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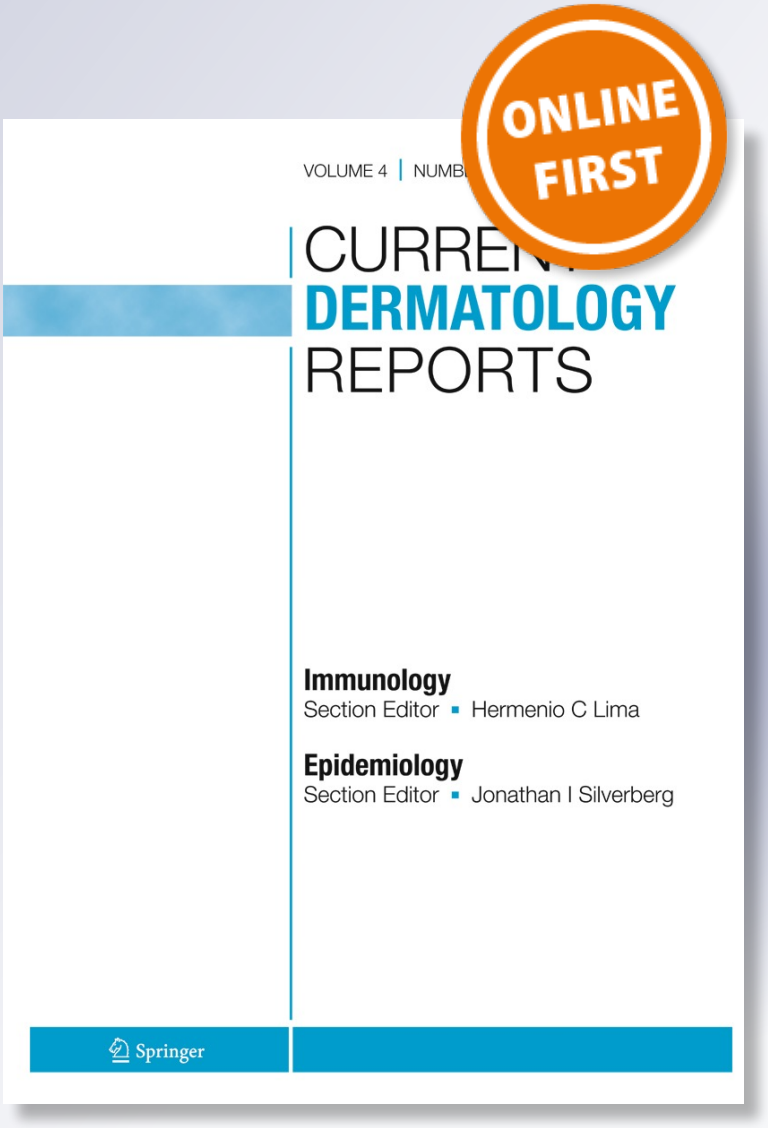

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COSMETIC DERMATOLOGY (JF SOBANKO, SECTION EDITOR)

Evaluating the Cosmetic Patient: Understanding which Patients Benefit from Minimally Invasive Procedures versus Those that Require Surgery or Lifting Procedures

Firas Al-Niaimi[1] · **Jason D. Bloom**[2]

Abstract Cosmetic consultations are rising steadily, and the armamentarium available to the treating physician varies widely from minimally invasive procedures to invasive surgery. Due to the diverse age ranges and varied aesthetic presentations of patients, no single approach is possible or suited for everyone. When choosing a particular procedure, a number of factors are taken into consideration such as the age of the patient, expectations, degree and duration of the expected outcome, cost, and overall experience of the treating physician. In this article, the face and neck areas have been divided into three zones and the discussion focuses on the treatment options available, highlighting in particular the scenarios in which surgical intervention is recommended versus non-invasive or minimally invasive procedures.

Keywords Aging · Cosmetic · Face-lift · Neck-lift · Rejuvenation · Volumization

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Introduction

Facial changes secondary to aging are a natural occurrence and although many happily adapt to these changes, a significant number of people seek treatments to slow down or reverse this process. The demand for treatments extends beyond the "aging face" and may include younger patients who seek to "enhance" or "improve" certain aspects of their appearance.

