

Adjunctive Aesthetic Procedures in Orthognathic Surgery

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KEYWORDS

- Fat grafting • Liposuction • Blepharoplasty • Lip lift • Injectables • Facial implants • Aging
- Aesthetic

KEY POINTS

- To reach the best outcome of orthognathic surgery it is of importance to have knowledge not only of correct occlusion but also of facial balance, beauty, and harmony.
- To improve facial balance, harmony, and beauty, surgeons should have knowledge of adjunctive facial aesthetic procedures and their possible outcomes.
- The ability to combine aesthetic procedures with orthognathic planning and surgery may enhance patient satisfaction and will make one a more complete surgeon.

INTRODUCTION

Aesthetics play an important role in the planning and performance of orthognathic surgery, along with function, occlusion, and airway. An important aesthetic goal in orthognathic planning is to improve facial balance, harmony, volume, and symmetry. It is therefore logical that adjunctive aesthetic procedures become a part of the overall orthognathic treatment plan and that their possibilities are discussed with orthognathic candidates. There is no consensus on what facial beauty is because it differs with time, between cultures, and between people. Professionals like to develop and use all kinds of measurements and analyses to try to objectively determine facial beauty and facial harmony, and thereby to provide guidelines for the planning of orthognathic and other types of facial surgery (Fig. 1). Although there are different analyses at clinicians' disposal, it is preferred not to treat patients by numbers but rather try to help them become the most beautiful version of

themselves. Despite the paradigm shift from two-dimensional orthognathic planning in profile view to more advanced three-dimensional (3D) virtual planning, clinical experience and artistry are still helpful in this respect.

Facial beauty and/or facial rejuvenation enhancement are the two most important reasons for opting for aesthetic facial surgery. These also apply to orthognathic surgery, along with functional improvement. The aim of many aesthetic procedures is to increase or change the volume in different regions of the face (eg, fat grafting, osteotomies of the malar region, alloplastic implants, liposuction), whereas for some it is to change the shape of certain facial parts (eg, rhinoplasty, otoplasty, lip fillers). Facial aging is a process that starts after the age of 25 and generally follows a standard pattern (Fig. 2). Individual variations and the severity of the aging process are not only influenced by genetic factors but also by environmental factors, such as smoking habits and sunlight exposure. There are roughly four factors

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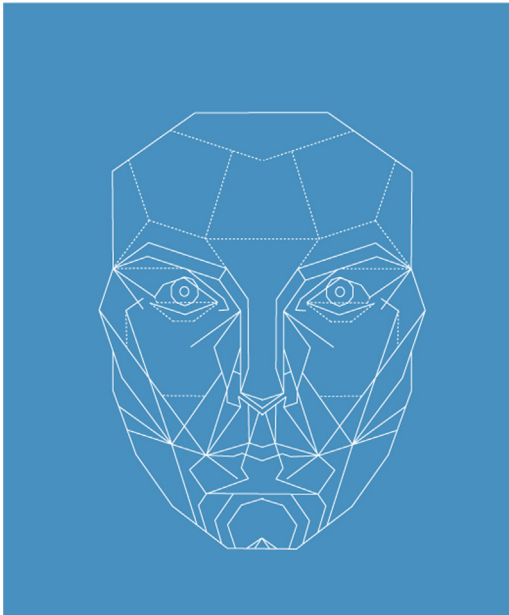


Fig. 1. Golden proportion face mask. This mask as developed by Dr Marquardt is based on the mathematical ratio of 1:1.618 (golden ratio) that appears recurrently in beautiful things in nature. The mask is an attempt to understand and quantify the perfect, ideal, or most beautiful facial proportions regardless of age or time.

involved in facial aging: (1) loss of volume (deflation), (2) displacement of tissues, (3) loss of elasticity, and (4) skin changes. Orthognathic advancement surgery of either jaw increases the facial volume, thus having an antiaging effect on younger patients and a rejuvenating effect on older individuals. Advancement of the maxillomandibular complex can enhance lip support, reduce nasolabial folds, and reduce jowling. Bimaxillary advancement, with or without genioplasty, is therefore often referred to as a reversed facelift (**Fig. 3**). Some aesthetic volumizing procedures can help with enhancing the volume further in different aesthetic regions of the face (eg, by fat grafting and malar augmentation), whereas those procedures aimed at removing redundant tissue can also create a more youthful appearance (eg, lip lift, blepharoplasty, and liposuction).

Aesthetic procedures are categorized as: (1) procedures that enhance the results of orthognathic surgery, and can be performed concomitantly; (2) procedures performed secondarily after a soft tissue edema has resolved and healing is complete; (3) procedures that can address undesired aesthetic changes that have occurred after orthognathic surgery; and (4) procedures that are performed to camouflage certain aspects in patients not desiring optimal orthognathic surgery.¹

