



Managing the Difficult Soft Tissue Envelope in Facial and Rhinoplasty Surgery

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Abstract

Background: The nasal soft tissue envelope affects the final rhinoplasty result, and can limit the expected improvement. Currently, no dependable and objective test exists to measure the thickness of the nasal skin and underlying soft tissue.

Objectives: This paper presents a simple, yet reliable method to determine the thickness of the soft tissue envelope. An algorithm is presented for treatment of the dermis and/or soft tissue apart from surgery of the underlying osseocartilaginous structures.

Methods: Seventy-five patients presenting for primary rhinoplasty underwent visual and ultrasound assessment of their nasal soft tissue envelope. At preoperative evaluation, the Obagi “skin pinch test” was used to assess the thickness of the nasolabial fold and whether or not the skin was oily. Patients were classified based on the pinch thickness. At time of surgery prior to injection of local anesthesia, ultrasonic assessment was done at the nasolabial fold, keystone junction, supratip, and tip to measure the thickness of the nasal dermis and underlying soft tissue.

Results: Patients determined to have thin, normal, and thick skin by the “skin pinch test” were found to have a nasolabial fold dermal thickness with an average of 0.7 mm (0.4–1.2 mm), 1.1 mm (0.8–1.8 mm), and 1.4 mm (0.7–2.0 mm). Patients determined to have thin, normal, and thick skin were found to have a dermal thickness at the keystone junction with an average of 0.3 mm (0.2–0.4 mm), 0.5 mm (0.3–1.1 mm), and 0.9 mm (0.6–1.2 mm), respectively. This difference in thickness also translated to the supratip and tip areas measured. However, all areas were also affected by the oiliness of the skin. Soft tissue thickness (SMAS and muscle) underlying the dermis was variable. Patients of non-Caucasian background were more likely to have a thicker soft tissue layer.

Conclusions: The “skin pinch test” is an easy and reliable way for the surgeon to evaluate the thickness of the nasal soft tissue envelope. The rhinoplasty surgeon can make decisions pre- and postoperatively to treat patients with difficult soft tissue envelopes.

Level of Evidence: 4

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The soft tissue envelope of the face affects the final surgical result and can limit the expected improvement. While the majority of aesthetic surgery papers focus on operative surgical technique, the skin receives little attention. In addition, the majority of articles/presentations about the difficult soft tissue envelope focus on maneuvers done during the operation without emphasis on preoperative and postoperative treatments.¹

Currently, no dependable and objective test exists to measure the thickness and the health of the skin and underlying soft tissue. Surgeons use their anecdotal experience to estimate the soft tissue envelope of the operative field, and then change his/her operative plan accordingly. This article presents a review of the soft tissue envelope of

the face. It follows with a simple, yet reliable method – the Obagi skin pinch test – to determine the thickness of the skin. This information is then presented specifically to address the difficult soft tissue envelope of the nose in rhinoplasty surgery. An algorithm is proposed for treatment of

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the dermis and/or soft tissue apart from surgery of the underlying osseocartilaginous structures. Importantly, this article is the first that the authors are aware of that discusses preconditioning of the skin and postoperative treatment of the soft tissue envelope for rhinoplasty patients. While ultrasonography has been used to evaluate the existence and thickness of the intradomal fat pad as well as the underlying structures of the nose, this is the first article discussing the role of sonogram in the preoperative and postoperative treatment of a rhinoplasty patient to optimize the soft tissue envelope.²

Skin Essentials for the Plastic Surgeon

Definition of Skin Health

To effectively treat skin, we must understand the definition of healthy skin. Only by restoring skin from a damaged or diseased state to “healthy,” can we truly effect change in the skin. One does not need to be a Dermatologist to deal with skin. Healthy skin has the following characteristics:³

- (1) Even in texture – proper keratinocyte exfoliation.
- (2) Even in color – even melanocyte production and distribution.
- (3) Hydrated – good barrier function and fibroblast activity.
- (4) Free of disease (melasma, rosacea, etc.).
- (5) Tolerant (can protect itself from sun, oil, etc.) – good barrier function.
- (6) Normal contour.

- (7) Firm/tight – fibroblast production of collagen and elastin.

Understanding the definition of skin health is important because it helps the clinician to make a comprehensive diagnosis, to organize a treatment plan, to monitor progress, and to judge the final result.

Anatomy and Function of the Skin

To treat skin, it is essential that we discuss the interplay between anatomy and function. Superficially, the epidermis has two main functions: barrier function and renewal. The epidermis is made up of several layers that include the stratum corneum, granulosum, basale as well as the basement membrane. Together, the layers contain a balance of lipids, water, and proteins that are in homeostasis.¹ This balance helps to hydrate the skin and creates tolerance to offending agents including the sun, oil, etc. This is also the layer that gets inflamed when damaged. The epidermis also serves a function by naturally exfoliating. Skin cells are replicated, serve their cellular function, and then progress more superficially where they eventually die and are “flecked off.” This exfoliation can be artificially enhanced chemically and mechanically. It can also be artificially decreased by moisturizers and will naturally decrease with age.⁴ This gives the appearance of skin that has lost its vitality – dull, rough, and dry.

Deep to the epidermis lies the epidermal-dermal junction (Figure 1). This is anatomically where the basement membrane of the epidermis abuts the papillary dermis.

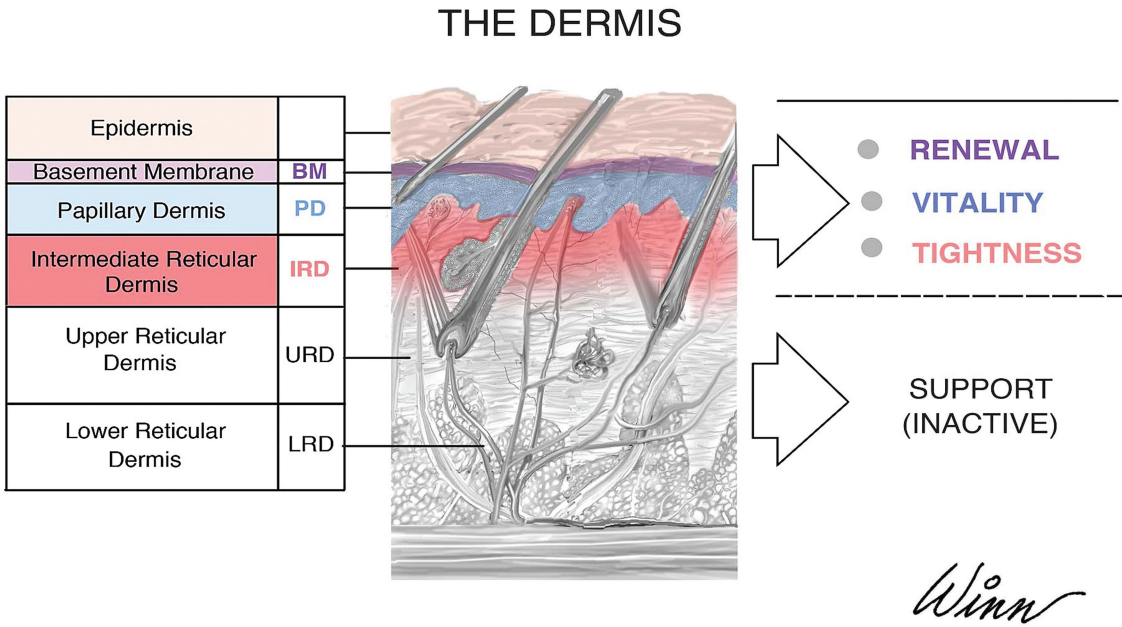


Figure 1. The skin is made up of the epidermis, basement membrane, and dermis. The basement membrane, papillary and immediate reticular dermis function to renew the skin and to maintain vitality while the upper and lower reticular dermis provide structural support.

