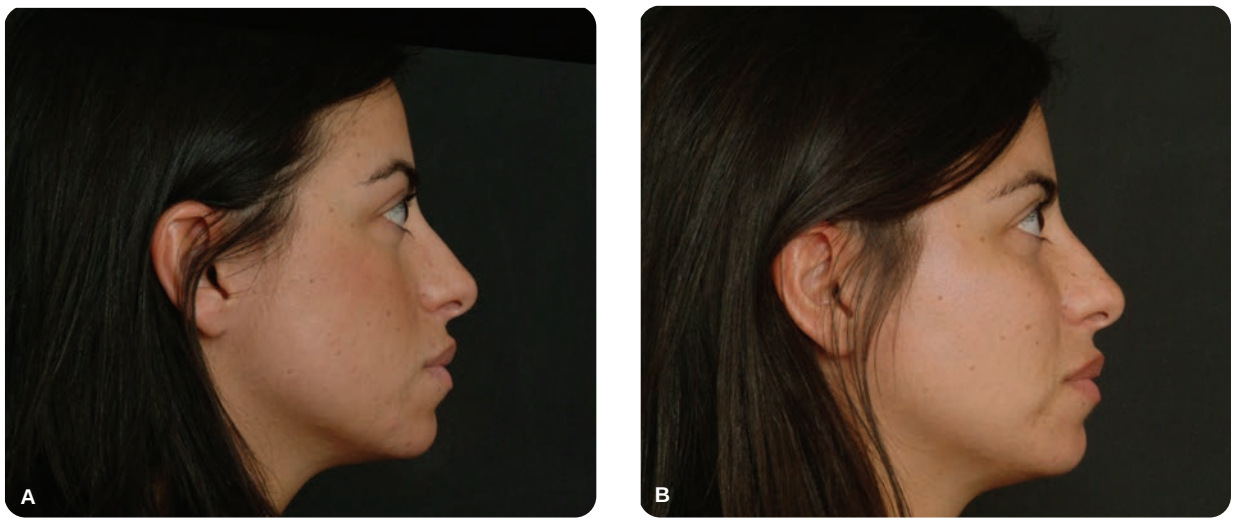


Figure 2-23A: A young woman who exhibits midfacial flattening that extends into the precanine fossa. **B:** Fat transfer was performed to restore midfacial volume. The precanine fossa was filled to establish a uniform contour with the adjacent cheek.

Figure 2-24A: This patient exhibits mild jowling with a deficient prejowl sulcus. **B:** The patient is shown with improvement of her jawline contour following isolated prejowl augmentation with autologous fat transfer.

Lower Face

For the lower face, the principal decision that should be made is whether the patient will benefit from fat enhancement alone or if fat enhancement should be combined with a facelift. Volume loss in the prejowl sulcus is one of the earlier signs of aging, and almost every patient, whether or not they undergo a facelift, will benefit from fat enhancement in the prejowl region. Patients with microgenia who are undergoing mentoplasty with an extended anatomical implant will attain some degree of filling of the prejowl sulcus from the implant. Occasionally, patients with a very deep prejowl sulcus will benefit from fat augmentation superficial to the lateral arms of the implant. Although significant amount of fat placed along the lateral mandible can help to soften the appearance of a jowl, we have found that in most patients, particularly in the presence of a heavy jowl, a standard facelift can achieve the desired objective with more assuredness while also managing the neck. If only a very minimal jowl is present without much neck tissue descent, then fat infiltration into the prejowl (anterior to the jowl) and the lateral mandible (posterior to the jowl) along with microliposuction of the jowl can be an effective strategy for jawline rejuvenation.

Prejowl Sulcus

As mentioned, most candidates for fat enhancement will benefit from prejowl augmentation regardless of the patient's age. Younger individuals who exhibit facial fat loss almost invariably will exhibit some degree of prejowl atrophy (Fig. 2-24). Unquestionably, more mature patients, whether they will benefit from a facelift or not, will profit from fat injection into the prejowl sulcus (Fig. 2-25).

Lateral Mandible

The lateral mandible can only be augmented if a concurrent facelift is not planned. Almost any style facelift will incorporate undermining of the lateral mandible, which prohibits fat enhancement to this area. The opening paragraph of this section discusses the main decision-making process for the lower face, which involves whether to perform a facelift with prejowl fat augmentation or simply augmenting the entire mandible with the exclusion of the jowl itself. The individual with a congenitally weak lateral jawline and with visibly deficient definition at the angle of the mandible will benefit from lateral mandibular augmentation. Men in particular may benefit from accentuation of a weak lateral mandible, especially at the mandibular angle, to fashion a more masculine facial shape (Fig. 2-26).

Figure 2-25A: This patient had a facelift 8 years prior to this photograph and complained of jowling that was now a result of prejowl volume loss. **B:** She is shown following isolated prejowl augmentation with autologous fat transfer.

Labiomental Sulcus

Although enhancement of a deep labiomental sulcus is technically straightforward, the benefit of softening this line is limited with fat. As mentioned, fat is ideal for volumetric enhancement, not for line effacement. A deep mental sulcus may benefit from fat enhancement, but the patient should fully understand the limits and unpredictability of the result. A patient who expects a great result from fat alone will often be disappointed. It is not uncommon that additional injectable fillers into this area may be subsequently needed to achieve the desired result.

Labiomandibular Fold (Marionette Line)

As with the nasolabial fold and the labiomental sulcus, improvement of the labiomandibular fold with fat alone can be limited. Nevertheless, it can be addressed to

Figure 2-26A: Preoperatively, this patient exhibits a deficient lateral mandible and mandibular angle. **B:** The patient is shown following fat transfer to the lateral mandible, angle of the mandible, and prejowl sulcus.

Figure 2-27A: This patient exhibits a relatively deep labiomandibular fold. **B:** The patient is shown following fat transfer to the labiomandibular fold in conjunction with a deep-plane facelift to improve this condition.

yield some improvement. In older patients with a very deep fold, a facelift will be needed to achieve an improved result (Fig. 2-27).

Anterior Chin

If the patient does not require chin augmentation but exhibits only a mild degree of microgenia, fat infiltration along the anterior chin can be proposed as a solution. Fat can also be used in patients who have undergone a prior chin implant but who require even further anterior projection. The anterior chin can be thought of as an extension of the prejowl sulcus, and additional fat can be infiltrated along the anterior chin to increase the combined effect of prejowl/mental fullness.

Concluding Remarks

During the preoperative phase, arrival at an agreed upon aesthetic goal is the principal aim. Equally important is the appropriate management of expectations. Patients need to understand what can and cannot be addressed through fat transfer. As emphasized, we believe that fat is not truly ideal for effacement of facial lines or for lip augmentation, given the limited improvement for the former and the limited improvement and increased morbidity for the latter. Moreover, expectations of postoperative morbidity should also be presented thoroughly. Fat enhancement can increase recovery time as compared with traditional lifting procedures due to the amount of ecchymosis and edema that persists for several weeks. The greater the volume of fat infiltrated, the longer the recovery period tends to be. For this reason we have separated the fat transfer procedure into a volumetric foundation phase (with standard morbidity) and a refinement phase (that adds additional recovery time), as will be explained in Chapter 3.

Chapter 3

Operative Technique

Introduction

The structure of this chapter is intended to guide the reader stepwise through the day of the operation, beginning with meeting the patient prior to the procedure to confirm and outline the aesthetic objectives, selection of an appropriate donor site for harvesting the fat, and the sequential description of the operative technique. The emphasis of the preliminary section on preoperative assessment will be placed on selection of donor site based on gender, anesthesia considerations, and individual anatomy. Determination of which facial areas to augment and to what extent has already been covered in detail in Chapter 2 and will not be reiterated herein.

The operative technique is divided sequentially into donor-site anesthesia, recipient-site anesthesia, fat harvesting, fat processing, and fat injection. To create a simplified "recipe" for the novice surgeon embarking on fat transfer, we have divided facial fat infiltration into three distinct levels: volumetric foundation, refinements, and advanced techniques. Volumetric foundation describes a reliable and consistent method of facial fat enhancement that would benefit the majority of patients with facial volume loss and which can serve as a foundation upon which further individual tailoring with supplemental fat (refinement) can be added. Volumetric foundation is based on an empiric enhancement of the face rather than artistic judgment. Refinements describe the second pass that the surgeon undertakes in adding more fat based on the patient's particular aesthetic deficits after the surgeon has completed the volumetric foundation, or first pass.[1] Finally, advanced techniques describe further refinements associated with a higher risk-to-benefit ratio and/or patient morbidity profile and should be undertaken only in more experienced hands. By following the proposed algorithm, surgeons can benefit from a deliberate, safe, and consistent treatment plan for facial fat enhancement.

In keeping with the concept of this book that fat transfer will often be used in a complementary fashion with traditional rejuvenative procedures, an outline is presented for how to incorporate these other procedures into the surgical plan. A superficial musculoaponeurotic system (SMAS) or deep-plane facelift can be safely and easily combined with facial fat transfer as long as fat is not infiltrated into the undermined skin—which could predispose toward fat migration and/or compromise longevity of the fat. Facelifting techniques lie beyond the scope of this text. However, the chronological order for facelifting, that is, when a facelift should be performed in conjunction with facial fat transfer, will be stressed. Similarly, the timing of blepharoplasty in relationship to facial

[1] Many surgeons who instruct others on fat grafting can make the process seem overly artistic and thereby daunting to a less artistically inclined surgeon. Therefore, we have tried to establish a useful "volumetric foundation" that is based upon empiric enhancement, where artistic "refinements" can be added as needed.

fat transfer will also be elaborated. Whether or not the prospective surgeon should decide to integrate facial-lifting procedures with fat enhancement, this chapter will provide the blueprint for undertaking facial fat enhancement as a stand-alone technique or as a complement to other traditional surgical enhancement methods.

Beyond the text, the accompanying DVD videos are intended to be a direct corollary to this chapter as both visual reinforcement and elaboration of method. This book was conceived as much as a video tutorial as a written guide, and the reader is encouraged to read this chapter, watch the videos, and return to the text again until the material becomes lucidly revealed. The second (bonus) DVD contains some content not discussed within the text and is meant as a supplement to the material presented herein.

Preoperative Assessment

On the day of surgery, the first step for the surgeon is to review in his or her own mind and with the patient the precise plan for the operative procedure. The two principal components of the preoperative plan involve determination of which facial zones to augment, how much fat to use, and selection of an appropriate donor site for harvesting.

Marking the Face

With the patient seated in an upright position, the surgeon can re-evaluate the dependent tissues that would benefit from lifting and the facial zones that need volume restored via fat transfer (**Fig. 3-1**). Detailed notes prepared during the initial cosmetic consultation and preoperative visit facilitate this process. The standardized operative planning sheet (**Fig. 3-2**), which enumerates the quantities and distribution for facial fat enhancement, can serve as a concrete

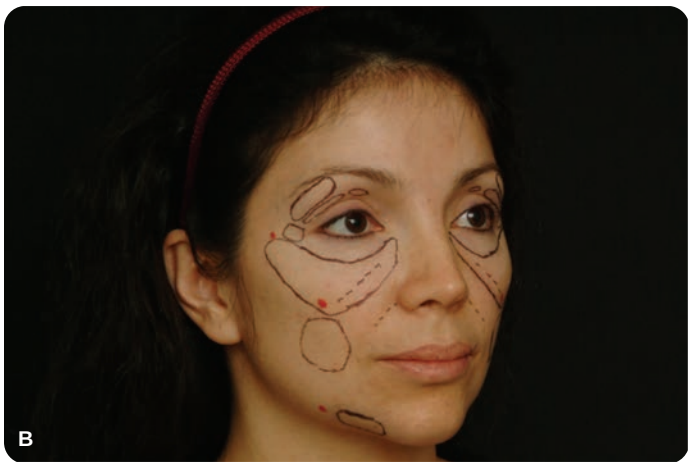


Figure 3-1A, B, C: This model demonstrates the preoperative markings for fat transfer (*solid black lines*). Outlined are the foundation areas, including the inferior orbital rim, nasojugal groove, lateral brow, lateral canthal region, lateral and anterior cheek, buccal, and prejowl sulcus. Also marked out in this patient are the locations for the more advanced injections into the upper eyelid below the superior orbital rim in both the central and lateral aspects. The dotted line running obliquely across the anterior cheek represents the malar depression/malar septum. The red marks indicate the primary cannula entry sites.

AUTOLOGOUS FAT TRANSFER INTRAOPERATIVE RECORD

Patient name: _____

Date: _____

Harvest site: _____

Harvest volume: _____

Fat volume: _____

	Right	Left
Inferior Orbital Rim		
Medial (deep)		
Lateral (deep)		
Superficial		
Tear Trough		
Lateral Canthus		
Nasojugal Groove		
Anterior Cheek		
Lateral Cheek		
Buccal		
Pre-Canine Fossa		
Nasolabial Fold		
Superior Orbital Rim		
Lateral Rim		
Upper Lid		
Central Upper Hollow		
Temple		
Labiomandibular Fold (Marionette)		
Pre Jowl Sulcus		
Chin		
Lateral Mandible		

Figure 3-2: This intraoperative record facilitates easy and accurate recording of volumes of fat transferred during a procedure.

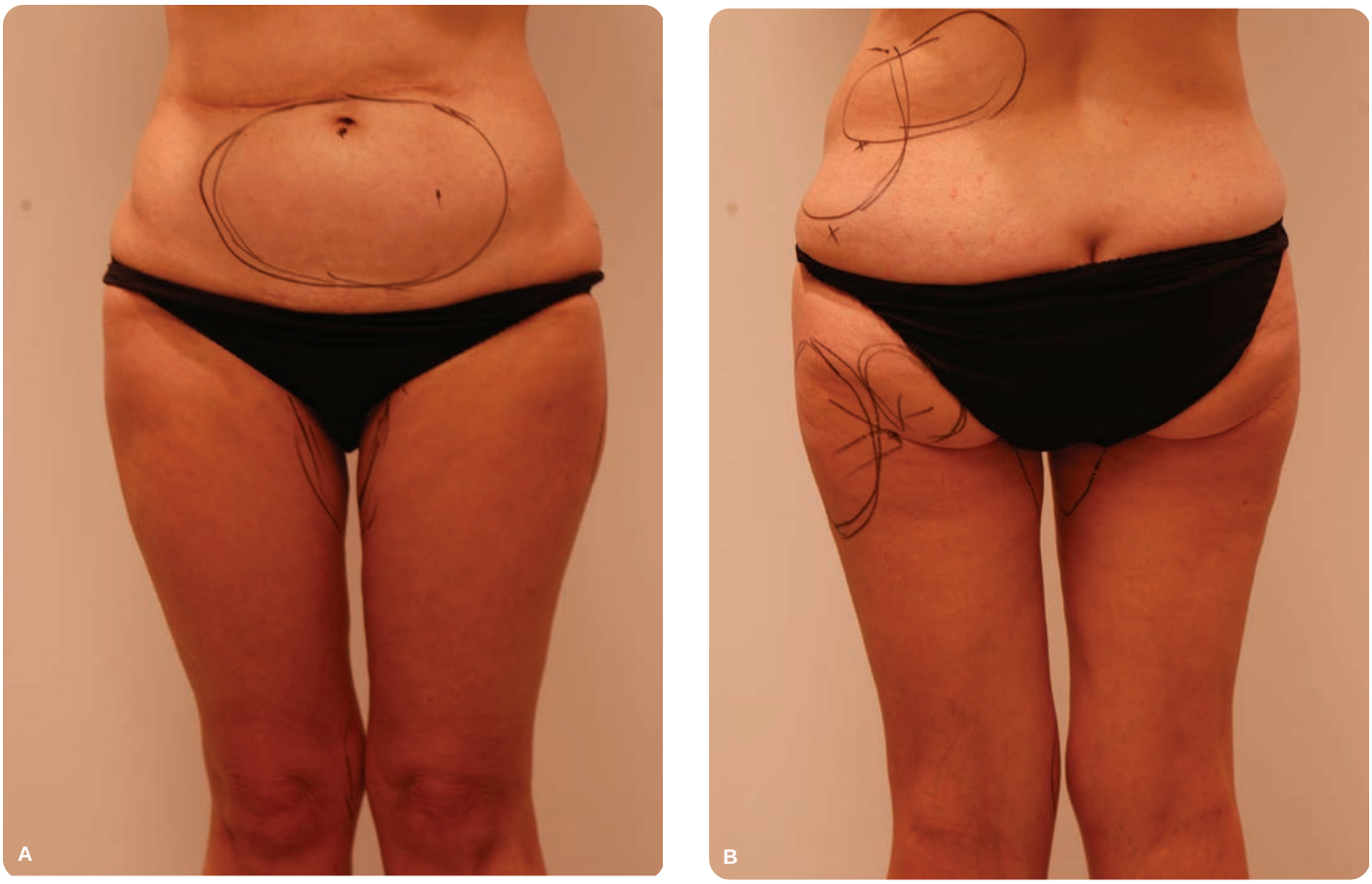


Figure 3-3A: Anterior view showing the markings for donor harvesting: the lower abdomen, inner thigh, and inner knee. **B:** Posterior view showing additional sites for harvesting: the lateral thigh, lateral buttock, hip (lateral waist), and waistroll (lower lateral back). Proposed entry sites for harvesting in the marked adjacent areas are indicated with an "X."

outline for the surgeon. With that in mind, the surgeon can then mark out the face with a surgical marking pen to indicate areas for facial fat transfer as well as the incisions for facelifting, browlifting, blepharoplasty, and so on, if ancillary procedures are to be combined.

Selection of Donor Site

Selection of an appropriate donor site can be performed the day of the procedure or already planned in advance (**Fig. 3-3**). For the less experienced surgeon, evaluation of the donor site prior to the date of surgery can prove to be helpful to facilitate a well thought out plan. However, for the experienced surgeon, judgment as to the ideal harvesting site can be quickly and easily made just prior to surgery. Clearly, not having to undress the patient on a separate day prior to surgery can be less intrusive for the patient and less time consuming for the surgeon. For a beginning surgeon, it may be worth the extra effort to determine in advance, with the patient, the ideal donor site. Even for the veteran, advance planning can help in special circumstances. For instance, a thin, athletic individual should be evaluated for the presence of adequate donor fat. If on examination limited donor fat is found to be available, the patient may need to be prepared for the possible use of alloplastic implants to obtain the desired result.

Patients who have undergone extensive body lipocontouring may have limited fat deposits from which to harvest, and it is always easier to harvest from virgin territories that have not been subjected to prior body liposuctioning. For those who have had liposuctioning in the past, overlooked areas that can prove to be an excellent source

TABLE 3-1 Selection of Donor Site in Women

TRUNK	EXTREMITY
1. Lower Abdomen	1. Inner Thigh
2. Hip	2. Outer Thigh
3. Waist	3. Buttock
	4. Anterior Thigh
	5. Triceps
	6. Inner Knee

The table shows the order of preference for donor-site fat harvesting based on gender and is divided into rank order of preferred sites for the trunk and extremities. The lower abdomen and inner thigh are preferred areas for harvesting in the female patient, primarily to avoid repositioning. Under local anesthesia, the outer thigh is often the preferred donor site. Details of donor-site selection are discussed in the text.

TABLE 3-2 Selection of Donor Site in Men

TRUNK	LOWER EXTREMITY
1. Hip	N/A
2. Lower Abdomen	

The table shows the order of preference for donor-site fat harvesting based on gender and is divided into rank order of preferred sites for the trunk and the lower extremity. The hip is generally the preferred area for harvesting in the male patient. The lower extremity is typically not an area for harvesting in men. Men who have excessive fat in these areas tend not to need facial fat transfer. Details of donor-site selection are discussed in the text.

for harvesting is the waistroll that descends along the lower back, the triceps, and the inner knee (Fig. 3-3). Although fat can be harvested from areas of prior liposuctioning, the amount may be more limited and the area generally more fibrotic. Advance preoperative evaluation can help to establish which region would be preferred.

Patients who have undergone abdominal surgery should always be carefully evaluated for the type of incisions they have and the presence of any obvious or occult ventral hernias that would obviate safe abdominal fat harvesting. If the surgeon plans to harvest from the abdomen, especially in a patient with prior abdominal surgery, the patient should be placed in a supine position and asked to valsalva. Effectiveness of the valsalva can be improved by having the patient raise his or her head off of the bed during abdominal contraction. During valsalva, the surgeon should palpate along and around the incision line as well as the entire abdominal cavity, including the umbilicus, to determine whether any ventral or umbilical hernia is present. Repeated valsalva and relaxation should be undertaken to ensure that the surgeon has thoroughly evaluated for this possibility. A vertical midline scar may not be as problematic as other abdominal incisions, since more fibrotic fat exists in the midline and conventional lower abdominal harvesting typically avoids the midline region.[2]

Gender distribution of fat is another important variable that can be instructive to the beginning surgeon. Women tend to accumulate adipose tissue as they age in the setting of facial fat loss. Conversely, men, young or old, who tend to gain excessive body fat, oftentimes have commensurately fuller faces that do not benefit as much from facial fat enhancement. Typically, men who are thin, athletic, or emaciated from disease profit from facial fat transfer but tend to have much less available body fat. (Tables 3-1 and 3-2 elaborate on the rank order based on gender for donor supply of fat.)

Women accrue fat principally along the inner and outer thighs, hips, and lower abdomen. Asking the patient where she thinks she has the greatest fat stores or has the

[2] Refer to the following section on fat harvesting of the lower abdomen for details.

TABLE 3-3 Body Positioning for Donor-site Harvesting

SUPINE	LATERAL DECUBITUS
Inner Thigh	Outer Thigh
Lower Abdomen	Hip
Anterior Thigh	Waist
Inner Knee	Buttock

The inner thigh, anterior thigh, lower abdomen, and inner knee are ideal donor sites for harvesting because the patient does not need to be repositioned. If the patient is under deeper sedation or general anesthesia, repositioning the patient without the benefit of the patient's assistance can be an added burden for the surgical team.

most difficulty losing fat is a very straightforward and beneficial method to help in determining the best potential donor site. The lower abdomen and inner thigh are favored sites for harvesting, as they do not require intraoperative repositioning (Table 3-3). Albeit an uncommon source for harvesting, the anterior thigh can also provide an excellent source for fat harvesting in individuals that have a disproportionately large fat distribution in this area. Like the lower abdomen and inner thigh, the patient does not need to be repositioned for fat harvesting. For patients who are under conscious sedation, body repositioning for fat harvesting is easier due to patient assistance in moving his or her own body.

Some practical matters about evaluation of donor site should be mentioned herein for the sake of completeness. The semiclothed female patient who is undergoing evaluation for donor site should always be accompanied by a female chaperone from the surgical staff in order to avoid any medicolegal ramifications. Most styles of underwear are amenable for fat harvesting. Standard bikini-style female underwear is acceptable for women; and a boxer or brief is appropriate for men.

Operative Technique

General Principles of Anesthesia

Fat transplantation can be undertaken with any level of anesthesia, from straight local infiltration to general anesthesia. Local anesthesia can be somewhat uncomfortable for the patient given the extent of local-anesthesia infiltration. General anesthesia is typically unwarranted. Our preference is level II conscious (also known as moderate) sedation that provides adequate patient comfort and cooperation if body repositioning is needed for fat harvesting.[3] If a combined procedure (with facelifting, etc.) is planned, and the surgeon is accustomed to general anesthesia, then general anesthesia is perfectly acceptable. Like all procedures, patient comfort, surgeon preference, and anesthesiologist/anesthetist experience will dictate what type of anesthesia is most suitable (**Fig. 3-4**).

Donor-site Anesthesia

Infiltration of local anesthesia begins with addressing the points of entry for fat harvesting. A small bleb of local anesthetic consisting of 1% lidocaine with 1:100,000 epinephrine is injected into the location through which the local anesthetic will be infiltrated and later where the harvesting cannula will be inserted: The reader is referred to the site-specific sections that follow on fat harvesting for details about where each incision site should reside.

[3] Level II anesthesia denotes sedation in which the patient can still respond to verbal cues. Therefore, the patient can be cooperative when asked to change positions as needed during fat harvesting.

Figure 3-4: Any kind of anesthesia from local to general can be used for autologous fat transfer. We have found that an intravenous mixture of remifentanil and midazalom has worked as our preferred method of anesthetic delivery.

Next, the local anesthetic is infiltrated into the donor site through the anesthetized bleb of skin. The mixture and amount of local anesthetic differs depending on whether the patient is under intravenous sedation or general anesthesia versus oral sedative or no sedation at all (Table 3-4). If the patient is under intravenous sedation or general anesthesia, a 20-cc Luer-Lok syringe with a mixture of 15 cc of normal saline and 5 cc of 1% lidocaine with 1:100,000 epinephrine is infiltrated into the donor site using a 7″ 22-gauge spinal needle in a fanlike distribution. Approximately 20 cc total of this mixture is injected into the donor site (per side of the patient) with half of the mixture placed along the deep aspect of the fat pad and half in the immediate subcutaneous plane.[4] By infiltrating principally into the deeper and superficial layers of the fat pad, the middle level remains relatively free of anesthetic for cleaner harvesting. The superficial portion, which is most sensitive, is injected first by stretching the skin taut with the nondominant hand. In this plane, the skin can appear to be distorted from the

TABLE 3-4 Local Anesthesia Preparations

	FOR PATIENTS UNDER ORAL OR NO SEDATION	FOR PATIENTS UNDER INTRAVENOUS OR GENERAL ANESTHESIA
Mixture	10 cc of normal saline and 10 cc of 1% lidocaine with 1:100,000 epinephrine	15 cc of normal saline and 5 cc of 1% lidocaine with 1:100,000 epinephrine
Amount	Total 20 cc into each donor site (per side), 10-cc deep to the fat pad and 10-cc superficial to the fat pad	Total 20 cc into each donor site (per side), 10-cc deep to the fat pad and 10-cc superficial to the fat pad

The mixture of local anesthesia for the donor site depends on the type of anesthesia to which the patient will be subjected, that is, oral or no sedation versus intravenous or general anesthesia. A greater concentration is needed for patients under oral or no sedation. The described mixtures are prepared in a 20-cc Luer-Lok syringe and are injected into the appropriate planes with a 22-gauge spinal needle. See text for details.

[4] The lower abdomen is an exception, with approximately 10 cc of anesthetic injected into each lower quadrant for a total of 20 cc for the entire lower abdomen. Obviously, additional anesthetic can be delivered as needed.

superficial injection, which is appropriate and should not raise alarm. The surgeon then grasps the fat pad with his or her nondominant hand to facilitate injection of the anesthetic into the deeper portion of the fat pad. If the surgery is being performed with oral sedation or just local anesthetic, a higher percentage of lidocaine is used. The 20-cc Luer-Lok syringe is filled with equal parts saline and lidocaine: 10 cc of normal saline and 10 cc of 1% lidocaine with 1:100,000 epinephrine. The same injection technique described above applies.

Recipient-site Anesthesia

Recipient-site anesthesia is divided into two distinct phases: (a) injection of discrete points and areas with a sharp needle, and (b) injection of broad areas with a blunt infiltrating cannula. The latter is carried out to avoid ecchymosis and hematoma formation that may arise from piercing vascular structures with a sharp needle.

Recipient-site Anesthesia Phase 1: Injection with a Sharp Needle

Injection of distinct points along the face that correlate with sensitive neurovascular structures should be undertaken first to decrease discomfort associated with broad injection of anesthesia (**Fig. 3-5**). The first seven points in Figure 3-5 are infiltrated percutaneously with a short $\frac{1}{2}''$ 30-gauge needle attached to a 5-cc syringe using 1% lidocaine with 1:100,000 epinephrine. The last two areas are injected in a fanning technique with a $1\text{-}\frac{1}{4}''$ 27-gauge needle attached to a 5-cc syringe using the same mixture of 1% lidocaine with 1:100,000 epinephrine. Approximately 5 cc of local anesthesia should be required per side of the face. Phase 1 is carried out on one side of the face, followed by the same technique on the contralateral side before repeating this sequence for Phase 2. To expedite this process, it may be easier to inject the first seven points using the short 30-gauge needle on both sides of the face first before returning to inject the last two points using the longer 27-gauge needle on each side. As an acupressure technique, the surgeon can gently pinch the site of injection immediately prior to infiltration to minimize discomfort if the patient is under lighter sedation. The chronologic order of injection is not important, but the sequence has been shown for ease of recall and to encourage a systematic approach. The first point of injection corresponds with anesthesia of the zygomaticofacial nerve of the maxillary branch of the trigeminal nerve, located along the inferolateral orbital rim (Fig. 3-5, Point 1). The second point corresponds with fat infiltration entry site B and is located 2 to 3 cm lateral to the lateral canthus (Fig. 3-5, Point 2). Next, the zygomaticotemporal branch of the maxillary division of the trigeminal nerve, located along the superolateral aspect of the orbital rim, is anesthetized (Fig. 3-5, Point 3). Continuing medially, the supraorbital bundle of the ophthalmic branch of the trigeminal nerve is infiltrated (Fig. 3-5, Point 4). The fifth injection site is situated along the lateral nasal wall midway along its length in order to minimize the discomfort associated with fat infiltration in this sensitive area (Fig. 3-5, Point 5). The sixth point corresponds to fat infiltration entry site A:[5] It is located inferolateral to the malar depression along a horizontal axis extending from the base of the nasal ala (Fig. 3-5, Point 6). The seventh point lies 2 cm behind the prejowl sulcus that typically falls about midway along the length of the mandibular body and corresponds with the fat infiltration entry site C (Fig. 3-5, Point 7). At this point, the contralateral side of the face can be injected with the same syringe outfitted with the 30-gauge needle before returning to the same side of the face to complete the last two injection sites using the longer 27-gauge needle.

The eighth injection site corresponds to the infraorbital nerve on the maxillary face (Fig. 3-5, Point 8). To anesthetize the nerve properly, the nerve is injected with the

[5] Of note, there are only four entry sites used for fat infiltration that will be referred to in all subsequent text as A, B, C, and D for sake of clarity. In Figure 3-5, these three points have been denoted parenthetically with A, B, C, and D after the numeral that corresponds with the chronologic injection sequence for anesthesia.

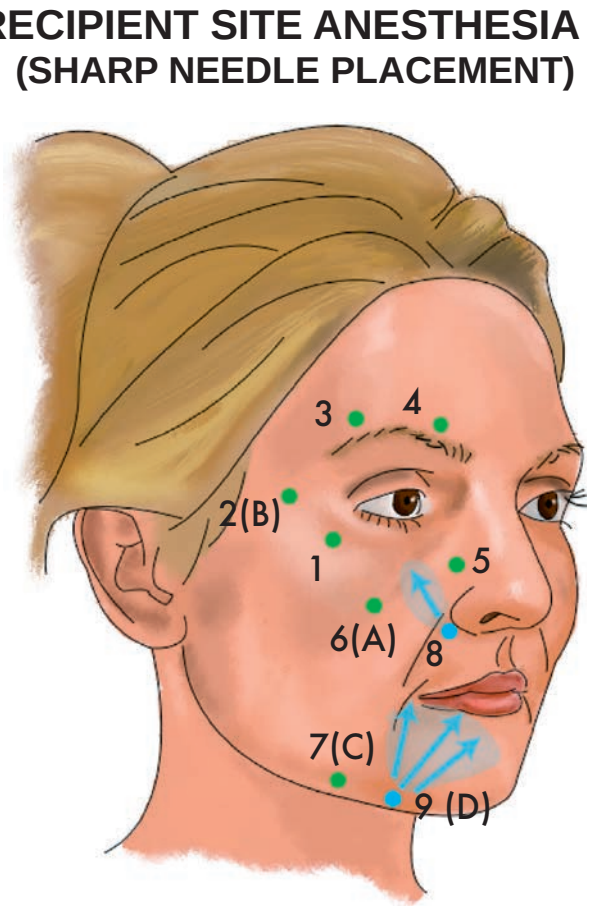


Figure 3-5: The illustration shows the first phase of recipient-site anesthesia administration. The numbers indicate where a small bleb of local anesthesia consisting of 1% lidocaine with 1:100,000 epinephrine using a 5-cc syringe outfitted with a ½″ 30-gauge needle is delivered as regional nerve blocks. The numbers with a parenthetical letter following correlate with entry sites where the infiltration cannula will be inserted. The blue arrows indicate infiltration of the adjacent soft tissue with local anesthesia using a 1-¼″ 27-gauge needle. The first point of injection corresponds with anesthesia of the zygomaticofacial nerve of the maxillary branch of the trigeminal nerve, located along the inferolateral orbital rim **(Point 1)**. The second point corresponds with fat infiltration entry site B and is located 2 to 3 cm lateral to the lateral canthus **(Point 2)**. Next, the zygomaticotemporal branch of the maxillary division of the trigeminal nerve, located along the superolateral aspect of the orbital rim, is anesthetized **(Point 3)**. Continuing medially, the supraorbital bundle of the ophthalmic branch of the trigeminal nerve is infiltrated **(Point 4)**. The fifth injection site is situated along the lateral nasal wall midway along its length in order to minimize the discomfort associated with fat infiltration in this sensitive area **(Point 5)**. The sixth point corresponds to fat infiltration entry site A: It is located inferolateral to the malar depression along a horizontal axis extending from the base of the nasal ala **(Point 6)**. The seventh point lies 2 cm behind the prejowl sulcus, which typically falls about midway along the length of the mandibular body and corresponds with the fat infiltration entry site C **(Point 7)**. At this time, the contralateral side of the face can be injected with the same syringe outfitted with the 30-gauge needle before returning to the same side of the face to complete the last two injection sites using a longer 27-gauge needle. The eighth injection site corresponds to the injection site to anesthetize the infraorbital nerve on the maxillary face **(Point 8)**. To anesthetize the nerve properly, the nerve is injected with the 1-¼″ 27-gauge needle from an entry site at the precanine fossa, directing the needle toward the bony face of the maxilla superolaterally (*arrow* with **Point 8**). Finally, the marionette line and labiomental sulcus are infiltrated in the subcutaneous plane from what will be entry site D for fat infiltration **(Point 9)**. The same 1-¼″ 27-gauge needle is used to anesthetize this area in a broad, fanning method (*arrows* with **Point 9**).