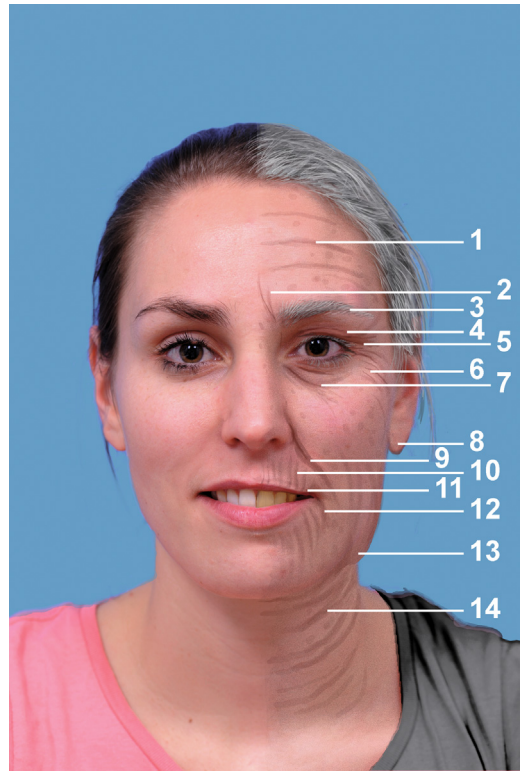


Fig. 2. Artist animation of facial aging. (1) Forehead wrinkles. (2) Frown lines. (3) Brow ptosis. (4) Dermatochalasis. (5) Lateral hooding. (6) Crow's feet. (7) Tear troughs. (8) Earlobe enlargement. (9) Deepening nasolabial folds. (10) Lengthening of upper lip. (11) Lip lines. (12) Marionette lines. (13) Jowling. (14) Neck wrinkles.

In this article, we discuss different facial aesthetic procedures that are combined with orthognathic surgery, to the patient's benefit, to help them become the most beautiful version of themselves. This overview is not extensive because certain procedures are covered elsewhere in this issue.

FACIAL FAT GRAFTING

Autologous facial fat transplantation, a commonly applied procedure in aesthetic surgery since the 1980s, is an easy to use, effective, and safe technique with a low complication rate and minimal donor-site morbidity.² The latter is because subcutaneous fat is abundantly available in most patients, and is fully biocompatible and conceivably permanent. However, fat grafting studies have reported between 25% and 80% long-term volume retention. This variable amount of volume retention is one of the major disadvantages of the technique and often necessitates repeated surgical



Fig. 3. Female patient (36 years old) with mandibular retrognathia and obtuse cervical angle and nose-lip angle. She underwent combined orthodontic and surgical treatment consisting of bimaxillary advancement with counterclockwise rotation and advancement genioplasty. No adjunctive aesthetic procedure was performed. The orthognathic surgery has led to an increased facial volume and improvement of the profile, sometimes referred to as reversed facelift. Preoperative situation in frontal (A), three-quarter (B), and profile view (C). Postoperative situation in frontal (D), three-quarter (E), and profile view (F).

procedures, so called touch-up procedures.³ Nevertheless, the volumizing effect of lipofilling is subtle and soft, creating a more youthful appearance, especially in the periorbital and zygomatic area (Fig. 4). Before starting the procedure, the patient should be examined in an upright position and markings should be made on the area of the skin with a volume deficit to accentuate the area of the planned correction. A series of preoperatively made patient photographs should be available during the process to help in evaluating the plan and the progress of the correction. The

procedure starts with injecting the donor site with an infiltration solution (Ringer solution or sodium nitrate combined with lidocaine 2%) followed by gentle manual liposuction, usually using a 10-mL Luer lock syringe, 2-mL negative pressure, and a blunt cannula with a small diameter (2.4 mm) and small holes. The fat is then processed with centrifugation, washing, or decantation techniques. Recent research points to a slightly beneficial outcome, regarding fat cell viability, from the washing method.⁴ The fat is subsequently injected into the subcutaneous tissues of the target areas



Fig. 4. Female patient (27 years old) with vertical maxillary excess and mandibular retrognathia. She underwent combined orthodontic and surgical treatment consisting of bimaxillary osteotomy with maxillary impaction, mandibular advancement, and advancement genioplasty. As an adjunctive procedure fat grafting (7 mL per side) of the zygoma and infraorbital regions was performed to enhance definition. Preoperative situation in frontal (A, B) and profile view (C). Postoperative situation in frontal (D, E) and profile view (F).

of the face using a small blunt cannula (0.9–1.2 mm diameter). According to a recent study, there is site-dependent variation in volumetric retention after facial fat grafting, with the zygoma area showing a 40% volumetric effect 1 year post-treatment compared with an unmeasurable volumetric effect in the lip area using a 3D measuring method.³

To enhance volume retention of the grafted fat, several fat enrichment strategies are being investigated, including adding: adipose tissue-derived stromal cells; tissue stromal vascular fraction; cellular stromal vascular fraction; and nanofat,

microfat, and platelet-rich plasma or fibrin to the grafted fat. Even though some studies show a promising beneficial effect of these additives regarding volume retention, high-quality research, with proper volumetric measurements, is lacking. Fat grafting results in excellent soft volume enhancement, which is beautiful.² However, fat grafting does not always provide enough projection, for instance to enhance the cheekbone area. In such situations, the fat can be too soft in its augmenting effect. Facial implants, or an intraoral zygoma osteotomy, can then be indicated. Fat grafting can also be used as an adjunctive

procedure to implant placement or zygoma osteotomy to create more projection and softness. When combined with an osteotomy, the fat grafting procedure should, preferably, be performed immediately after the osteotomy so the apparent effect of the osteotomy on the face can then be taken into account and swelling has not yet occurred.