This junction contains anchoring fibrils that attach the basal lamina of the epidermis to the collagen of the dermis. It is these fibrils that give the skin youthfulness by making it tight (minimal laxity when palpating the skin).

Finally, the dermis is the deepest layer of the skin and contains the papillary dermis (PD), intermediate reticular dermis (IRD), upper reticular dermis (URD), and lower reticular dermis (LRD). The basement membrane of the epidermis, the PD and the IRD are responsible for renewal, tightness and vitality. The URD and LRD are inactive (only supportive as infrastructure). The most active layer is the PD. The PD contains a large amount of collagen and elastin that gives the skin its tightness and resistance to stretch. This layer is also constantly using cell replication in a repair function and contains a large proportion of glycosaminoglycans to hydrate the skin. Importantly, sebaceous glands reside in the dermis. The larger the sebaceous glands, the more oily the skin, and the thicker the dermis. Hence, the more oily the skin, the thicker the skin.

Chronic damage to the skin can affect the final result of aesthetic surgical procedures. The 4 most common disease categories that a plastic surgeon is likely to see and to treat will be reviewed. The importance is not to understand every single disease and problem with skin. The key is to understand what the underlying problems are. As physicians we not only treat the symptoms, but also need to establish healthy skin. We can only strengthen skin by treating any disease process and/or abolishing any factors that are weakening skin – thereby restoring skin health.

Disorders of Sebum Thicken the Dermis

Rosacea (Figure 2) and acne are the 2 most common disorders of sebum that a surgeon is likely to encounter that can affect the final result. Rosacea is a chronic dermatosis that affects the central face, and is typified by remissions and exacerbations. This disease is often overlooked and early signs and symptoms can be subtle.^{5,6} A good understanding of this disease is essential to stopping the disease progression so that our surgical results may be enhanced. Rosacea is the most underdiagnosed disease in our experience. The generalized stigma of a red nose, engorged blood vessels, and acne is typical in late stages of the disease. However, most patients have milder forms of the disease that are difficult to pick up especially if patients have more pigmentation.^{4,7} In addition, almost 80% of Americans have no knowledge of rosacea.⁸ Research in the United States places the overall prevalence at just under 10%, and the prevalence in Caucasian women alone is 16%.⁹ In patients of Celtic ancestry, prevalence rates may be as high as 80%.¹⁰

This disease is an inflammatory process influenced by sebum; however, genetic, hormonal, and environmental issues play a role.² Rosacea has certain triggers, and the most common are sun, spicy food, emotions, hot baths,



Figure 2. This 60-year-old man demonstrates many of the symptoms of rosacea secondary to sebum including erythema, telangiectasias, textural damage, and weak skin preoperatively.

steam rooms, and alcohol.¹¹ It is a chronic and progressive disease with no “cure,” but the cutaneous inflammation can be controlled. The immune system employs inflammation when there is insult to its integrity. Specifically, the inflamed skin has weakened barrier function and increased permeability.¹ This results in decreased elasticity, textural damage and skin sensitivity. Moreover, inflammation propagates the aging process and melanin production leading to accelerated aging and nonspecific discoloration in rosacea sufferers.⁸

Pathophysiologically, the cathelicidin pathway is upregulated in rosacea inducing capillary vasodilatation, inflammation, and vascular proliferation secondary to mast cell proliferation.^{12,13} Patients often have a pink hue in the early form of the disease that progresses, intensifies, and flares with time. Rosacea causes sebaceous glands to grow rapidly and to produce large amounts of sebum that traps dead keratinocytes. As the oil causes inflammation, the nose in particular turns into a thickened (fibrotic), chronic wound. This inflammation weakens the nasal skin, destroys the texture, increases risk for pigmentation, clogs the pores, causes acne, brings increased amounts of blood supply to the face (erythema of rosacea), arrests natural exfoliation, and can cause rhinophyma and thick, glabrous skin. Associated edema can be temporary or persistent.³ The surgeon must be able to diagnose this disease during physical examination and to understand that without control, surgery can have a limited effect.

Acne comes in many forms (comedogenic, pustular, cystic, etc.) but it is more important to understand the problem. Like rosacea, this is a disease of inflammation and sebum. Once the hormones of puberty (specifically testosterone) cause oil glands to grow, sebum is introduced onto the face. This causes inflammation, clogged pores, and the buildup of oil. The naturally occurring bacteria on our face proliferates excessively causing erythema, infection, cysts, etc.¹⁴ Treatment involves creating healthy skin by appropriately cleansing, allowing natural exfoliation to occur, controlling oil, and strengthening skin.

Disorders of Sun

Photo-damage and photo-aging are sensitivity and aging from exposure to the sun (Figure 3). This is largely based on skin type and is somewhat accurately predicted by the classic Fitzpatrick classification.¹⁵ However, the sun affects some skin types (red, deviated white, brunette) much more than the Fitzpatrick system would suggest. This is seen early (mid-teens) with freckling. Over time, these patients are prone to solar lentigos, lentigo maligna, actinic keratosis, and ultimately, skin cancer as UV radiation causes inflammation and loss of elastin in the skin (premature aging).¹⁶ It is important to identify these patients early on and to educate them about the importance of strong skin and sun protection.

Disorders of Pigmentation

Post-inflammatory hyperpigmentation (PIH) and melasma are the 2 most common disorders of pigmentation that plastic surgeons are likely to encounter. PIH occurs when a patient's skin is prone to pigmentation after injury. That injury can be chemical or mechanical, and is often seen after peels, lasers, surgery, etc.¹⁷ These patients must be identified before any treatments are done on the skin so that it can be anticipated, predicted, prevented, and properly treated. Unlike chronic diseases of pigmentation (melasma, ochronosis, medication-induced hyperpigmentation), PIH can be treated and cured without recurrence. The key is prevention and recognition to make the diagnosis preoperatively.