1-¼″ 27-gauge needle from an entry site at the precanine fossa directing the needle toward the bony face of the maxilla superolaterally. Finally, the marionette line and labiomental sulcus are infiltrated in the subcutaneous plane from what will be entry site D for fat infiltration (Fig. 3-5, Point 9). The same 1-¼″ 27-gauge needle is used to anesthetize this area in a broad, fanning method. (Alternatively, all sites can be infiltrated using a blunt cannula described below.)

Recipient-site Anesthesia Phase 2: Injection with a Blunt Cannula

Injection of broad areas with the same blunt infiltrating cannula that will be used for fat infiltration minimizes the occurrence of ecchymosis that could in turn adversely contribute to the outcome: prolonged patient recovery and morbidity, difficulty for the surgeon to accurately evaluate fat volumes and contours, and perhaps reduced fat-cell viability. Injection is undertaken using 1% lidocaine with 1:100,000 epinephrine in a 10-cc syringe outfitted with the 1.2 mm or 0.9 mm blunt, spoon-tip cannula (Tulip Medical Inc., San Diego, CA) (**Fig. 3-6**). This infiltration cannula will be used for all blunt-cannula anesthesia infiltration. A standard 18-gauge needle is

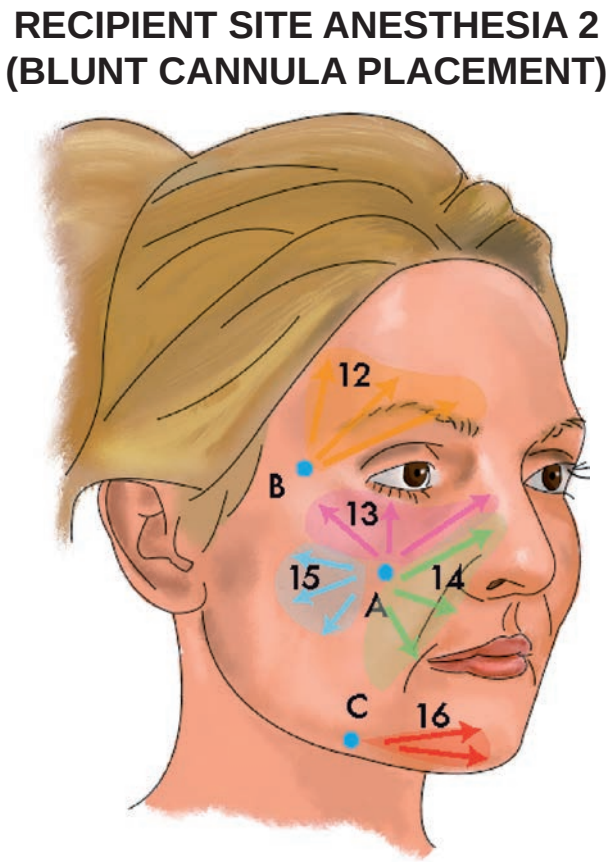


Figure 3-6: After the initial regional nerve blocks have been completed, the recipient sites where fat will be injected are anesthetized with the same blunt infiltrating cannula used for fat infiltration in order to minimize traumatic hematoma formation from sharp needle infiltration. As with Phase 1, the chronologic order in which anesthesia infiltration is undertaken for Phase 2 is irrelevant and is only listed in the proposed numeric order for ease of recall and communicative value. Starting superiorly, the temple and brow are infiltrated with local anesthesia in a fanning fashion, with placement in a subcutaneous plane in the temple and in a deep supraperiosteal plane in the lateral superior orbital rim that correspond with fat placement **(Region 12)**. Fat infiltration into the temple and below the superior orbital rim are advanced techniques and thus may not be needed for all patients. Next, the entire inferior orbital rim is anesthetized from entry site A **(Region 13)**. It should be understood that anesthesia is distributed evenly all the way from the entry site to the targeted site for fat placement (in this case, the inferior orbital rim), anesthetizing the entire passage that the infiltration cannula will traverse, as indicated by the shaded area. Local anesthesia is placed in the supraperiosteal plane along the inferior orbital rim, corresponding with the level at which fat will be infiltrated. The nasojugal groove, nasal sidewall, precanine fossa, and the entire length of the nasolabial fold are anesthetized using the blunt infiltration cannula **(Region 14)**. The bony nasojugal groove is infiltrated supraperiosteally. The buccal area is infiltrated in the deep subcutaneous plane in a fanning motion from entry site A **(Region 15)**. The buccal area tends to be somewhat sensitive for the patient, and anesthetic delivery should be slow and deliberate to minimize discomfort. The prejowl region is infiltrated from point C, covering both the anterior and inferior borders of the mandible where the fat will be distributed. Generally speaking, an intermediate plane of local infiltration will provide adequate anesthesia for the multiple levels of fat infiltration in this area **(Region 16)**. If the lateral mandible is intended for fat infiltration, then anesthesia is delivered in a similar manner as the prejowl area from the same entry point C.

used to puncture the skin at the designated sites (A, B, C, and D) for cannula entry. Each site should have already been anesthetized during the Phase 1 of recipient-site anesthesia, as described. The surgeon can look for the tiny blanched or raised wheal that arises after local-anesthetic infiltration to guide placement of the entry sites. Of note, the puncture site remains readily apparent in most cases as a small blood-tinged spot throughout the case, and no need for surgical marking is required to relocate the site.

As with Phase 1, the chronologic order in which anesthesia infiltration is undertaken for Phase 2 is irrelevant and is only listed in the proposed numeric order for ease of recall and communicative value. Starting superiorly, the temple and brow are infiltrated with local anesthesia in a fanning fashion with placement in a subcutaneous plane in the temple and in a deep supraperiosteal plane in the lateral superior orbital rim that correspond with fat placement (Fig. 3-6, Point 12). Fat infiltration into the temple and below the superior orbital rim constitutes an advanced technique and thus may not be needed for all patients (as discussed in a following section of this chapter). Next, the entire inferior orbital rim is anesthetized from entry site A (Fig. 3-6, Point 13). It should be understood that anesthesia is distributed evenly all the way from the entry site to the targeted site for fat placement (in this case, the inferior orbital rim), anesthetizing the entire passage that the infiltration cannula will traverse: These anesthetic territories are indicated by the shaded color areas in Figure 3-6. Local anesthesia is placed in the supraperiosteal plane along the inferior orbital rim corresponding with the level at which fat will be infiltrated. Approximately 2 cc for the entire inferior orbital rim should suffice.

The nasojugal groove, nasal sidewall, precanine fossa, and the entire length of the nasolabial fold are anesthetized using the blunt infiltration cannula (Fig. 3-6, Point 14). The bony nasojugal groove is infiltrated supraperiosteally. The buccal area is infiltrated in the deep subcutaneous plane in a fanning motion from entry site A (Fig. 3-6, Point 15). The buccal area tends to be somewhat sensitive for the patient, and anesthetic delivery should be slow and deliberate to minimize discomfort. The prejowl region is infiltrated from point C, covering both the anterior and inferior borders of the mandible where the fat will be distributed. Generally speaking, an intermediate plane of local infiltration will provide adequate anesthesia for the multiple levels of fat infiltration in this area (Fig. 3-6, Point 16). If the lateral mandible is intended for fat infiltration, then anesthesia is delivered in a similar manner as the prejowl region from the same entry point C.

Harvesting the Fat

Instrumentation

Refer to Table 3-5 throughout this section's discussion. A 10-cc Luer-Lok syringe outfitted with a 3-mm bullet-tip harvesting cannula (Tulip Medical Inc. or Miller Medical Inc., Mesa, AZ) is recommended for fat harvesting. Alternatively, Tulip manufactures a thinner 2.1-mm multiport harvesting cannula, which we will sometimes use in women who are extremely concerned with any incision (**Fig. 3-7**). One cc of 25% Albumin (Baxter, Deerfield, IL) is drawn into each syringe before the harvesting cannula is attached. Albumin helps to maintain equalized oncotic pressure, thereby reducing the incidence of lipolysis during harvesting (**Fig. 3-8**). We believe that addition of albumin is helpful, but many fat-transfer surgeons do not use it and still attain wonderful aesthetic and durable results. A 16-gauge Nokor needle (or No. 11 Bard-Parker blade) is used to create the stab incision through which the harvesting cannula is inserted.

General Considerations

There are key points that should be kept in mind to perform reliable and consistent fat harvesting, which are universally applicable irrespective of donor site. (For the surgeon

TABLE 3-5 Equipment and Instrumentation

	EQUIPMENT
Donor-site Anesthesia	• 20-cc Luer-Lok syringes
	• 22-gauge spinal needles
	• 1% lidocaine with 1:100,000 epinephrine
	• Normal saline
Recipient-site Anesthesia	• 5-cc and 10-cc syringes
	• ½″ 30-gauge needles
	• 1-¼″ 27-gauge needles
	• 18-gauge needle
	• Straight infiltration cannula
	• 1% lidocaine with 1:100,000 epinephrine
Donor-site Harvesting	• 10-cc Luer-Lok syringes
	• 25% Albumin (Baxter)
	• 3 mm bullet-tip harvesting cannula (15 cm length)
	• 16-gauge Nokor needle or No. 11 Bard-Parker blade
Fat Processing	• Syringe plugs and caps
	• Centrifuge with sterile sleeves
	• Test tube rack
	• 4 × 4 cotton gauze or Codman neuropaddies
	• 20-cc Luer-Lok syringes (quantity: 1)
	• Transfer hub
Fat Transfer	• 1-cc Luer-Lok syringes (quantity: 4)
	• Straight, blunt infiltration cannula
	1.2 mm × 6 cm spoon-tip cannula (Tulip Medical, Inc.)
	0.9 mm × 4 cm spoon-tip cannula (Tulip Medical, Inc.)

This table lists all of the equipment and instrumentation necessary to perform facial fat transfer.

well versed in liposuction techniques, these points may be intuitive, but for those with less liposuction experience, these principles will ease the learning curve for fat harvesting):

1. Only 1 to 2 cc of negative pressure should be applied to the syringe during harvesting to avoid the risk that undue pressure will cause lysis of adipocytes (**Fig. 3-9**).
2. The nondominant hand is used to stabilize the fat pad by gentle traction on the skin surface or with a gentle pinch. Squeezing the fat pad forcefully with the nondominant hand will increase the chance of contour irregularities in the donor site and limit the ability to fan across the entire donor site in a uniform fashion (**Fig. 3-10**).
3. The cannula should be placed into the central depth of the fat pad for maximal harvesting yield that will lead to a uniform result. Tenting and tethering of the skin with the cannula implies too superficial a passage of the instrument, which can lead to contour irregularities. This problem is particularly likely in the region of the inner thigh, where the surgeon must pass through a superficial fascial layer to enter the correct plane (see the following section on harvesting from the inner thigh for more details).
4. After three to four passes with the cannula through the fat, the cannula should be brought almost out to the point of the entry site before turning and reorienting the tip in another direction. A common error for the neophyte surgeon after completing

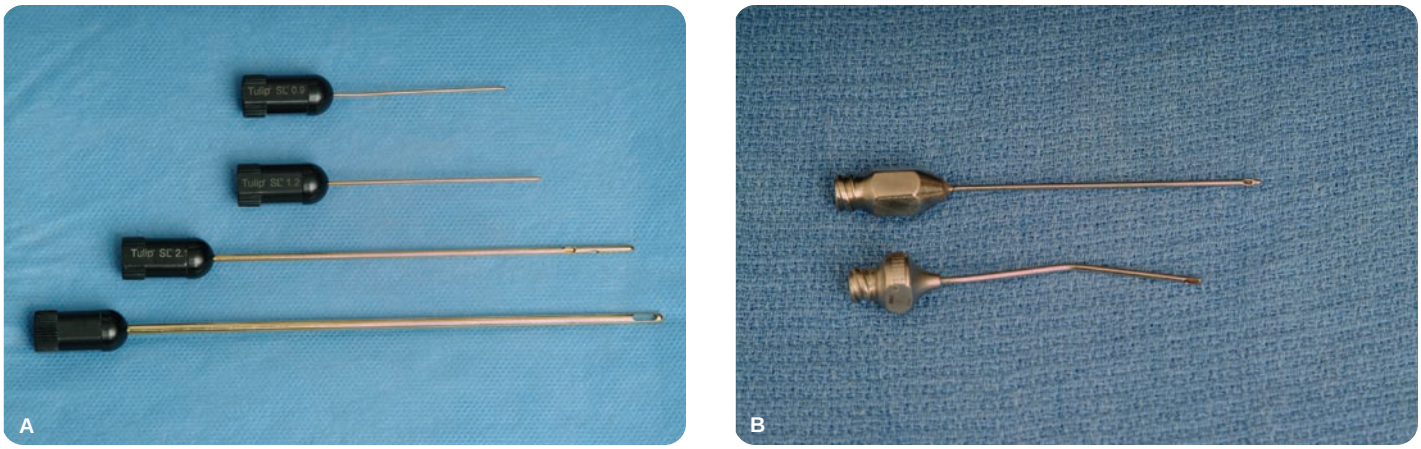


Figure 3-7A: The Glasgold set of fat-transfer instruments (Tulip Medical Inc.) **(top to bottom)**. The 0.9-mm injecting cannula (4-cm length) is particularly useful for periorbital superficial placement in the tear trough and inferior orbital rim as well as for the very fibrous recipient sites at the lateral inferior orbital rim and lateral canthal region. The 1.2-mm injecting cannula (6-cm length) is an all-purpose cannula that can be used for all other injections. The 2.1-mm multiport harvesting cannula (12-cm length is an alternative). The 3.0-mm bullet-tip harvesting cannula (15-cm length) is an all-purpose harvesting cannula. **B:** Alternatively, the Coleman-Donofrio infiltration cannula **(top)** (Byron Medical Inc.) is an all-purpose infiltration cannula. The Amar #7 cannula **(bottom)** (Miller Medical Inc.) is helpful for placement of fat into the curved superior orbital rim from lateral entry point B and can also be beneficial for placement of fat in the downturned lip and labiomandibular fold.

Figure 3-8: Placement of 1 cc of 25% albumin (Baxter) into each harvesting syringe may minimize fat-cell trauma during harvesting by maintaining an equalized oncotic pressure.

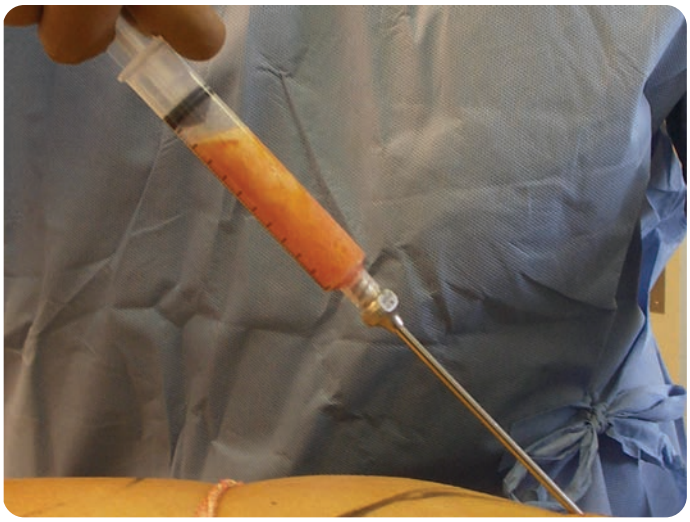


Figure 3-9: The photograph shows proper fat harvesting technique in which manual extraction is performed with only 1 to 2 cc of negative pressure exerted on the syringe plunger.

three to four passes is to simply turn his or her hand to realign the cannula without pulling almost all the way out to the entry site. Failure to withdraw the cannula sufficiently before changing directions will give the appearance of harvesting from a new area when in fact the same localized spot is being worked on (as demonstrated in the accompanying DVD) (**Fig. 3-11**). This error will lead to overzealous removal of fat in only one discrete area that may also reduce the quantity of fat harvested and more importantly can lead to donor-site contour irregularity.

5. The surgeon should always be conscious of where the tip of the cannula is situated within the donor site. If not mindful of the cannula position, the tip may be unintentionally passed beyond the anesthetized donor site area, leading to additional soft-tissue trauma and related pain. The first few times that a new surgeon begins to harvest fat from the donor site, he or she should progress very slowly and with each

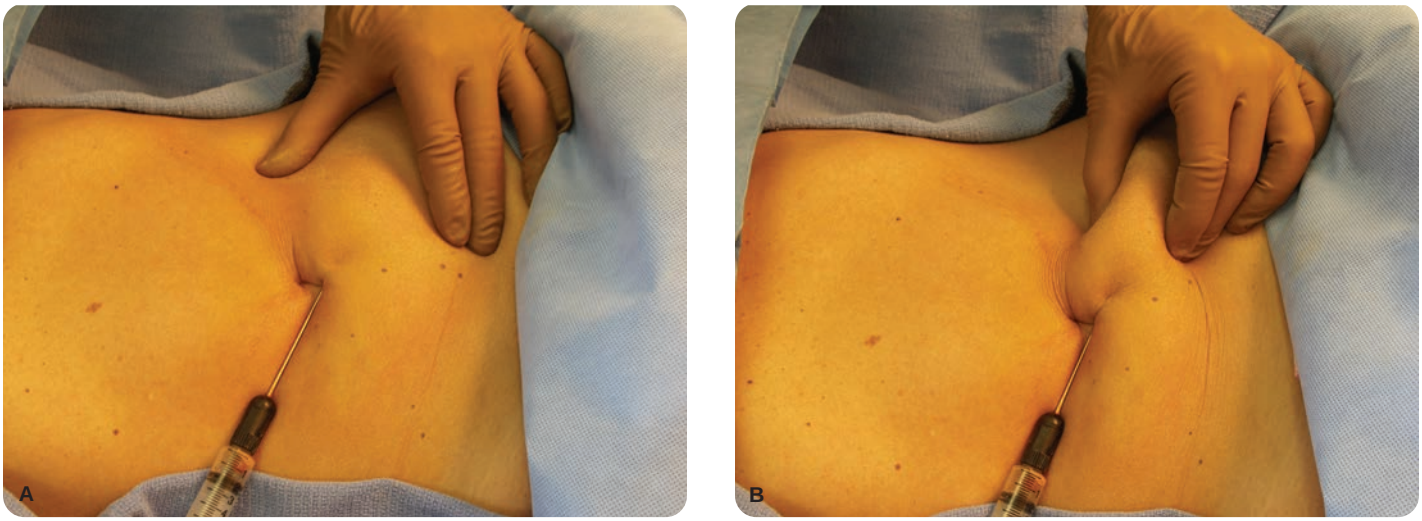
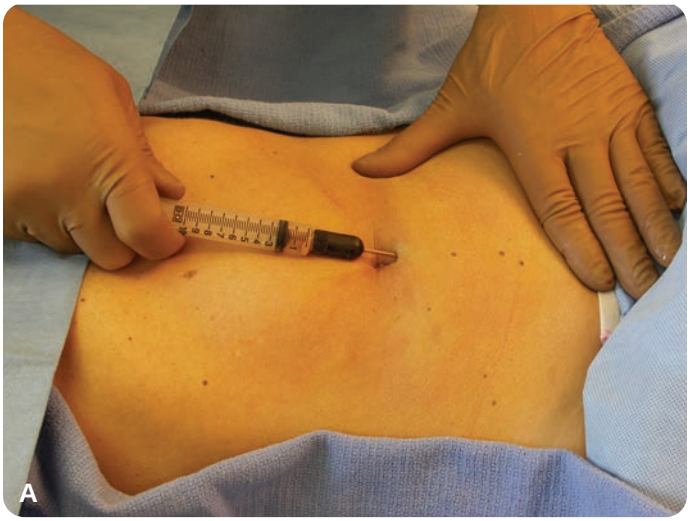


Figure 3-10A: Fat harvesting should be undertaken with the nondominant hand, applying only gentle and even traction to stabilize the fat pad. **B:** This photograph demonstrates improper technique in which the nondominant hand forcibly pinches the fat pad, which can lead to uneven harvesting and potential for contour irregularities in the donor area.



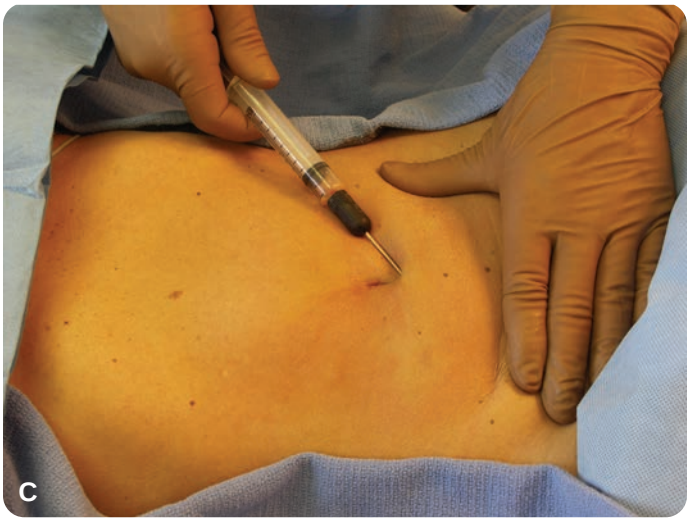


Figure 3-11A, B, C: When harvesting, it is important not simply to turn the cannula to another area for harvesting but instead to withdraw the cannula almost all the way to the entry site before redirecting the cannula tip. Doing so ensures that the cannula tip advances to the adjacent area rather than remaining inadvertently in the same area.

pass feel the tip of the cannula to ensure that it has not gone beyond the planned harvest site. Although this problem may seem infrequent, it is actually a common mistake for the beginner.

6. If the cannula appears to become clogged or if suction is lost, the entire cannula should be removed from the entry site and the tip cleared. The plunger can be drawn back until the fat is cleared from the cannula. Any air that was drawn into the syringe should be expelled before continuing. If the surgeon notices that no additional fat is entering the syringe, the most likely cause of this problem is a clogged cannula usually due to entrapment of fibrous tissue.
7. When calculating the total volume of fat that needs to be harvested, keep in mind that lidocaine, blood, albumin, and lysed fat cells will account for approximately half of the volume in the syringe. Accordingly, if a total plan for 50 cc of fat is desired, then approximately 100 cc (10 full syringes) should be harvested. If a greater amount of blood is encountered in each syringe than typical, a proportionately increased number of syringes may be needed to achieve the same desired amount of fat and vice versa. If the surgeon has difficulty calculating the amount of viable fat harvested in each syringe, he or she can centrifuge the first two to three syringes to determine the yield and calculate the remaining harvest on that initial yield.
8. There is usually no need to close the donor-site stab incision after harvesting.

9. Patients are often concerned with donor-site asymmetry. Due to the relatively low volumes of fat typically harvested, iatrogenic asymmetries are uncommon. The rare exception is in the thin patient, where these relatively smaller harvested volumes may actually translate into an asymmetry. Preoperatively, the surgeon should make the patient aware of any pre-existing asymmetries at the intended harvesting site and that such body asymmetry is normal. To further reduce patient anxiety regarding asymmetry, it is recommended to harvest from both sides of the body, even though unilateral harvesting will unlikely lead to any significant asymmetry.

Site-specific Technique

LOWER ABDOMEN

For the lower abdomen, the reader is reminded about the careful preoperative assessment of ventral scars and/or hernias that would limit or obviate harvesting in this region, respectively. Perhaps the greatest fear for the aesthetic surgeon unfamiliar with body surgery is fear of inadvertent and catastrophic entry into the visceral cavity—an apprehension that, for the most part, is unwarranted. Passage of the cannula through the thick rectus muscle is quite difficult because the resistance encountered is considerable. Furthermore, passage of the cannula on or near the rectus fascia will elicit significant discomfort, warning the surgeon that the cannula position is unnecessarily deep: Obviously, patient reaction would only be elicited under lighter sedation. To avoid discomfort or deep abdominal injury, the cannula should always be passed in a relatively parallel orientation to the skin surface.

The stab incision is made in the inferior aspect of the umbilicus (**Fig. 3-12**). The cannula is inserted and passed lateral to the midline, as the midline is very fibrous and also a region that tends to be more sensitive for the patient (**Fig. 3-13**). The midline should only be approached if the patient is under adequate sedation and if additional fat is required after depleting both lower lateral quadrants. Care should be taken to pass the cannula in a uniform fashion across each quadrant, with symmetrical removal of fat from each side. Although the risk of contour deformity with uneven fat removal is low, it is still preferred to harvest in a symmetrical fashion to further reduce that hazard.

INNER THIGH

While the patient remains supine, the contralateral leg is placed into a frog-leg position, with the knee flexed and externally rotated so that it lies flat on the table

Figure 3-12: The stab incision for entry of the harvesting cannula into the lower abdomen (or for any donor area for that matter) is made with either a 16-gauge Nokor needle **(shown)** or the tip of a No. 11 Bard-Parker blade.

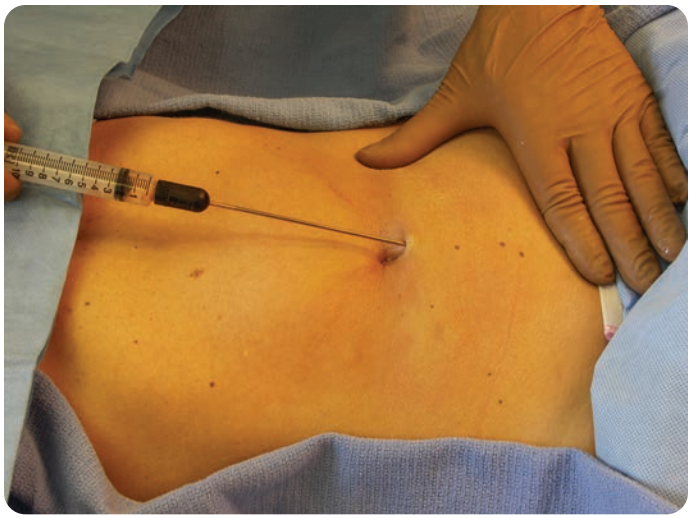


Figure 3-13: The harvesting cannula is shown inserted through the stab incision made with the 16-gauge Nokor needle. Bilateral lower lateral quadrants are harvested, as these regions of the abdomen carry the most adipose reserves. The central lower abdomen is more fibrous and usually is devoid of significant adiposity. The midline can be approached when harvesting yields are low and additional fat is required. The reader is referred to the main text for details of harvesting safely and effectively in the lower abdomen.

(**Fig. 3-14**). This positioning permits easy access to the straight leg for harvesting. The side that is frog-legged should not be harvested, as divoting is more likely to occur if harvesting from the frog-legged side. A stab incision on the extended leg is made in a skin fold along the inguinal line with a 16-gauge Nokor needle (or No. 11 Bard-Parker blade). Of note, this tiny incision can remain hyperpigmented for up to a year, and the patient should be cognizant of this possibility. The cannula is inserted through the stab incision and is passed inferiorly in the described fanning technique. Care must be taken

Figure 3-14A: The patient is shown in a supine position with the right leg frog legged (i.e., flexed and externally rotated) in order to permit access to the inner thigh of the straight leg. Harvesting fat from the frog-legged side can predispose toward contour irregularities and should be avoided. **B:** The photograph shows harvesting of the inner thigh from the straight leg. It is important that the surgeon pass through the initial fascial layer that feels as slight release in resistance. Harvesting superficial to this fascial layer is evident by the visibility of the cannula tip as it passes under the skin (which should not be truly visible when the cannula passes in the appropriate deeper plane). Superficial passage of the cannula can lead to low harvest yields but, more importantly, the potential for contour irregularities.

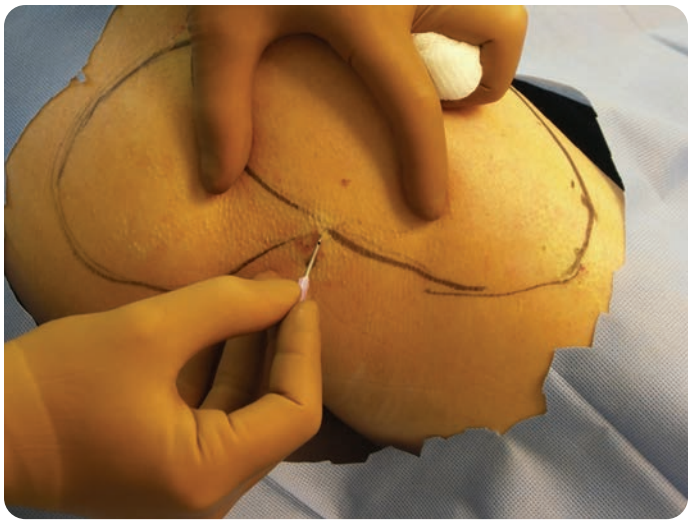


Figure 3-15: The entry site for lateral thigh and lateral buttock harvesting is the same, which falls at the lateral terminus of the buttock crease. The entry site is made with the 16-gauge Nokor needle (or No. 11 Bard-Parker blade). The photograph shows the patient in a left lateral decubitus position with the right lateral buttock marked as the smaller of the two black circles and the right lateral thigh as the larger, more oblong of the two circles.

to pass through the superficial fascia, as evidenced by a give in resistance when the cannula passes through this layer and by the lack of perceived skin tethering when the cannula is in the proper deeper plane. Fat can generally be easily and safely harvested from one side of the body without risk of donor-site asymmetry. However, patient concerns that postoperative asymmetry will arise should compel the surgeon to harvest bilaterally. To harvest the contralateral side, the leg positions should be reversed, straightening the contralateral leg, and frog legging the previously harvested leg.

OUTER THIGH

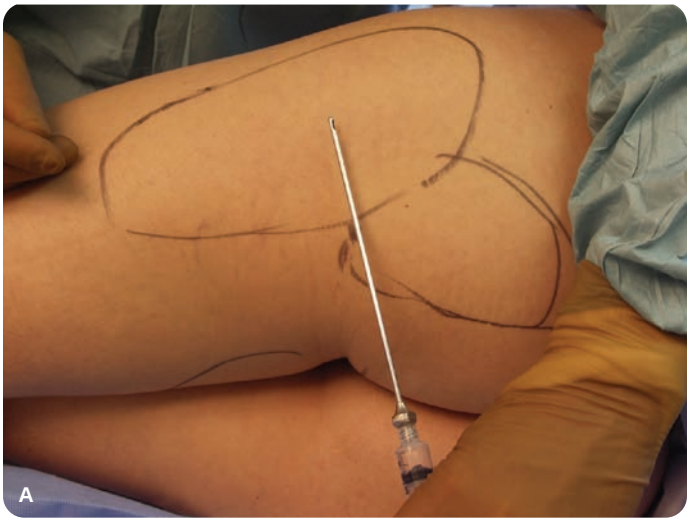
The outer thigh is generally only an adequate donor site for fat harvesting in women. To access this site the patient is placed in the lateral decubitus position. The stab incision is placed in the lateral aspect of the infragluteal fold at the lateral terminus of the buttock crease (**Fig. 3-15**). From this entry site, the cannula is directed in a broad fanning distribution anteriorly and inferiorly over a wide arc. With a sizable outer thigh mass, fat harvesting in this region can be among the easiest to obtain vast quantities of usable fat quickly (**Fig. 3-16**). Moreover, the outer thigh constitutes an area that tends to be less sensitive. The outer thigh is also a relatively forgiving area, with little chance of contour irregularity. The primary downside to this area is the need for intraoperative patient repositioning.

ANTERIOR THIGH

Some women will exhibit a large amount of anterior thigh fat accumulation that can be ideal for harvesting. Women who have undergone extensive outer thigh liposuctioning may have a disproportionately large accumulation of fat in the anterior thigh, making this a more favorable harvesting site. The patient is placed in the supine position for harvesting with both legs remaining straight (i.e., no frog legging is required). A stab incision is made along the inguinal line. A broad expanse of territory should be covered in order to avoid a contour deformity (**Fig. 3-17**).