SOFT TISSUE FILLERS

The use of soft tissue fillers has increased tremendously. In 2019, almost three-quarters of a million procedures were performed in the United States alone.⁵ Soft tissue fillers are predominantly resorbable and basically have two variations: hyaluronic acid (HA) fillers and biostimulatory fillers. Since the Food and Drug Administration approved Restylane (Q-med, Uppsala, Sweden) as an HA filler in 2003, most of the currently used fillers consist of HAs. HA fillers are based on glycosaminoglycan chains that coil in on themselves, resulting in a viscous and elastic matrix that is hydrophilic in nature. These fillers are easy to apply, not time consuming, and inexpensive. HA fillers also have an overall low rate of adverse events.⁶ The filler degrades over time, with the amount of cross-linking between the glycosaminoglycan chains theoretically changing the clinical half-life. Hence, the volumetric effect of HA fillers varies from 1 to 3 years, depending on the amount of cross-linking and other aspects of the filler, with the maximum effect occurring 1 to 3 months post-treatment. Soft tissue fillers are, in general, applied under local anesthesia in a precise manner using a needle or a cannula varying from 23 to 30 gauge. In the beginning, fillers were predominantly used to smooth out wrinkles but, over the last decade they have evolved into contour and shape defining fillers. The disadvantage of HA fillers, compared with fat grafting, is that the volumetric effect is not permanent, even though some authors claim a collagen stimulatory effect. The advantage over fat grafting is the constant and predictable volumetric effect, which is fairly equivalent in all the soft tissue layers. Therefore, HA fillers are indicated more for the lips than fat grafting (Fig. 5) and may be more effective for subtle defects, such as an A-frame deformity of the upper eyelid, marionette lines, prejowl depression, and mental creases. However, a too superficial injection, such as under the thin skin of the lower eyelid, can cause a blue discoloration of the skin called Tyndall effect, which is thought to occur because of stronger scattering of the blue light spectrum through the colloid particles.

Even though the volumizing effect of some HA fillers lasts for several years, it usually decreases over time, necessitating, as sometimes with fat grafting, touch-up treatments to maintain the desired result. HA filler treatment can be done immediately following an osteotomy, but it is generally performed postoperatively because the procedure is tolerated well and usually smaller volumes are applied compared with lipofilling. Therefore, applying the HA filler 3 to 6 months postoperatively when the edema has largely resolved, and the result of the osteotomy is examined while the patient is in an upright position, is usually preferred. It can even be beneficial to wait with lip augmentation until the orthodontic procedure has been completed and the orthodontic appliances taken out to rule out any projection caused by the appliance on the lips. Application of a lip filler can also compensate for the lack of dental lip support. Small imperfections that remain after, or are caused by the orthognathic surgery, can also be corrected in this manner.⁷

FACIAL IMPLANTS

Alloplastic facial implants are easily combined with orthognathic surgery, especially because most implants can be placed subperiosteally through the intraoral incisions that are being used for the orthognathic procedure. Implants can correct bony deficits in a rigid manner, giving a firm projection that mimics the projection of bone and simulates a bony feeling when palpated. Off-the-shelf facial implants are available in different shapes and sizes corresponding to various areas of the face lacking projection. They are modified, if needed, in the operating room using a scalpel. Mandibular angle, chin, and zygoma are especially popular regions to augment. Facial implants are often made of solid silicone rubber, porous polyethylene, titanium, or polyether ether ketone (PEEK).⁸ These implants, preferably fixated with screws, have stood the test of time and have proven to be safe. Complications are rare, mainly caused by bacterial biofilm formation and infection, usually leading to removal of the implant. Also, implant displacement can occur and, in time, resorption of the bone underlying the implant may result in loss of projection. Sterilizable 3D-printed bony models of the patient are helpful intraoperatively to estimate how and where the implant has to be modified. This is hard to judge in the patient during the surgery. The evolution of 3D planning has also led to more attention to patient-specific implants (PSIs). PSIs are made from several materials but are mostly made from polyether ether ketone. When combined with 3D

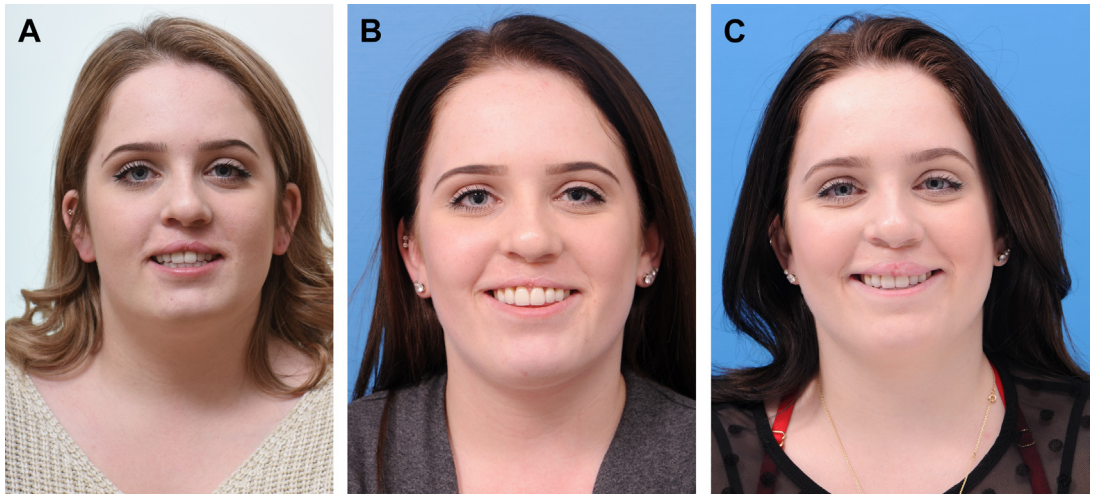


Fig. 5. Female patient (20 years old) with bilateral cleft lip and palate. (A) Frontal view of the situation after orthodontic treatment without orthognathic surgery. (B) Frontal view of the situation after aesthetic dentistry with eight porcelain facings of the upper teeth and first premolars. (C) Situation 1 year after injection of 2 mL hyaluronic acid filler (Voluma, Juvederm, Allergan Inc, Irvine, CA) for improved upper lip projection and volumization. (Courtesy of Marco Gresnigt, DDS, PhD, Groningen, NL (Figure 5B))

osteotomy planning, PSIs give excellent opportunities to correct, for instance, bony asymmetries and shapes in individuals in a precise way. Despite orthognathic surgery being well planned and executed, and correcting asymmetries to a large extent, some asymmetries can remain, especially in the mandible because it is not symmetric. It has proven to be helpful to correct the remaining asymmetries by placing a PSI of the mandibular angle and inferior border. Such implants are fabricated based on mirroring the image of a computed tomography scan that is made around 6 months after the orthognathic procedure (Fig. 6). Nevertheless, soft tissue asymmetries are hard to correct fully with implants and one should consider addressing them with additional fat grafting or filler injections either during implant placement or at a later stage.