Melasma is a disease of pigmentation (Figure 4). It is genetic, hormonal and environmental, can never be cured, but can be treated and prevented. Melanocytes live deep in our epidermis, make pigment, and transfer it to keratinocytes, which come to the surface as they mature. With melasma, some melanocytes are hyperactive. With stimulation, the melanocytes no longer make pigment at similar times and amounts. Pigment is fired unevenly into the epidermis and at times into the dermis. Thus melasma can be superficial or deep depending on whether the pigment is embedded superficially or deeper in the dermis. As introduced by the authors, the "Stretch Test" is done to determine the level of pigmentation.¹ When the skin is



Figure 3. Total skin evaluation on a preoperative patient. This 57-year-old woman is a natural white with extensive sun damage. She has normal skin (not oily) that is not fragile, with moderate laxity and normal thickness on skin pinch (1.5 cm pinch at the nasolabial fold). Looking at the 7 parameters of skin health, her texture is damaged in her "T-zone," especially along her glabella and nasal tip. Secondary to her pigmentation from photodamage, her skin is uneven in color and dehydrated. She is free of disease but her skin is weak and sensitive secondary to moisturizer abuse and sun damage. Contour is also uneven secondary to rhytides and her skin is loose.

stretched, if the melasma becomes lighter, this is superficial. If the tone does not change, it is deep. To treat melasma, the pigment must be managed, but again, it is much more important to make skin strong and stimulated while reprogramming the melanocytes to fire evenly. Only this will help prevent its recurrence.

Disorders of Sensitivity

Skin sensitivity is something that every plastic surgeon will encounter. Skin sensitivity is mainly an acquired disorder due to external factors that damage the barrier function of the skin. The primary causes are sun damage and inflammation; however, moisturizer abuse by our patients who are constantly hydrating their skin externally with products that are ill-suited to their skin type is often overlooked. Over time, misuse leads to thinning of the epidermis, buildup of dead keratinocytes, the arrest of barrier function, and reduced fibroblast activity and glycosaminoglycan activity.¹ Skin sensitivity must be corrected before any treatment or procedure because it weakens skin and disrupts the normal epidermal and dermal functions.



Figure 4. This 38-year-old woman has epidermal and dermal melasma preoperatively. The “stretch test” is performed to diagnose the depth of the melasma. If the skin is stretched and the pigmentation does not lighten, the pigmentation lies deep to the basement membrane.

METHODS

Seventy-five patients presenting for primary rhinoplasty in the primary author’s practice between January 2015 and January 2016 underwent visual and ultrasound assessment of their nasal soft tissue envelope (Sonosite Edge Ultrasound Machine, WA with a 25 MHz transducer). Guidelines were used keeping in accordance with the Declaration of Helsinki. Patients were excluded that had previous nasal surgery for any cosmetic or reconstructive reasons. At preoperative evaluation, the Obagi “skin pinch test” was used to assess the thickness of the dermis at the nasolabial fold. Also, the primary author assessed whether or not the skin was oily.¹ Patients were classified based on the pinch thickness at the nasolabial fold: thin (< 1 cm), normal (1-2 cm), and thick (> 2 cm). At time of surgery prior to injection of local anesthesia, ultrasonic assessment was done at the nasolabial fold, keystone junction, supratip, and tip to measure the thickness of the nasal dermis

Table 1. Comparison of Thin, Medium, and Thick Skin Patients

	Thin skin	Medium skin	Thick skin
Number of patients	8 (11%)	36 (48%)	31 (41%)
Number of oily patients	2 (20%)	10 (28%)	21 (71%)
Nasolabial fold dermal thickness	0.7 mm (0.4-1.2 mm)	1.1 mm (0.8-1.8 mm)	1.4 mm (0.7-2.0 mm)
Keystone dermal thickness	0.3 mm (0.2-0.4 mm)	0.5 mm (0.3-1.1 mm)	0.9 mm (0.6-1.2 mm)
Supratip dermal thickness	0.7 mm (0.4-1.0 mm)	1.2 mm (0.4-1.8 mm)	1.8 mm (0.7-2.7 mm)
Tip dermal thickness	0.8 mm (0.3-1.5 mm)	1.1 mm (0.3-1.6 mm)	1.6 mm (0.5-2.7 mm)

and underlying soft tissue. Steps of the rhinoplasty were recorded and statistics tabulated with weighted *t* tests.

RESULTS

Seventy-five patients (12 male and 63 female) were measured with the sonogram who presented for primary rhinoplasty (Table 1). The average patient age was 33 years old (range, 19-61 years) and no statistically significant difference was found between the ages of the thin, medium and thick skin groups. Eleven percent of patients (*n* = 8) were found to have thin skin, 48% (*n* = 36) to have medium skin, and 41% (*n* = 31) thick skin. Patients determined to have thin, normal and thick skin by the “skin pinch test” were found to have a nasolabial fold dermal thickness with an average of 0.7 mm (range, 0.4-1.2 mm), 1.1 mm (range, 0.8-1.8 mm), and 1.4 mm (range, 0.7-2.0 mm). Patients determined to have thin, normal and thick skin were found to have a dermal thickness at the keystone junction with an average of 0.3 mm (range, 0.2-0.4 mm), 0.5 mm (range, 0.3-1.1 mm), and 0.9 mm (range, 0.6-1.2 mm), respectively. This difference in thickness also translated to the supratip and tip areas measured. Patients determined to have thin, normal, and thick skin were found to have a dermal thickness at the supratip with an average of 0.7 mm (range, 0.4-1.0 mm), 1.2 mm (range, 0.4-1.8 mm), and 1.8 mm (range, 0.7-2.7 mm), respectively. Patients determined to have thin, normal and thick skin were found to have a dermal thickness at the tip above the domes with an average of 0.8 mm (range, 0.3-1.5 mm), 1.1 mm (range, 0.3-1.6 mm), and 1.6 mm (range, 0.5-2.7 mm), respectively.

The tip and supratip areas were also affected by the oiliness of the skin. Twenty percent of patients with thin skin were found to be oily. Twenty-eight percent of patients with medium skin were found to be oily. Seventy-one

percent of patients with thick skin were found to be oily. Patients with thin skin that was determined to be oily had dermal thickness that was 4, 12, and 17% thicker at the keystone, supratip and tip areas, respectively than non-oily skin patients. Patients with medium skin that was determined to be oily had dermal thickness that was 21, 123, and 82% thicker at the keystone, supratip, and tip areas, respectively than non-oily skin patients. Patients with thick skin that was determined to be oily had dermal thickness that was 56, 78, and 107% thicker at the keystone, supratip, and tip areas, respectively than non-oily skin patients.

Soft tissue thickness (SMAS and muscle) underlying the dermis was variable and did not reach statistical significance other than for thick skin patients, ie, No correlation can be made between the Obagi skin pinch test and the thickness of the soft tissue under the dermis for thin and medium skin patients. Patients determined to have thin, normal and thick skin were found to have a soft tissue thickness at the keystone junction with an average of 0.9 mm (range, 0.6-1.4 mm), 0.9 mm (range, 0.6-1.9 mm), and 1.2 mm (range, 0.9-2.4 mm), respectively. Patients determined to have thin, normal and thick skin were found to have a soft tissue thickness at the supratip with an average of 2.6 mm (range, 2.1-4.3 mm), 3.1 mm (range, 1.8-4.9 mm), and 3.1 mm (range, 1.7-4.6 mm), respectively. Patients determined to have thin, normal, and thick skin were found to have a soft tissue thickness at the tip above the domes with an average of 1.2 mm (range, 0.9-2.5 mm), 2.0 mm (range, 0.7-3.8 mm), and 2.4 mm (range, 1.5-3.6 mm), respectively. Patients of non-Caucasian background were more likely to have a thicker soft tissue layer.