INNER KNEE

The inner knee is generally not an optimal donor site. There tends to be a limited supply of fat, and removal of more than 15 to 20 cc of fat per side can leave a contour deformity. The harvested fat often exhibits a coarse, granular texture that is both difficult to



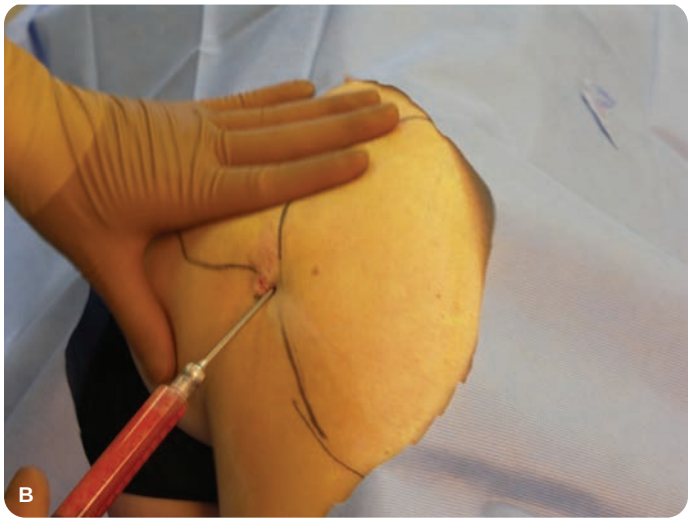


Figure 3-16A: The patient in the right lateral decubitus position, is shown with the left buttock (*small circle*) and left lateral thigh (*oblong circle*) exposed. The cannula is shown in the proposed direction of harvest from the entry site to the lateral thigh. **B:** The photograph shows actual fat harvesting from the right lateral thigh from the lateral buttock crease entry site with the patient in a left lateral decubitus position.

harvest and to infiltrate. Harvesting from the inner knee tends to be reserved for patients who have undergone extensive body liposuctioning in whom few virgin donor sites remain. The patient is positioned supine, and the stab incision is made at the inferior extent of the fat pad. Harvesting is performed from this point superiorly in a typical fanning method (**Fig. 3-18**).

HIP

The hip is a potential donor site for both men and women. The patient is positioned in the lateral decubitus position for access. The entry site is made along the posteroinferior aspect of the fat pad, at the superolateral extent of the iliac crest. The site is relatively easy to harvest and elicits very little patient discomfort. The fat quality is

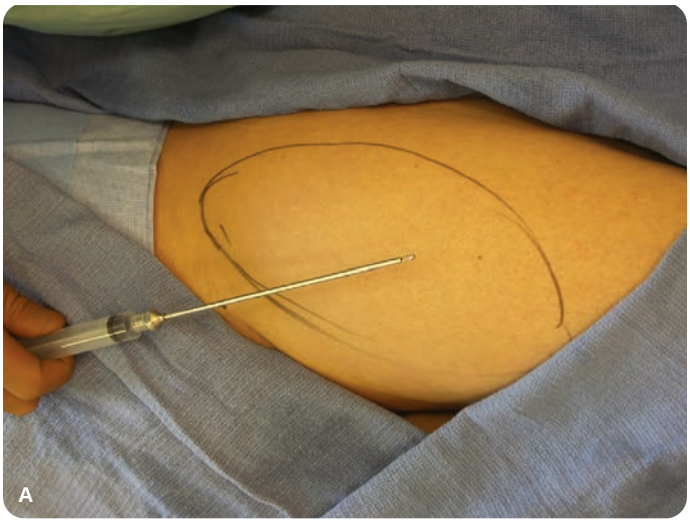


Figure 3-17A: The left anterior thigh is exposed with the patient in a supine position and harvesting cannula inserted medially along the inguinal line. **B:** Harvesting shown of the right anterior thigh from the inguinal entry site (same as that used for inner thigh harvesting) with the patient in the supine position.

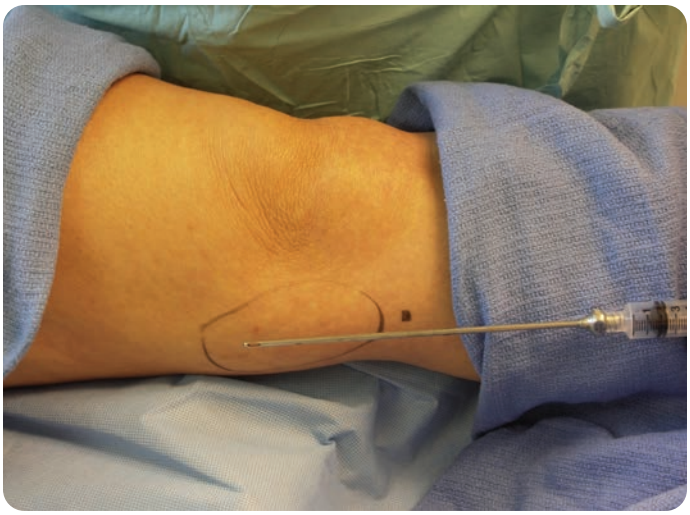


Figure 3-18: Harvesting from the inner knee tends to be reserved for patients who have undergone extensive body liposuctioning and in whom few virgin donor sites remain. The patient is positioned supine, and the stab incision is made at the inferior extent of the fat pad. Harvesting is performed from this point superiorly in a typical fanning method. The photograph shows the left inner knee marked out with the proposed inferior entry site and the patient positioned supine.

good, and it is hard to injure any important anatomic structure in this area. The hip tends to be a forgiving area in that contour issues postharvesting are uncommon. Harvesting from the entry site is carried out in a supero-anterior direction working perpendicular to the long axis of the fat pad (**Fig. 3-19**). At times, a second inferior-based entry site with the cannula running parallel to the long axis of the fat pad is helpful for maximal fat yield (**Fig. 3-20**).

BUTTOCK

The patient is laid in the lateral decubitus position for access. The stab incision is made in precisely the same location as for outer-thigh harvesting (i.e., the infragluteal fold along the lateral extent of the buttock crease). Harvesting is conducted superomedially

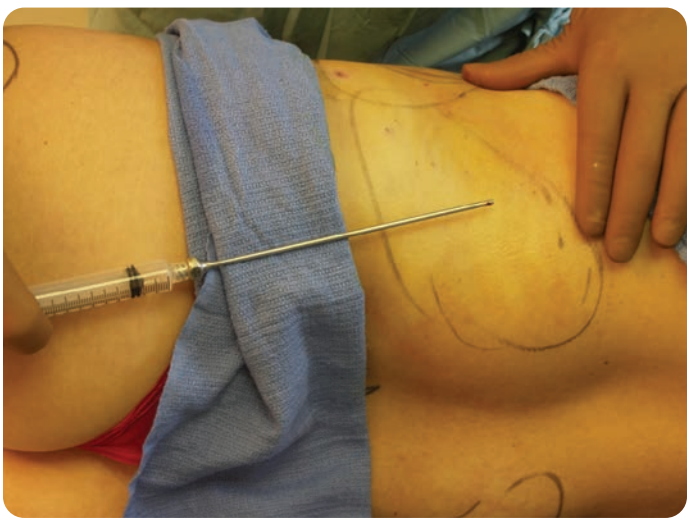


Figure 3-19: The hip is harvested from a posteroinferior entry site that falls at the superolateral extent of the iliac crest. The harvesting is undertaken in a superoanterior direction that is perpendicular to the long axis of the fat pad. The patient's left hip is exposed, and the patient is in the right lateral decubitus position.

Figure 3-20: At times, a second entry site that is situated more anteriorly can be used to harvest the hip in a superoposterior direction along the long axis of the fat pad. The patient's left hip is exposed, and the patient is positioned in the right lateral decubitus position.

to harvest the lower lateral quadrant of the buttock. This area is generally suitable only for women who have excessive fat deposition in this region (**Fig. 3-21**).

WAISTROLL

The waistroll constitutes the fat pad that descends along the lower lateral back from a superomedial to inferolateral direction. This area is generally present in both male and female patients and can be a reliable source of fat for either thin, athletic individuals or those who have already undergone extensive body liposuctioning. The patient is placed in the lateral decubitus position. The fat is harvested from an entry site located along the inferolateral extent of the fat pad but not in a prescribed skin crease; harvesting is conducted in a superomedial direction (**Fig. 3-22**). The fat tends to have a

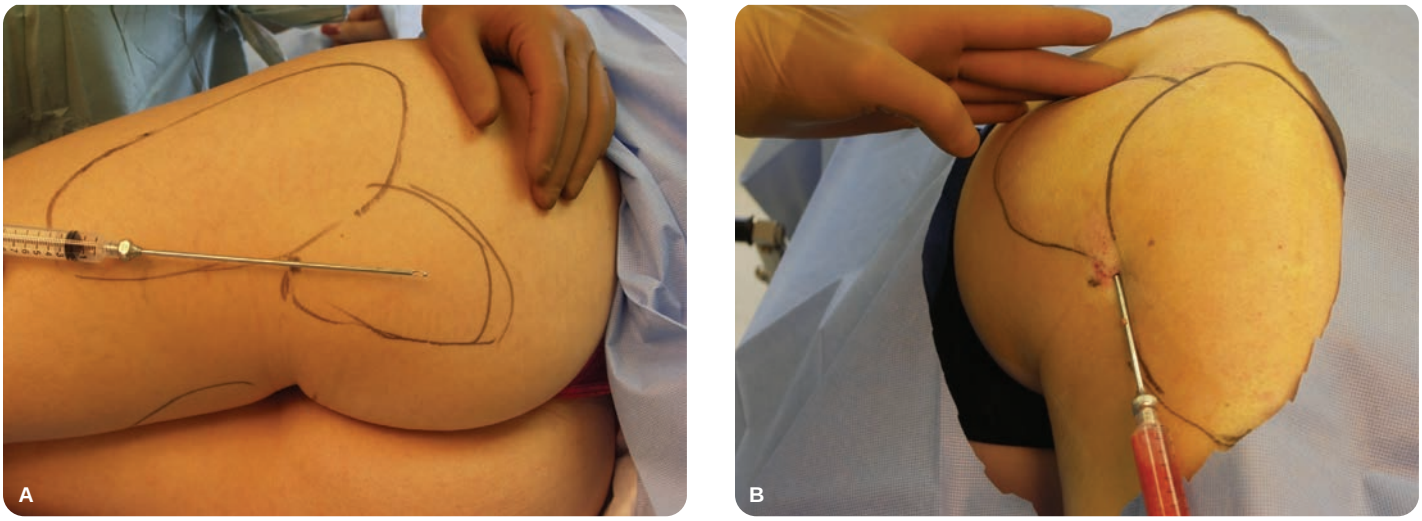


Figure 3-21A: The patient is shown in the right lateral decubitus position with the left buttock exposed. The cannula is shown in the proposed direction of harvest from the entry site at the lateral terminus of the buttock crease (same as that used for lateral thigh harvesting). **B:** Harvesting is shown of the right lateral buttock with the patient positioned in left lateral decubitus.

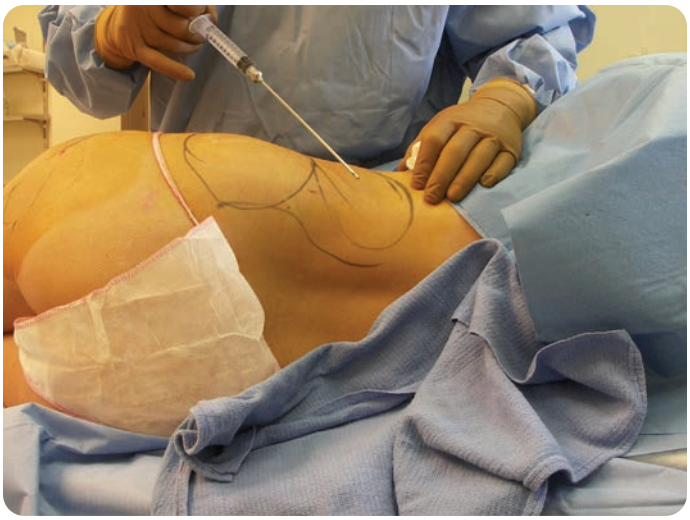


Figure 3-22: With the patient in the right lateral decubitus position, the left lower lateral back (waistroll) is shown exposed for harvesting. The entry site falls at the lower lateral extent of the fat pad and not in a specific definable anatomic location so that harvesting proceeds in a superomedial direction. This area is particularly useful in very thin patients and in those who have already undergone extensive liposuctioning elsewhere.

fibrous texture. Harvesting in this area is quite forgiving, in that superficial passage of the harvesting cannula (so long as the dermis is not actually abraded with the cannula tip) is not associated with a significant risk of contour deformity.

TRICEPS

The quality of fat harvested from the triceps area is comparable with other donor sites. The patient is positioned in the lateral decubitus with the assistant holding the arm outward. The surgeon makes an entry site along the posterolateral extent of the axillary fold, and harvesting is conducted parallel to the triceps down the length of the arm (**Fig. 3-23**). Care should be taken to avoid contour deformities if the cannula is passed too close to the skin surface.

Figure 3-23: Harvesting of triceps fat is undertaken with the patient in the lateral decubitus position (shown here in right lateral decubitus with the left triceps exposed) with the entry site made at the posterolateral extent of the axillary fold.

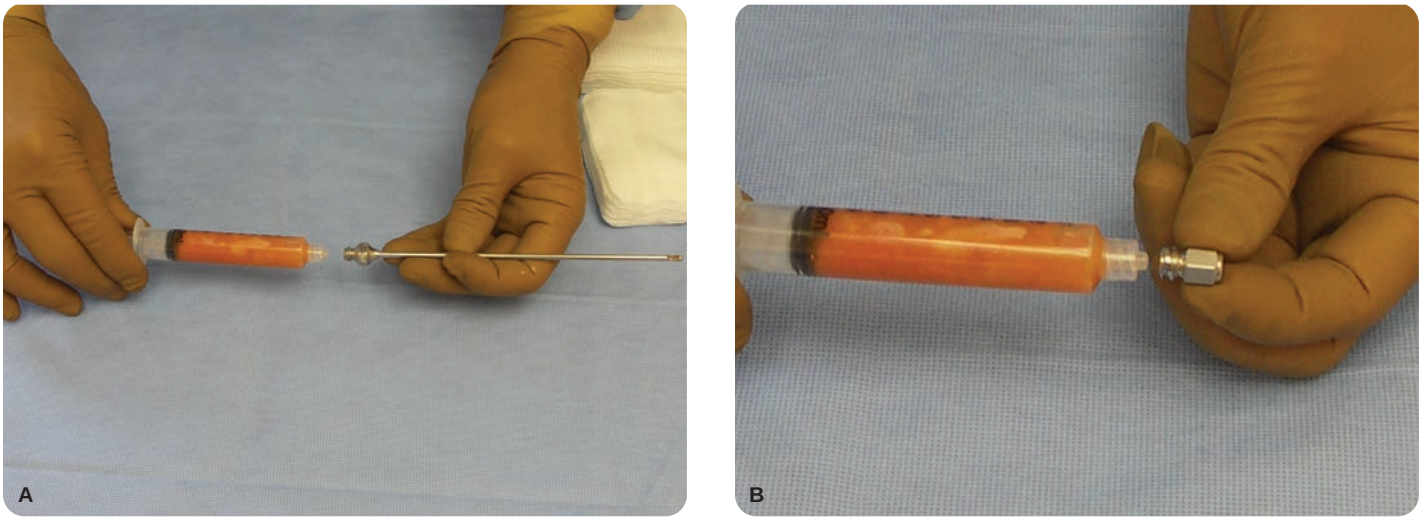


Figure 3-24A: After the fat has been harvested, it must be centrifuged to remove unwanted impurities including the lysed fat cells, blood, and lidocaine. The harvesting cannula is removed from the Luer-Lok side of the syringe. **B:** Then, the specially designed plug is used to close off the Luer-Lok side before centrifugation. (As a reminder, it is important *not* to use the small plastic plug that comes packaged with the syringes.)

Processing the Fat

As each syringe of fat is harvested, the harvesting cannula is removed, and the syringe is passed to the surgical assistant for processing. A plug is then placed on the Luer-Lok end of the syringe. The plunger is gently removed from the backside of the syringe, and the cap placed securely onto that end (**Fig. 3-24**). A specially designed cap and plug for the 10-cc Luer-Lok syringe are used (Miller Medical Inc.).[6] It is important not to use the small plastic plug that comes originally prepackaged with the syringe. Rather, only a dedicated plug designed for fat harvesting that prevents leakage should be used (**Fig. 3-25**).

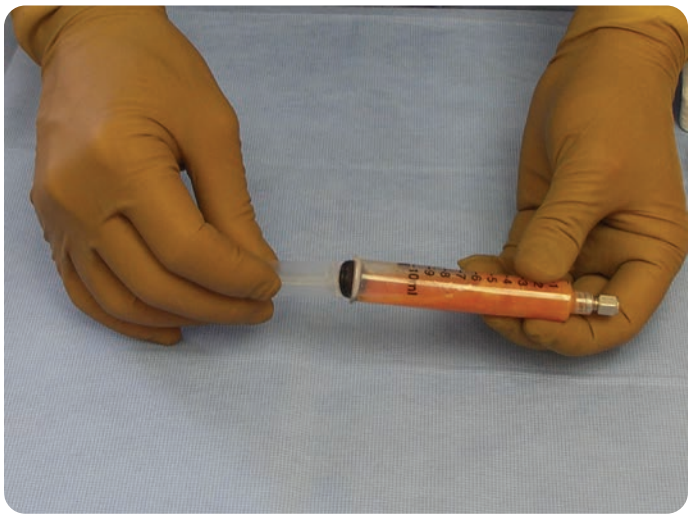


Figure 3-25: The plunger is removed from the syringe so as to insert the specially designed cap that is intended to seal the opened plunger side of the syringe prior to centrifugation.

[6] The reusable syringe plugs and caps manufactured by Miller Medical Inc. require the use of 10-cc syringes by Becton, Dickinson, and Company (Franklin Lakes, NJ) to fit properly.

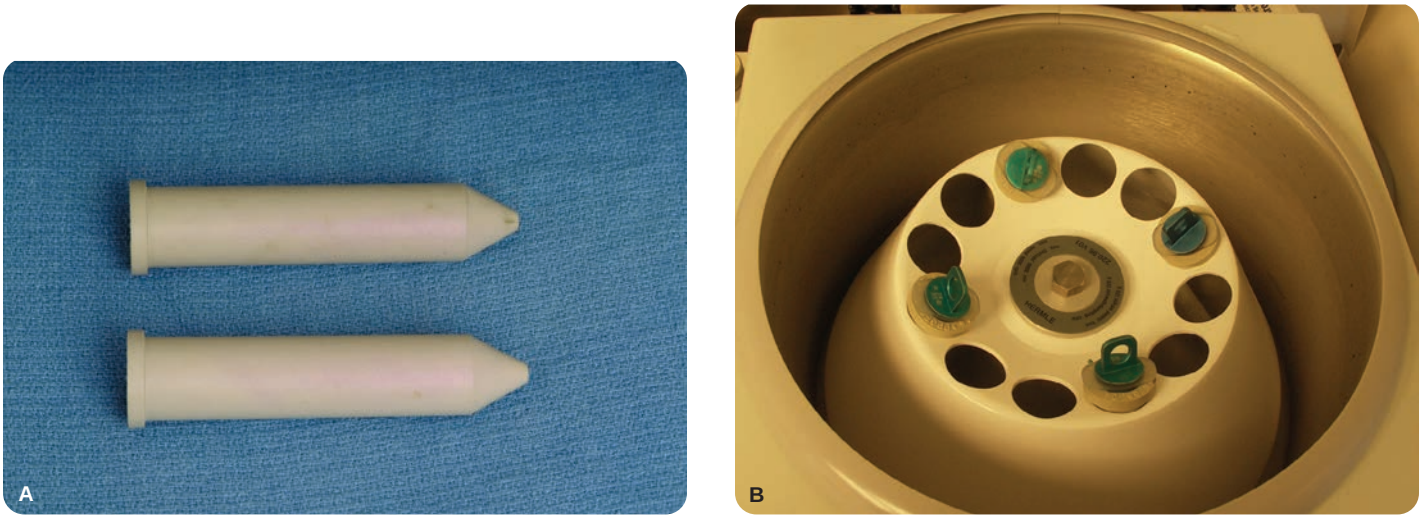


Figure 3-26A: In order to maintain a sterile environment, the syringes are inserted into sterile sleeves. **B:** The sterile sleeves are in turn inserted into the centrifuge in a balanced distribution.

Each syringe that is prepared in this fashion is placed into the test tube holder on the sterile field until a balanced number is attained for centrifugation (**Fig. 3-26**). The number of syringes required to balance a centrifuge is contingent upon the design of the machine and how many syringe holders can be accommodated. The prepared syringes are then inserted into the centrifuge in a sterile manner. There are many styles of centrifuge machines that can maintain sterility. For instance, individual sleeves can be sterilized that hold the syringes and which are handled sterilely when inserting and removing the syringes from the centrifuge (**Fig. 3-27**). This style of centrifuge is illustrated in this book (as supported in the accompanying figures (Miller Medical Inc.). Alternatively, the entire rotary element can be sterilized in some models and then placed into the centrifuge in a sterile fashion. It is critical that the syringes be placed into the centrifuge machine in a balanced manner so that the motor is not damaged. The centrifuge is set to spin at 3000 rpm for 3 minutes as a standard (**Fig. 3-28**). However, a spin cycle of anywhere between 2 to 3 minutes at a rate of between 2000 to 4000 rpm is acceptable. Some centrifuge models may not have the option of adjusting the revolutions per minute, and the surgeon should ensure that the purchased model spins at a sufficient velocity.

Figure 3-27: The centrifuge is shown with the desired settings of 3000 rpm at 2 to 3 minutes spin time. Generally, a spin cycle of anywhere between 2 to 3 minutes at a rate of between 2000 to 4000 rpm is acceptable.

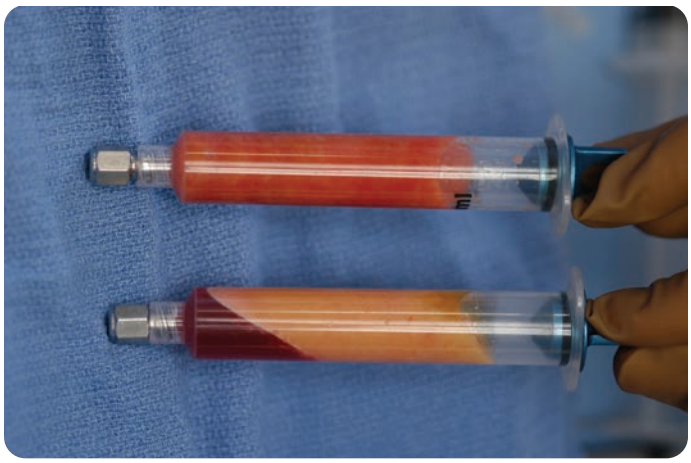


Figure 3-28: The fat is shown uncentrifuged **(above)** and centrifuged **(below)**. The centrifuged fat shows the heavier blood and lidocaine at the bottom **(left)** and the lysed fat cells at the top **(right)**.

After the syringes have been centrifuged, they are removed sterilely from the machine and placed back into the test tube rack with the plug side (Luer-Lok side) down. The cap is removed, and the supranatant that contains the free fatty acids from lysed fat cells is first poured off onto a sterile cotton gauze (**Fig. 3-29**). The syringe is turned back upright, and the plug is removed from the Luer-Lok hub. The infranatant that contains a mixture of blood and anesthetic solution should be allowed to pour out onto a gauze (**Fig. 3-30**). The plug need not be returned to the syringe, as the remaining contents are now principally solid. *It is imperative that the supranatant be poured off prior to the evacuation of the infranatant; otherwise, the fat will easily tumble out of the syringe from the loss of vacuum on the plug side.*

A 4 × 4 gauze is then inserted into the back of the syringe to wick away any residual supranatant that remains (**Fig. 3-31**). The gauze should be left in place for 5 to 10 minutes to adequately remove the residual supranatant. It is important that the gauze not be trimmed for insertion, as tiny cotton fragments may be mixed with the fat and then be injected as a foreign body along with the fat. Alternatively, cotton neuropaddies can also be used in place of the gauze. After the gauze is inserted, the syringe is returned to the test tube rack for the requisite minimum of 5 to 10 minutes.

Figure 3-29: With the plug on the Luer-Lok side kept in place, the supranatant consisting principally of lysed fat cells is poured off first. The supranatant must be poured off before the infranatant; otherwise, the column of fat can easily slide right out of the syringe with the vacuum removed.

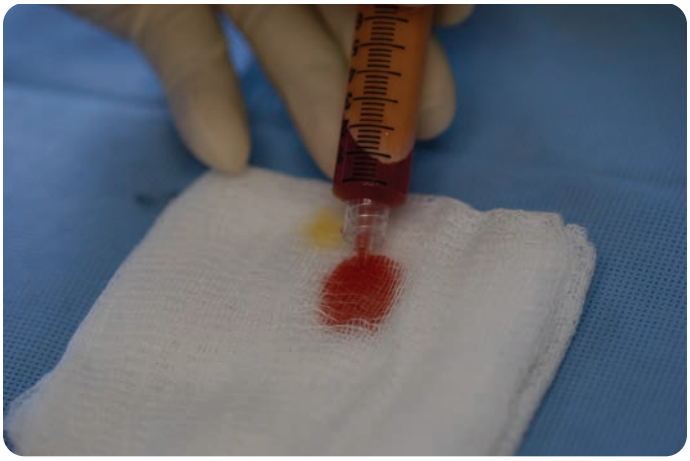


Figure 3-30: After the supranatant is poured off, the plug from the Luer-Lok side is removed, and the blood and lidocaine mix of the infranatant is drained away.

When a sufficient number of syringes of processed fat have been collected, the gauze is removed, and the fat contents are poured into the back end of a 20-cc Luer-Lok syringe one at a time until approximately 15 cc of fat have filled the 20-cc syringe (**Fig. 3-32**). Typically, a processed 10-cc syringe of harvested fat will yield about 5 cc of fat after the supranatant and infranatant have been discarded; so, three 10-cc syringes will usually be used to fill one 20-cc syringe up to the 15-cc mark. Transferring the processed fat into a 20-cc syringe affords two advantages. First, the small residual blood/lidocaine/albumin mixture that remains is kept in the original 10-cc syringe and is not transferred into the 20-cc syringe. Removal of this aliquot of residual infranatant enhances the purity of the final content of fat. Second, a large 20-cc syringe allows for quick and easy transfer of the fat into the 1-cc Luer-Lok syringes in preparation for fat infiltration.

The plunger is placed onto the back end of the 20-cc syringe with the plunger side down, allowing the fat to slide down toward the plunger as the plunger is gently inserted so as to avoid accidentally spraying out the fat from the syringe. The plunger is inserted into the syringe until all of the air is removed. A Luer-Lok transfer hub (Miller Medical Inc.) is attached on one end to the 20-cc syringe, and the other end is attached to a 1-cc Luer-Lok syringe (**Fig. 3-33**). The 1-cc syringe is gently filled from the 20-cc syringe until the 1-cc plunger is brought all the way back to the end of the syringe. The

Figure 3-31: An uncut 4 × 4 gauze is inserted into the plunger side in order to wick away any of the remaining oily supranatant for a period of 5 to 10 minutes before continuing.

Figure 3-32: After wicking the residual supranatant, the 4 × 4 gauze is removed, and the contents are transferred into the back of a 20-cc syringe. By placing approximately 15 cc of fat (typically 3 harvested/centrifuged syringes) into the 20-cc syringe, two objectives are met. First, the tiny residual plug of blood/lidocaine is kept in the original 10-cc syringe so as to enhance the purity of the transferred fat. Second, it is faster to transfer the fat from the 20-cc syringe into the individual 1-cc infiltration syringes.

plunger of the 1-cc syringe is then completely removed, and fat continues to be transferred until the fat meets the end of the syringe (**Fig. 3-34**). This technique removes the tiny air bubble that would otherwise remain. The plunger of the 1-cc syringe is then reinserted, and the syringe is detached from the transfer hub (**Fig. 3-35**). Transfer continues until all of the fat has been removed from the 20-cc syringe. As fat continues to be processed and the 1-cc syringes are depleted for fat infiltration, additional 1-cc syringes of fat can be prepared in the described method.

Fat Injection

General Principles

Although many types of cannulas can be employed for facial fat transfer, we have tried to simplify the process for the reader without sacrifice in the ease or quality of the surgical delivery. We emphasize the use of two basic types of cannulas for fat infiltration—a straight all-purpose cannula for most injections and a curved cannula for placement of fat along the superior orbital rim and the depressor labii inferioris,

Figure 3-33: Using a Luer-Lok transfer hub, the contents of the 20-cc syringe are transferred to 1-cc Luer-Lok syringes intended for fat infiltration.

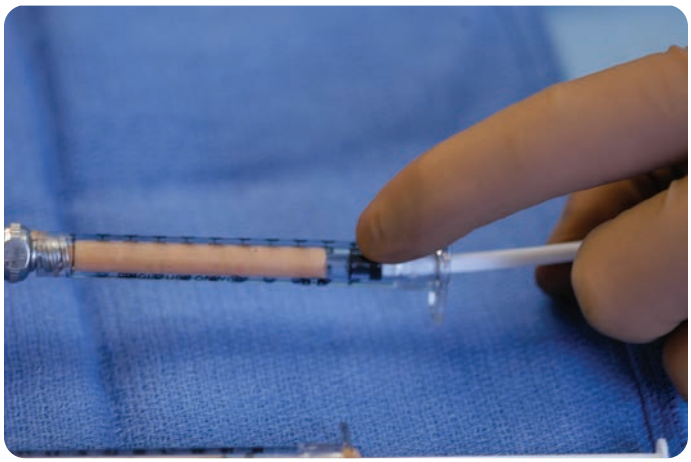


Figure 3-34: As the fat is transferred into the 1-cc syringe, a tiny air bubble is noted at the end of the syringe, which must be removed prior to injection.

or labiomandibular fold (Table 3-6). Alternatively, a straight cannula can be used for all injections. Of the available all-purpose straight cannulas, we recommend the Tulip 1.2-mm (6-cm length) blunt spoon-tip injector (Tulip Medical, Inc.). Alternatively, the Coleman-Donofrio 16-gauge infiltration cannula (Byron Medical Inc.) is a good all-purpose injecting cannula (Fig. 3-7). For a curved cannula, we recommend the Amar #7 cannula (Miller Medical Inc.). Although many different cannulas can be used for each particular facial site or specific anatomic situation, the use of these two types of cannulas should be thought of as a reliable method for both the beginning and the advanced fat-transfer surgeon. As the surgeon gains increased skills, he or she may feel that the use of only one or two cannulas is insufficient, and at that time, additional cannulas can be purchased based on personal preference. One such cannula that we feel is extremely useful is the Tulip 0.9-mm blunt spoon-tip injector (4-cm length) (Tulip Medical, Inc.). This delicate cannula is useful when more superficial periorbital injections are being undertaken and in thick fibrous areas such as along the lateral canthus.

The underlying principle of modern fat transfer relies on blunt insertion of tiny parcels of fat that are placed in multiple anatomic layers. Sharp instrumentation can cause damage to underlying neurovascular structures, which can lead to temporary or permanent neuropraxia and/or hematoma formation. Any ecchymosis and/or frank hematoma that ensue can compromise overall fat viability by hindering nutrition from

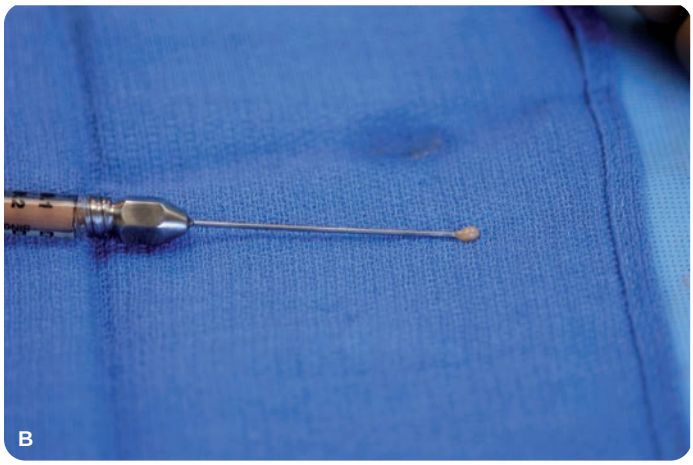


Figure 3-35A: The plunger is pulled all the way out to remove the tiny air bubble, then reinserted back to the 1-cc mark. **B:** The syringe is primed before beginning injection.

TABLE 3-6 Master Table for Systematic Fat Infiltration

ORDER	SITE	CANNULA	ENTRY SITE	VOLUME (CC)	AMOUNT PER PASS	LEVEL*	TISSUE BARRIER	PHASE
1	Medial inferior orbital rim	straight	A	1	3 to 5 per 1/10 cc	D	None	Volumetric foundation
2	Lateral inferior orbital rim	straight	A	1	3 to 5 per 1/10 cc	D	None	Volumetric foundation
3	Nasojugal groove	straight	A	1	1/10 cc	D	None	Volumetric foundation
4	Lateral cheek	straight	A	2	1/10 cc	D, I, S	None	Volumetric foundation
5	Buccal	straight	A	2	1/10 cc	I	None	Volumetric foundation
6	Anterior cheek	straight	B	3	1/10 cc	D, I, S	Malar septum	Volumetric foundation
7	Superior orbital rim (SOR)	straight or Amar #7	B	1	3 to 5 per 1/10 cc	D	None	Volumetric foundation
8	Lateral canthal area	0.9-mm straight	B	0.5	3 to 5 per 1/10 cc	D	Fibrous adhesions	Volumetric foundation
9	Prejowl sulcus	straight	C	3	1/10 cc	D, I, S	Fibrous adhesions	Volumetric foundation
10	Tear trough	0.9-mm straight	A	1	3 to 5 per 1/10 cc	I	None	Refinements
11	Lateral cheek	straight	A	1–4	1/10 cc	D, I, S	None	Refinements
12	Anterior cheek	straight	A & B	1–2	1/10 cc	D, I, S	Malar septum	Refinements
13	Buccal	straight	A & B	1–5	1/10 cc	I	None	Refinements
14	Precanine fossa	straight	A	1–2	3 to 5 per 1/10 cc	D	None	Refinements
15	Nasolabial fold	straight	A	1–2	3 to 5 per 1/10 cc	S	None	Refinements
16	Lateral jawline	straight	C	1	1/10 cc	D, I, S	None	Refinements
17	Marionette line	straight or Amar #7	D	1–2	1/10 cc	S	None	Refinements
18	Labiomental sulcus	straight or Amar #7	D	1–2	1/10 cc	D, I, S	None	Refinements
19	Inferior margin of SOR	straight or Amar #7	B	0.5–0.75	3 to 5 per 1/10 cc	D	None	Advanced
20	Central upper eyelid	straight or Amar #7	B	0.3–0.5	3 to 5 per 1/10 cc	D	None	Advanced
21	Temple	straight or Amar #7	B	2	3 to 5 per 1/10 cc	S	None	Advanced

*D, Deep; I, Intermediate; S, Superficial tissue planes.