Changes to the face as a result of aging occur at multiple levels: skin, subcutaneous fat, muscle, and skeletal bony structure [1]. Facial changes appear to be mostly influenced by aging with ethnicity and gender playing a minor role [2]. Overall, the changes involve thinning of the dermis with altered collagen and elastin function, weakening of ligaments and facia that "hold" or "suspend" the skin and soft tissue structures at certain points, subcutaneous fat alterations, muscle atrophy, and bone resorption [1, 2]. These changes lead to topographic changes that are commonly associated with the aging process such as brow ptosis, midface deflation, and jowl formation in the lower face.

Anti-aging or cosmetic treatments ranging from non-invasive to surgery have become widely available and regularly utilized. The choice of treatment modality is based on a number of factors which include patient's choice, type and nature of the condition to treat, problem severity, and age. In this article, the face is divided into three areas for simplified facial analysis: upper, mid, and lower. The standard horizontal division landmarks of the face have been used and are defined as the trichion to the glabella for upper face, glabella to subnasale for midface, and subnasale to pogonion for lower face. The neck area will be included in the lower face section. Furthermore, the changes that occur with aging in each facial area and the preferred treatment options are discussed.

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Upper Face

The upper third of the face encompasses the forehead and eyebrow/eyelid area. This is often the first area in which the earliest signs of aging become apparent [3]. The periorbital complex is often a region in which often minor improvements translate to remarkable and pleasing aesthetic results. The forehead, eyes, and brow must each be assessed independently, but their interrelation as a whole unit must be taken into careful consideration, too. Evaluation of the area should take place with the person in an upright sitting position and in a relaxed setting with assessment of the area both in animation as well as at rest. Good-quality photographs taken from different angles are paramount and any asymmetries or deformities should be noted.

Forehead/Glabella

The forehead and glabella should be assessed both at rest and in motion. In the majority of cases, the most common complaint is that of horizontal lines across the forehead and vertical lines in the glabellar region. These lines are the result of frontalis muscle activity in the forehead and both the procerus and corrugator muscles in the glabella [4]. Minimally invasive treatments with botulinum toxin are an effective method in this region [5]. Careful attention should be given to the shape and position of the eyebrows and the length of the forehead for optimal results and avoidance of any complications. The placement of dermal fillers can occasionally be used to fill in deeper or "etched in" lines, albeit with caution and only following muscle relaxation with botulinum toxin [6]. Surgical intervention in the forehead is rarely required with the exception of brow lifting procedures, which will be discussed under the subsequent section, or when shortening of the forehead length is required.

Eyebrows/eyelids

The eyebrows hold a particular aesthetic importance and are often a common site for cosmetic intervention. The "ideal" brow shape and position varies considerably with age, culture, gender, and aesthetic trends [3]. These factors should be taken into consideration when assessing this area of the face. Differences exist between the shape of the eyebrows in men and women, with the latter arching laterally and resting above the supraorbital rim. In men, the eyebrows tend to be more straight and horizontal with no arching and at the level of the supraorbital rim [3, 7]. Although there is no defined consensus on the brow height (eyebrow to hairline distance), this generally is around 5 to 6 cm in women and often higher in men due to the receding anterior hairline with male-pattern baldness [8].

Brow ptosis is a common reason to seek cosmetic intervention and can be caused iatrogenically due to inadvertent excessive use of botulinum toxin in the frontalis or as a result of aging [3]. In the latter case, this occurs primarily due to the effects of gravity with some possible weakening of the orbital retaining ligaments and a minor contribution from temporal hollowing [9].

Brow ptosis due to botulinum toxin is best corrected by the combination of the passage of time and reassurance that the effects of the toxin are temporary. Attempts to elevate the brow by injecting into the "brow depressor" muscles including the procerus, corrugators, and lateral portion of the orbicularis oculi may aid in this case, if appropriate [10]. Temporal hollowing can be corrected by placement of filler material in the deep supra-periosteal plane to achieve some lifting effect, although its contribution to brow lifting has limited capacity. Temporal hollowing can present with or without concomitant brow ptosis.

Brow ptosis as a result of aging is best treated surgically with a brow-lift procedure [3]. Several methods exist which include direct, mid-forehead, coronal incision, pretrichial incision, and endoscopic and temporal endoscopic brow-lift. The choice of the technique depends on a number of factors such as the hairline (mid-forehead brow lifts could suit a male patient with a receding hairline and deep forehead rhytids), the addition of a mid or lower face-lift (the incision can be extended to the temporal line to achieve concomitant brow lift), or less invasive options with decreased concern regarding the prospect of a visible scar (direct brow lift).