Examples of sonogram of different skin thicknesses are shown in Figures 5-7.

DISCUSSION

Evaluating Skin

To properly treat skin, we must do a thorough evaluation to identify our patient's skin type, to determine the physiologic components that are unhealthy, and to determine what, if any, disease(s) are present. This will guide our overall treatment of symptoms during the process of creating healthy skin. If the symptoms are treated without creating healthy skin, the symptoms will recur.

Traditional dogma uses the Fitzpatrick classification to categorize skin type.¹⁵ By looking at the response to sun exposure in terms of tanning and burning, physicians are taught to make decisions regarding treatment. In general, darker skin people will react with pigmentation in a more variable pattern. This classification scheme is simple, yet impractical because the physician can only make generalizations about skin based on tanning. Below is a more

practical classification system that allows us to classify skin and to treat skin. When the authors see a patient, we classify them based on 5 parameters, and then look at the 7 parameters of healthy skin. We evaluate:

- (1) What is the patient's skin type? Our classification is natural white, deviated white, brunette, mixed, natural Asian, deviated Asian, natural black, and deviated black (Figure 8). The natural white and natural black almost always react to procedures and injury without pigmentation. The deviated classes and brunette have a greater problem with pigmentation. Finally, the mixed or complex (Native American, Indian, etc.) are the most variable.
- (2) Is the patient's skin oily? Oil on the skin will make any treatment less effective.
- (3) Is the skin fragile? Fragile skin heals poorly and feels like leather when pinched between the thumb and forefinger.
- (4) What is the thickness of skin? This is measured by pinching the cheek skin above the nasolabial fold – the Obagi skin pinch test – where > 2 cm is considered thick, 1-2 cm is normal, and < 1 cm is thin. This will affect our treatment plan especially when it comes to procedures. For example, patients with thin skin will have the greatest benefit from tightening procedures including controlled depth trichloroacetic acid (TCA) peels, but will also have the smallest margin of error during the procedure.
- (5) What is the amount of skin laxity?

After this, we look at their skin in terms of the 7 parameters of skin health (discussed in the introduction), and decide what is missing or altered. This will form our comprehensive diagnoses and then guide our treatment plan.

Principles of Skin Care

The fundamental goal is to restore healthy skin while treating damaged skin at the same time. After evaluating the skin based on the parameters described above in terms of skin health and patient classification, a treatment plan is created. While we may prescribe treatments that restore texture, even color tone, etc., the overall goal is to make healthy skin. Many treatments aimed at symptoms will make a mild to moderate improvement only to have the patient's symptoms come back very quickly. This is because without healthy skin, the symptoms will return. This is similar to the way that a patient with a failing heart will continue to have lower extremity edema even after diuretics have been used. The unique part about this approach is that skin health is restored while also treating skin disease at the same time.

To create healthy skin, a minimum number of steps must be performed on a daily basis. The first step in any

effective skin care program aimed to restore healthy skin is epidermal correction. This involves cleansing, exfoliating, and controlling oil on the skin surface. A cleanser is selected to remove sebum and impurities leading to inflammation. A proper mechanical exfoliant will shed dead keratinocytes and augment the natural cycle of exfoliation. Finally, oil control pads containing salicylic and/or mandelic acid will reduce pore size, remove any remaining oil, and soothe the skin by targeting the inflammatory cascade.¹⁸

Disease-specific agents for diseases of sebum include glycolic acid to speed epidermal exfoliation and to minimize trapped sebum. Oil control is also supported by benzoyl peroxide that acts as an antimicrobial agent. Epidermal stabilization is accomplished via a potent mixture of anti-oxidants and sunblock to promote anti-inflammation, DNA repair, melanocyte stabilization, and decreased inflammation (by decreasing the skin’s sensitivity to UV light).



Figure 5. (A) A 46-year-old woman with thin skin as determined by the Obagi skin pinch test preoperatively. She was also determined to be not oily. (B) Sonogram done preoperatively measures the dermis at 0.4 mm at the keystone junction and supratip areas. Notice the thickness of the dermis does not change because the patient is not oily. The subcutaneous tissue measures 0.8 mm and 3.2 mm at the dermis and supratip areas, respectively.



Figure 6. (A) A 39-year-old woman with medium thickness of skin as determined by the Obagi skin pinch test preoperatively. She was determined to be oily. (B) Sonogram done preoperatively measures the dermis at 0.4 mm, 1.0 mm, and 0.9 mm at the keystone junction, supratip, and tip areas, respectively. Notice the thickness of the dermis increases on the nose towards the tip as the patient is oily. The subcutaneous tissue measures 0.9 mm, 2.6 mm, and 0.9 mm at the dermis, supratip, and tip areas, respectively.

The exact treatment of the many number of skin conditions and diseases are beyond the scope of this article however a few basic guidelines will be proposed:

- Any patient interested in anti-aging or with prolonged sun exposure will benefit from growth factors as well as retinol/retinoic acid.



Figure 7. (A) A 35-year-old woman with thick skin as determined by the Obagi skin pinch test preoperatively. She was determined to be oily. (B) Sonogram done preoperatively measures the dermis at 1.0 mm and 1.4 mm at the keystone junction and supratip areas, respectively. Notice the thickness of the dermis increases on the nose towards the tip as the patient is oily. The subcutaneous tissue measures 1.1 mm and 4.4 mm at the dermis and supratip areas, respectively. Of note, patients of Asian ethnicity typically have a much thicker subcutaneous layer requiring debulking during rhinoplasty to achieve tip definition.