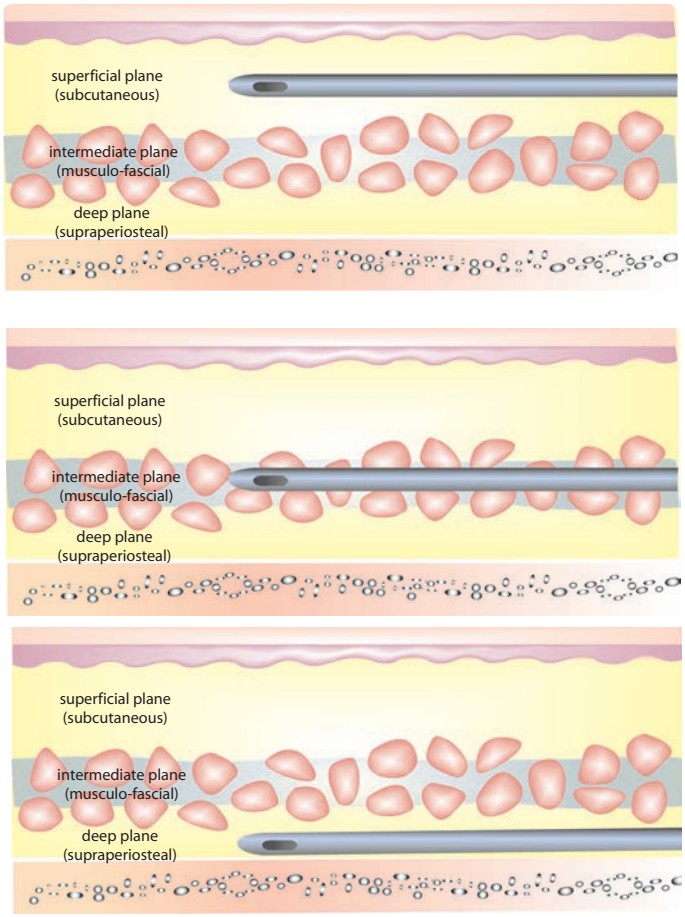


Figure 3-36: The illustration shows the conceptual outline of the three layers intended for fat placement discussed in the main text: deep (supraperiosteal), intermediate (musculofascial), and superficial (subcutaneous). Throughout the text, references are made to these three conceptual levels to guide the surgeon in the intended plane of fat infiltration as appropriate per facial zone.

diminished contact with surrounding tissue. Therefore, only blunt instrumentation should be used for fat infiltration.

Only small fat deposits are placed per pass of the infiltration cannula (as will be further specified later). Infiltration of very small fat deposits permits improved surface-to-volume contact between the surrounding tissue and the deposited fat, thereby increasing the nutrition to the fat cells and their consequent viability. The other reason for placement of very small parcels of fat is the avoidance of palpable or visible discrete lumps of fat. The following section will divide placement per pass of fat between three to five passes per 0.1 cc (in nonforgiving facial zones) and a full 0.1 cc per pass (in more forgiving facial zones). Fat infiltration can be carried out in both directions of cannula passage, that is, during insertion and withdrawal or if preferred only during withdrawal. *It is important that if the cannula becomes clogged, the entire cannula be removed before clearing the obstruction.* Doing so avoids inadvertent placement of an oversized bolus of fat into a specific locus.

Fat is infiltrated into three facial planes: deep (immediately above the periosteum), intermediate (within the muscle, fascia, and deep subcutaneous plane), and superficial (in the medium to superficial subcutaneous plane) (**Fig. 3-36**). For the deep plane, the cannula tip gently rubs against the bone as a guide without penetrating the periosteum. The intermediate plane is a bit more arbitrary, as the surgeon must estimate that he or she is approximately in the central substance of the soft tissue. Similarly, the superficial plane lies in the upper third of the soft-tissue depth. Although these depths are

approximate, the surgeon should strive to visualize the perceived depth and work within the confines of that layer. In turn, as multiple passes are made in a particular layer, the surgeon should gradually transition from a deeper level within a particular layer toward a more superficial level until the arrival of the next level. Therefore, the entire time, the cannula is gradually passing from a greater depth to a more superficial depth without abrupt transitions. This graduated deposition of fat ultimately permits the most uniform distribution. These subtleties are difficult to convey in either text or video format and will become more self-evident with ongoing practical implementation of the technique.

In review, the technique that will be described herein is separated into three distinct levels: volumetric foundation, refinements, and advanced techniques. Volumetric foundation outlines a systematic and standardized infiltration of fat that benefits almost every patient (**Fig. 3-37**). Accordingly, the same amount and order is carried out in every patient. Without a need for artistic interpretation, placement of the volumetric foundation remains consistent in amount and distribution based on empiric recommendations. After the volumetric foundation has been completed for both sides of the face, a second pass of fat infiltration is conducted that describes additional volume and distribution of fat that a particular patient requires based on individual anatomy (**Fig. 3-38**). Judgment as to how much and where to place the fat during the refinements phase is based on some degree of artistry and experience. Accordingly, the starting surgeon need not undertake additional refinements until he or she is comfortable with the standard volumetric foundation. Finally, advanced techniques describe facial sites that require more skill to undertake without incurring complications (**Fig. 3-39**). As evident (or will be so), the entire procedure of fat transfer is carried out through four distinct entry ports (A, B, C, D) for each side of the face. These are general entry points that we use, but with experience, the surgeon should feel free to make insertion sites anywhere necessary for optimal fat placement. The techniques in this book emphasize the use of a specific entry site for filling a specific area. In the accompanying DVD, it is obvious that at times areas will be approached from multiple directions. Often, optimal fat augmentation is achieved by placing fat from perpendicular directions into the same site, and the surgeon should feel comfortable in attempting this variation. The only exception is the inferior orbital rim, where fat should only be placed perpendicular to the bony rim. We have found in the past that placement of fat parallel to the inferior orbital rim (e.g., from a lateral entry site) led to frequent complications that could easily have been avoided by approach from a perpendicular orientation (described below).

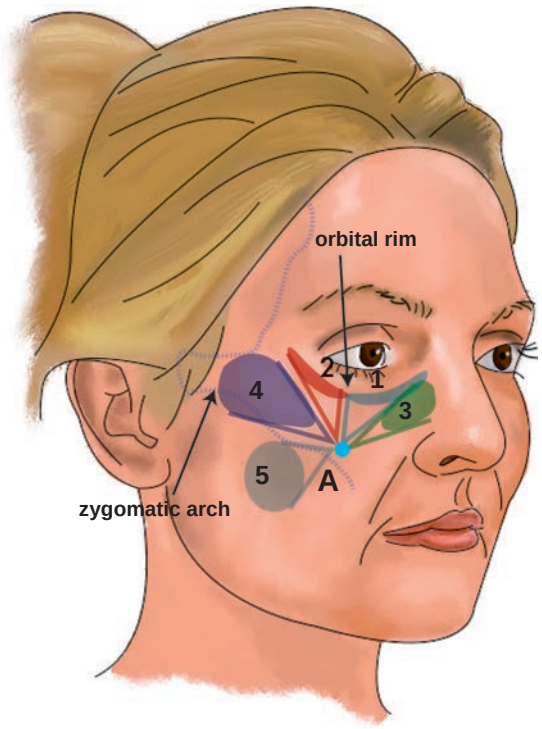
Precise recording of volumes used are important in order to evaluate one's results and to help evolve individual technique so as to obtain optimal results. We use a standard intraoperative worksheet (Fig. 3-2) to record fat volumes into each of the areas detailed.

Volumetric Foundation

MEDIAL INFERIOR ORBITAL RIM

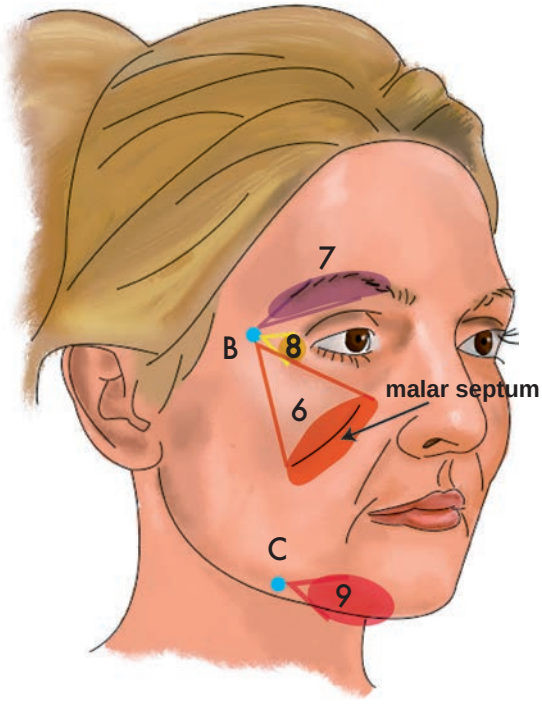
The inferior orbital rim is technically the most challenging area, as poor technique may lead to visible surface irregularities (**Fig. 3-40**). The relatively thin skin and lack of overlying soft tissue make proper placement of fat critical, and even slight overcorrection of this area is unacceptable. Although a patient may exhibit a markedly deep recession along the inferior orbital rim, the surgeon should avoid the temptation to overfill this region and should follow the volume guidelines enumerated in this section. Additional fat can always be placed along the inferior orbital rim at a later date, and underfilling is much easier to correct than lumps or overfilling. The volumetric foundation recommends an initial 2 cc of fat placed deeply in the immediate supraperiosteal plane along each inferior orbital rim. In the markedly hollow patient, this conservative quantity will often undercorrect the inferior orbital rim. The first refinement is to place an additional 1 cc of fat in an intermediate plane, which remains still deep below the orbicularis-oculi muscle, but need not hug the

VOLUMETRIC FOUNDATION 1



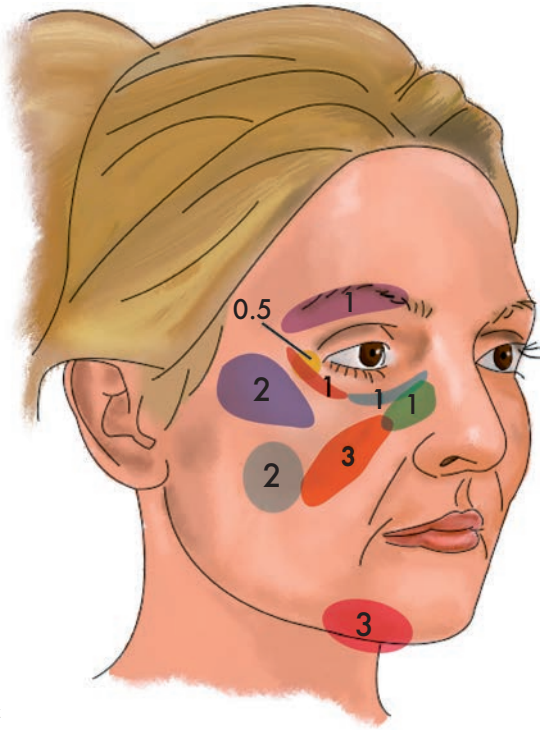
A

VOLUMETRIC FOUNDATION 2



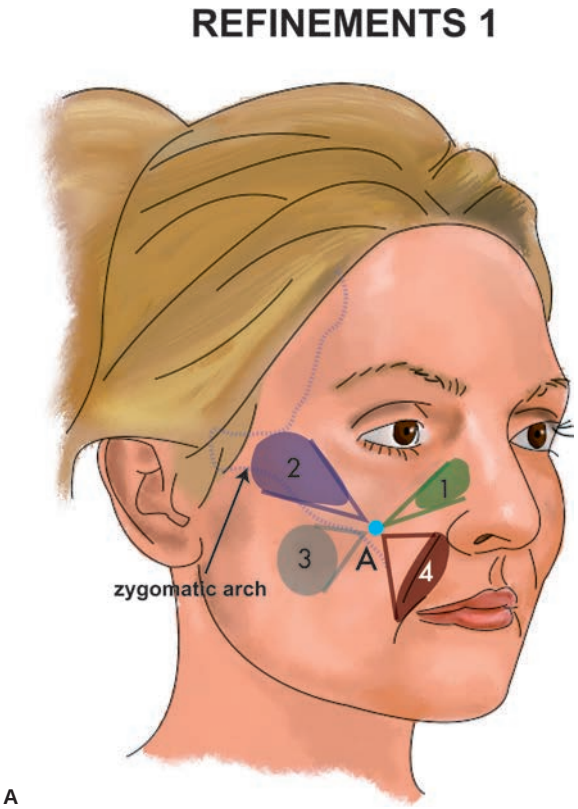
B

VOLUMETRIC FOUNDATION (Fat Volumes, 14.5 cc/side)

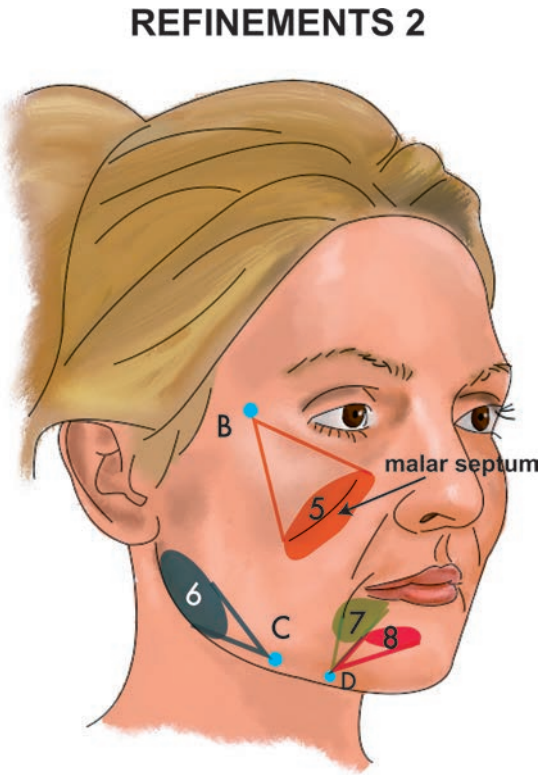


C

Figure 3-37A: Volumetric foundation refers to the empiric and standardized quantities and distribution of fat that are beneficial to most patients. The prescribed areas for augmentation are numbered according to a recommended chronologic sequence for fat infiltration, all of which is infiltrated from entry site A: **(1)** medial inferior orbital rim, **(2)** lateral inferior orbital rim, **(3)** nasojugal groove, **(4)** lateral cheek, **(5)** buccal. **B:** For sake of clarity, the second half of the volumetric foundation is shown in a separate illustration. From entry site B, fat is infiltrated into the following areas: **(6)** anterior cheek with emphasis of placement in the malar septal depression, **(7)** superior orbital rim, **(8)** lateral canthus/lateral inferior orbital rim hollowing. From entry site C, fat can be infiltrated into **(9)** the prejowl sulcus. **C:** As a guide, the volumes are recommended as a starting point for a surgeon beginning to learn fat infiltration. The numbers listed correspond to the volumes in milliliters of fat proposed for each facial zone.



A



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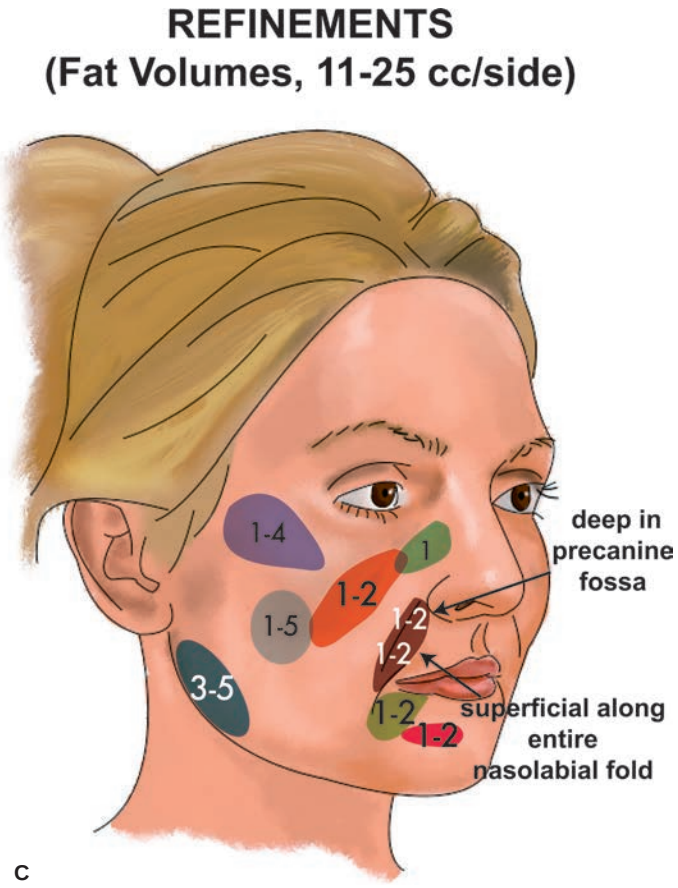


C

Figure 3-38A: After volumetric foundation has been completed, the surgeon can attempt additional passes of fat infiltration based on aesthetic judgment and experience. Refinements are not necessarily recommended for the surgeon just starting out with fat infiltration. The numbers correspond to the areas for additional enhancement from entry site A as follows: **(1)** tear-trough deformity, **(2)** lateral cheek, **(3)** buccal, **(4)** precanine fossa/nasolabial fold. **B:** For sake of clarity, the second half of the refinements is shown in a separate illustration. From entry site B, additional fat can be infiltrated into **(5)** the anterior cheek/malar septum. From entry site C, **(6)** the lateral mandible can be enhanced. From entry site D, **(7)** the labiomandibular fold and **(8)** the labiomental sulcus can be approached. **C:** As a guide, the volumes are recommended as a range based on aesthetic judgment and acquired experience. The numbers listed correspond to the volumes in milliliters of fat proposed for each facial zone.

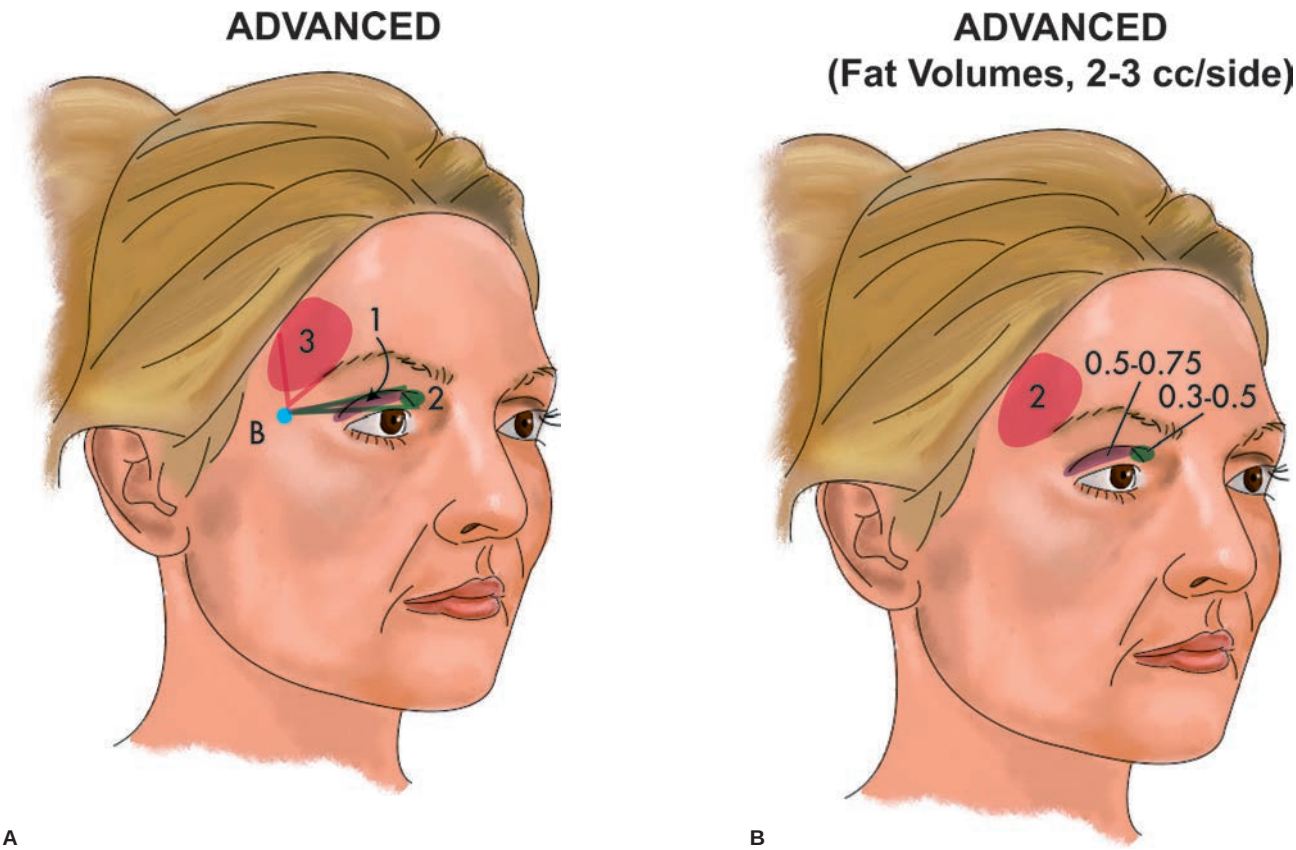


Figure 3-39A: Advanced infiltration is recommended for an experienced surgeon, as the potential morbidity increases with these techniques. From entry site B, the advanced areas for fat infiltration include the following: **(1)** upper eyelid (along the inferior border of the superior orbital rim), **(2)** notching of the upper eyelid where middle fat pad was previously removed, **(3)** temporal hollow. **B:** The numbers listed correspond to the volumes in milliliters of fat proposed for each facial zone.

periosteum and should be undertaken in the appropriate patient as soon as development of technical skill permits. However, approaching or exceeding a total of 4 cc (including both volumetric foundation and refinements) along each inferior orbital rim often risks overcorrection.

To facilitate meticulous adherence to volume placement, the inferior orbital rim is partitioned halfway such that 1 cc of fat is distributed medially, and another 1 cc is placed laterally. In order to avoid visible contour irregularity, only a very small amount of fat should be infiltrated per pass (three to five passes per 0.1 cc; Table 3-6). In addition, the fat should be placed deeply, immediately above the periosteum. The surgeon inserts the straight cannula into entry site A. With the nondominant index finger, the surgeon palpates the medial inferior orbital rim and guards the cannula tip from injuring the globe. The cannula tip is first placed along the far medial extent of the inferior orbital rim so that the cannula tip abuts the periosteum. The cannula is then passed back and forth across the rim an approximate distance of 2 mm on either side of the rim edge, with the described minute amount of fat placed as the cannula continues to gradually work medially to laterally. The nondominant index finger is used not only to guard the globe from injury but also to provide sensitive tactile feedback as to the precise depth and position of the cannula tip.

LATERAL INFERIOR ORBITAL RIM

The exact same technique is applied to the lateral inferior orbital rim to complete the second 1 cc of fat distributed along the lateral half of the inferior orbital rim (**Fig. 3-41**). The same cautions and limitations described for the medial inferior orbital

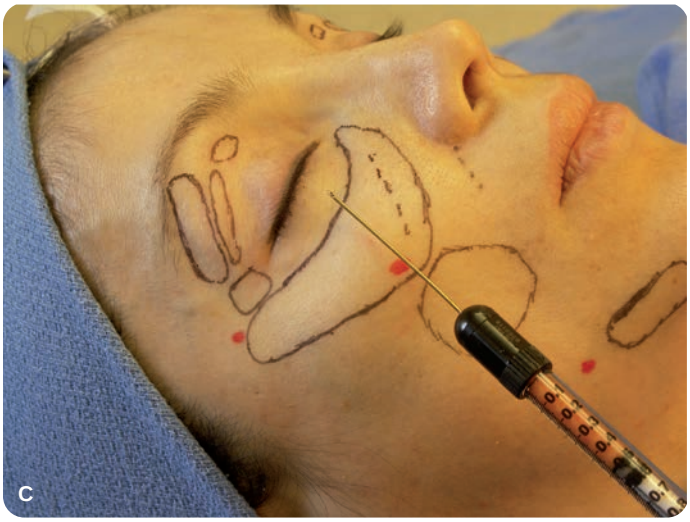


Figure 3-40A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the medial inferior orbital rim with the cannula orientation for fat infiltration in this area. **B:** The index finger of the nondominant hand is placed along the inferior orbital rim to protect the globe from injury and to provide tactile feedback that the depth and position of the cannula tip is correct during fat infiltration. **C:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat along the medial inferior orbital rim.

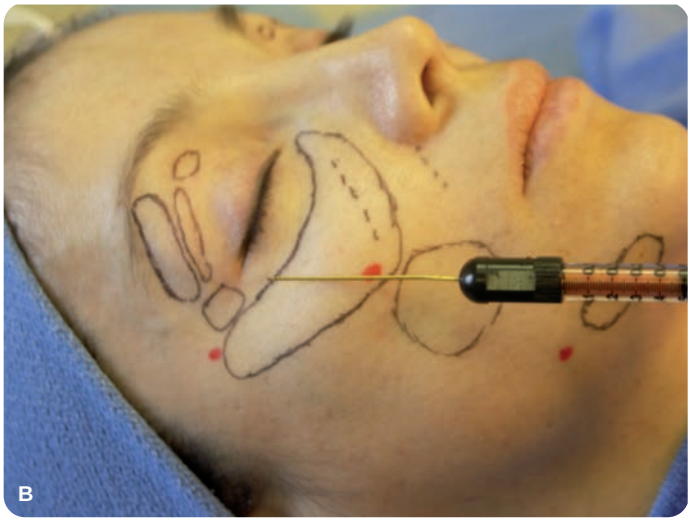


Figure 3-41A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the lateral inferior orbital rim with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat along the lateral inferior orbital rim.

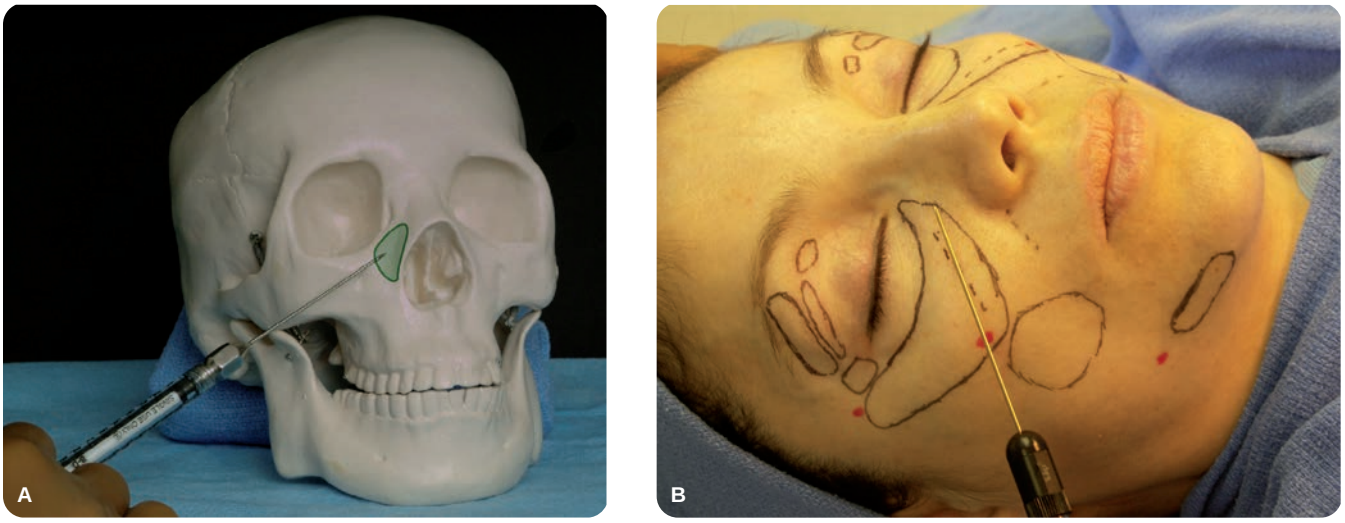


Figure 3-42A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the nasojugal groove with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the nasojugal groove.

rim are equally relevant for the lateral portion. Generally speaking, cannula passage through soft tissue is relatively easy during fat transfer except for a few distinct areas (Table 3-6), including the lateral canthal/lateral inferior orbital rim area. Due to the fibrous adhesions near the lateral extent of the inferior orbital rim, passage of the cannula may be slightly more difficult, and the Tulip 0.9-mm cannula may pass more easily to facilitate this maneuver.

NASOJUGAL GROOVE

After the inferior orbital rim has been adequately infiltrated, the nasojugal groove is approached. The nasojugal groove is a fan-shaped bony depression. The superior limit is the medial extent of the inferior orbital rim, and the nasal sidewall defines the inferomedial extent. Placement of fat is performed from the same entry site A and is undertaken in the same deep supraperiosteal plane as for the inferior orbital rim (**Fig. 3-42**). Unlike for the inferior rim, a generous 0.1 cc of fat can be infiltrated per pass of the cannula without risk. A total of 1 cc is placed into the nasojugal groove. The nasojugal groove is softened by placement of fat not only into the very depth of the nasojugal trough but also in a fanning technique across the deepest recess marching toward the nasal bone medial to and the maxillary face lateral to the groove. The general configuration of fat deposition should assume a narrow triangle with the apex at entry site A and the broader base situated along the nasal sidewall. Of note, the bony nasojugal groove is not necessarily a visible entity but a palpable bony structure, so tactile feedback with the nondominant hand and the cannula tip abutting bone should serve as the guide for fat placement. The visible tear trough that appears as a skin depression may or may not directly correlate with the nasojugal groove, that is, the tear trough may be situated directly superficial to the underlying nasojugal groove or, alternatively, lie superior or inferior to it. Management of the tear trough is discussed in the Refinements section and should not be confused with the bony nasojugal groove that is discussed herein.

LATERAL CHEEK

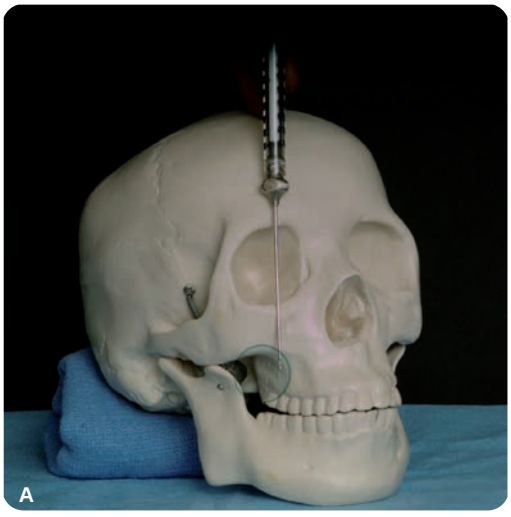
Like the inferior orbital rim and the nasojugal groove, bony landmarks are used as a guide for fat infiltration. As facial bone structures may be visually obscured by the administration of local anesthesia, constant palpation with the nondominant hand is helpful to maintain accuracy in placement. Unlike the three previous areas of infiltration (medial inferior orbital rim, lateral inferior orbital rim, and nasojugal groove), fat is placed into all three soft-tissue planes for optimal aesthetic enhancement. Starting in

Figure 3-43A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the lateral cheek with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the lateral cheek.

the deep supraperiosteal plane, the cannula is passed from the same entry site A toward the lateral bony zygoma to fill this region broadly approaching but not arriving at the lateral canthus (which will be filled later from entry site B) (**Fig. 3-43**). As this area is more forgiving than the three previously treated areas, 0.1 cc of fat can be placed per pass of the cannula, and the surgeon need not stay immediately in the supraperiosteal plane. In fact, as fat is continually infiltrated, the surgeon will continue to march upward from a deeper plane to a more superficial one, crossing gradually across all three soft-tissue levels (defined in the General Principles section).