Eyelid ptosis as a result of botulinum toxin is a complication that is treated with sympathomimetic eye drops, such as apraclonidine, until the ptosis resolves, which can take several weeks [11]. Ptosis secondary to levator aponeurosis dysfunction or detachment requires surgical correction and "reattachment" of the levator to the inner orbital rim and/or tarsal plate [12]. Eyelid ptosis is occasionally confused with "eyelid hooding," the latter occurring as a result of brow ptosis and/or herniation of the orbital fat through a weakened septum. A "true" eyelid ptosis can be diagnosed by the degree of coverage of the upper eyelid on the superior limbus (usually 1–2 mm) and by comparison to the other side [13]. Eyelid skin hooding is treated with an upper blepharoplasty procedure, in which excess skin is removed in conjunction with a strip of the orbicularis muscle and the "bulging" orbital fat. Though this procedure is primarily surgical, the use of ablative lasers for laser-assisted blepharoplasty has been reported [14].

Midface

The midface, which encompasses the area between the eyes and the mouth, is an important area from the aesthetic point of view. Midfacial changes due to the aging process give

considerable and discernible alterations to the individual, which form another common reason to seek aesthetic treatments. The changes that occur due to aging involve the skin, subcutaneous fat (both the superficial and deep compartments), and skeletal changes. Muscle atrophy plays a less important role in the features that are associated with aging in this area. In order to better understand the changes that occur in the midfacial region with aging, it is crucial that one has a thorough understanding of the "fat compartments," the "retaining ligaments" of the face, and the role they play in aging.

Fat Compartments

The fat in the midface is compartmentalized into superficial and deep layers that play an important role in the aging process [15]. In a young person, this fat tissue is closely packed together, giving rise to a soft tissue distribution with the typical fullness in the upper midface relative to the flatter lower midface [15]. The fat is arranged in "pads," and the superficial and deep components of the fat relate to their position in respect to the superficial musculoaponeurotic system (SMAS) layer. The superficial midface fat pads are composed of the nasolabial, infra-orbital, medial cheek, and middle cheek fat. In the lateral part of the midface, there is the temporolateral cheek fat pad that extends from the temples down into the neck. The deep fat pads consist of the suborbicularis oculi fat (SOOF), deep medial cheek fat (medial and lateral parts), and buccal fat [15]. The aging of the midface experiences volume loss of these fat compartments together with sagging and inferior migration, most likely secondary to the combination of gravity and weakening of the facial retaining ligaments [15, 16•, 17]. This current understanding of the aging midface has resulted in the combined approach of revolumization together with suspension of descendant tissue.

Retaining ligaments

The facial retaining ligaments are fibrous structures that, as their name suggests, "retain" or "suspend" the tissues of the face. They arise from the underlying periosteum of the facial skeleton and extend perpendicularly through the SMAS and subcutaneous layer to attach to the dermis [18••]. These fibrous ligaments act as anchor points, retaining and stabilizing the skin and SMAS to the underlying deep fascia and facial skeleton in defined anatomic locations. Important retaining ligaments in the context of cosmetic treatments are the orbicularis, zygomatic, and mandibular retaining ligaments.

The orbicularis retaining ligament arises from the periosteum of the orbital rim and encircles the orbit with the septum and orbital fat all contained within its boundaries. The zygomatic ligament arises from the inferior border of the anterior zygomatic arch, posterior to the insertion of the zygomaticus minor muscle, and inserts into the skin, serving as another anchoring point. Additionally, the mandibular retaining ligaments arise from the anterior third of the mandibular body, slightly above the mandibular border, restraining the anterior skin and preventing gravitational sagging; a result of this attachment is that the mobile skin which is posteriorly located tends to sag and forms "jowls."

Aging Signs of the Midface

The main contributing factors of aging observed in the midface area are attributed to volume loss coupled with tissue descent. Volume loss is seen primarily in the superficial and deep fat compartments, although skin and muscle atrophy does occur [16•]. These changes lead to clinical observations such as deepening of the nasolabial fold, under-eye hollowness as a result of the downward migration of the eyelid/cheek junction, tear trough deformity formation, orbital rim bony prominence, and the appearance of rhytids somewhat parallel to the nasolabial fold, which are the medial extension of the nasojugal fold (corresponding to the anatomic location of the zygomatic ligament) (Fig. 1). Weaking of the orbital septum and the subsequent formation of lower eyelid fat "bulging" is also often observed [9].