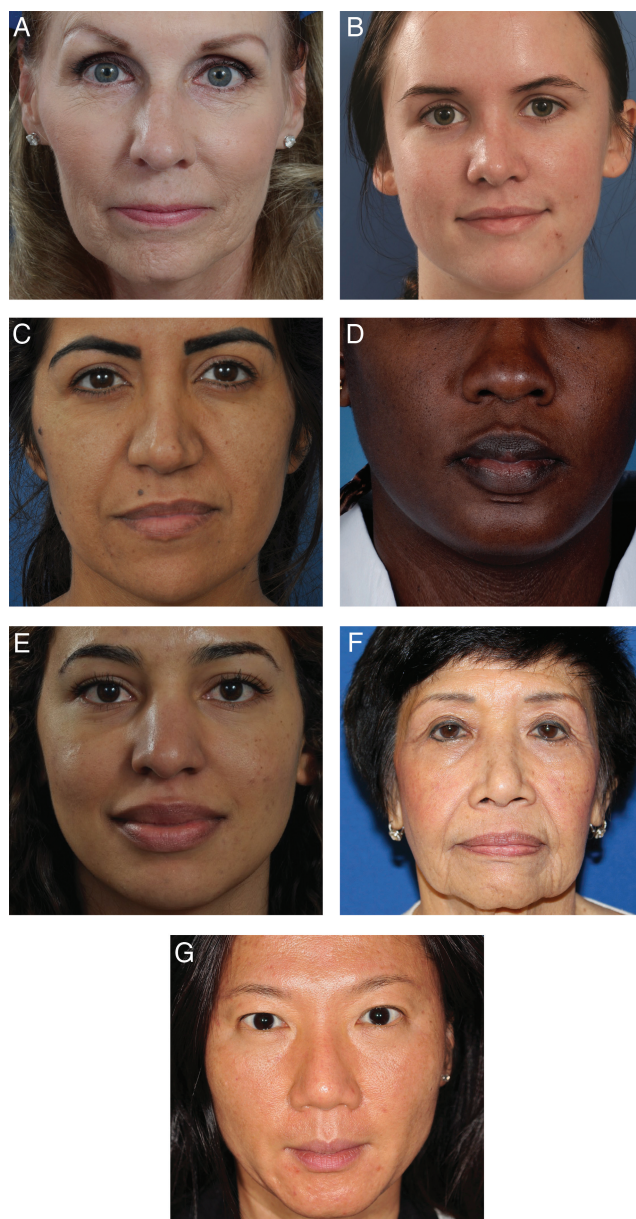


Figure 8. Our skin classification scheme is useful because it not only provides useful information regarding sun tolerance, but also how the skin may react to injury (ie, mechanical, chemical). The more deviated the skin, the more unpredictable the reaction to procedures. For example, naturally black skin will not tan and will tolerate injury with little risk of dyspigmentation. On the other hand, deviated black skin is prone to pigmentation problems. Representative (A) natural white, (B) deviated white, (C) complex or mixed, (D) natural black, (E) deviated black, (F) natural Asian, and (G) deviated Asian patients.

- Patients with disease related to sebum and inflammation will only truly benefit after oil has been controlled. If a patient is having a limited effect with your treatment program, oil control must be considered first.
- Issues related to pigmentation can be controlled with hydroquinone (HQ)-containing products and nonhydroquinone-containing products. Patients become resistant to HQ within 5 to 6 months and some patients can have rebound hyperpigmentation.¹⁹ Cycle on and off with HQ-containing products. PIH can be cured but diseases such as melasma can only be controlled and the patients must be followed closely. Patients with deep melasma may need further treatments beyond topical creams including TCA peels.
- The benefits of Vitamin A in treating and maintaining the skin are almost endless.^{1,3,20} Retinoids increase barrier function, thicken the epidermis, enhance exfoliation, decrease acne, help distribute melanin, improve moisturization, decrease pore size, slow aging, and upregulate collagen, elastin and glysoaminoglycan production. Vitamin A is absolutely essential in the general repair of skin, and specifically, rosacea. A good general repair of the skin involves 3 keratinocyte maturation cycles, or approximately 5 months of treatment. Patients must be educated about what these products do, their benefits, and the anticipated reactions. The anticipated reactions when these products are used (red, dry, peeling skin, etc) are intentional. In effect, a short-lived acute inflammation using retinoic acid topically is created during the general repair. However, after the period of general repair the therapeutic properties of retinoic acid slows and chronic inflammation predominates. The patient can be transferred from retinoic acid to retinol, which is much better tolerated for long-term use.
- If not counseled properly, patients often think they are having an allergic reaction when first using retinoids. They are not allergic reactions but anticipated reactions of treatment. Counseling patients appropriately is paramount. Those with rosacea especially will look worse before they look better. If a patient is prone to hyperpigmentation (as diagnosed at their first visit based on their skin type and parameters of skin health) plan on treating this prophylactically at the start of treatment.
- Sun exposure and UV rays exacerbate inflammation and is especially detrimental with those who suffer from rosacea. Sunscreen is very important to reduce flares.²¹ We advocate what has been termed a triple-defense system for protection using a physical sun block, fractionated melanin to downregulate the production of melanin, and anti-oxidants.^{8,22}

Clinical Translation: Treatment of the Difficult Soft Tissue Envelope in Rhinoplasty

The overall nasal shape is governed by not only the osseocartilaginous vault, but also by the soft tissue envelope of the nose. The vast majority of rhinoplasty literature focuses on the intraoperative management of the underlying bone and cartilage. However, upon review of 100 patients presenting for primary, cosmetic septorhinoplasty between January and July 2015, 34% of patients had a soft tissue envelope that was deemed difficult in the primary author's practice. A difficult soft tissue envelope meant that the overall result would be negatively affected by the characteristics of the skin and subcutaneous tissues. Most surgeons do not regularly modify the soft tissue envelope of the nose during rhinoplasty. However, maneuvers can be done surgically to allow for a more favorable cosmetic outcome.^{23,24} This discussion will not only present an algorithm for intraoperative management of the difficult soft tissue envelope, but also will discuss the new ideas of preconditioning and postoperative management.

While overall thickness remains important, dividing the soft tissue envelope into the dermis and subcutaneous tissue allows the surgeon to understand what can be modified intraoperatively, and what can be modified in the preoperative and postoperative periods. It is not enough to simply say that the soft tissue envelope is thin or thick if we are to achieve optimal results. The soft tissue envelope must be divided into its components and treatment can be tailored to either the dermis, the subcutaneous tissues, or both. A preoperative and postoperative algorithm was developed and followed since January 2015. This algorithm has been followed in all patients since January 2015, even though the skin pinch test data were only compiled from patients presenting for primary rhinoplasty to avoid confounding factors. No complications have been observed with the surgical modifications discussed below.

At the preoperative visit, the skin pinch test is done to determine the thickness of the skin. Then, it is determined whether or not the patient is oily. The components of the algorithm are described below.

Thin Soft Tissue Envelope: Dermis, Subcutaneous Tissues, or Both

Thin skin has the advantage that the rhinoplasty surgeon has the opportunity to achieve maximum definition of the nose. However, patients with thin skin also can have the opposite problem where even subtle irregularities are both visible and palpable. Patients with thin skin often have thin dermis, thin subcutaneous tissue, or both (Figure 5).

Unfortunately, the soft tissue envelope can only be manipulated intraoperatively (except in extreme cases requiring fat grafting).²⁵ For patients with thin skin, dissection in a sub-perichondrial and subperiosteal plane is recommended to keep as much tissue on the nasal flap as possible and to preserve these vascularized tissues for coverage.²⁶ Even the slightest irregularity can be apparent at the keystone junction after surgery and therefore preservation of cartilage (upper lateral cartilage) is paramount to a smooth result. The thickness of the soft tissue envelope in a thin-skinned patient as determined by the Obagi Skin Pinch Test can be less than 0.5 mm. It behooves the surgeon to thicken the soft tissue envelope during surgery and this camouflage can be done with fascia, dermis, perichondrium, or a skin substitute. In primary rhinoplasty, the primary author has found that the deep temporal fascia works best in a vascularized bed as there is large quantity, harvest can be done in less than 10 minutes, and thickness is often greater than 1 mm thick (Figure 9 and [Supplementary Video 1](#), available as [Supplementary Material](#) at www.aestheticsurgeryjournal.com). Therefore, this graft can triple the thickness over the osseocartilaginous framework. This graft is often used over the dorsum, but can also be placed on the tip for additional padding and coverage. The two disadvantages are the scar in the temporal hair as well as the propensity for redness of the nasal skin in the early postoperative period. However, there have been no cases of alopecia and persistent redness likely secondary to elevating a thin soft tissue envelope has been treated with intense pulsed-dye laser in 1 case.