BUCCAL

If a concurrent lower facelift is planned along with infiltration of the buccal region, the extent of undermining for the facelift should not include the buccal area. Placement of fat is undertaken in the deep subcutaneous plane in a radial manner from entry site A (**Fig. 3-44**). A total of 2 cc are placed with 0.1 cc per pass. Additional fat can be



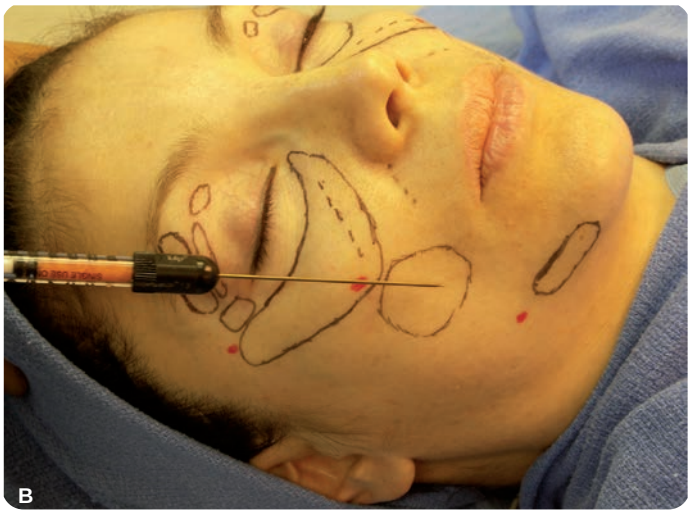


Figure 3-44A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the buccal region with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the buccal region.

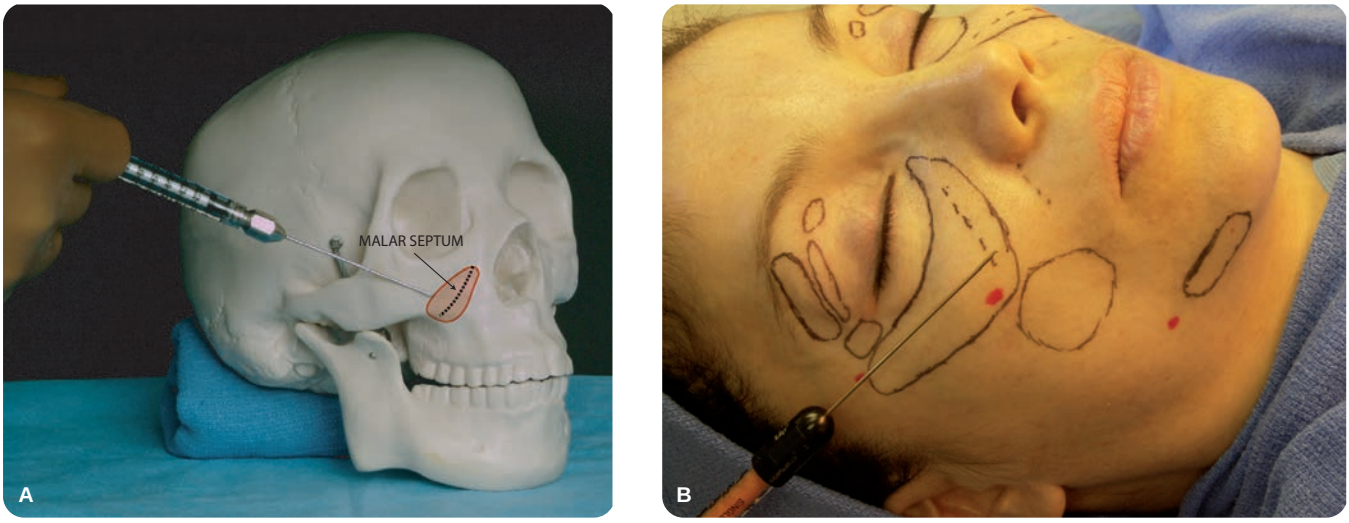


Figure 3-45A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the anterior cheek while the dotted line shows the malar septum with the cannula orientation for fat infiltration in these areas. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the anterior cheek.

deposited during the refinement phase (described later) as needed. The buccal area tends to be a forgiving area for fat enhancement and can oftentimes benefit from a generous amount of transplanted fat.

ANTERIOR CHEEK

The anterior cheek, which constitutes a continuum with the lateral cheek mound, is targeted next. The anterior cheek is approached from entry site B, and the same principles of infiltration explained for the lateral cheek apply, namely, continual infiltration from deep to superficial planes (across all three soft-tissue levels) and placement of 0.1 cc per pass (**Fig. 3-45**). A total of 3 cc of fat is infiltrated into this area during the volumetric foundation. Additional fat placement is discussed in the Refinements section.

Unlike the lateral cheek, special considerations must be made in the anterior cheek. First, a tough, fibrous malar septum is present through which the cannula must forcibly breach in order to access the medial-inferior extent of the anterior cheek. The physical presence of the malar septum is variable—at times tenacious and at times almost absent. The second important and unique characteristic of the anterior cheek concerns the occasional presence of a malar mound (Chapter 2). Treatment of the malar mound depends upon its severity. For the sake of clarity, this section assumes that no malar mound is present. For a detailed discussion of management of the more conspicuous malar mound, please refer to Box 3-1, page 70.

From entry point B, the surgeon places fat along the entire expanse of the anterior cheek with emphasis placed principally at the deepest recess, typically along the malar septum and immediately inferomedial to it. As mentioned, a tough fibrous septum can be encountered and must be breached repeatedly with the cannula while fat is being deposited. A total of 3 cc of fat is deposited from entry point B, placing the fat along every level: deep, intermediate, and superficial.

SUPERIOR ORBITAL RIM

The superior orbital rim should be enhanced to provide an adequate frame for the eye by balancing the fat enhancement undertaken in the cheek and inferior orbital rim (**Fig. 3-46**). This area tends to be forgiving in terms of avoiding contour irregularities from uneven fat infiltration. From entry site B, a curved Amar #7 infiltration cannula is used to follow the curvature of the superior orbital rim. Of note, the same straight cannula used elsewhere can also be employed as an alternative. Because fat placement

Box 3-1 Grades of Malar Mound

Grade 0:	No malar mound present
Grade I:	Malar mound without swelling
Grade II:	Malar mound with variable swelling and normal overlying skin
Grade III:	Malar mound with fluctuating edema and a skin fold (festoon)

Grade 0 implies that there is no physical protuberance of a malar mound. Therefore, fat infiltration in the anterior and lateral cheek is simplified, as volume can be placed uniformly to achieve the desired enhancement in this region.

A Grade I malar mound can be addressed with fat infiltration, with less fat placed under the malar mound so as not to accentuate this feature. By placing fat principally around the malar mound, the visibility of the mound can be reduced by contouring and blending the malar mound with the surrounding malar depression. (It is important for the patient to understand that complete correction is extremely difficult, and improvement rather than correction is the appropriate expectation.) At times, breaking up the mound using the infiltration cannula without suction can help to flatten it. We have found that the use of suction will often worsen rather than improve the condition. Problems encountered with Grade I mounds include making them appear more prominent by filling underneath and converting a Grade I to a Grade II mound. If a Grade II malar mound develops from a Grade I mound, this unfortunate outcome will often take months to resolve and may require steroid injections as detailed in Chapter 4 to ameliorate the condition.

The hallmark of a Grade II malar mound is fluctuating edema with normal overlying skin. These patients are extremely difficult to treat because fat transfer, undermining, or microliposuction will often cause either permanent or longstanding worsening of the swelling and may convert a Grade II mound into a Grade III mound.

A Grade III malar mound is characterized by a skin fold or festoon along the malar septum that is often associated with recurrent swelling and abnormal skin texture. While the fold is not always present, it can usually be demonstrated by massaging the lower-eyelid skin toward the malar septum. Patients are always acutely aware of its presence. The excess skin should be conservatively excised before fat is infiltrated. While patients are concerned that they will be left with a visible scar, our experience is that the incision heals beautifully with excellent patient satisfaction. We have treated Grade III mounds with fat transfer alone and occasionally have obtained significant improvement without the need for skin excision, but these patients were always prepared for the possibility of staged skin excision if necessary.

is along the entire lateral extent of the brow, which constitutes a relatively long distance, greater amounts of between 0.1 to 0.2 cc of fat can be placed per pass. The placement of fat is performed across the plane of least resistance, which corresponds to the deep to medium soft-tissue planes. The fat is distributed from the inferior edge of the superior orbital rim and is feathered upward toward the superior aspect of the hair-bearing portion of the brow. A visible step-off along the superior or inferior borders of the infiltrated fat should not cause alarm and will settle over time. Some gentle molding and sculpting can be undertaken to redistribute the fat more evenly if any gross asymmetry is evident. This technique for sculpting is not as beneficial in many other facial areas. Unlike the inferior orbital rim where fat is placed by working perpendicular to the bony rim, fat is infiltrated along the superior orbital rim in a parallel orientation. This technique of placement along the superior orbital rim parallel to the rim is possible because this region is more forgiving than the inferior orbital rim.

LATERAL CANTHUS

After the superior orbital rim has been properly restored, the relatively small depression along the lateral canthus is addressed from the same entry point B (**Fig. 3-47**). As

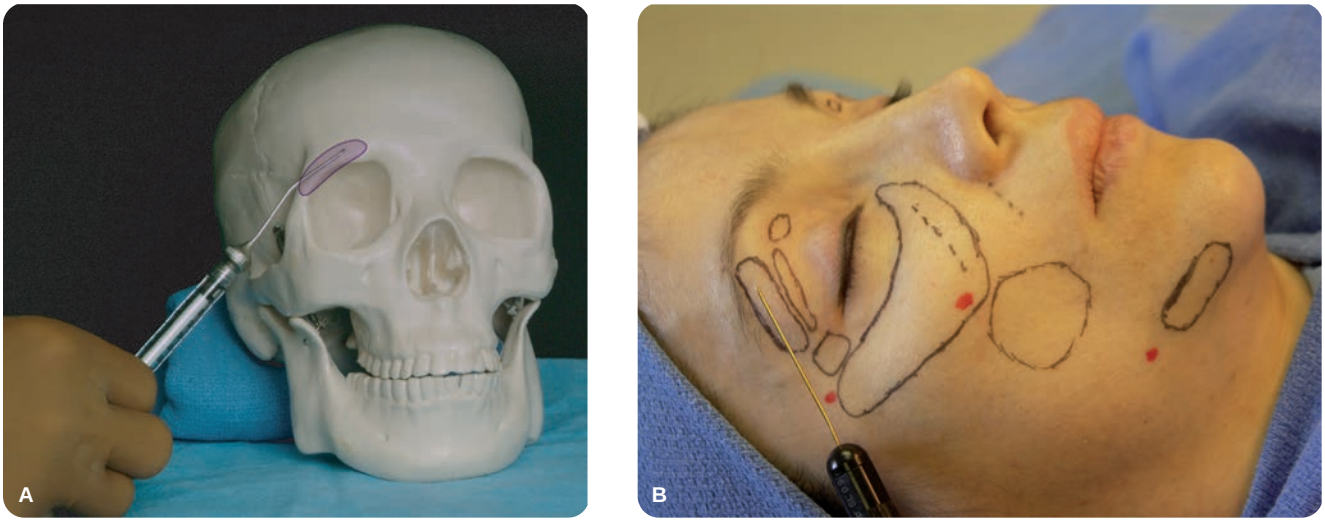


Figure 3-46A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the superior orbital rim with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat along the superior orbital rim. Either a straight or curved cannula can be used for this injection.

mentioned before, the lateral canthus is replete with tough, fibrous adhesions. In addition, the lateral canthus tends to be quite vascular, and hematoma formation is possible, which can in turn obscure the site and reduce fat-cell viability. If any incipient swelling arises, the surgeon should hold immediate pressure for several minutes until no further engorgement is evident. Use of a 0.9-mm blunt cannula reduces the incidence of ecchymosis and hematoma collection. The lateral canthal region is quite unforgiving like the inferior orbital rim, and it is important to maintain a conservative approach toward enhancement. Only three to five passes per 0.1 cc of fat should be administered for a total of 0.5 cc, and placement should be targeted only for the deep, supraperiosteal plane along the lateral extent of the inferior orbital rim. As the direction of the cannula is toward the eye, the nondominant hand should be used as a guide to prevent injury to the globe and to maintain accurate placement (just as with the remainder of the inferior orbital rim).

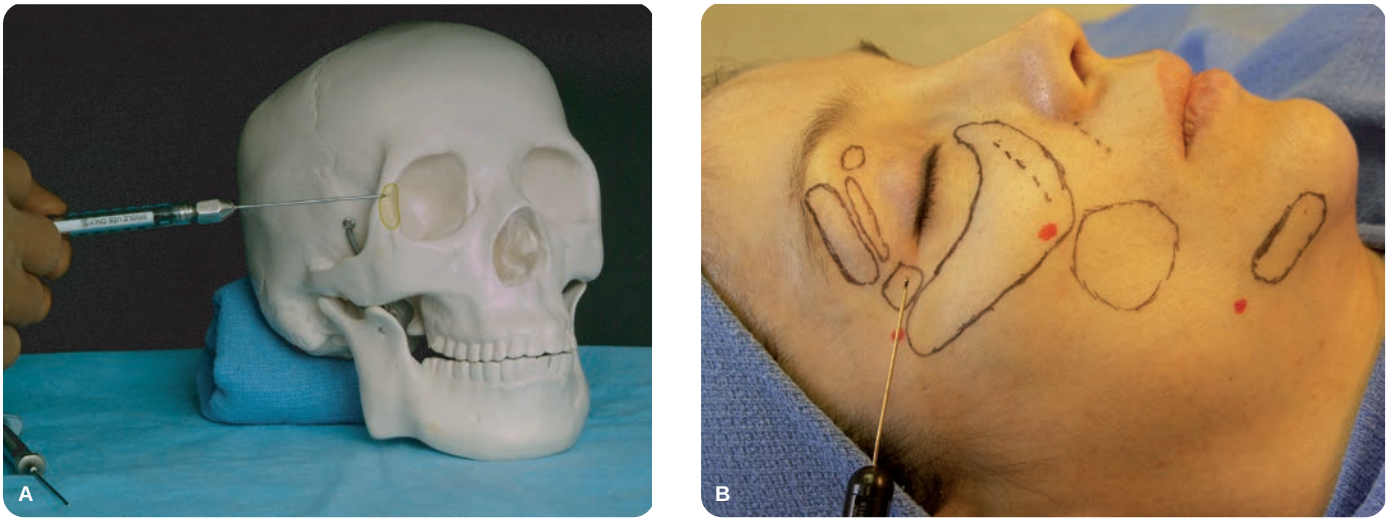


Figure 3-47A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the lateral canthus/lateral inferior orbital rim with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the lateral canthus/lateral inferior orbital rim.

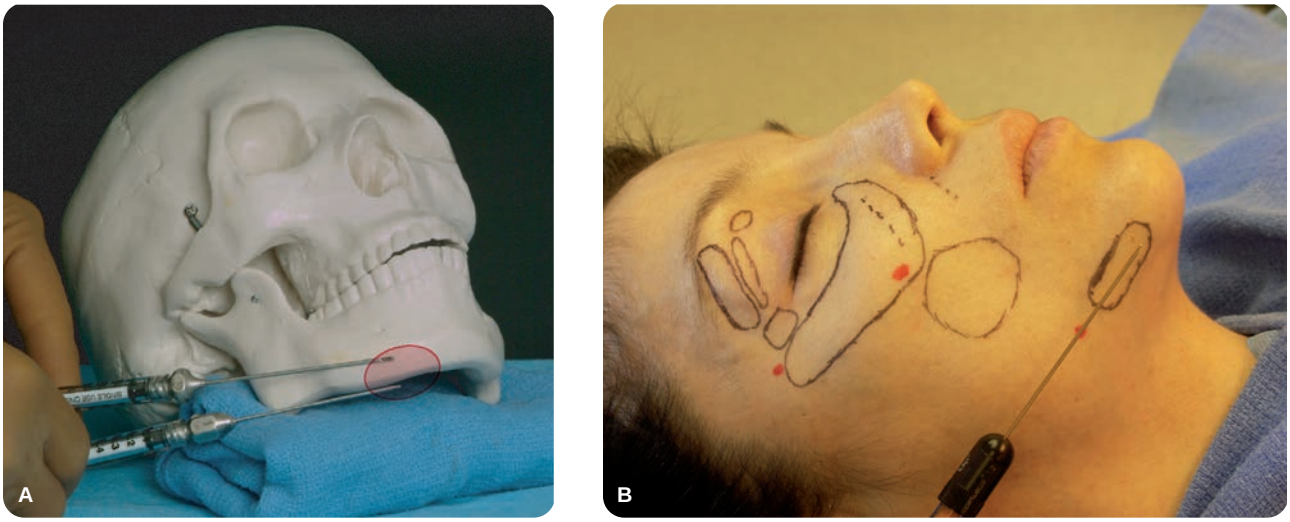


Figure 3-48A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the prejowl sulcus with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the prejowl sulcus.

PREJOWL SULCUS

The prejowl sulcus is approached from entry site C along the midportion of the mandible (**Fig. 3-48**). The prejowl depression should be viewed as a three-dimensional cylindrical hollow that runs along the anterior face of the mandibular body, the inferior aspect of the mandibular body, and the transition zone between these two areas. The prejowl sulcus is a forgiving area for enhancement. A total of 3 cc of fat are infiltrated with 0.1 cc per pass: one cc should be injected into each of the three described zones, illustrated in Figure 3-36. Like the superior orbital rim, a demarcated border may arise along the superior and inferior limits of injection that may elicit alarm for the beginning surgeon. This contour deformity will eventually soften over time. Also like the superior orbital rim, the surgeon can elect gently to soften this abrupt transition by careful molding. Although accurate fat placement is the cardinal principle to which to adhere in facial fat transfer, the superior orbital rim and mandibular border appear to be two areas that can benefit from some degree of digital manipulation if needed. Like the lateral canthus and the anterior cheek, the prejowl sulcus may have some tenacious adhesions that must be overcome during cannula passage. The cannula passes progressively from the immediate supraperiosteal plane all the way to the superficial subcutaneous tissue.

Refinements

After both sides of the face have undergone volumetric foundation with fat grafting, individual tailoring with a variable amount of additional fat can be undertaken as a refinement. The more volume of fat that a patient receives, the more significant becomes the recovery period, marked by increased ecchymosis, edema, and time toward resolution of these conditions. The foundation should be viewed as sufficient in most cases for the beginning surgeon, especially a surgeon who is embarking on his or her surgical career and whose reputation may be partly staked on a rapid recovery. The added morbidity associated with additional fat placement in this refinement phase may not be worthwhile for the novice surgeon who is unaccustomed to the amount of postoperative edema associated with significant fat transfer. Nevertheless, based on patient anatomy and proper preoperative counseling, supplemental fat infiltration may be an advisable course of action.

TEAR TROUGH AND INFERIOR ORBITAL RIM

As mentioned in the Volumetric Foundation section, the bony nasojugal groove and the skin depression, referred to here as the tear trough, should not be confused. During volumetric foundation, the bony nasojugal groove is filled in a deep, supraperiosteal

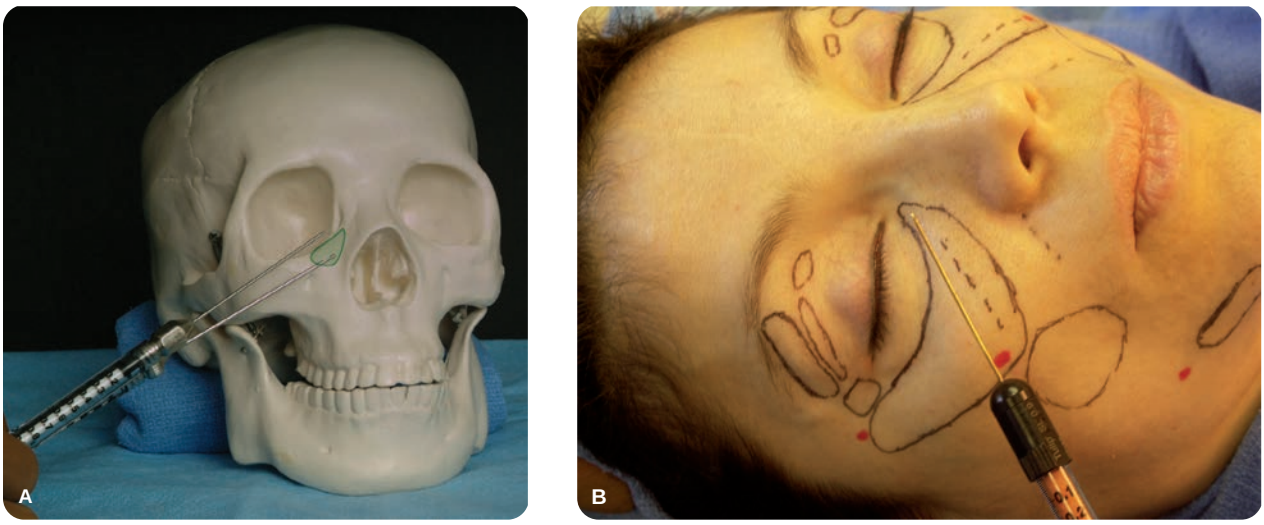


Figure 3-49A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the tear trough/medial inferior orbital rim with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the tear trough/medial inferior orbital rim as a refinement.

plane, using palpation of the bony depression as the only guide. To fill the depressed, visible tear trough, the plane is still deep below the orbicularis-oculi muscle but is more superficial than the supraperiosteal plane for the nasojugal groove. Also, recall that the relationship of the overlying tear trough and the underlying nasojugal groove is variable. For the tear trough, the surgeon follows the visible landmark of the skin depression, which is marked preoperatively in the sitting position. Clearly, if the patient does not exhibit any skin concavity in this area, no fat need be delivered to the tear trough (since it does not exist). Only 0.5 to 1.0 cc of fat should be placed, with three to five passes per one tenth of a cc, using site A as the port of entry (**Fig. 3-49**).

Also using site A, the inferior orbital rim can be further augmented when appropriate. As previously mentioned, adding fat in an intermediate level to the inferior orbital rim is very important in the moderate to markedly hollow lower eyelid. As soon as the surgeon has achieved excellent control of placement and volume of fat in this sensitive area, the additional fat advocated in this refinement phase should be incorporated into one's strategy. Unfortunately, it will take experience with undercorrecting patients before the surgeon can determine the appropriate recipient for this additional volume. It is necessary to emphasize again that undercorrecting the inferior orbital rim is far preferable to overcorrecting. Placing a total of more than 4 cc of fat into the inferior orbital rim and tear trough complex should only be performed by surgeons with extensive experience.

LATERAL CHEEK

Additional fat can be layered into the lateral cheek based on individual anatomic requirements. Anywhere from 1 to 3 cc total of extra fat can be deposited during the refinement phase. The cannula is inserted into entry site A and fanned across the lateral cheek (that lies immediately over the zygoma) in the intermediate soft-tissue level (Fig. 3-43). The path of least resistance for the cannula corresponds to this intermediate plane. As in the volumetric foundation phase, the nondominant hand can be used to guide fat infiltration using the palpated bony zygoma as the central landmark over which the fat is infiltrated into the lateral cheek.

ANTERIOR CHEEK

Some individuals exhibit a markedly depressed anterior cheek that corresponds principally with the malar septum and with the confluent region immediately inferomedial to the septum. Even though the malar septum was partially avulsed from cannula passage

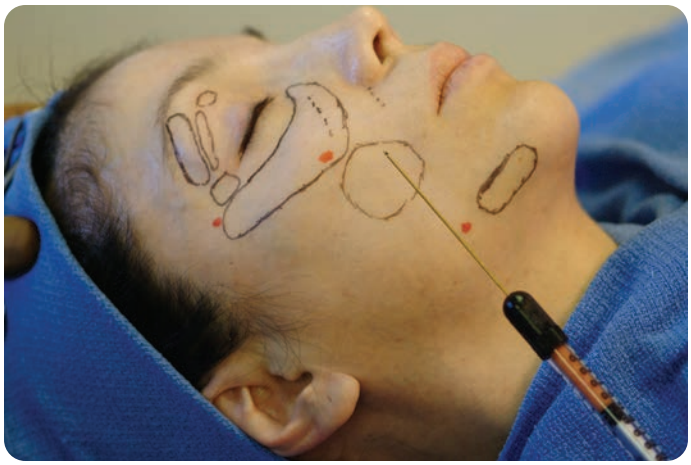


Figure 3-50: Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the buccal region as a refinement approaching from an inferior direction via entry point C.

during volumetric foundation, residual presence of the septum can still make cannula passage somewhat arduous while other times, not so. Instead of entering from site B, the surgeon should at this time access the anterior cheek from entry site A that lies inferomedial to the malar septum (Fig. 3-45). Approximately two thirds of the additional fat should be deposited along the depression at the malar septum and inferomedial to the malar septum while the remaining third is feathered superolateral to the septum. A total of 1 to 2 cc of fat can be infiltrated with 0.1 cc per pass into this area during the refinement phase. Most of the fat can be delivered into the intermediate soft-tissue level.

BUCCAL

A significant buccal hollow often requires additional outlay of fat into this area to match the newly enhanced cheek superiorly (**Figs. 3-44, 3-50**). Based on the perceived severity of the buccal depression, anywhere from 1 to 5 cc of additional fat can be infiltrated from entry site A or site C with a full 0.1 cc per pass delivered. The fat should be deposited along the deep subcutaneous plane as done during the volumetric foundation phase. Buccal enhancement tends to be quite forgiving with minimal contour deformity even with more superficial cannula passage.

PRECANINE FOSSA/NASOLABIAL FOLD

As discussed elsewhere in the text, fat transfer is not intended to efface the nasolabial fold. Most patients desirous of this end are better served with filler materials that achieve superior effacement with limited morbidity. Nevertheless, fat transfer to the precanine fossa and nasolabial fold is mandatory to soften the transition between the augmented cheek/buccal complex and the nonaugmented upper lip area (the region that lies medial to the nasolabial fold).

The recessed triangle (the precanine fossa) that lies medial to the superior aspect of the nasolabial fold and lateral to the nasal ala can have its depth exacerbated by anterior cheek fat augmentation. Therefore, the precanine fossa should be targeted aggressively. Furthermore, enhancement in this area is conducted in a different plane from the nasolabial fold in general. The precanine fossa and nasolabial fold are approached from entry site A (**Fig. 3-51**). The precanine fossa is filled with 1 to 2 cc of fat placed deeply in the supraperiosteal plane with 0.1 cc per pass. Additionally, 1 to 2 cc are fanned across the entire nasolabial fold in a superficial plane with three to five passes per 0.1 cc in this region. The nasolabial fold is augmented by passing the cannula from entry site A back and forth across the nasolabial fold in a perpendicular orientation. Moderate resistance, which is easily overcome, is encountered as the cannula breaches the nasolabial fold.

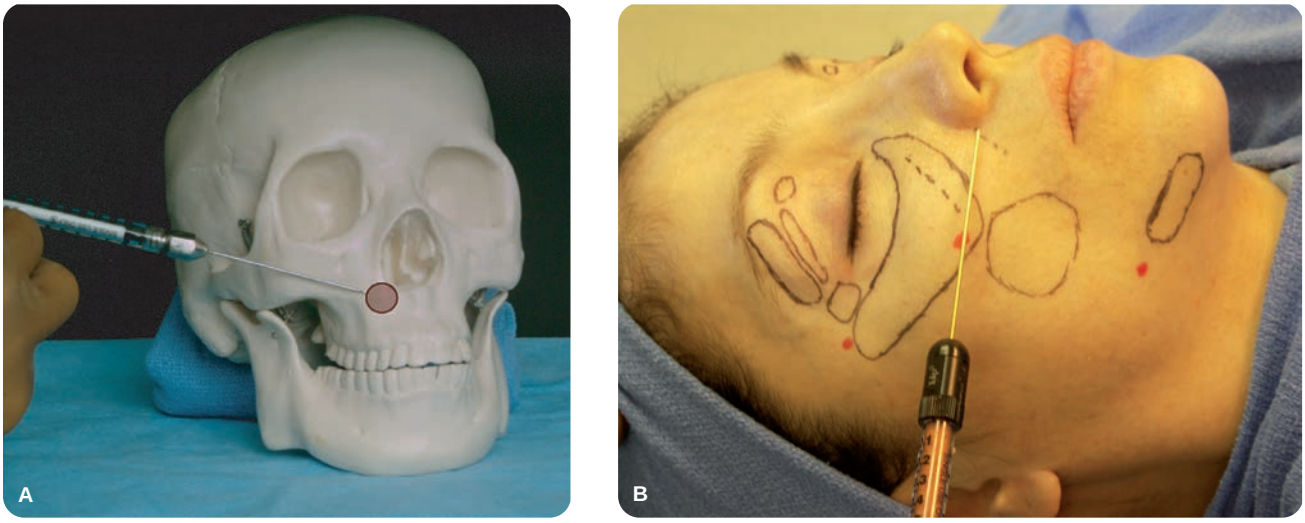


Figure 3-51A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the precanine fossa with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the precanine fossa.

LATERAL JAWLINE

The lateral jawline is only addressed if a concurrent lower facelift is not planned. Any facelift, whether SMAS or deep plane, will necessitate undermining the lateral mandibular skin and thereby obviate the possibility for fat transfer in this area. If no lower facelift is planned, then fat can be administered to the lateral mandible. From entry site C, fat is placed along the inferior border of the anterior mandible in a deep subcutaneous plane using a 0.1 cc per pass for a total of 4 to 10 cc of fat (**Fig. 3-52**). Of note, the same radial expansion of the prejowl sulcus should be administered to the lateral mandible, that is, the inferior border of the anterior face of the mandibular body, the anterior border of the inferior mandibular body, and the transition zone between these two areas. Care should also be taken to remain posterior to the jowl (if one should exist) so that additional fat in this area does not exacerbate the prominence

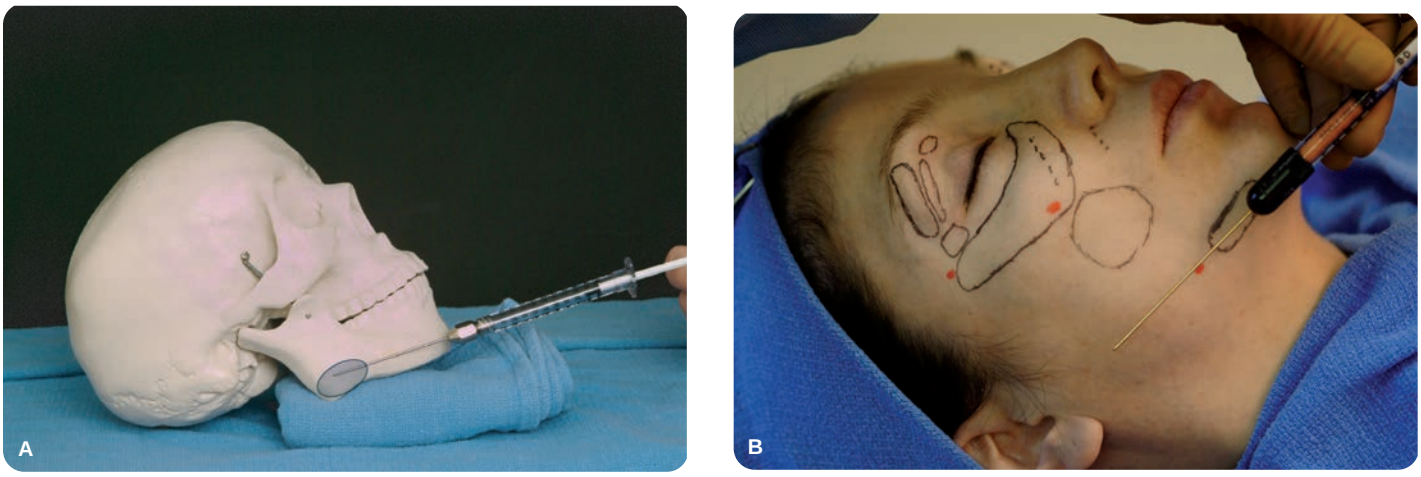


Figure 3-52A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the lateral mandible with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the lateral mandible.

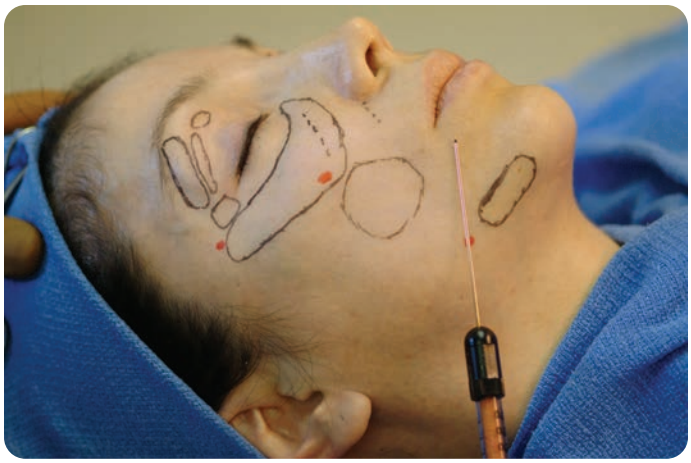


Figure 3-53: Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the labiomandibular fold.

of the jowl. Like the prejowl sulcus, the lateral mandible is a forgiving area and can benefit at times from some molding of the fat if needed.

LABIOMANDIBULAR FOLD (MARIONETTE LINE)

The labiomandibular fold, or marionette line, is approached from entry site D (**Fig. 3-53**). A total of 1 to 2 cc of fat are delivered with 0.1 cc per pass placed into the superficial, almost subdermal, plane. This area is forgiving and is unlikely to suffer a contour irregularity from superficial infiltration. As the labiomandibular fold is addressed, the fat is deposited only medial to the fold to prevent exaggeration of the fold with lateral placement. As with the nasolabial fold, a realistic objective is not to eliminate the labiomandibular fold with fat but to soften the depression medial to it. Effacement of the labiomandibular fold may be better achieved with other types of soft-tissue fillers.