There are various reasons why facial implants are not used extensively in orthognathic patients, even though they can lead to improved results. First of all, orthognathic surgery is mostly performed in young adolescents with favorable soft tissue volumes. Osteotomies of the chin- and zygoma are usually effective in facilitating the needed correction in these patients. This is, of course, not the case for patients with congenital disorders or needing improvements in mandibular angle definition because this can only be done with angle implants. In older patients, volume loss, deflation and projection are corrected using implants that give more support in the deflated area (eg, chin implants with a prejowl extension and submalar/

zygoma implants). One has to realize that a bony osteotomy performed at a younger age is beautiful during the first few decades, but can become unfavorable as the patient ages because of a certain loss of soft tissue volume and elasticity. This is obvious for large maxillary impactions, leading to invisibility of the upper teeth, and for mandibular setbacks in people with poor chin-neck definitions, leading to submandibular excess. One should also realize that large chin advancements may help to create a prejowl depression once jowling starts at a later age. Because many maxillofacial surgeons are mainly acting as bone surgeons, they feel more comfortable with performing osteotomies than applying an implant. This is also probably influenced by the bad reputation that implants still seem to have, although not in our and many other surgeons' experience.

SUBMENTAL LIPOSUCTION/LIPECTOMY

Accumulation of submental fat can cause effacement of the cervicomental angle, which becomes even more profoundly visible in mandibular retrognathia cases. Performing an advancement of the mandible and/or a genioplasty can improve the cervicomental angle quite well. Reducing any palpable subcutaneous fat in the submental area can contribute to the result.⁹ This can usually be achieved easily after orthognathic surgery using a liposuction cannula of approximately 15 cm in length and a diameter of approximately 3 mm, and preferably only a few suction holes near the