Thick Soft Tissue Envelope

Patients with thick skin can be divided into those with thick dermis, thick underlying soft tissue, or both. Thick skin is an issue in cosmetic rhinoplasty that for many surgeons seems insurmountable. Unlike the thin-skinned patient where even subtle irregularities are present, in thick skinned patients achieving definition is the most difficult issue. Numerous articles have focused on the intraoperative maneuvers that can be done on the cartilaginous framework to achieve definition.^{27,28} These will not be covered in this article although we will mention that rigid support with septal extension grafts, tip grafts, columellar struts, and lateral crural strengthening maneuvers all work well to create projection and definition. However, even with all of these maneuvers that are challenging and require large amounts of cartilage, the thick soft tissue envelope can still result in lack of definition and loss of projection. The subtle polygons of the nose cannot be visualized and surface highlights are lost entirely.²⁹



Figure 9. (A, C, E, G) Preoperative and (B, D, F, H) 13-month postoperative photographs of this 45-year-old woman who was determined to have thin skin by the Obagi skin pinch test. She underwent an open septorhinoplasty with medial oblique and low to low osteotomies done with the Piezo saws, dorsal reduction, spreader grafts, tip support with a columellar strut, tip suturing, and alar rim grafts. A fascia graft was fastened over the dorsum before closure to provide padding.

Thick Dermis

Patients with thick dermis often have oily skin as well. This is the case in 45% ($n = 34$) of patients measured and it should be noted that patients of certain ethnic backgrounds have notoriously thick, oily skin.³⁰ The skin can be optimized by controlling oil production. This will shrink the oil glands, decrease skin inflammation, improve healing, and decrease swelling.

Patients determined to have thick dermis benefit from preconditioning with a combination of salicylic acid, mechanical scrub, alpha hydroxyl acids, and retinoids to shrink the oil glands. In the primary author's practice, this preconditioning is done for at least 6 weeks prior to surgery to optimize the soft tissue envelope for cosmetic rhinoplasty (Figures 10 and 11). Appropriate use of retinoids as well as mechanical and chemical exfoliants on the skin creates an acute inflammatory response that causes massive exfoliation and stimulation of keratinocytes. This regimen is stopped 5 days before surgery and restarted 10 days after surgery. This "general repair" of the skin is continued for a total of 5 months and then the patient is transitioned onto a maintenance program consisting of retinol instead of retinoic acid as described above.

Selected patients including those with sebaceous gland hyperplasia, rosacea and cystic acne benefit from a postoperative treatment program with 20 mg of isotretinoin (Accutane) started at 3 to 4 weeks following surgery and continuing for 4 to 5 months (Figure 12). This medication acts to decrease the size of the oil glands, exhibits anti-inflammatory properties, and promotes healing.^{31,32} Specific to the nose, it has been demonstrated that facial cutaneous blood flow is reduced as well as nasal volume. With concomitant topical therapy, long-lasting disease remission is achieved after the drug is stopped.¹ Using this low dose of isotretinoin, the medication is well tolerated by patients.

Contraindications to isotretinoin include plans for pregnancy, inflammatory bowel disease, hepatitis, drug addiction, and patients who are unreliable. Urine pregnancy tests in females must be done monthly in accordance with the iPledge program and routine labs are checked monthly (complete blood count, complete metabolic panel, urinalysis, and lipid panel in our practice). In our practice, the process of putting patients on isotretinoin is done when indicated. However, if this is not a medication used in your common practice we recommend working closely with a dermatologist. Teenagers and patients with acne are routinely put on isotretinoin and dosing is based on weight (often 60-80 mg/day). With our proposed low dose of 20 mg/day, side effects are seen in less than 2% of patients. Dry lips is the most common patient complaint.

Oftentimes, patients with thick, oily skin have severe textural damage on the surface of their nose. Three to six

weeks after rhinoplasty, a combination of trichloroacetic acid peel and CO₂ fraxel is performed on these patients to shrink pores and for textural smoothing and resurfacing.³³ The peel effectively decreases pore size while the laser decreases the thickness of the dermis and smooths the overlying contour. If isotretinoin is to be used in conjunction, it is started when the patient has completely healed from the laser procedure (Figure 12). It must be emphasized that this procedure should not be done in isolation as it does not treat the underlying pathology. Oily skin and rosacea must be treated before and after any surgical procedure to control healing, to prevent recurrence, and to halt the progression of the disease.

Thick Subcutaneous Tissue

Patients determined to have thick underlying soft tissue benefit from all the same pre- and post-conditioning regimens as patients with thick dermis. In addition, patients are routinely defatted using an open approach.³⁴ Dissection at a subdermal level is done followed by resection of the intervening soft tissues down to the cartilage level (Figure 13 and [Supplementary Video 2](#), available as [Supplementary Material](#) at www.aestheticsurgeryjournal.com). Oftentimes, up to 4 mm of subcutaneous tissues can be excised allowing for mechanical thinning of the soft tissue envelope. We prefer this approach to primary defatting of the nasal skin flap as advocated by Davis.²² Dissecting at a subdermal level offers a clean plane of dissection without concern for blood supply and no thinning of the dermis occurs.

The Role of Ultrasound

The role of ultrasound in rhinoplasty cannot be overstated. Ultrasound was first used in 2004 to describe the existence of the interdomal fat pad.² This fat pad was later visualized and the dimensions measured using ultrasonography. Ultrasound was suggested as an objective and inexpensive way for the operating surgeon to measure the thickness of the nasal tip.³⁵ Also, removing the interdomal fat pad was described as necessary to achieve more tip definition. The primary author utilizes an ultrasound both in the office, and in the operating room. Preoperative and postoperative sonograms are routinely done on patients to visualize the underlying components of the soft tissue envelope as well as the osseocartilaginous components. Tasman et al recommend using ultrasound to assess preoperative deformities. His group also used ultrasound to correlate tip definition with underlying soft tissue structure and unsurprisingly found that tip refinement was inversely correlated to preoperative soft tissue thickness.³⁶ Nemati et al found that ultrasound was much more accurate than physical examination by the operating surgeon in predicting the thickness of the nasal skin envelope.³⁷ Interestingly they found that defatting