LABIOMENTAL SULCUS

Finally, the labiomental sulcus can be softened with fat infiltration through entry site D, passing deep (below the mentalis muscle) to superficial (subdermal) with 0.1 cc per pass delivered for a total of 1 to 2 cc per side (**Fig. 3-54**). As this area is forgiving, placement of fat near the skin should not result in contour deformity if performed in a relatively uniform fashion.

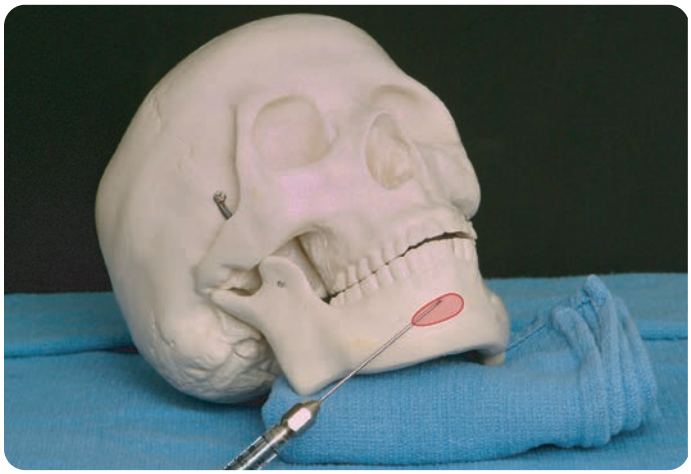


Figure 3-54: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the labiomental sulcus (on the right side) with the cannula orientation for fat infiltration in this area.

Advanced Techniques

Advanced techniques are recommended for more experienced fat-transfer surgeons. These techniques address areas that can potentially have great benefit from volume augmentation but carry a smaller margin of error. The primary issues that may arise in these delicate areas are visible contour deformity and/or prolonged edema. In early experience with any technique, obtaining consistent results with minimal problems is of utmost importance. As such, it is stressed that the advanced techniques be implemented once the surgeon has gained an appreciation of the efficacy and pitfalls of the volumetric foundation and refinements.

Individuals with very hollow upper eyelids are not easily addressed with fat transfer and will suffer a considerable period of profound edema if aggressive management of this area is undertaken. As mentioned in Chapter 2, it is important to ensure that the patient desires correction of the hollowed upper eyelid and understands that it may be several months before he or she is happy with the result.

From a technical standpoint, correction of a hollow upper eyelid is not approached by trying to put fat at the greatest depth of the upper-eyelid sulcus but by building fullness from the inferior aspect of the superior orbital rim down into the upper eyelid. By creating a fullness superior to the deep sulcus, the hollow appearance is minimized, and the depth of the sulcus is camouflaged. It is difficult if not impossible to try and fill out the deepest part of the sulcus. Intraoperatively, using the straight cannula or the curved #7 Amar cannula via entry site B, the fat is laid just under the ledge of the superior orbital rim. Passes are made in the plane deep to the orbicularis muscle (following the path of least resistance), working from a superior to inferior direction. The fat is infiltrated with three to five passes per 0.1 cc. The total volume used ranges from 1 to 2 cc, depending on the severity of hollowing.

UPPER EYELID (IATROGENIC DEFECT)

The isolated depression of the central upper-eyelid region is oftentimes the by-product of prior upper blepharoplasty in which the middle fat pad was largely removed. Infiltrating three to five passes per 0.1 cc, volume restoration with a total of 0.3 to 1 cc of fat can be undertaken in the same plane described earlier for the inferior border of the superior orbital rim (intermediate plane corresponding to the path of least resistance) from entry site B using a curved #7 Amar cannula (**Fig. 3-55**). Prolonged and profound edema after fat transfer to the central upper-eyelid region can render a patient looking quite abnormal for an unacceptably long period of time.

Figure 3-55: Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat along the inferior margin of the superior orbital rim (an advanced technique). Placement of fat into the central upper eyelid hollow is also done via this same approach.

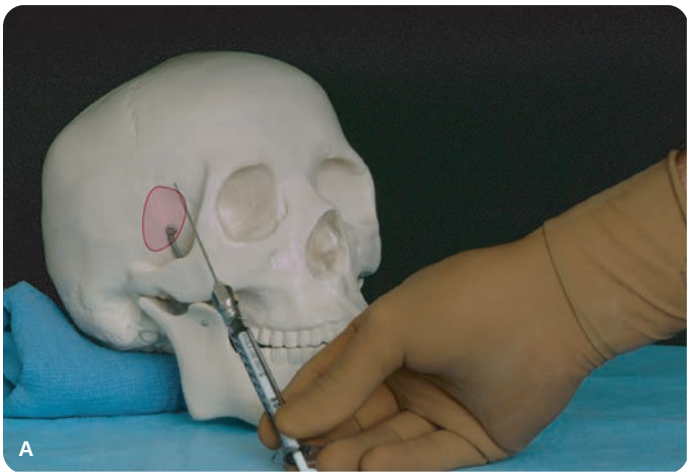


Figure 3-56A: Skull model showing the use of bony landmarks to guide placement of fat infiltration. The circled area shows the temporal fossa with the cannula orientation for fat infiltration in this area. **B:** Intraoperative photograph showing the orientation and direction of the infiltration cannula for placement of fat in the temple.

TEMPLE

The temple is approached from entry site B with the standard straight cannula described for all of the mentioned applications except for the curved cannula recommended for the superior orbital rim and central upper eyelid (**Fig. 3-56**). A total of 1 to 2 cc of fat are delivered in a fanning motion in the subdermal plane, using only three to five passes per 0.1 cc. It is advised to augment the temple in the most uniform manner possible to avoid contour problems. Some diffuse elevation and even a demarcated border are acceptable at the end of infiltration. However, noticeable contour irregularities can be gently softened with digital massage until improvement is witnessed. Care should be taken to avoid laceration of the abundant and prominent temporal vasculature by slow and deliberate passage of the cannula. Any bleeding that is seen should be countered with immediate and sustained manual pressure. At this point, the contralateral side can be enhanced until a desirable aesthetic endpoint is achieved and the affected side completed with the same volume as administered on the contralateral side.

Complementary Fat Grafting: Combining Fat Grafting with Traditional Facial Rejuvenation Procedures

As the book title purports, the mission of this book is twofold: present a clear, rational, and systematic approach to fat grafting and describe how to integrate fat grafting as a complement to traditional lifting procedures. This section will concisely elucidate the latter. Rather than fully integrate the sections on lifting procedures and fat grafting, traditional rejuvenative procedures are discussed here separately for sake of clarity. The aim of this section is not to instruct a surgeon on how to perform a facelift, among other procedures, as many books already fulfill this demand. Further, this book assumes that the surgeon has a familiarity with facelifting and is not attempting to recommend that a prospective surgeon adapt his or her style to a specific technique, as doing so is simply unnecessary. However, some guidelines as to what techniques are more suitable to integration with fat grafting will be espoused as well as the sequence of performing lifting procedures and fat grafting. Finally, as mentioned before, if a

surgeon should elect to perform only fat grafting without a concurrent lifting procedure some of the time or always, he or she can concentrate on the entire chapter up to this point and disregard this section.

As a brief aside, the rationale for combining a lifting procedure with fat grafting is several-fold. We believe that the aging face cannot be explained through the singular philosophy of volume contraction and therefore do not feel fat grafting is the only solution. Gravitational descent is thought to be another mechanism by which the face undergoes aging. Therefore, evaluation of a patient for volume contraction and/or gravitational soft-tissue descent will dictate which method(s) are applicable for that patient. Although fat enhancement alone has been shown to overcome and mask the signs of facial descent, the volume required to do so can lead to significant morbidity (i.e., ecchymosis, edema, and time to healing). Furthermore, there are patients whose expectation will never be met by trying to achieve the results of a facelift on the jawline with fat transfer alone. Accordingly, judicious selection of a lifting procedure can provide a targeted benefit for a patient without raising the bar of morbidity.

Currently, we perform far fewer full-face fat transfers and have found the merit in combining selective fat transfer with facelifting procedures. Although we only occasionally undertake full-face fat transfer in isolation, 90% of our facelifts receive some degree of fat transfer. The most common scenario for an individual who undergoes full-face fat transfer alone is a younger patient in his or her thirties without much facial descent who presents for correction of facial hollowing. When performing full-face fat transfer as a stand-alone procedure, typical volumes range from 50 to 100 cc of fat, depending on the patient; whereas with a facelift, selective fat transfer usually runs between 20 to 50 cc.

Timing

The chronologic sequence of combining a traditional rejuvenative procedure and fat grafting is important. Body harvesting is completed first, followed by blepharoplasty, then fat grafting, and finally browlifting and facelifting (Table 3-7). The recommended order of procedures is as follows:

1. Body harvesting is completed first for several reasons. It is easier to complete body work first and then concentrate on the face. If the fat is harvested first, then the surgeon can concentrate on the face alone thereafter. Also, body positioning for fat harvesting may require patient cooperation. It is easier to have the patient under lighter anesthesia initially for body repositioning and then deeper anesthesia for the remainder of the case. Finally, harvesting the fat first permits the technician to process the fat as the surgeon continues to work.

TABLE 3-7 Chronologic Order of Fat Transfer and Other Facial Surgeries

TIMING
1. Donor-site anesthesia
2. Recipient-site anesthesia
3. Upper and lower blepharoplasty anesthesia
4. Donor-site harvesting
5. Mentoplasty
6. Upper blepharoplasty
7. Lower transconjunctival blepharoplasty
8. Fat transfer
9. Malar implant
10. Browlift
11. Face- and necklift

2. Mentoplasty with alloplastic implant is undertaken if planned.
3. Blepharoplasty is completed after fat harvesting. The upper blepharoplasty is approached first, as it requires little to no assistance. During this procedure, the technician processes the bulk, if not all, of the fat. The assistant can then help with the lower blepharoplasty.
4. Fat is infiltrated next, as little time should elapse between the harvesting and infiltration in order to optimize fat-cell viability.
5. If concurrent malar implants are planned (for the patient who has limited body fat for harvesting), then they should be inserted at this time.
6. Brow and facelifts are completed last so that a circumferential dressing can be applied immediately afterwards to minimize risk of hematoma formation.

Technique

The key to safely and effectively combining incisional-based surgery with fat grafting is selection of technique that does not disturb the transplanted fat: Any tissue undermining in the area of transplanted fat can predispose toward fat migration and compromised viability. Accordingly, browlifting of any kind (coronal, trichophytic, or endoscopic) is untenable as a concurrent procedure with fat grafting of the superior orbital rim. If a browlift is entertained (see Chapters 1 and 2 for aesthetic criteria to determine when to perform a browlift), then fat should not be infiltrated into the superior orbital rim. The following five procedures will be discussed in broad terms as they apply to integration with fat grafting:

1. Upper Blepharoplasty

As traditional upper blepharoplasty typically involves removal of skin and fat, the surgeon must retrain his or her thinking to appreciate the beauty of a full upper eyelid rather than believe that a skeletonized eyelid looks attractive. Accordingly, only excessive skin is removed during an upper blepharoplasty, which is then followed by fat enhancement of the brow. Occasionally, the medial fat pad can be protuberant enough to require selective reduction. By contrast, the middle fat pad rarely requires reduction except in the overly full upper eyelid with no obvious sulcus that could benefit from some reduction of the middle fat pad as well but in a conservative fashion.

2. Lower Blepharoplasty

A skin-muscle flap may not be appropriate for the lower eyelid when fat grafting of the inferior orbital rim will be carried out because violated tissue planes may disturb the stability of the transplanted fat. A conservative transconjunctival blepharoplasty is the ideal technique to be combined with fat grafting. Generally speaking, only the medial and middle fat pads need to be addressed in most cases; and, again, only a very conservative amount of fat should be removed. The lateral fat pad need only be addressed infrequently. Typically, a patient exhibits a discernible hollow in the lateral orbital rim, which would be exacerbated by fat removal in this area. However, a patient that demonstrates a noticeable bulge in the lateral eyelid should have the lateral compartment decompressed, as fat grafting alone in this area fails to conceal this bulge in most cases (Chapter 2, Fig. 2-9). The reader should note that even with a transconjunctival lower blepharoplasty, some transplanted fat could escape through the blepharoplasty incision. The amount typically is small and should not raise concern.

3. Malar Implant

As mentioned, a malar implant alone will usually worsen the infraorbital hollow, as the implant cannot extend superiorly past the infraorbital nerve. However, in patients without significant reserve of fat for harvesting—such as thin, young men and women and older thin men, as older women tend to accrue body fat despite a thin face—a malar

implant may be an important adjunct to establish a volumetric foundation upon which additional fat is placed. A malar implant is positioned after fat transfer because implantation of the alloplast first can distort tissue planes from edema and make judicious placement of fat more difficult. Because the malar implant is positioned in a subperiosteal plane away from the orbital rim, the transplanted fat will not be affected by the surgical dissection and placement of the implant. As the malar implant is intended to reserve the limited fat harvest for areas other than the anterior cheek, fat should be targeted principally along the inferior orbital rim (superiorly) and the buccal/submalar region (inferiorly).

4. Browlifting

Although any kind of browlift can be performed with fat infiltration, we prefer endoscopic browlifting for the minimal tissue trauma and efficacy. However, the surgeon can select the appropriate browlift technique based on personal preference and/or clinical judgment. As mentioned, the only real caveat is avoidance of fat infiltration in the area of the superior orbital rim and temple where the tissue planes have been disturbed.

5. Facelift (Cervicofacial Rhytidectomy)

Either a SMAS or deep-plane facelift are acceptable techniques with fat grafting. The main caveat, as emphasized before, is avoidance of skin undermining in the region of fat grafting. In particular, undermining of the buccal region during a deep-plane facelift precludes the use of fat in this territory. Also as mentioned before, the lateral mandible is an area that cannot be addressed with fat enhancement, as every style of facelift requires some degree of undermining in this area. However, augmentation of the prejowl sulcus is routinely performed with every facelift.

Immediate Postoperative Care

After fat transfer alone, no circumferential dressing need be applied. The patient is simply observed in the recovery unit until discharge criteria are met. Circumferential dressings can be applied to face and browlifts at the end of the procedure, if routinely done by the surgeon. We do not use dressings after these procedures and have found fibrin glue adequate for closing potential dead spaces. Icing for the first 48 to 72 hours and head elevation can facilitate more rapid convalescence and is routinely advised to the patient. Other details that pertain to the management of the patient after the first day and that concern addressing potential complications are discussed thoroughly in the following chapter.

TECHNICAL PEARLS & TIPS

1. *Selection of donor site prior to the day of surgery may be beneficial in select patients. For example, gaunt patients with sparse donor fat, patients who have undergone extensive body lipocontouring in the past, or patients who have had prior abdominal surgery when the lower abdomen is an area favored for harvesting.*
2. *For patients who have undergone extensive body liposuctioning, an area often overlooked that can provide an excellent donor source for harvesting is the waistroll, the roll of adipose that extends superomedially to inferolaterally along the lower lateral back.*
3. *Asking the patient where he or she thinks that he or she has the most fat or where fat is the most difficult to lose is very helpful to guide the surgeon's search for the ideal donor site.*
4. *Infiltration of local anesthesia into the donor site is carried out into the more superficial and deeper portions of the fat pad, with the central portion left relatively untouched for fat harvesting.*
5. *A different local anesthetic mixture is used for patients under oral sedation versus deeper sedation (Table 3-4).*
6. *During fat harvesting, avoid tenting or tethering the skin with the cannula, which implies too superficial a passage.*
7. *During fat harvesting, the cannula should be almost entirely withdrawn to the skin entry site after three to four passes to redirect the cannula into another area. Simply turning the angle of the cannula without withdrawal does not actually move the cannula tip to a new harvesting site, which can lead to overharvesting in one area.*
8. *When calculating the total fat that should be harvested, the surgeon should recall that typically 50% of the filled syringe would be comprised of nonviable contents (blood, lidocaine, albumin, and lysed fat cells). A greater amount should be harvested in cases in which more blood is encountered in the syringe, which can raise the nonviable portion of the collected syringe upwards of 70% to 80%.*
9. *If a patient needs fat harvested from an area that requires repositioning (Table 3-3), consider a lighter sedation to permit patient cooperation with repositioning.*
10. *During fat processing, remember to always remove the supranatant first before the infranatant.*
11. *If the infiltration cannula becomes clogged, the cannula should be completely withdrawn and then cleared before reinsertion. Doing so will minimize the chance of inadvertently administrating an oversized bolus of fat into a particular area.*
12. *Bony landmarks are a key guide to placement of fat, for example, the inferior orbital rim, the zygoma, and the mandible. The nondominant hand provides tactile feedback to ensure that the cannula is passed in the desired area for enhancement.*
13. *The surgeon should complete the standard volumetric foundation first before deciding whether the additional fat refinement would be justified. Additional placement of fat during the refinement phase can raise the degree of morbidity and should be undertaken with surgical experience and with proper patient preoperative counseling.*
14. *Advanced techniques should be undertaken only in experienced hands.*
15. *Only skin is removed in an upper blepharoplasty, with occasional removal of a protuberant medial fat pad as needed.*
16. *A conservative transconjunctival lower blepharoplasty should be performed, removing an appropriate amount of medial and middle fat pad. The lateral fat pad should be addressed if there is a sizable protuberance of fat in that area.*
17. *Consider using a malar implant in combination with fat transfer in thin patients who lack sufficient fat reserves for harvesting.*
18. *The lateral mandible cannot be addressed if a concurrent facelift is performed. Care should be taken to avoid undermining skin in areas of transplanted fat.*

Chapter 4

The Postoperative Period and Management of Complications

Introduction

Postoperative care for the patient undergoing autologous fat transfer is relatively straightforward. However, managing patient expectations postoperatively may be more involved. In contrast to the postoperative facelift patient who perceives that the contour of the jawline is now relatively straight and the neck similarly elevated, the patient after a fat transfer must continue to observe ongoing evolution of change even up to a year after the procedure. What may be interpreted as dissipation of fat over time must be reinterpreted clearly for the patient as the slow ebbing of edema.

Management of postoperative complications can also be quite different from what the surgeon who typically only performs lifting procedures is accustomed to encounter and treat. A systematic identification of the problem and related treatment must be undertaken to ensure adequate correction and resolution. Specific problems such as lumps, bulges, malar edema, overcorrection, and undercorrection will be reviewed, each having a specific approach for treatment, as opposed to more universal, postsurgical problems such as infection, hematoma, and nerve injury.

The Postoperative Period

Postoperative Care

Unlike traditional lifting procedures that may enlist the use of drains and compressive dressings, fat transfer does not require any such supportive devices. As no true incision is made, there are no sutures to care for or to remove from the body or face. Accordingly, no specific skin cleansing regimen or topical ointment is required. Patients are discharged with instructions to ice their recipient sites liberally for the first 48 to 72 hours postoperatively and to maintain a semi-inclined posture at night for the first week to minimize edema. Beyond the initial postoperative period, patients may note fluctuation in their swelling that may be worse when they wake up or after increased activity. Icing of the swollen area can help to counteract the edema, accelerating the return to baseline. It is not unusual for patients to find that icing for up to 2 weeks will ameliorate the edema and alleviate a common flushed sensation. Besides these simple instructions, the patient need not perform much else by way of postoperative care (**Fig. 4-1**).

Postoperative fat transfer instructions

1. You may have bruising, swelling, and mild discomfort in both the face and the part of the body from where the fat was harvested. This is normal and will gradually resolve over a period of a few days to weeks. You may also notice some pressure and tightness in your face after surgery, and this is normal and should resolve over a period of the first 1 to 2 weeks.
2. You should use ice packs liberally in the areas of the face where fat was transplanted for the first three days after surgery in order to minimize swelling and to speed up the resolution of swelling. If the body area where fat was harvested experiences any discomfort, some icing over the harvested area can also be undertaken for the first couple of days. You can continue to use ice over the swollen areas after surgery as needed for comfort and swelling.
3. For the first two nights, it is preferred that you sleep in a semi-upright recliner, like a La-Z-Boy, if you have one. If not, sleeping with an additional pillow under your head will help reduce the swelling more quickly. It is preferable if you continue to sleep with your head elevated in this fashion for the entire first week after surgery if it does not interfere with the restfulness of your sleep.
4. You will notice that you will look more swollen either 2 or 3 days after surgery, and this appearance should be expected and should not raise any alarm or concern. The swelling should continue to decrease after the first several days.
5. You may notice that one side of the face is more swollen or lumpy than the other side. This again is normal. Swelling resolves unevenly and you may notice these imperfections even for several weeks after surgery.
6. Dietary salt should be limited if possible in order to reduce facial swelling.
7. During your rest and recovery at home, you should avoid the temptation to do a lot of household busywork like cleaning and gardening that involves bending over and straining, that can lead to pronounced and prolonged swelling.
8. Vigorous exercise should be avoided for one week. If you are accustomed to routine and frequent workouts and would like to resume your fitness regimen early, then you may start lighter exercise after the first few days of rest. If you notice significant facial swelling after your workout, you should reduce the amount of exercise you are engaged in. Light exercise with half to one third of your normal weight and with only slow muscle contractions is allowed.
9. There are no restrictions in activity for the body part from where the fat was harvested. However, care should be taken to avoid straining and raising stomach pressure that can lead to an increase in facial swelling.
10. There are no sutures that need to be removed if all you had was a fat transfer. (If you had a facelift or other procedure performed, you may have incisions and sutures that require care.)
11. You can apply makeup to the face the day after surgery if needed.
12. You may notice ongoing changes for up to a year after surgery. This does not mean that your fat is going away, but typically a little swelling can persist even up to 6 months after surgery.

Figure 4-1: Postoperative instruction sheet given to patients to detail what they should know and expect regarding their convalescence.

Restrictive activity can help to expedite resolution of edema. More specifically, patients are instructed not to engage in household busywork like gardening and cleaning. These activities require frequent bending over and straining that can lead to additional edema and delay recovery. Ideally, vigorous exercise should be modified to facilitate dissipation of edema. Patients who normally pursue a serious workout regimen will experience some degree of psychological deflation arising from a protracted abstinence from physical fitness. Accordingly, early return to light exercise may help to invigorate the patient's spirits and thereby aid in recovery. Although no activity restriction needs to be made to the donor site from where the fat was harvested, raising intra-abdominal pressure can lead to increased and prolonged facial edema and should be avoided. Light, isometric weight lifting, in sitting and standing positions only, that involves about a third to half of the normal weight routinely lifted can be undertaken with slow muscle contraction without any harm. More vigorous walking is encouraged within a few days of surgery. Dietary salt restriction can also prove beneficial for minimizing postoperative facial edema.

Although infection is rare, we routinely prescribe perioperative antibiotics, such as cephalexin, that target skin flora to further minimize that likelihood. Narcotic pain medication is prescribed yet is frequently unnecessary, with patients usually relying on acetaminophen or no pain medicine at all. Following fat transfer, the face typically does not elicit any significant discomfort. In the facial recipient sites, patients commonly describe having a sensation of skin tightness or pressure, facial flushing, and/or mild periorbital soreness, all of which are normal in the postoperative period. At the donor site, patients frequently describe tenderness with a dull ache that resolves over a period of a few days.

As no bandages need to be changed or sutures removed, postoperative visits are made mostly to follow the clinical progress and to manage the patient's postoperative expectations. For the surgeon just starting out in autologous fat transfer, frequent patient visits should be the norm so that the surgeon can begin to appreciate the nature of the postoperative course that results from his or her handiwork. For instance, the patient can be seen the following day after surgery, then a week after the procedure, and every week thereafter until most bruising and swelling resolve. For the more experienced fat transfer surgeon, a customized postoperative plan can be executed based on the patient's level of anxiety or need for care. A patient who is fretful about the appearance of swelling can be seen every week for reassurance, whereas a less anxious patient who is comfortable with the recovery process can be asked to follow up 1 week after surgery and then 4 to 6 weeks thereafter.

Postoperative Course

Guiding the patient through the projected postoperative course *before* surgery is helpful in establishing realistic recovery times and thereby permits the patient to schedule time off from work and away from important social events. Variability in healing should always be emphasized before surgery and as the patient heals afterwards. However, as a guideline, most patients require a full 2 weeks off from work to look "socially acceptable." Helping an individual to understand what he or she will look like immediately after surgery and in the ensuing months will relieve anxiety and dispel misconceptions.

In the immediate postoperative period, the patient will exhibit a variable degree of ecchymosis and edema based proportionately on the volume of fat transferred. The greatest amount of ecchymosis and edema occurs from addressing the inferior orbital rim (**Fig. 4-2**). Performing concurrent ancillary procedures, such as face and browlifting, will generally worsen the degree of ecchymosis and edema due to increased operative time and surgical manipulation. Ecchymosis typically lasts for 2 weeks, but a lesser degree of periorbital ecchymosis at times can endure for even 1 to 2 weeks longer and may be difficult to camouflage completely. Patients should understand that recovery is variable and that 2 weeks may be insufficient to arrive at a point where the patient perceives he or she is socially acceptable. Informing a patient that recovery may exceed several weeks, however, may make undergoing a fat transfer less tenable, as most working individuals cannot afford that much time off from work. Judicious, albeit realistic, preoperative counseling is important in every case.

A patient at 2 weeks after surgery will still be swollen and may not feel socially acceptable. However, most onlookers, even those who are familiar with the patient, will often not perceive this deformity and will simply look at the patient as appearing more refreshed and rejuvenated. It is helpful to have the patient look at a photograph of another patient at 2 weeks postsurgery (**Fig. 4-3**). Most patients will find this result acceptable, but the surgeon can admonish that the photographed patient still did not like the way he or she looked at that time. The distinction between how patients view themselves and how others view them is important to emphasize. If the patient is very happy with the way he or she looks after the second postoperative week, adoration of the result at this early a phase can actually be problematic, as much of the volume present is still edema. Counseling the patient with regard to this is important for establishing realistic expectations down the road. Fortunately, if additional volume is needed,

Figure 4-2A: Preoperative appearance of a 49-year-old female with facial volume loss. **B:** Postoperative appearance at three days following periorbital, perioral, and midface autologous fat transfer with a total of 45 cc of fat demonstrating severe bruising. **C:** Seven days postoperative view. **D:** Thirteen days postoperative view. **E:** Thirty days postoperative view.

another surgery can be easily performed to enhance the result. Conversely, taking away too much volume is much more difficult. For this reason, we routinely counsel all patients that touch up procedures are often necessary.

Although swelling will persist for months, patients often are happy with their appearance by the fourth week. Patients should be advised about the continued resolution of edema so as not to mistake these changes as a sign of fat dissipation. Typically, most edema has resolved by the sixth postoperative month, and the volume that persists thereafter is relatively permanent. This brings up another common patient query

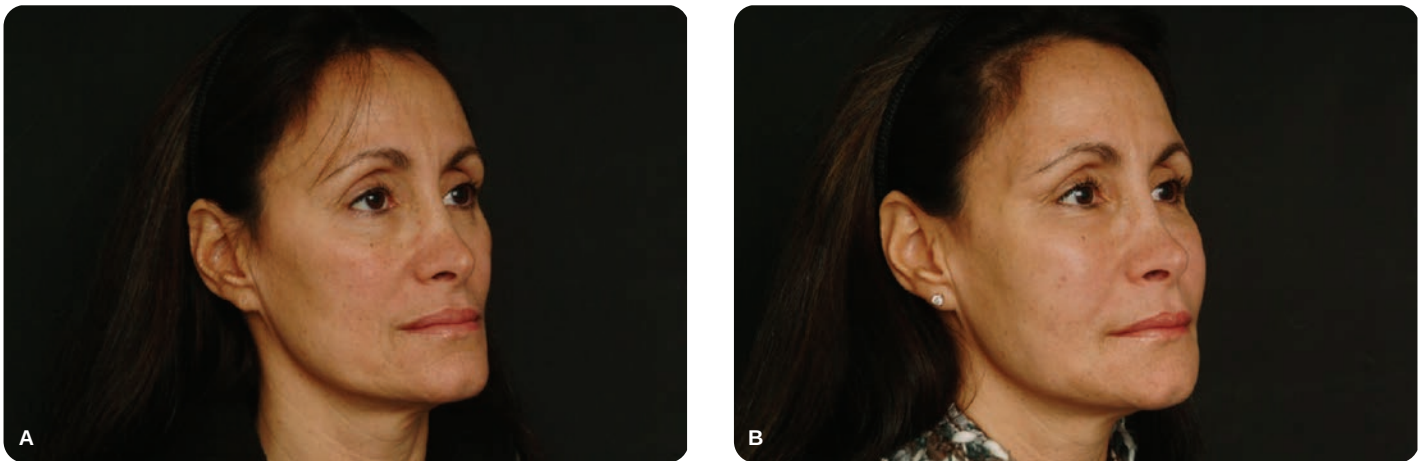


Figure 4-3A: Preoperative appearance of a 51-year-old female with facial volume loss. **B:** Appearance at 10 days following fat transfer of 65 cc to the periorbital, perioral, and midface demonstrating good resolution of bruising and most of the deforming edema at this point.

as to the longevity of the result. It is helpful to inform the patient that of the transferred adipocytes, some will survive and some will resorb. There is no exact percentage that can be quoted, and there are variables that can affect the survival, such as a history of smoking. If a patient gains significant weight, that weight will be noticeably evident in the face, as the transplanted fat cells hypertrophy. Even though some of the transplanted fat appears to be permanent, ongoing chronologic aging that will subtract volume over time will continue to erode the result. Based on the patient's aging process, results will have variable longevity and will require additional sessions as indicated. Significant weight change can also affect the long-term result. Patients who have a marked weight loss following surgery are likely to notice diminished volume in their face.

What we have noticed in many patients undergoing fat transfer is that some additional volume may be observed after a year. This curious phenomenon lacks a definitive explanation but has been commonly seen by our patients. In addition to this late change, we have noticed a change in skin tone and texture after the first year, during which time rhytids and uneven skin texture may improve (**Fig. 4-4**).

Figure 4-4A: Preoperative appearance of a 60-year-old female with notable panfacial volume loss. **B:** Postoperative appearance 2 years following perioral, periorbital, and midface fat transfer and facelift. A total of 50 cc of fat was transferred, with 30 cc allocated to the perioral region and the remaining 20 cc distributed in the periorbital and malar regions. This patient also demonstrates significant improvement of perioral skin texture and rhytids.

Management of Complications

Although many types of complications can theoretically arise after fat transfer, this section will address only the commonly encountered problems and how to correct them. Using a blunt infiltration cannula significantly reduces the likelihood of a sensory or motor nerve injury. In our practice, we have yet to encounter a temporary or permanent paralysis. Management of this problem is expectant, and a discourse on treatment of a permanent paralysis lies beyond the scope of this text. The use of blunt cannulas, as well as the practice of not forcing a cannula when meeting significant resistance, will also reduce the likelihood of vascular injury. Development of a hematoma is exceedingly rare, especially if these principles are followed. In our practice, we have seen one hematoma that resolved with aspiration. Arterial embolism with consequent skin necrosis has been reported but is an extremely rare condition. Treatment of this condition is limited and expectant. Discussion of adjuvant therapy and local wound care will not be entertained herein and would detract from the clarity and simplicity of the proposed management protocol.

Most surgeons who are adept at managing problems associated with lifting procedures (e.g., facelift, browlift, etc.) will need to learn a new set of tools to address the unique complications that arise after fat transfer. Although complications can occur anywhere in the face, the most common area for a problem after fat grafting is the periorbital region, where contour deformities are more readily apparent and more difficult to manage. Most of the following discussion will be centered on the treatment of periorbital complications but can be easily extrapolated to other areas of the face that experience similar complications.

Identification of the Complication

Identification of the problem at hand is primary. We have divided the types of common complications that can be encountered as follows: contour irregularities (further divided into the categories of lumps or bulges), persistent malar edema, overcorrection, undercorrection, and divoting at the cannula entry site (Table 4-1). This section will principally discuss the nature of each complication and briefly introduce the appropriate management. Detailed treatment protocols have been reserved for the subsequent section.

Contour Irregularities

LUMPS

A lump is a small, discrete fat mass that can arise for one of two reasons: placement of too large a fat bolus during injection and/or placement of the bolus too close to the skin. The periorbital region is the most susceptible to this complication due to the combination of thin overlying skin and the paucity of soft tissue overlying the orbital rim providing less of a buffer. Conservative fat placement in the periorbital region, especially early in the learning curve of performing fat transfers, is helpful in avoiding this problem. Initial management relies on observation for resolution of edema; followed by steroid injections; and if needed, direct excision of the offending lump, which is a very targeted and effective method of correction (**Fig. 4-5**).