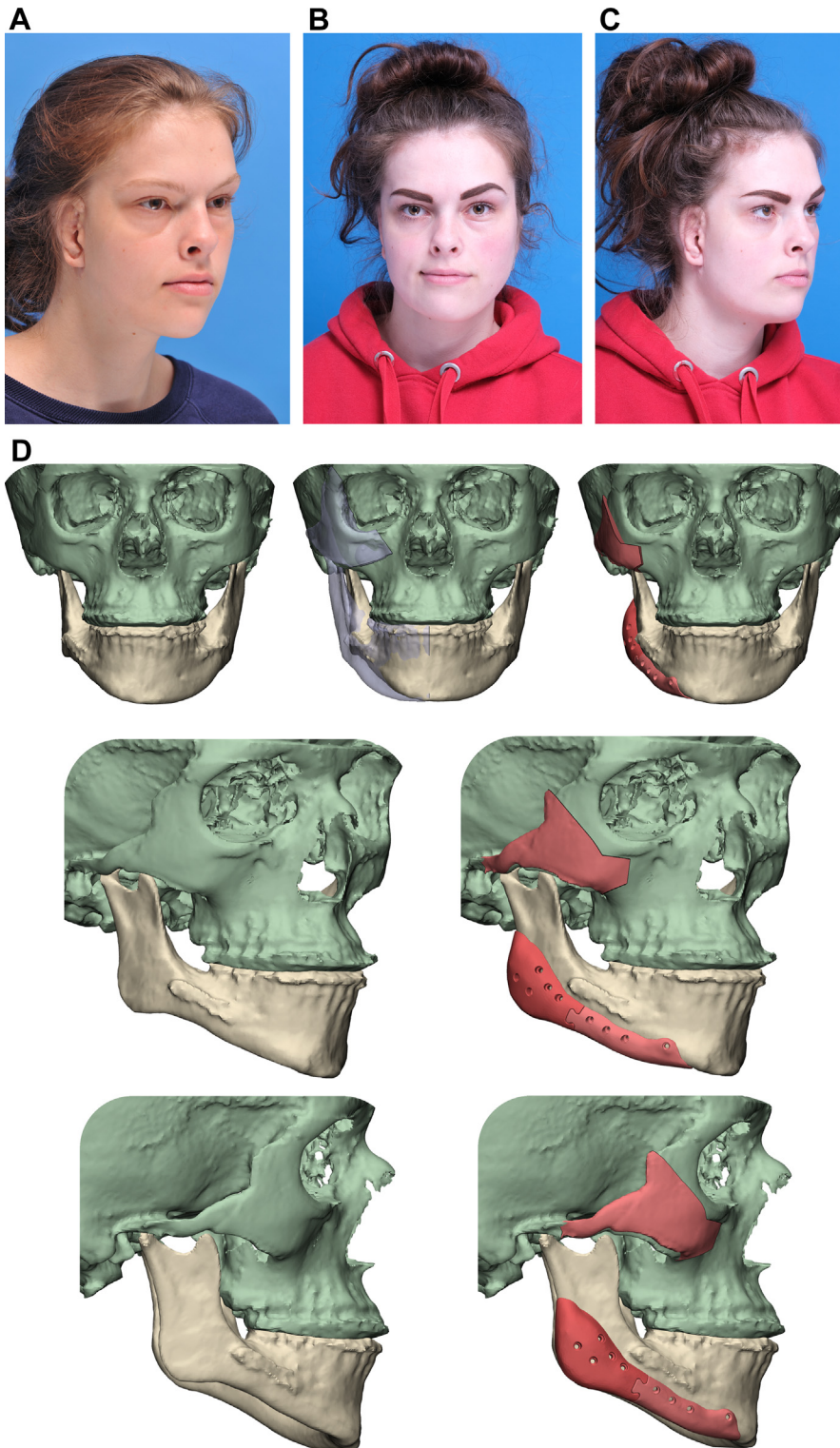


Fig. 6. Female patient with right-sided hemifacial microsomia. At age 10 to 12 years she underwent ear reconstruction elsewhere. At age 18 she underwent mandibular orthognathic surgery to correct the occlusion. At age 19 a PSI from polyether ether ketone was placed to increase the projection of the right mandibular angle and inferior border. This was combined with an intraoral zygoma osteotomy with outward rotation and fat

tip. A simple method to create the needed negative pressure of 30 to 50 mL is to use a Luer lock syringe. During the liposuction procedure, the plunger is locked using a simple clasp. Usually, 5 to 10 mL of fat is extracted via a small stab incision just behind the submental crease in the facial midline. One must keep in mind that the position of the hyoid plays an important role in the cervico-mental angle. The lower and more anterior the hyoid bone is situated, the less one can expect from the visible effect of a submental liposuction on this angle. Besides this, the presence of platysma banding and skin laxity can also affect the outcome of the liposuction in a negative way. A lipectomy might be more effective for such cases or for when there is abundant submental fat extending to the anterior neck. This is performed through a small 2- to 3-cm incision just posterior of the submental crease, which also gives the opportunity to perform a corset platysmaplasty and anterior neck lift. All the mentioned submental procedures can be done under local anesthesia, but it is mostly beneficial to perform them following the orthognathic surgery while the patient is still under general anesthesia. Nevertheless, it is advocated to perform local anesthesia in the area to be treated because of the vasoconstrictive effect, thus minimizing the chance of a hematoma. Complications are rare because the critical structures are all underneath the platysma or deeper in the neck, except for the marginal branch of the facial nerve, which is at risk when penetrating the platysma. Postoperatively, great care should be taken to support the submental skin with an elastic bandage for a few days to prevent blood accumulation and sagging of the skin, both of which negatively influence the end result (Fig. 7).

OTOPLASTY

Misshapen and protruding ears may also bother patients who are in for orthognathic surgery. In most instances, the protrusion is caused by a combination of hyperplasia of the posterior conchal wall and lack of antihelical fold, with the latter playing a bigger role because of the antihelix not developing. To evaluate this, the ear has to be examined in different directions (front, behind, and side) and, preferably, measured. Behind the ear, from the mastoid area to the outer helical rim,

the superior aspect should measure 10 mm, and the middle portion (superior to the lobule) should measure 20 mm. Ears can be corrected as of 5 or 6 years of age and at any age in adulthood.

An ear correction begins at the posterior auricular crease. If an excision of the conchal bowl is also planned, the skin should be excised in an elliptical shape.¹⁰ Although different procedures have been described, we prefer the Mustardé technique for creating the antihelical fold.¹¹ The Mustardé technique is done with or without scoring the scaphoid cartilage on the anterior auricle from the posterior approach. The antihelical fold is created using slowly resorbable mattress sutures equidistant and perpendicular to the planned fold position. The conchal bowl is resectioned in a kidney bean shaped fashion. Connective tissue and muscle attachments are removed down to the mastoid fascia so that the ear can be adapted to the cranial base passively using nonresorbable sutures. Our patients wear a compressive head wrap for 2 days after which they are instructed to wear a head band over the ears while sleeping for 2 additional weeks.

When combining otoplasty with orthognathic surgery, we prefer to perform the osteotomies first and then redrape for the ear surgery. The advantage of combining the procedures is that the healing and downtime are combined without compromising the results (Fig. 8).

BLEPHAROPLASTY

When looking at a face, the eyes are the first and most looked at feature. Eye-tracking studies confirm this; age judgements are made on preferential attention toward the eye region. The definition of a beautiful eye varies, but it is generally agreed that youthfulness correlates with attractiveness.¹² An eye is considered to be attractive when it has typical youthful features instead of aging ones. A beautiful, youthful eye is described as full and convex. Conversely, an aging eye appears hollower, because of volume loss and fat atrophy.

Eye region aesthetic surgery is therefore one of the most effective interventions to enhance facial aesthetics, with blepharoplasty of the upper eyelids being one of the most commonly performed procedures. The aim when doing the procedure

← grafting of the infraorbital, zygomatic, and mandibular angle region (15 mL) on the right side. Situation before placement of the PSI in three-quarter (A) view. Situation (at age 23) after placement of the PSI, zygoma osteotomy, and fat grafting in frontal (B) and three-quarter (C) view. (D) From left to right, in frontal, three-quarter, and profile view the design of the polyether ether ketone implant consisting of two parts and the planning of the zygoma osteotomy is depicted.