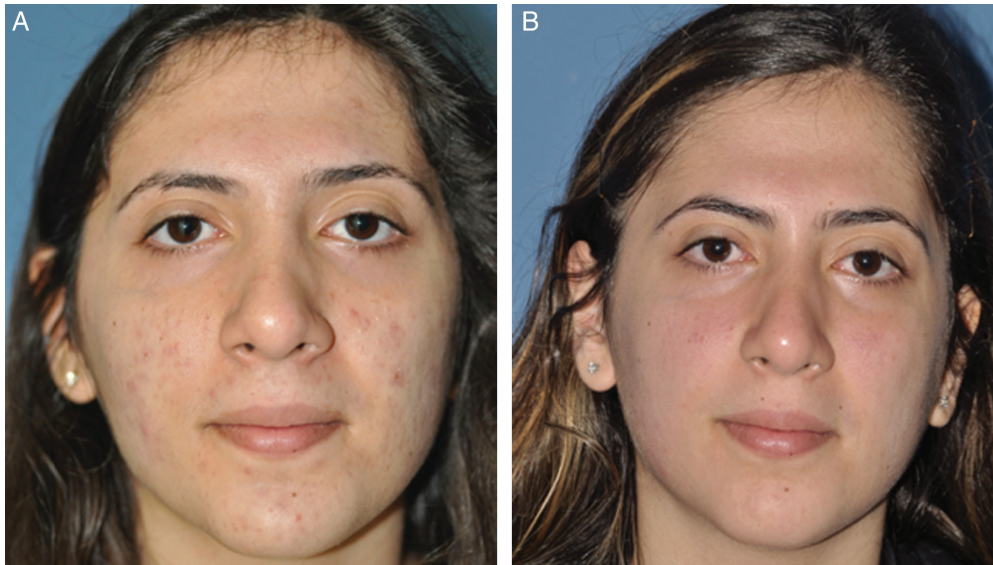


Figure 10. (A) This 19-year-old woman had a previous rhinoplasty by another surgeon. She demonstrates oily skin, cystic acne, and post-inflammatory hyperpigmentation. (B) After 6 weeks of preconditioning, healthy skin has been restored. Preconditioning included a cleanser for oily skin, mechanical scrub, oil control pads, anti-oxidants, hydroquinone, glycolic acid, retinoic acid, and sunscreen.

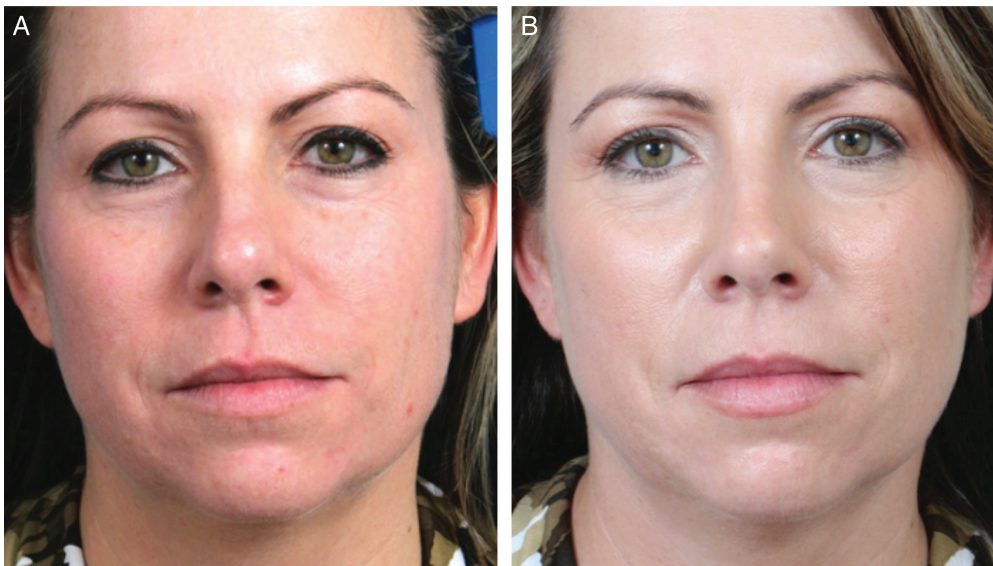


Figure 11. (A) This 40-year-old woman demonstrates rough texture, discoloration and weak skin secondary to oil and excessive sun exposure. The skin has moderate laxity and she has erythema of rosacea. (B) After 2 months of skin care, healthy skin has been restored. The skin is now even in texture and color, strong, free of disease, and well hydrated. Preconditioning included a cleanser for oily skin, mechanical scrub, oil control pads, anti-oxidants, glycolic acid, retinoic acid, and sunscreen.

of the nasal tip resulted in no statistically significant decrease in soft tissue envelope thickness at 1 year when measured by ultrasound. However, we see 2 issues with this study. The first is that the defatting was done in thick and “normal” patients using a closed technique and an endpoint of 1 cm³ fat removal was used. In the primary author’s practice, he

favors an open approach and all of the fat below the subdermal plexus is removed from the columellar breakpoint to the supratip and from the right to left A1 accessory cartilages. This results in a much larger volume of fat removed. The second issue is that measurements of the soft tissue envelope did not decipher between dermis and the underlying