The approach to the cosmetic patient seeking treatment in the midface area should take a number of factors into account.

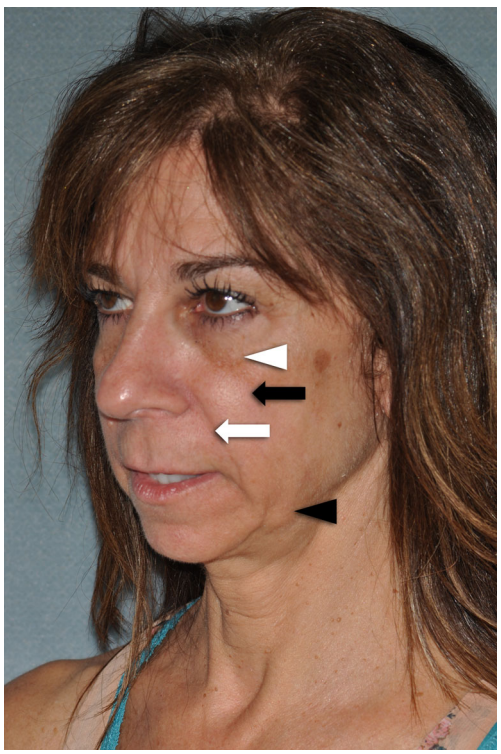

Fig. 1 This patient exhibits multiple signs of midface aging, from volume loss and tissue ptosis in the midface (*black arrow*), deepening of the nasolabial fold (*white arrow*), jowling (*black arrowhead*) to hollowing in the periorbital area (*white arrowhead*). (Used with permission of the patient, Jason D. Bloom, MD)

The factors that should be considered upon outlining a management plan for the patient include tolerance for "down time, " age, degree of tissue ptosis or volume loss, expectations, health status, patient preference, and cost. Young patients with minimal volume loss and tissue descent are usually very good candidates for minimally invasive treatments, often with very pleasing cosmetic results and high patient-recorded satisfaction [19•, 20•]. Injectable fillers that lift and augment the volume of the midfacial tissues are usually the best option in this particular age group. Although the use of fillers in this group often yield good results, the use of cheek implants in this setting provide increased durability. With that in mind, surgical placement of solid facial implants are becoming less popular with the recent advent of longer lasting fillers and structural fat grafting [20•].

In the older patient group, a surgical intervention like a mid-face-lift can be considered for patients seeking long-term results and in particular in those individuals who have marked volume loss and tissue descent. While non- or minimally invasive procedures in this group can certainly result in aesthetically pleasing outcomes, the use of surgery should be considered as an adjunct for long-lasting improvement to these non-invasive treatments. The ultimate decision and choice of procedure takes into account a thorough discussion with the patient to outline all the potential complications and the expected benefits and treatment outcomes.

Ear deformity and nasal deformity corrections are almost always treated surgically. Except, with respect to the nasal region, filler materials are occasionally used to achieve improved contouring of the nasal dorsum, and ablative lasers or electrosurgical devices are used for resurfacing in rhinophyma [21].

Lower Face and Neck

The aging changes that occur in the lower face and neck are primarily cosmetic and rarely have functional importance. Similar to the midface, the changes observed here are largely due to the effects of volume loss, tissue descent, and skeletal resorption [2, 9]. Increasing skin and tissue laxity coupled with volume loss and the downward migration of the superficial jowl fat pad give rise to the "jowling" effect observed in the area lateral to the mandibular retaining ligaments. Further mandibular bone resorption and recession can accentuate the jowling effect and also lead to chin ptosis [9].

In the neck, the aging process leads to formation of platysmal bands, loss of the cervicomental angle (generally around 90° in youth), and excessive sub-mental fullness secondary to fat accumulation. Coupled with the tissue descent observed during aging, the bony definition of the mandible is obscured by the development of jowls, making this one of the most common cosmetic complaints for which intervention is sought [9].

Perioral changes occur in the form of thinning and elongation of the upper cutaneous lip, formation of radial rhytids, deepening of the nasolabial folds, drooping of the lateral oral commissures, and thinning of the vermillion lip border [22].