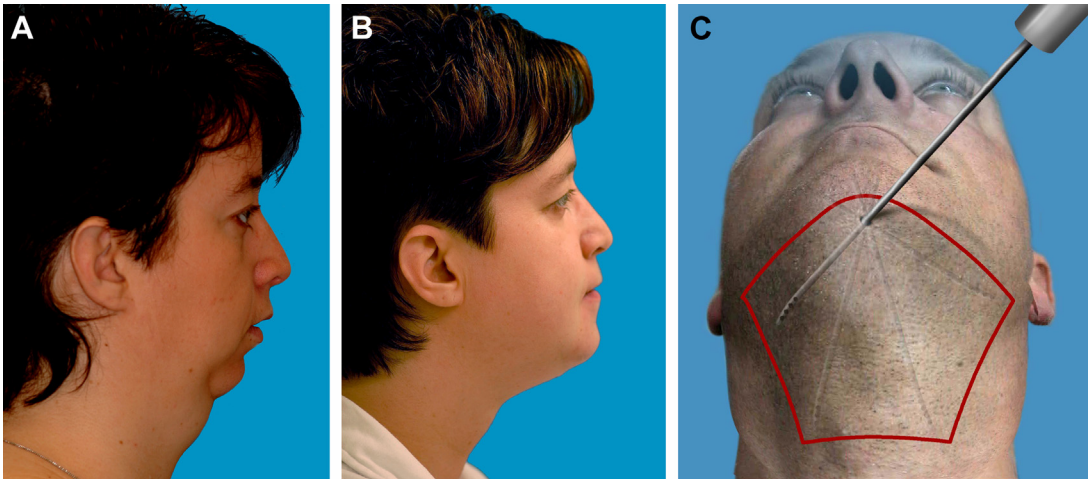


Fig. 7. Female patient (34 years old) with severe obstructive sleep apnea and mandibular retrognathia with obtuse cervical angle and fat deposition. She underwent combined orthodontic and surgical treatment consisting of counterclockwise bimaxillary advancement and advancement genioplasty. As an adjunctive procedure cervicofacial liposuction was performed to increase chin definition and improve the effect on the obstructive sleep apnea. (A) Profile view of the situation before combined treatment. (B) Profile view of the situation after orthognathic surgery and liposuction. Note the profile change. (C) Schematic drawing of the liposuction area bounded by the inferior mandibular border, the sternocleidoid muscles, and the hyoid.

on most aging patients is to correct skin excess (dermatochalasis) and lateral hooding.

In the past, surgeons were inclined to perform more invasive blepharoplasties, where excess skin was removed together with a strip of orbicularis oculi muscle, sometimes combined with excision or redistribution of fat from the medial and central fat compartments. Nowadays, surgeons tend to be more conservative and less invasive, by sparing the orbicularis oculi muscle and the orbital fat, because this preserves the fullness of the periorbital region, thus preventing the aged hollow orbit appearance.¹³ Most of the patients just need the so-called skin-only procedure.

The preferred shape of the skin excision is not standard and varies from elliptical, lenticular S-shaped, and trapezoid to excisions that extend beyond the lateral orbital rim. Each surgeon has his/her own preference, and there is no consensus as to which is the most suitable blepharoplasty procedure, and for which patient.

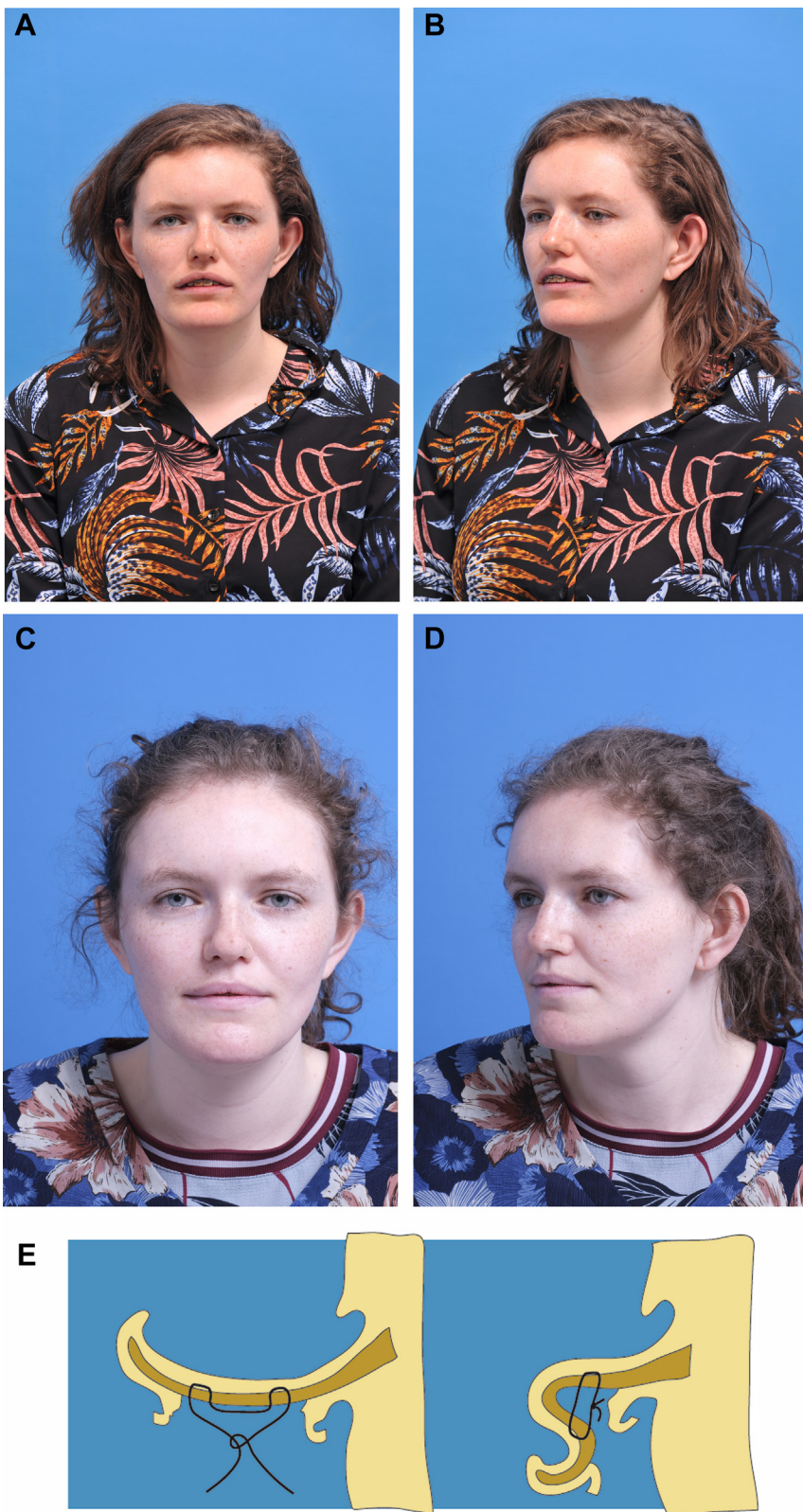
The eyebrows are also an important part of the periorbital esthetic unit. In the diagnostic phase, it is important to determine their position and shape. Sometimes a browlift may be a better choice of treatment.¹⁴