BULGES

We use the term *bulge* to describe a wider area of elevation at the recipient site. The underlying cause of a bulge may be due to persistent edema or fibrosis. Alternatively, it may be secondary to uneven placement of a large bolus of fat or placement of the bolus in an incorrect location. Bulges generally present as a visible elevation along the inferior orbital rim, particularly laterally, with an underlying palpable area of induration (**Fig. 4-6**). The problem has been noticed predominantly in patients where fat injection of the entire inferior orbital rim was performed from an entry point near the

TABLE 4-1 Complications and Related Management

COMPLICATION	MANAGEMENT
Lump	1. Precise, intralesional steroid injection provides limited benefit. 2. Direct local excision is usually preferred.
Bulge	1. If fibrotic, then use an intralesional steroid injection. 2. If nonfibrotic, consider liposuction. 3. Direct local excision if other interventions failed.
Persistent malar edema	1. This condition must be distinguished from overcorrection. 2. If true malar edema, limit salt intake and inject locally with steroid until resolution. 3. If malar edema is associated with a malar mound, then direct excision of the mound may be needed.
Overcorrection	1. This condition must be distinguished from persistent malar edema. If malar edema is present, liposuction should not be undertaken. 2. If true overcorrection, wait 6 months. If there still appears to be overcorrection, microliposuction can help to debulk the area.
Undercorrection	Plan a touch-up surgery. If there is gross undercorrection, this can be done as early as 2 months from the original surgery. If there is subtle undercorrection, wait 6 months before touch up.
Divot at the injection site	1. This is uncommon. 2. This condition is easily corrected by subcising the tethered area using a 20-gauge needle. Filling may be needed under the depression.

lateral canthus. This approach was accompanied by the problem of placing an excessive amount of fat along the rim in a relatively imprecise fashion. We have found that the method discussed in Chapter 3 of only approaching the inferior orbital rim from an inferior-based entry site with the cannula tip oriented perpendicular to the inferior orbital rim to have practically eliminated the incidence of this complication. In addition, limiting the amount of fat transferred to the orbital rim during a given session to less than 4 cc at the very most and 2 cc as a standard foundation has also contributed to limiting the incidence of this problem. This type of bulge typically feels quite firm and fibrotic, and microliposuction is not indicated. Instead, the problem is much more amenable to repeated steroid injections into the palpably thickened tissue. Obviously, the potential for steroid-related dermal atrophy can arise, so management should proceed slowly and conservatively with low-dose and low concentration steroids initially, then progressing in dose and strength cautiously and deliberately.

A second type of bulge can occur in the malar region owing to overcorrection in this area. It is particularly obvious when the patient smiles due to the tethering effect of the malar septum and may disappear altogether when the individual ceases facial animation (**Fig. 4-7**). The bulge typically manifests in the lateral aspect of the cheek (lateral to the malar septum), which is accentuated by a medial depression along the malar septum and the adjacent territory medial to the septum. There is no palpable fibrosis, and the tissue feels like soft fat. Steroid injection is not particularly effective when there is no firm fibrosis, and treatment of this condition involves targeted microliposuction using a Klein 18-gauge Capistrano liposuction cannula (HK Surgical

Figure 4-5A: Preoperative appearance of a 53-year-old female who demonstrates marked volume depletion, particularly in the periorbital region. **B:** Following an endoscopic browlift and upper-eyelid blepharoplasty and fat transfer of 3.5 cc to each inferior orbital rim through a lateral entry point, this patient exhibits a visible contour deformity, or lump, along the inferior orbital rim. (Lateral access to the inferior orbital rim in the past led to numerous contour problems in this sensitive area, mandating a change to the current method of a perpendicular, inferior-based approach.) Beginning at 3 months after surgery, attempts to correct the lump using triamcinolone injections were instituted. The initial session began with 0.1 cc of triamcinolone 10 mg/cc. At the following two subsequent visits, each spaced 1 month apart, the area was injected with 0.1 cc of triamcinolone 25 mg/cc (i.e., a mixture of the standard 10 mg/cc and 40 mg/cc concentrations). With there being no significant improvement after this conservative protocol, a planned direct excision of the lump was undertaken at 7 months following the initial fat transfer. **C:** Intraoperative view of the direct excision of transplanted fat that accounted for the offending lump. Of note, the incision was made along the inferior orbital rim for better camouflage. The incision was closed in two layers, using 6-0 poliglecaprone 25 (Monocryl, Ethicon) sutures to approximate the orbicularis oculi in an interrupted buried fashion, and interrupted and mattressed 6-0 polypropylene for skin closure. **D:** Final postoperative result at 18 months after removal of the offending lump showing elimination of the lump without evidence of a visible scar.

Inc., San Clemente, CA). A similar type of bulge may arise after the patient experiences significant weight gain after fat transfer. As the grafted fat cells are viable, they will enlarge along with overall weight gain. Preoperatively, patients should be counseled about the risks of significant weight gain that exceeds 20 to 30 pounds, which can be reflected unfavorably in the face. Weight loss is the preferred therapy. We have had to deal with bulges due to weight gain only a few times.

Figure 4-6A, B: Preoperative view of a woman showing facial volume loss associated with aging. **C, D:** Postoperative view, 4 months following fat transfer of 30 cc of fat to the periorbital and midface regions. A total of 2.5 cc of fat was placed along each inferior orbital rim from a lateral canthal entry point. Following surgery, this patient demonstrated a persistent indurated bulge along the left inferior oribital rim. Beginning at the 5-month postoperative visit, triamcinolone injections were initiated using 0.1 cc of the 10 mg/cc concentration. This dose was continued for two subsequent treatments spaced at 1-month intervals. At the 9-month follow-up visit, the concentration of triamcinolone was increased to 40 mg/cc using the same 0.1 cc dosage, as no noticeable improvement had been remarked at that time. **E:** Following the increase in steroid concentration, the 14-month postoperative photograph demonstrates resolution of the bulge but a loss of most of the transplanted fat placed along inferior orbital rim.

Persistent Malar Edema

Proper diagnosis of this problem is the most important, and oftentimes difficult, first step in treatment. Fullness in the malar region may represent one of three conditions: persistent malar edema, a fat bulge, or overcorrection. Each problem mandates a different kind of intervention. Malar edema attains little benefit from liposuction, which can actually worsen and prolong the condition. In contrast, liposuction is the treatment of choice for an overcorrected area. Persistent malar edema can be recognized by visual findings and careful history taking. Malar edema often presents with a

Figure 4-7A: Preoperative appearance of a woman desiring facial rejuvenation. **B:** Postoperative photograph taken following periorbital fat transfer, facelift, and upper-eyelid blepharoplasty showing overcorrection of the inferior orbital rim complex with obvious tethering by the malar septum. **C:** Contour image taken with 3D Vectra System demonstrating the surface anatomy.

boggy, edematous appearance of the malar mound that may fluctuate in severity. Oftentimes, the edema is well delineated at its inferior limit by the malar septum (**Fig. 4-8**). However, overcorrection, which is rare, is typified by uniformly diffuse malar enlargement. Preoperative patient counseling can help to minimize the occurrence of this postoperative phenomenon. Smokers are more likely to experience persistent malar edema. This may also be exacerbated by alcohol consumption or increased salt intake. Appropriate preoperative evaluation and identification of the presence and type of malar mound (discussed in Chapters 2 and 3) are essential to avoiding this problem. Correction of mild malar edema requires time and patient reassurance. While most cases will resolve without intervention, repeated steroid injections may be necessary for resolution. We will not begin triamcinolone acetonide (Kenalog) injections sooner than 2 months after surgery and if possible will wait at least 4 months before beginning intervention. Lower concentrations of triamcinolone acetonide are recommended, beginning with 10 mg/cc, occasionally diluted to 5 mg/cc with 0.05-cc injections for a total of 0.1 to 0.2 cc per problem area with an interval of treatment approximately 1 to 2 months apart. If no interval improvement is noted, the concentration of steroid can be cautiously increased as follows: 5 mg/cc to 10 mg/cc to 25 mg/cc (mixing half 10 mg/cc with 40-mg/cc concentrations) to full-strength 40 mg/cc. Great caution should always be exercised when administrating steroid solutions due to the risk of dermal and subcutaneous atrophy and the potential for developing telangiectasias. If some clinical improvement is noted, then the same strength of steroid can be maintained until clinical resolution of the condition. We have found that serial monthly steroid injections resolve

Figure 4-8A: Preoperative view of a 54-year-old woman desirous of facial rejuvenation. **B:** Postoperative view taken 15 months following a facelift, mentoplasty, lower-eyelid transconjunctival blepharoplasty with minimal fat removal, and fat transfer consisting of 2 cc of fat along each inferior orbital rim and 2 cc in each anterior cheek. At 4 months following surgery, she exhibited persistent left malar edema that was treated with 0.05 cc of triamcinolone 10 mg/cc. Triamcinolone injections were repeated three times. This photograph shows her at 15 months postoperatively with persistent left malar edema that has only partially resolved with triamcinolone injections.

the problem after an average of four to five total injection sessions in the most significant cases. If the patient has a Grade III malar mound, the possible need for staged excision should have been discussed preoperatively and may be necessary if conservative treatment with steroid therapy fails.

Overcorrection

Overcorrection represents a condition in which too much fat was transplanted as far as the patient's (and/or surgeon's) aesthetic taste would dictate. This situation is extremely unusual, although in the first few months following surgery, it is not an uncommon patient fear. A conservative approach coupled with ongoing clinical experience will minimize the likelihood of this problem. As edema settles over the period of weeks to months, the patient may ultimately be satisfied with the result. A minimum waiting period of 6 months or longer should be extended before a verdict of overcorrection is rendered. As previously stated, the most targeted and beneficial method to reduce an overcorrected area is to perform microliposuction with a Klein 18-gauge Capistrano liposuction cannula (HK Surgical Inc.).

Undercorrection

We have found that of all the potential problems that require intervention, undercorrection is the easiest to address. Additional fat transfer is a simple and straightforward matter compared with any of the previously mentioned problems (**Fig. 4-9**). From a philosophical standpoint, we must retrain how we think about approaching a patient, which may be quite a bit different from how we have done so for facelifts, browlifts, and the like. When performing a facelift, we will always try to get the best result and fine-tune it based on intraoperative observations. We either achieve our goal and attain an excellent result or fall a bit short and only get a very good result with this approach. When thinking about fat transplantation, factors such as intraoperative edema from the local anesthetic and ongoing fat infiltration make trying to achieve the "perfect" result nearly impossible. As we hope this chapter has demonstrated, placing just a little too much fat in a critical area such as the inferior orbital rim can lead to a quite unsatisfactory result that is difficult to correct. In contrast, undercorrection in this area may achieve a result that the patient is happy with even if there is not complete effacement of the concavity. Patients have been pleased with conservative results that the surgeon may view as not his or her best work. It is better to attain consistently good results than to achieve a

Figure 4-9A: Preoperative view of a 47-year-old female with significant volume deficiency in the periorbital and malar regions. **B:** At the time of the initial procedure, a total of 31 cc of fat was transferred to the periorbital and midfacial regions, which included 2.5 cc of fat along each inferior orbital rim, 5 cc to each anterior cheek, and 4.5 cc to each lateral cheek. The photograph shows the patient 5 months following fat transfer, at which time both the patient and surgeon agreed that inadequate volume correction was attained. A second fat transfer was performed at that time. **C:** The photograph shows the patient with adequate correction 1 year following the second fat transfer, at which time an additional 20 cc of fat was placed that included 2 cc along each lateral inferior orbital rim, 3.5 cc in each anterior cheek, and 3 cc in each lateral cheek.

few excellent results in the face of greater morbidity. Accordingly, we have developed this book around this concept of safe, systematic, and complementary fat grafting.

The inferior orbital rim has the most potential for complications, and treatment of this anatomic territory should always follow the dictum of conservatism if not frankly undercorrection as one begins the journey of learning fat grafting. For instance, when a patient exhibits a prominent lateral orbital fat pad, a combination of selective fat pad debulking with conservative fat transfer to this area will help to steer a surgeon away from the potential of an unsightly contour deformity due to aggressive fat grafting alone.

Even with the best estimates, a patient may eventually become seemingly undercorrected after a few months. This outcome may in fact not reflect technical error but the variability in fat resorption and dissipation that is encountered in some individuals. As our experience has revealed, the amount of fat that a patient loses after a few months provides an excellent guide to determine how much additional fat is required to achieve an ideal result. With accumulated clinical experience, we have observed that only rarely do we need to correct a patient more than once after the initial surgery. If only the malar or buccal region requires a little touch up, the recovery can be quite abbreviated. A patient who undergoes this minor procedure on a Friday oftentimes is able to return to work by Monday without significant edema or ecchymosis.

Divoting at the Cannula Entry Site

Albeit rare, on two occasions we have encountered divoting at the cannula entry site (**Fig. 4-10**). Skin tethering can be easily corrected with a standard subcision technique using a 20-gauge needle across the scarred dermal attachments. The depression may also require injection with a filling material to completely correct it.

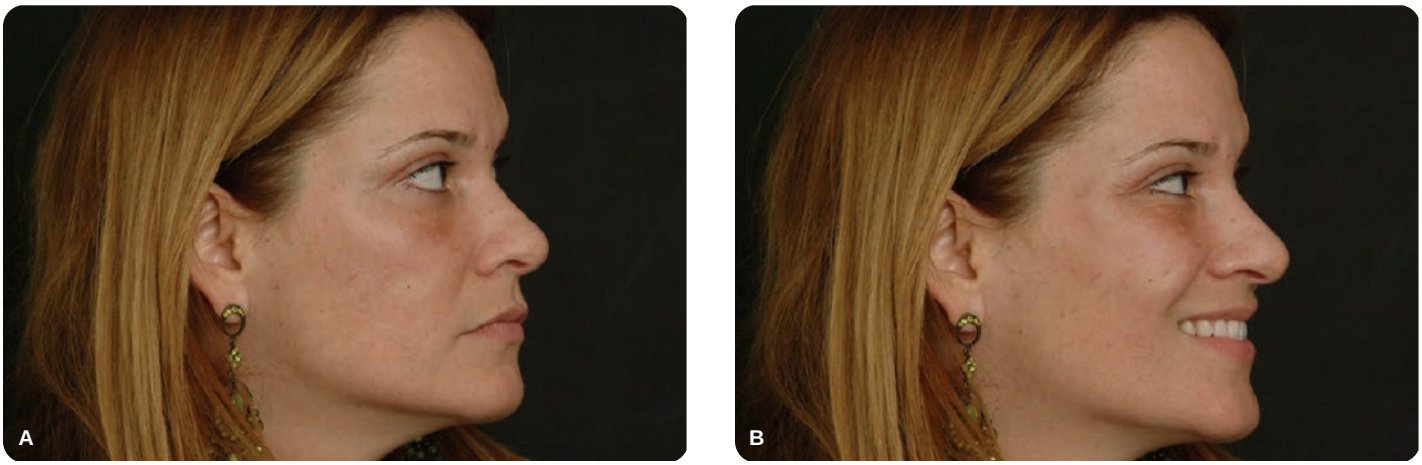


Figure 4-10A, B: This patient developed a divot at the mid-cheek entry site created with a standard 18-gauge needle. The divot was more noticeable when the patient smiled. The problem was entirely corrected with subcision of the tethered area using a standard 20-gauge needle.

Treatment Options for a Complication

We have already introduced the different problems that can arise following fat transfer with a cursory discussion of the appropriate management for each problem. This final section will be devoted to a more in-depth review of options for management, specifically steroid injection, microliposuction, and excision.

Steroid Injection

Steroid therapy should not be viewed as a universal panacea for all types of problems related to fat transfer. In fact, steroid use can create well-known problems, including the development of dermal and subdermal atrophy, divoting, and/or superficial telangiectasias. Judicious steroid use in the appropriate clinical setting is mandatory to obtain benefit and to limit risk. We use intralesional steroids for palpable, firm discrete masses like lumps and bulges or to reduce persistent malar edema.

We typically rely on intralesional triamcinolone acetonide (Kenalog) in various strengths for these purposes. Kenalog is manufactured as either a 10- or 40-mg/mL strength. We dilute and mix these two concentrations to achieve anywhere from 5 mg/mL to the full-strength of 40 mg/mL. We use a 1-cc syringe outfitted with a 30-gauge needle for injection with a total amount of 0.05 cc to 0.1 cc per specific site of injection. As a rule, lower concentrations are used for larger volumes of injection, and we almost always start with lower concentrations and incrementally increase the concentration or dose if the condition fails to improve with the current mixture. As the side effects of steroid use are unpredictable, conservatism should always be exercised. The interval between injections is variable, with a recommended minimum time period of 1 month. We tend to prefer to wait an entire 2 months to see a discernible effect from the prior session before treating again. A longer period of time may be required to see the full effect from any given session. Kenalog is ideal for treatment of deep, indurated fat bulges. In several cases, we have seen resolution over the course of a year with repeated steroid injections. The main risks of steroid-induced atrophy are loss of transferred fat volume and a visible depression that can (but may not) resolve over time. The infraorbital region is particularly sensitive to high concentrations of steroid. It is recommended that in this area, increased concentrations should not be done quickly but only after repeated lower doses have not achieved the desired effect. If a poststeroid injected defect persists, fat, a hyaluronic acid-based filling material, or other available fillers can be used to recontour the defect.

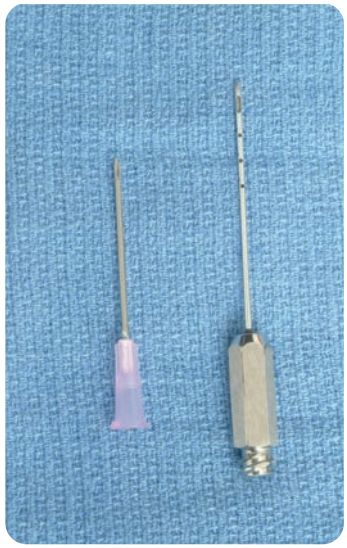


Figure 4-11: The photograph shows the Klein 18-gauge Capistrano microliposuction cannula (HK Surgical Inc.) **(right)** used for precise reduction of overcorrected areas adjacent to a standard 18-gauge needle **(left)**.

Figure 4-12A: Preoperative photograph of a woman desiring facial rejuvenation. **B:** Postoperative view following upper-eyelid blepharoplasty and fat transfer to the periorbital region that included 2.5 cc of fat placed along each inferior orbital rim. The entire inferior orbital rim was infiltrated with fat from a lateral entry point. Following surgery, the patient had persistent fullness bilaterally in the area of the fat transfer, as shown in the photograph. Fluctuating swelling was observed in this area, which led to conservative steroid therapy prior to any contemplation of excision. Due to the degree of fullness, at the 2-month postoperative visit, 0.1 cc of triamcinolone 10 mg/cc was injected into this area, which was repeated 1 month later. By the 6-month postoperative visit, no improvement was noted in the patient's condition. At that time a decision was made to pursue operative intervention with excision of the offending lump. The incision was made in the tear trough remaining just inferior to the elevated area. **C:** Following direct excision of both the excess fat and the overlying redundant skin, good correction of the inferior orbital rim hollowing and elimination of the unsightly lump are noted.

Microliposuction

We have been relatively unsuccessful in reduction of indurated bulges using liposuction cannulas. Oftentimes, attempts at liposuction of a bulge or a lump can induce prolonged swelling with little gain as far as volume reduction. Similarly, malar edema also can be exacerbated with microliposuction without discernible improvement. Although other surgeons have reported success with treating malar edema using liposuction techniques, we have been consistently disappointed and distressed with this method and do not advocate it. For diffuse areas of overcorrection, microliposuction with the aforementioned Klein 18-gauge Capistrano liposuction cannula (HK Surgical Inc.) has proven to be successful (**Fig. 4-11**).

Excision

Although a patient may deem a direct excision of an unsightly lump as an offensive proposition due to the necessity for a visible incision, it is truly the most targeted and effective solution to resolve the presence of a discrete lump of fibrotic fat. Patients must be carefully counseled that excision may be the best option in quickly and effectively eliminating the problem despite a facial incision that may not reside in a discreet location. As the periorbital region tends to be the most common site for excision of fat lumps, we will focus our attention to this anatomic zone. Placement of the incision in the tear trough will minimize the risk of a perceptible incision line (**Fig. 4-12**). Rarely, we have had to extend that incision more laterally to remove a lump of transplanted fat. The lateral extension of the incision can either continue inferiorly along the malar septum or curve gently along the inferior orbital rim, depending on which line the incision can be hidden more effectively in. The incision usually heals best when placed at the junction of the thin lower-eyelid skin and the thicker cheek skin. These types of incisions typically heal quite well, and we have had near universal patient satisfaction. A relative contraindication is thick, sebaceous periorbital skin that can take many months to heal in an acceptable manner. Patients are counseled that the incision can be camouflaged with makeup 4 days after surgery, when the sutures are removed. Oftentimes, patients are satisfied that the appearance with makeup is already a vast improvement over the previously visible lump. Nevertheless, several months are routinely required for resolution of incision-line erythema and minimal edema, especially along the superior skin flap. Ultimately, the patient should expect that the incision line will disappear to the naked eye.

In order to make the suggestion of a visible incision more palatable to the patient, any excessive or redundant skin along the lower eyelid can also be removed in the incision line to enhance the patient's aesthetic appearance. Again, we have found that incisions falling along the inferior orbital rim heal exceptionally well and that the risk of lower-eyelid malposition is significantly less than with a traditional skin-muscle lower-eyelid blepharoplasty. We determine the amount of redundant skin to be removed by pinching the excess skin between nontoothed forceps and erring on the conservative side for removal. Muscle excision/incision is useful for exposing transferred fat when there is a lump that needs to be excised. If the muscle is excised or incised, we reapproximate the muscle as a separate layer with a few interrupted, 6-0 poliglecaprone 25 (Monocryl, Ethicon) sutures. The skin is closed with attention to obtaining good wound eversion. Although vertical mattress sutures will help with wound eversion, we use them sparingly (two or three such sutures), as we have observed skin irregularities that can persist for some time due to excessive reliance on mattress closures. Skin sutures are typically removed on the fourth postoperative day. If any wound-edge erythema arises, we use intense pulsed light (IPL) phototherapy after the second week and continue treatment every month until resolution of the condition. Our experience is that excisions are an indispensable tool in the treatment of lumps, bulges, and excessive skin as well as persistent malar bags and have healed quite favorably and essentially invisibly over time.

Chapter 5

Case Studies

Introduction

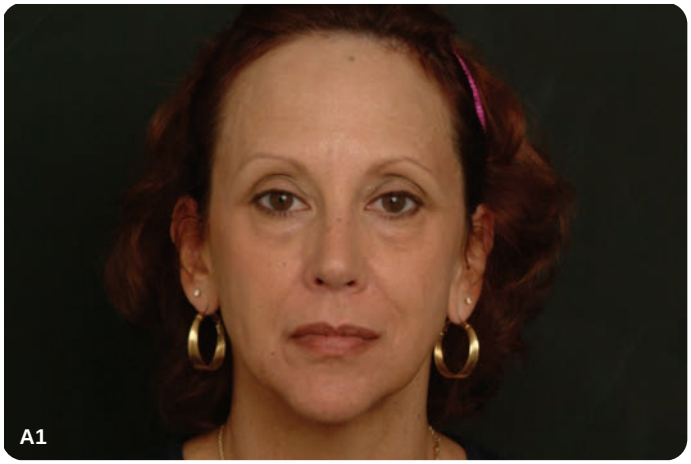
These case studies should be approached after the reader has firmly grasped the aesthetic principles and techniques outlined in the preceding chapters for a more lucid understanding of the content presented herein. Most of this book has been dedicated to a stepwise presentation of how to perform facial fat grafting in an easy and reproducible manner. The title of this book, *Complementary Fat Grafting*, refers to our strategy of combining fat grafting with ancillary surgical procedures like facelifting and alloplastic implants to enhance overall patient satisfaction. As mentioned previously, this book is primarily intended to provide an explicit description of how and why to perform fat grafting. We do not desire to review other methods of facial rejuvenation, as we believe that the surgeon who is already comfortable with these techniques can implement fat grafting into his or her practice and combine it with existing techniques for facial rejuvenation. This chapter is designed to help that surgeon contemplate how to combine fat grafting in a complementary nature using real case studies for illustrative purposes. For the physician who elects to perform only fat grafting, this book still holds significant relevance, as the techniques outlined in the earlier chapters can be easily accomplished without other surgical intervention.

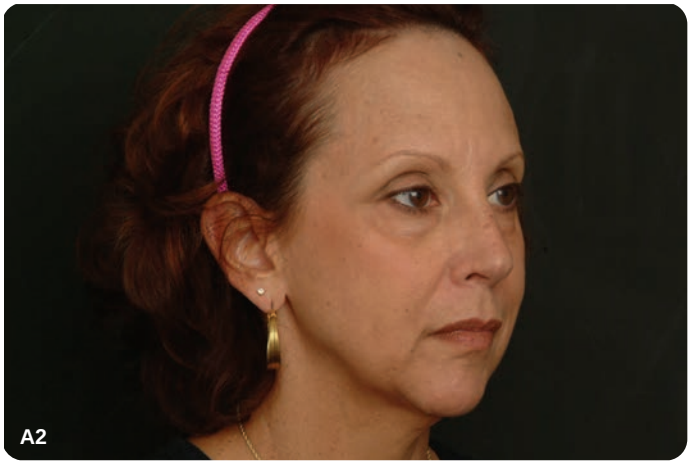
Case Studies

Case Study **1**

INTRODUCING THE COMPLEMENTARY APPROACH

Preoperative Views


A1


A2


A3

Postoperative Views


A4


A5


A6

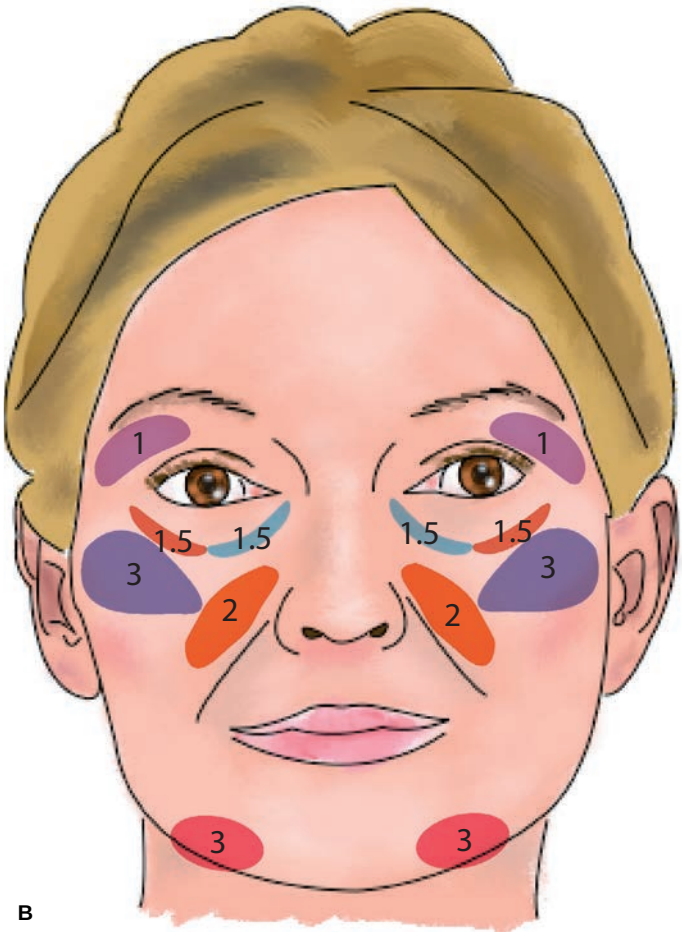


Figure 5-1A: *Case Study 1* introduces the complementary approach of combining autologous fat grafting with traditional rejuvenative procedures. The patient underwent a deep-plane rhytidectomy, microliposuction of her jowls, conservative transconjunctival blepharoplasty, and autologous fat transfer. She is shown 13 months post-operatively, with good aesthetic improvement but mild undercorrection of her inferior orbital rim. This case demonstrates the importance of a facelift in achieving the optimal aesthetic result along the jawline for a patient with moderate to marked jowling, which is enhanced by the addition of fat to the prejowl sulcus. Combination of conservative blepharoplasty with autologous fat transfer can optimize the result and minimize the risk of orbital-rim overcorrection. **B:** Schematic illustration of *Case Study 1* shows fat-transfer volumes and distribution with a total of 24 cc of fat: 1 cc to the superior orbital rim, 2 cc to the deep (supraperiosteal) inferior orbital rim, 1 cc to the intermediate depth of the inferior orbital rim, 2 cc to the anterior cheek, 3 cc to the lateral cheek, and 3 cc to the prejowl sulcus.

History

This 55-year-old woman presented with principal complaints of undesirable lower-eyelid "bags" and prominent jowls. She did not have any significant past medical or surgical history that was contributory.

Consultation

On examination, the patient had good brow position with notable hollowing of her superior orbital rim. Her inferior orbital rim demonstrated mild pseudoherniation of fat in her medial and middle fat compartments, with marked hollowing along the entire length of her inferior orbital rim. She demonstrated a relative flattening of her anterior and lateral cheek. Her jowls were quite pronounced, contributing to an

overall poor contour of her jawline. She also showed significant volume contraction in the prejowl sulcus, which served to exacerbate the appearance of her already heavy jowls. At the time of consultation, the patient was recommended a cervicofacial rhytidectomy, microliposuction of her jowls, and conservative transconjunctival blepharoplasty combined with fat transfer to the volumetrically depleted areas, namely, the superior and inferior orbital rims, the anterior and lateral cheeks, and along her prejowl sulcus.

Intervention

With the above recommendations, the patient underwent a deep-plane rhytidectomy with submentoplasty and microliposuction of her jowls. A conservative transconjunctival blepharoplasty was done to address the lower eyelid medial and middle fat pockets. In addition, she received (per side) 1 cc of fat transferred to the superior orbital rim, 2 cc to the inferior orbital rim in a deep plane, 1 cc to the intermediate depth of the inferior orbital rim, 2 cc to the anterior cheek, 3 cc to the lateral cheek, and 3 cc to the prejowl sulcus on each side of the face.

Results

The patient was very pleased with her aesthetic result. She is shown 13 months after the above procedures with slight undercorrection of her inferior orbital rim, which would benefit from additional fat transfer.

Commentary

Although fat grafting alone along the jawline would have undoubtedly benefited the patient, the heaviness of the jowl mandated a combined approach to achieve the optimal aesthetic result:

1. The rhytidectomy helped straighten her jawline by elevating the redundant, descended soft tissue of the jowl.
2. Microliposuction is useful, particularly in a full and heavy jowl.
3. Fat grafting in the hollow prejowl sulcus can provide improved jawline contouring and obscure the presence of the jowl.

This complementary use of fat grafting in the prejowl sulcus to achieve a straightened jawline has yielded the most uniformly successful results in our hands. Although competing philosophical constructs exist to explain the aging process, gravity versus volume depletion, the question the surgeon should answer is not which mechanism is responsible for aging but how the most likely route toward a successful result can be achieved. Clearly, a rhytidectomy alone can accomplish wonderful aesthetic results. Conversely, pioneers in fat grafting have equally accomplished remarkable benefit in attaining an improved jawline contour with fat grafting alone. In our clinical experience, we have found that combining these approaches can enhance the aesthetic outcome.

Similarly, the patient's lower-eyelid fullness was most effectively managed through a combination of selective transconjunctival blepharoplasty with fat grafting along her inferior orbital rim. In this patient, the volume loss along the inferior orbital rim and cheek is the more significant problem than actual pseudoherniation of lower-eyelid fat. This is particularly evident on the preoperative photograph of her profile. If an isolated technique were to be used, fat grafting along her inferior orbital rim, transitioning into the cheek, would be much more important than transconjunctival blepharoplasty alone. However, we have found that combining transconjunctival blepharoplasty with targeted fat transfer to the inferior orbital rim has yielded the best aesthetic outcomes. In contrast to this patient, when prominence of the lower-eyelid fat is more a function

of pseudoherniated fat rather than volume depletion, then the importance of blepharoplasty increases proportionately. Considering that most complications in fat grafting occur in the periorbital region owing to either placement of too large a discrete bolus of fat or too much overall volume, judicious lower eyelid fat reduction with blepharoplasty can reduce the volume needed when fat grafting and thereby minimize the risk of complications. The patient at 13 months postoperatively manifests slight undercorrection of her inferior orbital rim, which can be easily corrected with additional fat grafting to this area. Overcorrection of the inferior orbital rim is much more difficult to correct and can be avoided with a conservative approach, as discussed in the previous chapters.

Although the patient's original complaint did not concern her relatively hollow cheek region, it was important to discuss with the patient the benefit of fat grafting in this region. Framing the eye concerns not only providing a youthful frame around the eye by supplementing a hollow inferior and superior orbital rim but to think of the cheek as a natural extension of that frame. A fuller, sensuous cheek can accentuate the beauty of the eye. Additional fat in the cheek also carries with it relatively low morbidity, can be rapidly placed, and adds to overall patient satisfaction with the improved facial harmony that is achieved.