Various techniques and treatment options are available for lower face and neck rejuvenation, and these will be further subdivided below:

Perioral/Chin Region

In the majority of cases, changes that occur in this area can be enhanced with minimally invasive procedures. Treatment of the nasolabial folds and the pre-jowl sulci should include an assessment of the midface as well as the degree of severity. Midface volumization often yields good results in the effacement of these features; however, a surgical face-lift may be more appropriate in those individuals with a moderate to severe degree of tissue descent and jowling [23]. As highlighted previously, this can be combined with other non-surgical interventions.

Changes in the chin from mild volume loss to hyperactivity of the mentalis can be treated with minimally invasive procedures such as botulinum toxin to improve the dimpled "peau d'orange" appearance of the chin and dermal fillers to soften a deep labiomental crease. Lack of chin prominence or projection, called microgenia, can be treated surgically with a chin implant or even with some thicker fillers that would help in lifting the tissues in this area [24]. This can be combined with a submentoplasty in which the ptotic fatty tissue in the submental area can be removed. Alternatively, surgical attempts to release and redrape the ptotic sub-mental tissue can be achieved transorally or transcutaneously through the submental crease without the need for a chin implant, if there is adequate chin projection.

Jawline and Neck

Mild changes in the contour of the jawline can respond to dermal fillers and botulinum toxin to redefine the outline, although often the tissue descent and jowling effect requires surgical treatment, either for the lower face and neck alone or in combination with the midface [23, 25] (Fig. 2).

Platysmal bands in the neck can respond to botulinum toxin injections, if this is the sole complaint of the patient. Overwhelmingly, most of the age-related changes in the neck require more invasive procedures such as an anterior plastysmaplasty and lateral neck-lift to treat the tissue laxity, descent, and recreate an acute cervicomental angle [23, 25]. Liposuction can achieve good results in the effacement of the excess fat accumulation in the sub-mental area and along the jawline. A relatively new technique used in the treatment of tissue laxity in the neck is the use of energy-based devices such as radiofrequency and lasers in an invasive mode to

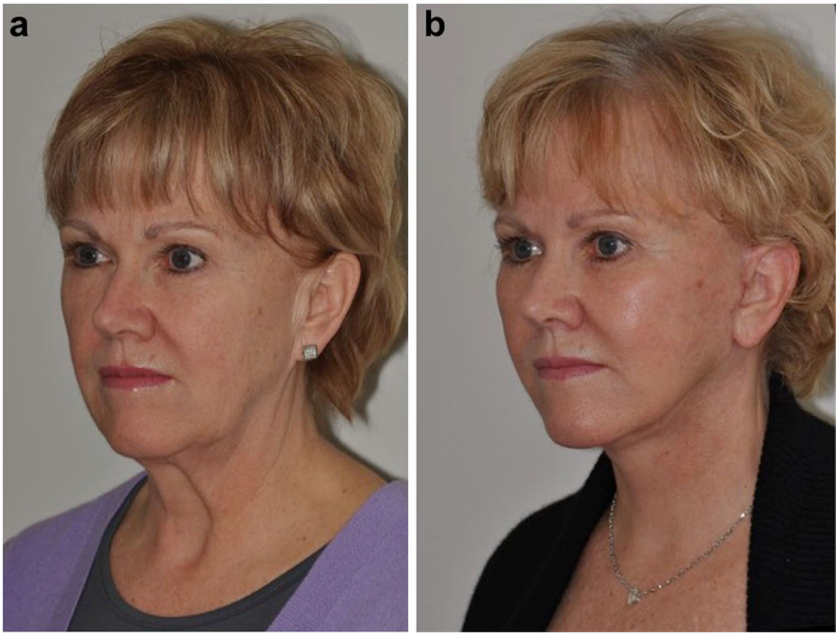

Fig. 2 Before (**a**) and after (**b**) views from a 60-year-old woman who underwent a deep plane rhytidectomy and neck-lift. Notice the significant improvement in the midface deflation, jawline jowl formation and neck laxity with a single surgical procedure. (Used with permission of the patient, Jason D. Bloom, MD)

"tighten" the tissue from within [26]. Though still invasive, this is significantly less invasive in comparison to a surgical neck-lift and does not require the need for general anesthesia.