Most orthognathic candidates are rather young and do not show signs of aging, whereas those older than the age of 40 can show signs of aging, and so an upper blepharoplasty may be indicated for them. The procedure is combined well with the osteotomy and takes about an extra 30 minutes.

We prefer to do the eyelid surgery after the osteotomy. The best results are attained by placing the markings for the upper eyelid incisions while the patient is in an upright position. This should be taken into account when combining the procedures. Care should also be taken when disinfecting and draping for the osteotomy so that the markings remain intact for the blepharoplasty. When performing a blepharoplasty under general anesthesia, local infiltration anesthesia is still warranted. This is also the case for cooling the eyelids during the first postoperative hours (Fig. 9).

LIP LIFT

The inclination of the upper teeth and orthognathic positioning of the maxilla influence lip position, lip shape, and tooth display, and should be considered when planning a combined treatment. A lip lift offers the possibility to rejuvenate the upper lip and to improve lip accent and appearance by eversion of the vermillion display.¹⁵ The small single procedure can result in a large and noticeable change in the face, including a younger and more sensual appearance by shortening the perceived height of the midface, and by increasing the dental show of the upper arch. Most of the patients' nasolabial folds appear softer and shortened. Indications for the procedure include: a long or heavy upper lip; poor dental show; poor filler results (overfilled lips); filler complications; postsurgical drooping after rhinoplasty or orthognathic surgery;



poorly defined or thin upper lip; mild asymmetry, especially of the Cupid's bow; and buried or drooping mouth corners. The patients often present with excessively long and drooping lips, looking tired and aged. An elongated upper lip can lengthen the appearance of the entire midface and, the longer the lip, the more likelihood of displaying diminished function while losing character and definition of the Cupid's bow. When planning the orthognathic surgery, it is often better to shorten a long upper lip rather than let it determine the position of the maxilla and upper teeth.

The so-called buffalo horn excision subnasal lip lift has already been in use for more than four decades, with a variety of personal modifications. Nasal base widening and atrophic scarring, striations and hypopigmentation are the most encountered postoperative problems. They seem to be mainly because of skin closure under tension and incision length and shape. It is therefore advocated by some authors to go for a deeper subsuperficial musculoaponeurotic system release and suspension of the superficial musculoaponeurotic system to the pyriform ligament to attain tension-free skin closure.¹⁵

While planning the lip lift, one should consider the overall facial balance by comparing the soft tissue proportions, and dental or skeletal predominance. A primary goal of the lip lift for most patients and surgeons is to increase the tooth show at rest and at function. Although a lack of tooth show exaggerates the aged appearance and can diminish sensuality, there is a turning point that must be respected for each patient, where the sensuality and youthfulness gained from an increase in tooth show and lip shortening transitions to a toothy or skeletonized appearance after excessive excision. There are no measurements or strict guidelines that would indicate this specific point. Rather than measuring the proportions directly, it is recommended to look at the face as a whole and simply envision the consequent changes. The overall intent is to make an appropriate lip fit in relation to its surrounding structures, especially the nose, cheeks, and chin.

Drawing the incision lines and determining the amount and shape of the skin excision are of

paramount importance. The upper incision usually runs across the entire nasal base in the natural alar-facial and alar-labial crease. The incision continues under the nose, making sure not to invade the nasal sill. As a security measure, one can mark the minimum amount of remaining upper lip. This would, for most patients, be around 12 mm, measured from the Cupid's bow peak superiorly to the lower skin marking while the lip is on stretch mode. The amount to be excised ranges between 4 and 10 mm, with most excisions ranging between 5 and 7 mm. Excisions aiming for notable tooth show are typically between 7 and 9 mm. An excision of more than 10 mm is not advised because this dramatically increases healing time and makes redistribution of the skin difficult in the average patient. If there is a minor Cupid's bow asymmetry, it is corrected at this stage with an asymmetric excision. Lateral asymmetries cannot be corrected with a surgery centered at the base of the nose.¹⁵

The procedure can also be used for patients with adequate tooth show but who wish to improve their upper lip height, character, and volume. Even the most conservative lip lift can change the slope and vector of the vermilion, making it look like a lip filler has been applied.