Case Study **2**

FRAMING A NEGATIVE-VECTOR EYE AND COMBINED USE OF ALLOPLASTIC IMPLANTS

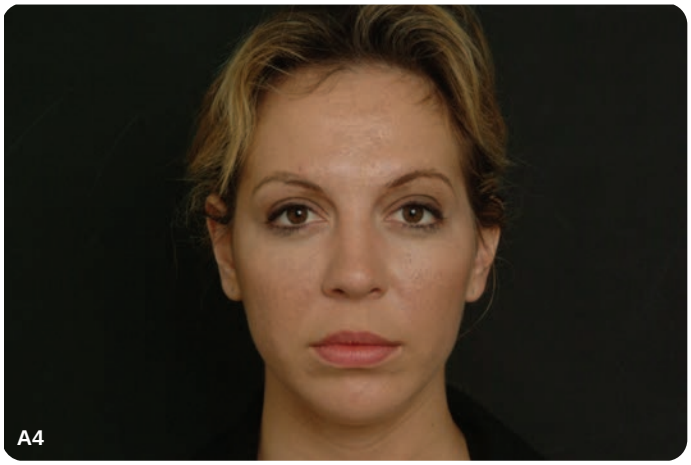
Preoperative Views


A1


A2


A3

Postoperative Views


A4


A5


A6

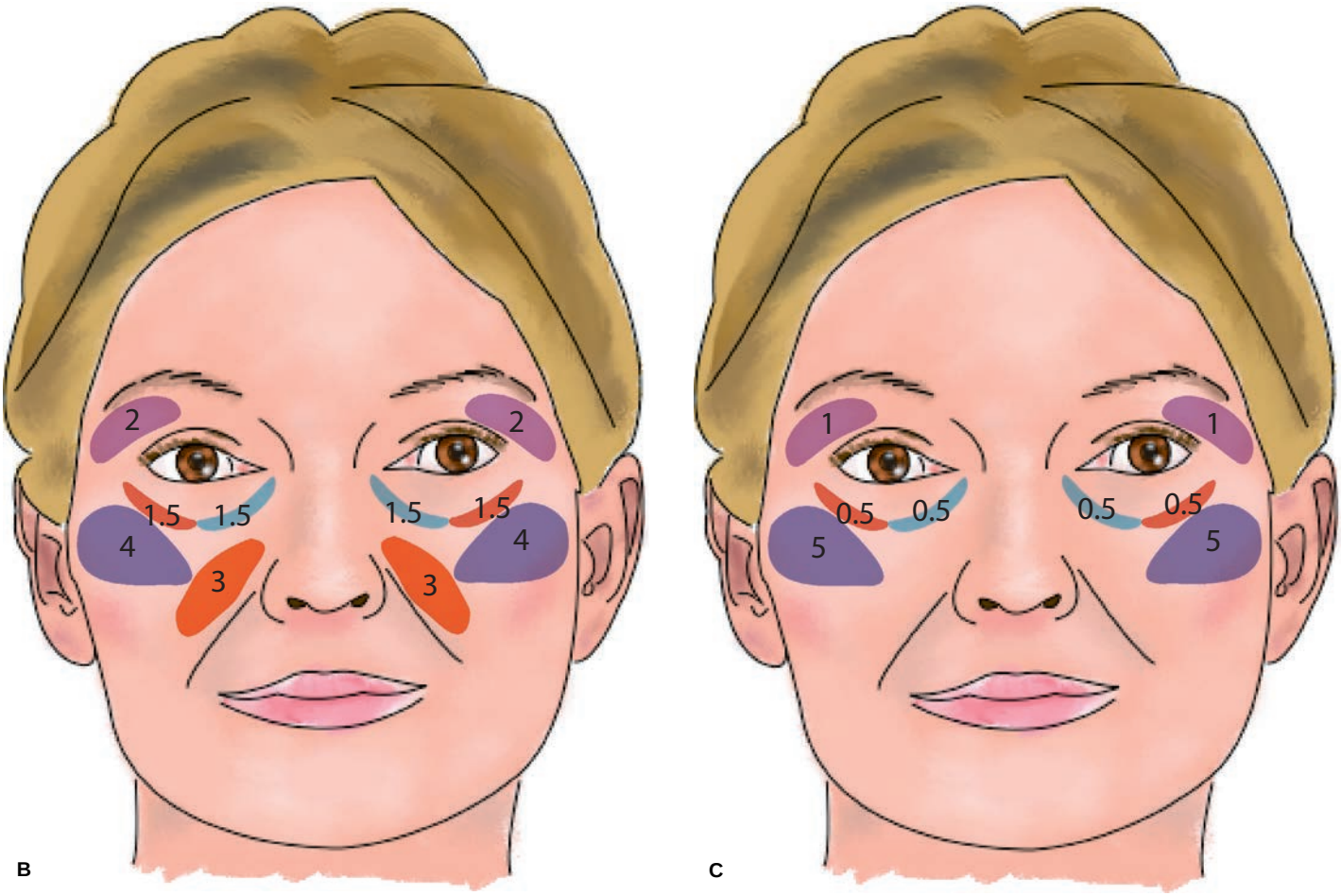


Figure 5-2A: *Case Study 2* demonstrates the concept of framing the eye and the benefit of alloplastic implants combined with autologous fat transfer. This patient has a negative-vector eye, mild pseudoherniation of lower-eyelid fat, a retruding superior orbital rim, and microgenia without occlusal malalignment. The negative-vector eye was corrected by increasing the projection of the inferior orbital rim and cheek with fat transfer. A minimal amount of lower medial fat was removed through a transconjunctival approach. Had the lower-eyelid blepharoplasty been undertaken without fat transfer, the procedure would have only exacerbated the prominent appearance of her globe. De-emphasizing her prominent eye also included fat transfer to the superior orbital rim. Although autologous fat transfer can improve a deficient chin, the predictability of adequate projection is less certain than with a standard alloplastic implant. Her microgenia was addressed with a medium-sized extended anatomical silastic chin implant, which gives a more precise and predictable correction than is achieved with fat transfer. **B:** Schematic illustration of *Case Study 2* shows fat transfer volumes and distribution during the first surgery using a total of 24 cc: 2 cc to the superior orbital rim, 2 cc to the deep (supraperiosteal) inferior orbital rim, 1 cc to the intermediate depth of the inferior orbital rim, 3 cc to the anterior cheek, and 4 cc to the lateral cheek. **C:** Schematic illustration of *Case Study 2* shows fat transfer volumes and distribution during the touch-up surgery totaling 14 cc: 5 cc to the lateral cheek, 1 cc to the inferior orbital rim, and 1 cc to the superior orbital rim.

History

This 35-year-old woman presented with complaints of bulges under her eye and a round appearance of her face. She did not have any significant medical or surgical history.

Consultation

During consultation, the patient was shown that what she perceived as a bulge under her eyes was principally due to the relative hollowing along the inferior orbital rim and

malar region with only minimal fat pseudoherniation in the lower eyelid. More importantly, she exhibited a prominent globe that projected anterior to the superior and inferior orbital rim. A conservative transconjunctival blepharoplasty to remove minimal medial fat with autologous fat transfer to the midface and upper and lower orbital rims improved the appearance of her prominently positioned globe.

She also demonstrated moderate microgenia without occlusal malalignment. An alloplastic chin implant provides a more assured method of achieving predictable and precise projection of the mentum than with autologous fat transfer. Correction of her microgenia with a chin implant along with the periorbital and midface fat transfer would yield a more heart-shaped, and feminine face that would also enhance overall facial harmony.

Intervention

The patient underwent a conservative transconjunctival blepharoplasty with removal of minimal medial fat only, insertion of a medium-sized extended anatomical silastic chin implant, and autologous fat transfer. She received (per side) 2 cc of fat to the superior orbital rim laterally, 2 cc to the deep inferior orbital rim, 1 cc to the intermediate depth of the inferior orbital rim, 3 cc to the anterior cheek, and 4 cc to the lateral cheek for a total of 12 cc per side. The patient returned for a touch-up with additional fat consisting of 7 cc per side (5 cc to the lateral cheek, 1 cc to the inferior orbital rim, and 1 cc to the superior orbital rim) 20 months later.

Results

The patient is shown preoperatively and 11 months after her touch-up surgery with additional fat. She demonstrates overall improved facial harmony, a more youthful facial configuration, adequate chin projection, and a more vibrant, proportioned, and youthful eye. She was extremely pleased with the aesthetic outcome.

Commentary

The principal objectives of this case study are to demonstrate the importance of proper evaluation and correction of a negative-vector eye and the benefit of alloplastic implants in combination with autologous fat transfer.

A negative-vector eye is defined as a globe that is situated anterior to the inferior orbital rim. Traditional blepharoplasty that is predicated upon excision alone can exacerbate this condition rather than improve it. In particular, the lower eyelid is susceptible to scleral show and rounding when a skin-muscle blepharoplasty is undertaken. Any attempt to remove the lower-eyelid fat alone, without adding volume, will accentuate the prominent eye. Correction of a negative-vector eye is dependent on augmenting the lower frame of the eye. In our experience, autologous fat transfer provides the ideal means of providing anterior projection at the level of the inferior orbital rim, restoring the frame around the eye, and rejuvenating the periorbital region. As discussed in Chapter 1, we believe that one of the important objectives of facial rejuvenation is recreating the fullness around the eye that is generally lost with aging. This goal is of even greater importance in an individual with a prominent-appearing eye.

Fat grafting alone in the periorbital region could have been sufficient for this patient. However, we have found that judicious and conservative transconjunctival blepharoplasty, in the presence of visible pseudoherniated lower-eyelid fat, reduces the need for aggressive fat augmentation. The reader is reminded that most complications that arise after fat transfer (which are difficult to correct) occur in the periorbital region due to improper technique and overzealous transplanted volumes. Combining fat grafting with conservative blepharoplasty can reduce the volumes needed for fat transfer

compared with volumes that would otherwise be required for fat transfer alone and can thereby optimize the result while reducing the chance of a complication. Fat grafting can provide an easy and targeted rejuvenation of the lost volume along the prejowl and anterior chin. However, patients who have discernible microgenia will benefit, if they are amenable, to alloplastic implantation to achieve a more predictable outcome. Patients with only mild microgenia that principally arises from soft-tissue loss of aging can be easily corrected with fat grafting alone. The extended anatomical chin implant permits some correction of the volume loss in the prejowl sulcus as well as a more seamless overall mandibular contouring than a central button-style implant. Additional fat can be added for patients who require greater volume in the prejowl sulcus than an extended chin implant can yield alone. The surgeon should be cautious to remain more superficial when transplanting fat in the prejowl region when a chin implant is concurrently inserted to avoid disturbance of the implant.

It is worth reiterating as well that malar implants are used less often than a chin implant to achieve volumetric enhancement for the following reasons. A malar implant alone in the gaunt or maturing face can be visible due to the lack of soft-tissue envelope to camouflage it. This is rarely if ever the case with a chin implant. Further, the infraorbital hollow can be exacerbated with the use of a malar implant alone. Malar implants do not provide the level of complex contouring of the cheek for recreating a smooth confluence between the lower-eyelid and malar regions that autologous fat transfer affords. However, a cheek implant can be combined with fat grafting in an individual with little donor fat in order to achieve the desired aesthetic result.

Case Study **3**

COMBINING FAT GRAFTING WITH A FACELIFT

Preoperative Views


A1


A2


A3

Postoperative Views


A4


A5


A6

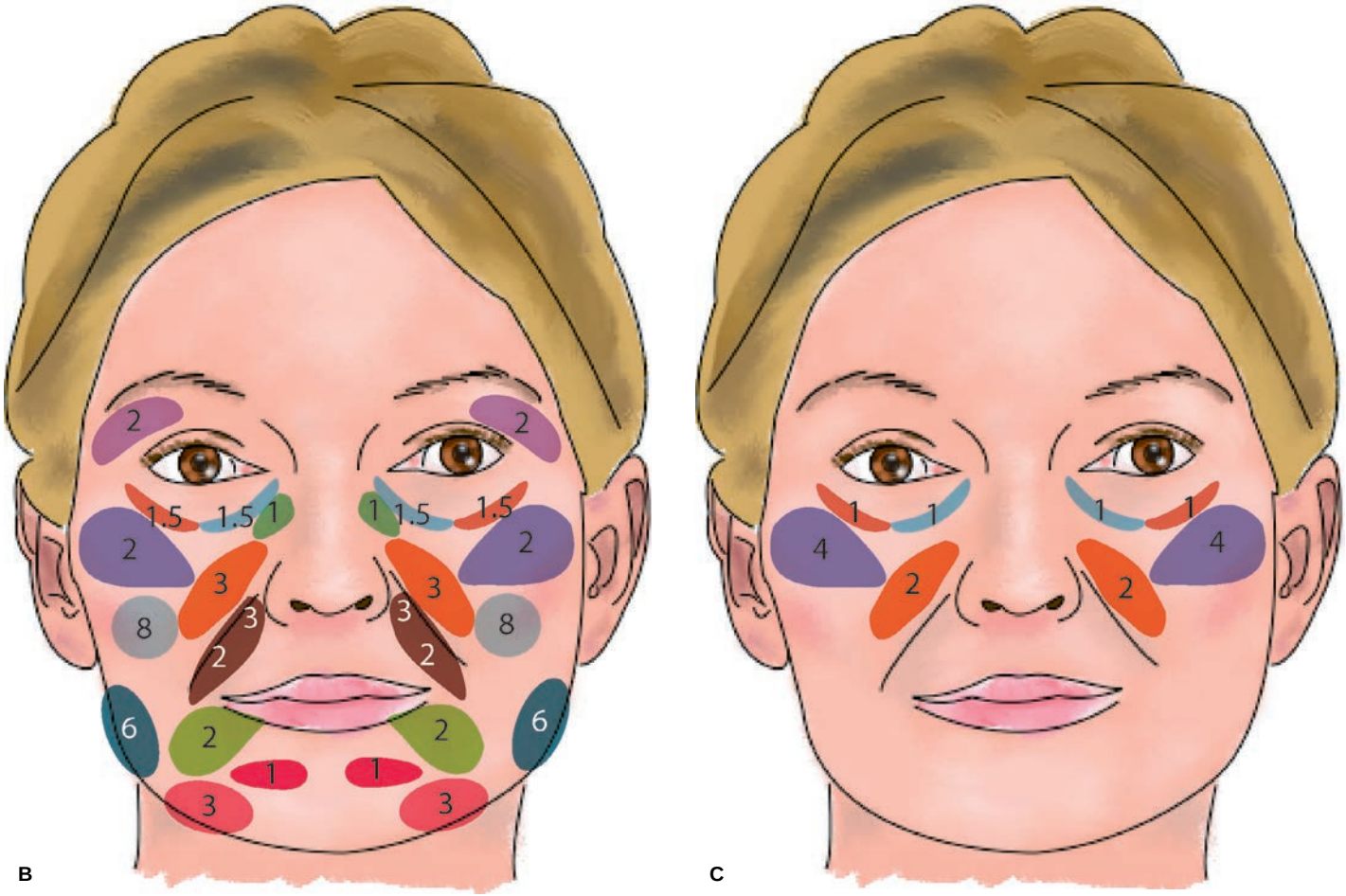


Figure 5-3A: *Case Study 3* demonstrates the importance of incorporating a facelift in patients whose primary focus is jawline correction. Fat grafting alone along the jawline will often fail to achieve adequate rejuvenation of the lower face and neck in these patients. This patient presented with the principal concern of an aged-appearing jawline. Although aware of the limitations, she opted to initially undergo isolated fat transfer. Despite a favorable aesthetic outcome, she was dissatisfied with the jawline result and was only content after a subsequent cervicofacial rhytidectomy. The patient is shown following the fat transfer and facelift procedures. **B:** Schematic illustration of *Case Study 3* shows fat transfer volumes and distribution, using a total of 64 cc during the first surgery: 2 cc to the superior orbital rim, 2 cc to the deep (supraperiosteal) inferior orbital rim, 1 cc to the nasojugal groove, 2 cc to the lateral cheek, 3 cc to the anterior cheek, 8 cc to the buccal region, 3 cc to the precanine fossa, 2 cc to the nasolabial fold, 3 cc to the prejowl sulcus, 6 cc to the lateral mandible, 1 cc to the labiomental sulcus, and 2 cc to the labiomandibular fold. **C:** Schematic illustration of *Case Study 3* shows fat transfer volumes and distribution during the touch-up surgery totaling 16 cc: 2 cc to the inferior orbital rim in an intermediate plane, 2 cc to the anterior cheek, and 4 cc to the lateral cheek per side.

History

This woman underwent an endoscopic browlift and subperiosteal midface lift 4 years prior to presenting for correction of jowling and a feeling of laxity along the jawline. Prior to the midface lift, the patient already had signs of significant midfacial volume depletion, which was not adequately addressed with the procedure. At the time, the patient was concerned about the longevity of fat transfer and elected to have the midface lift instead. Her primary concern at the time of this consultation was her jawline, despite ongoing volume depletion of her midface.

Consultation

The patient showed early signs of jowling along with panfacial volume depletion. The benefits of fat transfer alone, a facelift alone, or a combination of both procedures to correct the perceived problem along the jawline were discussed with her. She elected to undergo fat grafting alone to correct the jawline as well as the perioral and buccal regions. It was also strongly recommended that we augment her midface and periorbital region to create a balanced rejuvenation.

First Intervention

The patient underwent full facial autologous fat transfer, emphasizing the perioral, buccal, and prejowl regions to correct her lower facial aging. A total of 64 cc was placed at that time, including (per side) 2 cc to the superior orbital rim, 2 cc to the deep inferior orbital rim, 1 cc to the nasojugal groove, 2 cc to the lateral cheek, 3 cc to the anterior cheek, 8 cc to the buccal region, 3 cc to the precanine fossa, 2 cc to the nasolabial fold, 3 cc to the prejowl sulcus, 6 cc to the lateral mandible, 1 cc to the labiomental sulcus, and 2 cc to the labiomandibular fold.

Results

The patient demonstrated improvement in the buccal, perioral, and jawline after lower facial fat transfer but was still dissatisfied with the appearance of her jawline. Although pleased with the overall shape and form of her face following autologous fat transfer, she felt that the jawline was too "loose" and did not have the straightened contour that she had expected.

Second Intervention

Three months following her initial fat transfer, the patient elected to undergo a deep-plane cervicofacial rhytidectomy combined with touch-up fat grafting consisting of 2 cc to the inferior orbital rim in an intermediate plane, 2 cc to the anterior cheek, and 4 cc to the lateral cheek per side.

Results

She was very pleased with her result. She felt that her jawline had attained a profile that she desired and also voiced that the upper facial fat transfer brightened her eyes and balanced her face.

Commentary

Full-face fat grafting can provide remarkable facial rejuvenation but at times can fall short in correcting the jawline to the level that many patients envision. This case study demonstrates the importance of how a rhytidectomy when combined with fat grafting can impact overall patient satisfaction and how, vice versa, fat grafting can enhance a rhytidectomy result. It is not to say that practitioners of full-face fat grafting alone cannot achieve successful results in the jawline with only fat grafting even in patients with marked jowling but that in our experience a combination, or complementary, approach has produced more consistent satisfaction than either procedure (facelift or fat grafting) alone. Clearly, patients who have only very early jowling and whose attention is not focused on the jawline are excellent candidates for fat grafting alone. However, patients who are primarily focused on the shape of their jawline may ultimately be dissatisfied with the result obtained from isolated fat grafting. Also, patients who

feel that the skin is loose along the jawline will usually be dissatisfied with only a fat transfer or volume-filling approach.

In contrast to this case, we have also seen patients following an isolated facelift who felt that they did not obtain their desired result of looking as they did when they were younger. The straightened jawline and improved neck contour achieved with a standard rhytidectomy do not necessarily make a patient appear younger. This outcome can be attributed to the fact that when looking at someone's face, our primary focus is more likely to be centered on the periorbital area rather than the jawline. If the periorbital region is not adequately addressed in a patient with periorbital and midfacial volume loss, the patient is apt to feel as if the face was not fully rejuvenated. As mentioned throughout this book, traditional blepharoplasty alone can further deplete the precious tissue around the eyes and remove rather than restore the lost frame of the eye. Accordingly, fat grafting with a facelift (when indicated) can provide the most global rejuvenation of both the upper and lower face. The aphorism "1 + 1 = 3" has merit here, as the overall effect of multiple procedures is cumulatively greater in effect than the sum of its parts.

It is also worth noting that the patient's midface lift did provide some degree of facial rejuvenation but failed to achieve the harmony and balance afforded by volume rejuvenation achievable with autologous fat transfer. For a heavy cheek, in which a full ptotic malar pad drapes over the nasolabial fold, we have at times combined a percutaneous cheeklift with volume contouring of the cheek. However, in most cases, fat grafting alone with or without blepharoplasty (Case Study 1) can provide superior upper and midfacial rejuvenation without the need for midface elevation.

Case Study **4**

FAT GRAFTING AND A SMAS RHYTIDECTOMY FOR THE GAUNT, ATHLETIC INDIVIDUAL

Preoperative Views


A1


A2


A3

Postoperative Views


A4


A5


A6

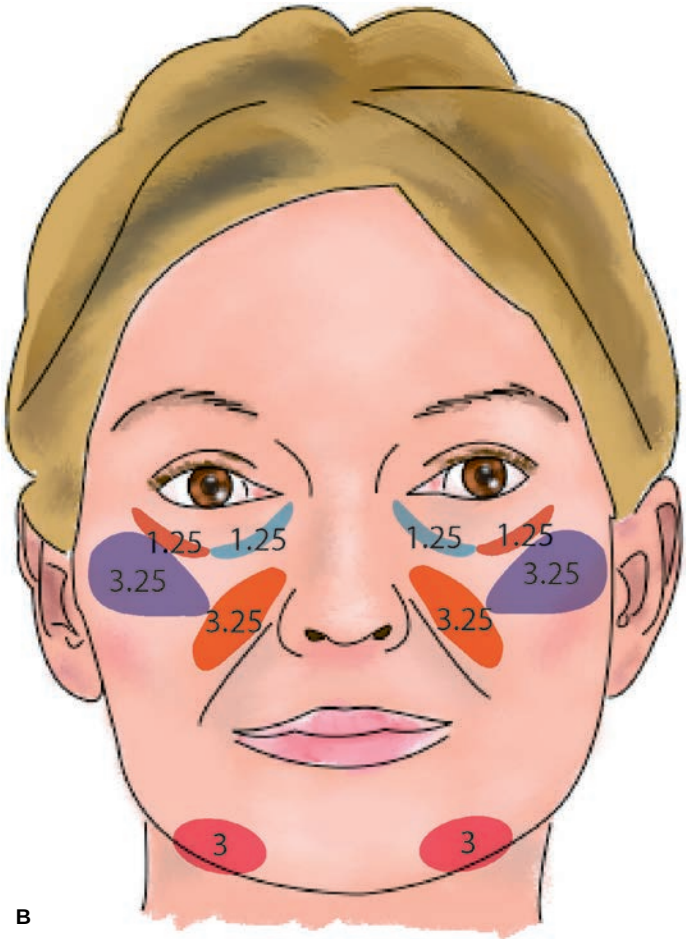


Figure 5-4A: *Case Study 4* demonstrates the benefit of autologous fat transfer for the gaunt, athletic face to restore lost vitality and youth. The patient liked the sculpted appearance of her face, particularly the buccal hollow, but was not pleased with the relative hollowness of the periorbital region. She was also bothered by her lack of jawline definition. In her case, autologous fat transfer alone could have provided the majority of improvement, including along her jawline, as the deficient prejowl sulcus accounted in large part for her poor jawline contour. Nevertheless, her focus on the jawline appearance made a combination with a limited SMAS rhytidectomy a good option to ensure the highest likelihood of success in her lower face. This patient shows good maintenance of her rejuvenation in 6-year follow-up photographs. **B:** Schematic illustration of *Case Study 4* shows fat transfer volumes and distribution totaling 24 cc: 3.25 cc to each anterior and lateral cheek, 2.5 cc to the inferior orbital rim and 3 cc to the prejowl sulcus.

History

This 41-year-old woman presented with the primary complaint of scarring in the region of her nasolabial fold and nasal ala secondary to expanded polytetrafluoroethylene implants that had become infected and required removal. She was also displeased with the loss of definition along her jawline. Her active weight lifting regimen had accelerated her midfacial atrophy, but she liked the sculpted appearance that her buccal hollowing imparted.

Consultation

Our discussion for volume enhancement to reverse both the aging process and the gauntness due to her athleticism was tempered by the patient's desire to maintain her sculpted

appearance. The poor definition of her jawline was primarily a result of volume loss in the prejowl sulcus. The patient was advised that fat grafting would help to correct the relative volume loss of her midfacial and infraorbital regions without compromising her athletic appearance. A limited SMAS rhytidectomy was also recommended to enhance the overall appearance of her jawline in combination with fat grafting to the prejowl.

Intervention

The patient underwent selective facial fat grafting with 3.25 cc of fat to each anterior and lateral cheek, 2.5 cc of fat to the inferior orbital rim, and 3 cc to each prejowl sulcus. She also underwent a concurrent SMAS rhytidectomy to improve her jawline and neck contour.

Results

The patient is shown 6 years after facial fat grafting and limited SMAS rhytidectomy with good maintenance of her volumetric enhancement and a youthful jawline appearance.

Commentary

The erroneous fear that fat grafting will transform a lean face into a fat one is a common misconception among patients. Facial fat grafting along the malar and infraorbital region can provide dramatic rejuvenation without the stigma of gaining unwanted weight. By filling the cheek and the prejowl region, the face may actually look less heavy, as the relative volume is higher in the cheek/prejowl compared with the jowl/lateral mandible. For an athletic individual, the surgeon should advise the patient that a vigorous, daily exercise regimen might compromise the volume of the grafted fat, requiring subsequent sessions to obtain the desired result. However, this patient was able to show a 6-year follow-up with good persistence of her transplanted volume despite her active lifestyle. Smokers should be counseled preoperatively that fat viability might be affected due to nicotine's negative effect on the microvasculature. Establishing realistic expectations is always warranted but should be emphasized in certain types of individuals whose metabolism or microvasculature may limit the success of the endeavor.

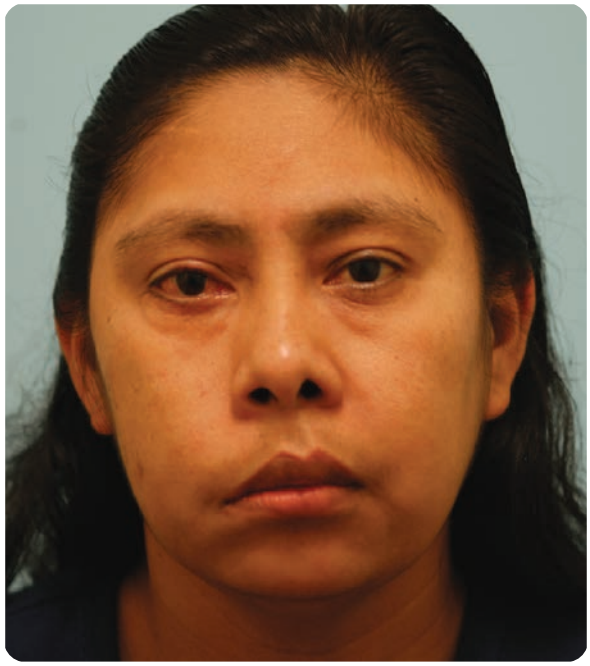
When a patient has early signs of jowling with a relatively thin face, fat grafting alone may suffice. However, if the patient is truly focused on the appearance of the jawline, then a rhytidectomy can be helpful to limit variability of the result and to increase the likelihood of an improved jawline contour. In this case, a limited SMAS rhytidectomy was all that was needed to accomplish the task, which showed good long-term benefit for the patient.

Case Study 5

FAT GRAFTING FOR FACIAL RECONSTRUCTION

Preoperative View

Postoperative View



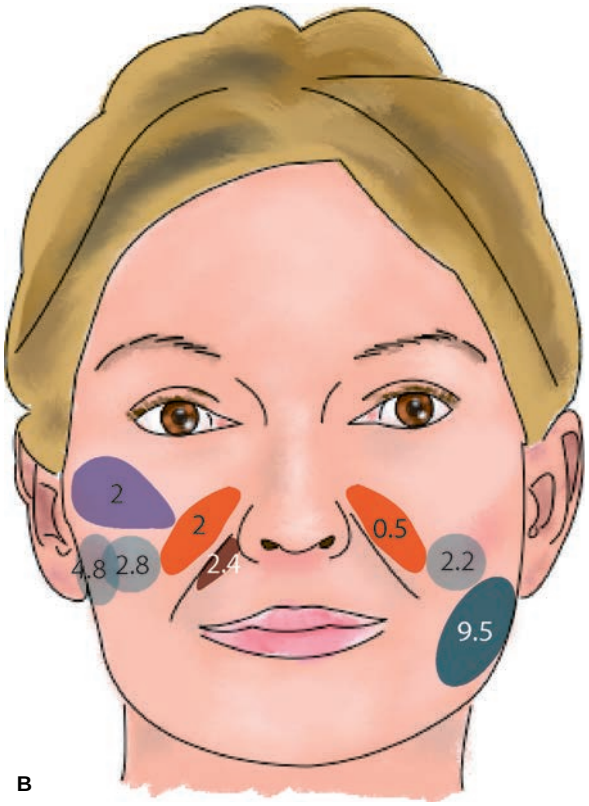


Figure 5-5A: *Case Study 5* demonstrates the implementation of fat grafting for correction of post-traumatic facial deformities. This patient had right hemifacial paralysis and subsequent right hemifacial atrophy secondary to a childhood injury. She underwent fat grafting principally to the atrophic right upper face. Additional fat was placed in her left lower face to restore balance with the protuberant bony deformity of her right lower face. A tarsal strip procedure and gold weight were used to improve right-eyelid closure. Her left nasolabial fold was corrected with serial microdroplet silicone treatments. A paired set of unidirectional barbed sutures placed into her right labiomandibular fold was used to lift the ptotic tissues. In her postoperative photographs, she exhibits a much more symmetrical appearance to her face, de-emphasizing her traumatic childhood scars. **B:** Schematic illustration of *Case Study 5* shows fat transfer volumes and distribution totaling 26.2 cc: 9.5 cc to the left lower face, 0.5 cc to the right anterior and lateral cheek, 2.2 cc to the left buccal region, 4 cc to the right anterior and lateral cheek, 2.8 cc to the right buccal region, 4.8 cc to the submalar region, and 2.4 cc to the right precanine fossa.

History

This 42-year-old woman was physically abused as an infant, resulting in multiple right-sided facial bone fractures and a permanent, complete paralysis of the right side of her face. Over the intervening 40 years, the patient developed marked facial atrophy of the right side of her face secondary to her facial-nerve paralysis. The atrophy was more noticeable in the right upper quadrant of the face than in the right lower quadrant due to the presence of a protuberant bony deformity in the lower right side. The unilateral facial paralysis also left her with dry eye symptoms from the inability to close her right eyelid, a prominence of the right upper lip, a descended right oral commissure, and a deeper left nasolabial fold.

Consultation

At the initial consultation, it was immediately apparent that she had a fragile emotional state and introspective demeanor. The patient's primary goals were to reduce the functional impairment of the right eye (inability to close the eye and persistent dry eye symptoms), restore symmetry, and re-establish as normal looking an appearance as possible so as to deflect attention away from these traumatic scars. The patient was counseled that the surgical intervention would proceed in multiple stages, and much time was spent establishing realistic goals regarding what could be achieved and the fact that absolute facial parity would be unattainable.

Intervention

The patient underwent implantation of a thin-profile gold weight in her right upper eyelid and a tarsal strip of her right lower eyelid in order to improve her eyelid closure and related symptoms. She was also initiated on an aggressive regimen of ocular lubrication. The redundant tissue of her right upper lip was resected, and the patient underwent asymmetric augmentation with facial fat grafting in order to achieve greater facial balance and harmony. The patient had a total of 26.2 cc of fat grafted with placement of 9.5 cc to the left lower face, 0.5 cc to the left malar septal depression (anterior cheek), 2.2 cc to the left buccal region, 4 cc to the right anterior and lateral cheek, 2.8 cc to the right buccal region, 4.8 cc to the submalar region, and 2.4 cc to the right precanine fossa. Subsequently, the patient received serial monthly treatments with silicone microdroplets to her left nasolabial fold and left labiomandibular fold. A threadlift was performed on the right lower portion of the face in order to elevate the right side of her lip and to help efface the right labiomandibular fold.

Results

The patient is shown 1 year following her initial procedures, including eyelid and lip surgery as well as facial fat grafting. She is approximately 7 months following completion of all silicone injections and is 6 months following threadlift of her right lower face. The most remarkable difference is the overall enhanced facial balance achieved through deliberate, asymmetric placement of fat. The atrophic right upper face appears more in harmony with the left upper face after selective augmentation of the atrophic right side. The relative prominence of the right lower face has been partly camouflaged by adding volume to the right upper face. In addition, fat infiltration of her left lower face has helped to balance the right and left lower quadrants of the face.

Commentary

This book has emphasized the potential of facial fat grafting as a purely cosmetic endeavor. This case study underscores the efficacy of fat transfer for reconstructive

purposes. Of all the many therapeutic interventions the patient in this case study received, she gained the most profound improvement through facial fat grafting. Unlike the recommended symmetrical distribution of fat infiltration advocated throughout the book, asymmetric fat infiltration can yield tremendous benefit in select clinical cases like this one. Fat grafting effectively corrected the atrophic portion of the right upper face but at the same time was used to offset the protuberant right lower face by augmenting the contralateral side to attain greater symmetry. Interestingly, besides facial symmetry, the patient also now bears a younger countenance. Preoperatively, the atrophic right side of the face appeared much more aged than the left side. With volume restoration of these deficient areas, the patient not only looks more balanced but also looks rejuvenated to a certain extent.

The result attained with fat grafting in this case is instructive even for patients who are desirous of fat grafting for only cosmetic purposes. The fuller lower lateral face (jowl and lateral mandible) that manifest with aging can contribute to the appearance of a square face (Chapter 1). By augmenting the cheeks and chin with facial fat grafting, the relative size of the lower lateral face can appear smaller when juxtaposed to the fuller contours of the newly enhanced cheeks and chin. The reader is encouraged to evaluate a prospective patient's entire face to see how each component relates to the other. What oftentimes appears to be a prominent part of the face is actually due to a deficient adjacent region. Careful analysis of the entire face and how individual features relate to each other can lead to proper analysis and consequent intervention.

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Note: A *b* following page numbers refers to boxes, *f* refers to figures, and *t* refers to tables.

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