Discussion and Conclusions

The demand for cosmetic consultations and treatments continues to rise steadily with an ever growing aesthetic market and multiple medical and surgical specialties, which encompass a wide range of interventions from non-invasive to surgical procedures. The desire to look attractive and rejuvenated has always been an integral part of human nature, and the current cultural norms further add to this dimension and desire. Furthermore, as the population continues to age, at least in the Western societies, it is expected that the demand for such treatments will continue to grow.

Patients seeking cosmetic treatments have divergent desires and expectations and tolerate different levels of invasiveness and "down time." It is therefore vital that a thorough assessment and discussion takes place prior to any plans or interventions. Patients may have previously formed biased opinions about certain treatments, and this in turn can lead them to choose a procedure in which the risk of a disappointing outcome is high. Numerous factors play a role from the viewpoint of both the patient and the treating physician, and these can form an important part of the decision-making process. Factors include the age of the patient, the desire for "down time" or surgery, cost, pre-existing health conditions, expectations, previous treatments, patient's preference, surgical candidacy, the nature and severity of the cosmetic issue, and the physician's experience and recommendations. All the aforementioned factors should be taken into consideration prior to formulating a decision and treatment plan. Obtaining high-quality photographs is a vital component of the cosmetic consultation, and this should be taken from different angles of the face and both in animation and at rest.

A thorough understanding of the facial anatomy and the changes that occur in relation to the aging process are paramount in any facial cosmetic treatment. The physician's approach should not focus on a single area but rather take into consideration the interplay of other factors such as skin

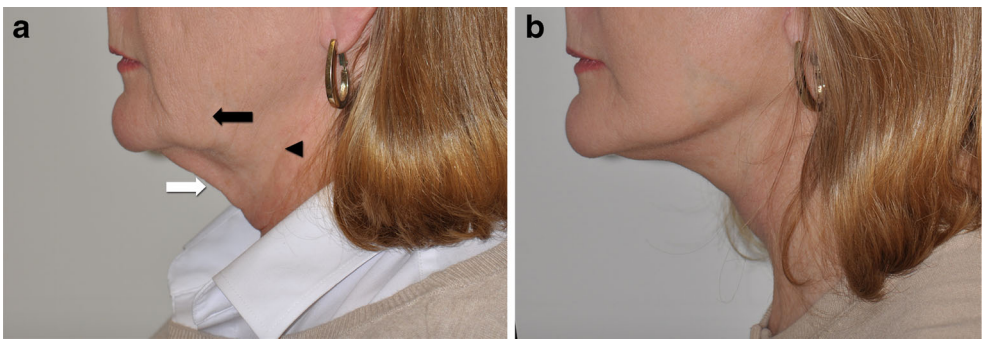

Fig. 3 Jowling (*black arrow*), platysma banding (*white arrow*), and generalized neck laxity (*arrowhead*) (**a**) are difficult to treat in a patient like this without a surgical procedure like a lower face and neck-lift (**b**). (Used with permission of the patient, Jason D. Bloom, MD)

Table 1 Upper and lower face/neck treatment options

Complaint	Management approach/option	Comment
Forehead and glabellar creases	Botulinum toxin +/− filler injections (for deeper rhytids, but only after it is first weakened)	Surgical intervention rarely required unless shortening of the hairline or a longer lasting outcome is required
Temporal hollowness	Filler injections	Care must be taken with the superficial temporal artery and nerve
Brow ptosis	• Chemical brow lift may be attempted in mild cases • Surgical or endoscopic brow lift gives durable and optimal results	Procedure can be combined with an upper eyelid blepharoplasty and/or a midface lift
Perioral rhytides	• Botulinum toxin/fillers • Laser and energy-based devices for resurfacing • "Soft" fillers	Care must be taken not to compromise the functional activity when using botulinum toxin
Chin deformities	• Botulinum toxin/fillers for labiomental crease, "peau d'orange" appearance, and chin volumization • Consider chin implant for absent or poor chin projection	Mild chin projection can be corrected with the use of filler injections
Platysmal bands	• Botulinum toxin • Significant bands can be improved with an anterior platysmaplasty	Excessive toxin administration can cause difficulty in swallowing
Jowling	• May require a combination approach of liposuction and energy-based "tightening" or surgical lifting procedures	Face-lift (rhytidectomy) can be combined with a midface lift in a single procedure
Poor jawline definition	• Botulinum toxin and filler injections • Face and neck-lift often leads to the most significant improvement	Care should be taken with the marginal mandibular nerve to avoid injury in this area

quality, skeletal abnormalities, and facial proportions. Simply "fixing" what might appear to be an undesirable issue for a patient without taking other factors into consideration could lead to a suboptimal cosmetic outcome.