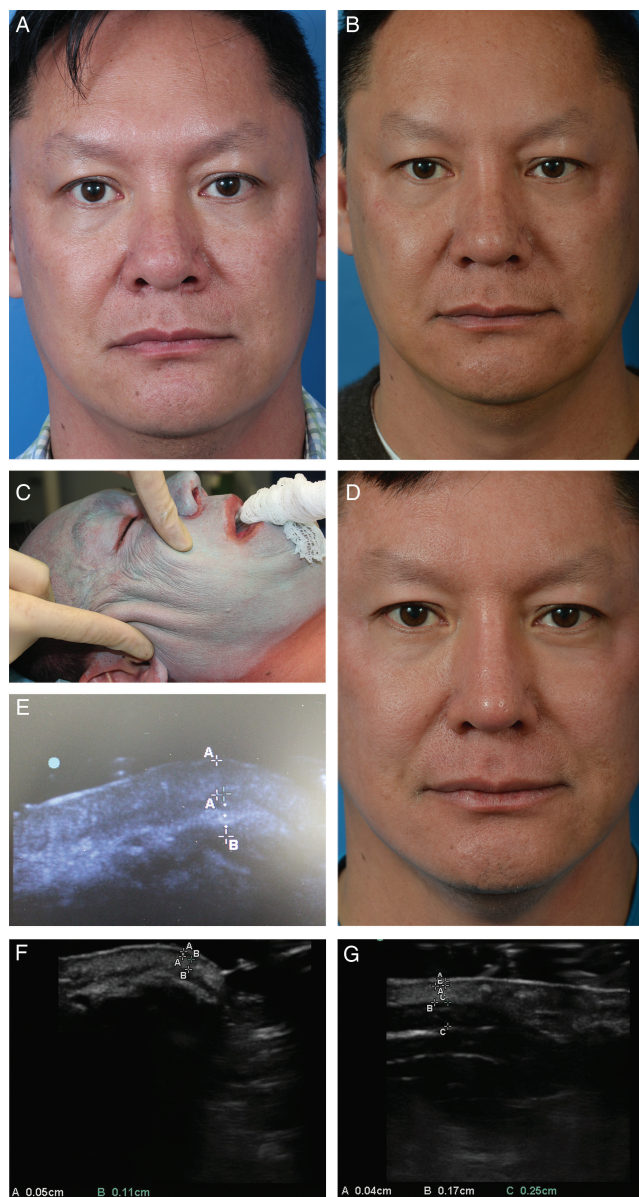


Figure 12. (A) This 44-year-old man had a previous rhinoplasty with domal division by another surgeon and wished to have a higher dorsum and increased tip definition. He has thick, oily skin, phymatous rosacea, rough/glabrous nasal texture, nonspecific discoloration, telangiectasias, and dullness. (B) The patient underwent 6 weeks of preconditioning with a cleanser for oily skin, mechanical scrub, oil control pads, anti-oxidants, hydroquinone, glycolic acid, retinoic acid, and sunscreen. This was followed by formal septorhinoplasty with defatting of the tip, diced cartilage in fascia graft, septal extension graft, and tip grafting. Ten days following surgery he restarted his skin treatment regimen. He is shown 3 months after his secondary septorhinoplasty. (C) At 3 months after surgery, the patient underwent a controlled depth (papillary dermis) blue peel followed by CO2 fraxel of the nose and

soft tissues. Many patients have thick dermis with “normal” or thin underlying soft tissue. Defatting would not be the most helpful maneuver in these patients.

Aside from visualizing preoperative deformities and helping with intraoperative decisions, the sonogram has been very useful postoperatively. Oftentimes it is difficult to determine whether suboptimal early results are due to swelling, surgical scar, poor operative planning, or poor execution of the operation (Supplementary Figure 1). For example, a pollybeak seen early after surgery can be from soft tissue swelling, scar, loss of tip support, or inadequate reduction of the anterior septal angle. Visualization, palpation and “operative experience” are our only methods to make this assessment currently. With the use of sonogram, the primary author is able to determine definitively the cause of this deformity. Also, this is a very useful tool with patients. Verbally telling a patient that they have swelling is much more convincing when you can demonstrate it visually with an ultrasound picture. Finally, it has allowed us to begin to quantify our pre- and post-treatment modalities. If a patient is put on isotretinoin for example, we can measure monthly the decrease in the thickness of the dermis (Figure 12). Likewise, CO₂ resurfacing can be quantified. Overall this has allowed for a more precise and predictable operation through good preoperative planning (and conditioning if necessary) and postoperative treatment.

Study Limitations

The major limitation is the lack of outcomes data. The skin pinch test has been validated, and the primary author feels that with an accurate test to determine skin thickness, surgical planning has been more effective. However, we have not as yet randomized different patients with respect to pre-treatment, the skin pinch test or postoperative treatment. The primary author also feels

peri-oral areas. (D) Nine days after this procedure, the patient again restarted his skin treatment regimen as well as 20 mg of Isotretinoin daily. This was continued for 5 months. The patient is shown at 13 months after his secondary septorhinoplasty. (E) This sonogram was taken directly before the patient’s controlled depth TCA peel and CO2 fraxel 3 months after surgery. The dermis measures 1.5 mm and the subcutaneous tissue 1.1 mm at the nasal tip. (F) This sonogram was taken at 13 months post-operatively. The dermis measures 0.5 mm and the subcutaneous tissue 1.1 mm at the nasal tip. The dermis has been shrunk by 67% with the isotretinoin and CO2 fraxel procedure. (G) With the sonogram we visualize the keystone junction at 13 months postoperatively. The dermis measures 0.4 mm, the subcutaneous tissue 1.7 mm, and the diced cartilage in fascia graft 2.5 mm.



Figure 13. (A, C, E, G) Preoperative and (B, D, F, H) 12-month postoperative photographs of this 26-year-old woman who was found to have medium thick skin that was oily. She underwent septorhinoplasty, radix augmentation with a diced cartilage in fascia graft, septal extension graft, multi-layer tip graft, and lateral crural strut grafts for lateral support. (I) The nasal tip was dissected at a subdermal level and all subcutaneous tissue removed (the subcutaneous tissue was measured to be 2.7 mm by sonogram). (J) Piezo instrumentation was used to resect the septal body as well as a portion of the perpendicular plate of the ethmoid. (K) The septal resection was fastened as a septocolumellar “tomahawk” graft with bone posteriorly and cartilage projecting over 1 cm above the dorsum.

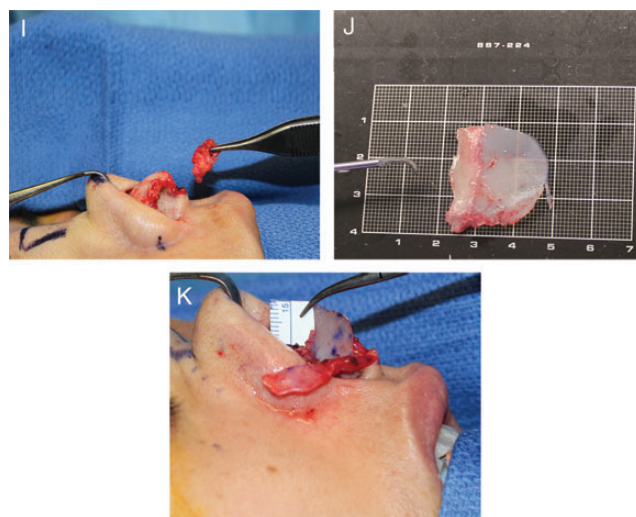


Figure 13. *Continued*

that sonographic data have allowed better postoperative management of rhinoplasty patients. For example, supratip scar can be measured and injected under direct vision with subsequent sonographic follow-up. More outcomes data are also needed to validate this approach to postoperative management.

CONCLUSIONS

The “skin pinch test” is an easy and reliable way for the surgeon to evaluate the thickness of the dermis. Specifically, the rhinoplasty surgeon can evaluate the thickness of the dermis and overall soft tissue envelope at the keystone area. This thickness also translates into the lower third of the nose, but the oiliness of the skin also plays a role and affects the dermis specifically. With more sophisticated gathering of data about the soft tissue envelope of the nose and face, results are not only enhanced but also patients who otherwise would not have gotten a limited result can now be treated with greater success as the soft tissue envelope is treated specifically. Preconditioning and postoperative treatment of the soft tissue envelope are distinct, new ideas. Finally, the role of ultrasound in rhinoplasty has great utility and we believe will play a critical role in the future.

Supplementary Material

This article contains supplementary material located online at www.aestheticsurgeryjournal.com.

Disclosures

Dr Obagi is the owner of ZO Skin Health, Inc. (Irvine, CA), and Drs Kosins and Obagi are co-owners of the ZO Skin Centre (Newport Beach, CA). Dr. Kosins is a former consultant for ZO Skin Health, Inc. (Irvine, CA).

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