Trends in certain cosmetic procedures change and shift with time as some become more sought after compared to others [6, 20•]. Cultural and geographic differences impact what constitutes beauty and the desire for certain procedures. In the Westernized world, there has generally been a gradual shift from invasive surgery to minimally invasive or non-invasive treatments [20•]. Many patients fear the potential complications of surgery or the stigma that something is drastically wrong with them that may require surgery. Equally, many young patients may not need or want to undergo a surgical procedure. Nevertheless, there still is a place for surgery because some cosmetic problems almost exclusively require surgical intervention for optimal results. In the upper face, this would include procedures like a long-lasting brow lift, reduction of the hairline, and an upper eyelid blepharoplasty for excessive eyelid skin or orbital fat pseudoherniation through a weakened septum [4, 8].

In the midface, the surgical indications, while dependent on the patient to a degree, include a deep plane face-lift for marked midface tissue descent, lower eyelid blepharoplasty,

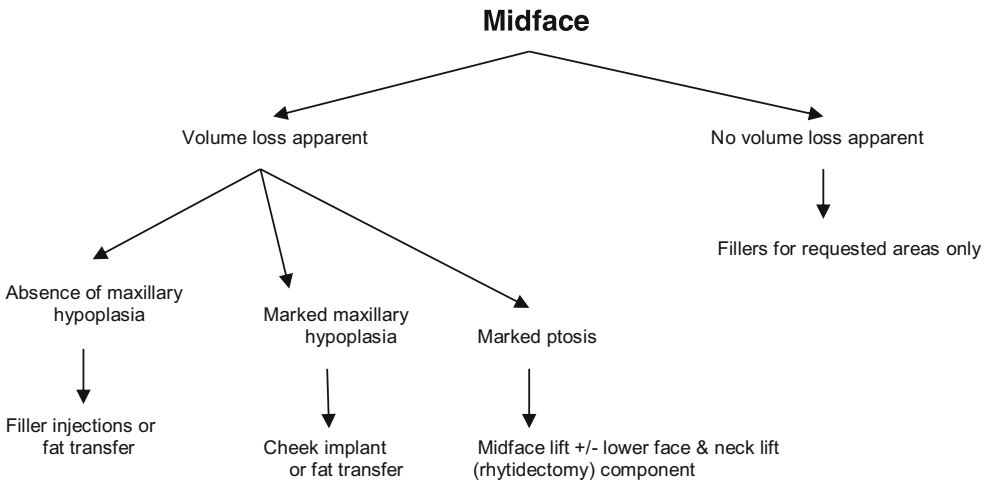

Fig. 4 Midface complaints and treatment algorithm

and a cheek implant in the setting of marked maxillary hypoplasia that requires durability.

The lower face and neck equally has its share of surgical appropriateness, and this would include a face-lift (with or without a concomitant neck-lift) to release and resuspend the jowls and improve the jawline laxity and tissue descent (Fig. 3), and chin implant or mentoplasty in cases of inadequate chin projection [24].

It is not uncommon for a patient to request simultaneous treatment for a number of facial issues and hence, it is not possible to have an algorithm or list of treatments per complaint. Nevertheless, this article attempts to give guidance on some of the preferred treatments per facial area (Table 1 and Fig. 4). In real clinical practice, however, the majority of physicians apply a combined approach of multiple treatments, which in some cases may consist of surgical interventions in addition to non-invasive treatments.

As treatment options continually increase and our understanding of beauty, aging, and the dynamic changes that happen with facial anatomy expand, so will the choices and types of procedures offered to our patients. It is important for physicians in this sector to keep up-to-date with these ongoing developments and changing trends.

Compliance with Ethics Guidelines

Conflict of Interest Firas Al-Niaimi declares that he has no conflict of interest.

Jason D. Bloom has received compensation from Pharmaceutical Project Solutions, Inc., Merz Aesthetics, and Galderma for service as a consultant; has received honoraria from Merz Aesthetics and Galderma for service as a trainer; and has received payment for service on speakers' bureaus from Merz Aesthetics, Galderma, Solta Medical, Inc., ThermiAesthetics, and Zeltiq Aesthetics, Inc.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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