A lip lift can be combined with some orthognathic surgeries (Fig. 10), including mandibular surgery if no other procedure is involved. The presence of a nasal tube is, however, a disadvantage so switching to an oral tube after the orthognathic procedure is considered. A lip lift should not be performed at the same time as a maxillary orthognathic procedure. Not only will the intraoral approach to the maxilla, and probably the swelling, have an influence, but also the healing process after repositioning the maxilla is somewhat unpredictable. Hence it is better to postpone the lip lift for those cases. We prefer to perform the lip lift as an outpatient procedure under local anesthesia once the brackets have been removed so that they do not influence the lip projection, and once the maxillary healing is complete (6 months at least).

Fig. 8. Female patient (24 years old) with mandibular retrognathia and a deep bite. She underwent combined orthodontic and surgical treatment consisting of clockwise bimaxillary advancement. As an adjunctive procedure the protruded left ear was corrected using Mustardé transcartilaginous nonresorbable sutures to increase the antihelical fold. Frontal (A) and three-quarter view with left ear (B) of the situation before surgery. Frontal (C) and three-quarter view from left side (D) after surgery and postoperative orthodontic treatment. (E) Schematic drawing of the Mustardé procedure with accentuation of the antihelical fold using transcartilaginous sutures from a posterior access.

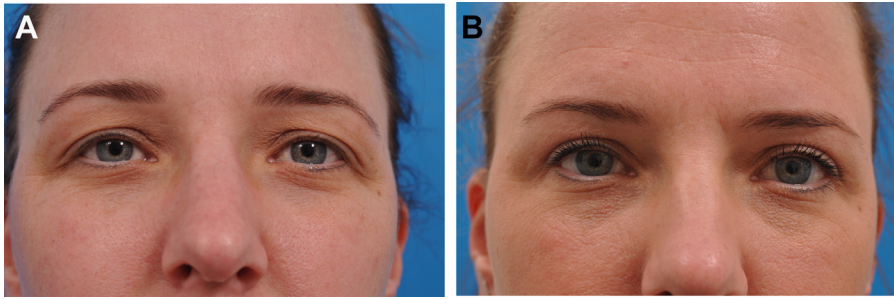


Fig. 9. Female patient (38 years old) with mild dermatochalasis of the upper eyelids (A). She underwent a skin-only upper blepharoplasty to improve the eyelid crease and to slightly increase the tarsal platform show. Note the subtle rejuvenating effect of the procedure (B).



Fig. 10. Female patient (60 years old) with mandibular retrognathia and lengthening of the upper lip caused by facial aging. She underwent a combined orthodontic surgical treatment with mandibular advancement. The surgery was combined with a subnasal lip lift to shorten the upper lip and to evert the vermillion. Preoperative situation in frontal (A, B) and three-quarter view (C). Postoperative situation in frontal (D, E) and three-quarter view (F).

SUMMARY/DISCUSSION

Orthognathic surgery is much more than the correction of a malocclusion. The facial aesthetics also play an important role in patient satisfaction with the orthognathic surgery. Therefore, considerations regarding aesthetic factors should be discussed thoroughly with the patient and taken into account in every preoperative consultation and treatment planning. Even state-of-the-art planned and executed orthognathic procedures have their boundaries and shortcomings, and noticeable unfavorable side effects, such as mandible border irregularities and projection deficits. Discussing these possible outcome aspects with the patient beforehand not only prevents postoperative excuse conversations, but also highlights the great care taken by the surgeon in the process of achieving the best possible end result for the patient. Furthermore, this opens the door for mentioning additional esthetic procedures to either prevent unwanted outcomes or to improve treatment outcomes with respect to facial harmony, balance, and aesthetics, without making the patient feel that the surgeon is trying to sell extra procedures. Starting a discussion about the patient's facial aesthetics, and the possibility of adjunctive procedures, may be new to many surgeons because most of us are trained to base the discussion and treatment suggestions on the care demand expressed by the patient. In fact, in our experience, if one discusses aesthetics and the possibilities in a professional way, the patients tend to appreciate it. Nevertheless, one may be balancing on a thin line in that ethical issues may arise because, as a facial surgeon, one is biased and may foresee more small flaws in the outcome than the patient. One has to consider that undertreatment and overtreatment can result in unfavorable outcomes and/or unhappy patients. In this respect, care must be taken not to change the facial aspects of a patient in an overextensive way because it may even result in psychological problems for the patient in adapting to the facial changes. Thus, one has to keep this issue in mind when discussing the treatment options and planning before the orthognathic surgery in general, but maybe even more before performing adjunctive aesthetic procedures (especially in one procedure), because they can add up to a more profound outcome. Most adjunctive aesthetic procedures can, and are preferably, combined with the orthognathic surgery, especially when the outcome is expected to be good. From a practical point of view, this is beneficial for the patient. When in doubt whether to advocate an adjunctive aesthetic procedure or whether it is

desired, it is much safer to refrain from doing it during the primary orthognathic surgery and plan it as a second-stage procedure after evaluating the outcome together with the patient. Besides clinical experience, 3D imaging and virtual surgical planning are a great help, especially for asymmetrical patients, despite that a lot of work still needs to be done regarding the accuracy of the soft tissue outcome predictabilities of the 3D surgical planning software. The 3D planning of adjunctive procedures, such as facial implant placement or fat grafting, is impossible in the currently available orthognathic virtual planning software. Despite the availability of planning software and all kinds of facial analyses, one would rather not treat by numbers and deliver unit sausage faces but rather help people become the best versions of themselves.

As with any type of nonsurgical or surgical procedure, training and experience are of utmost importance when offering and performing aesthetic facial surgery. Standard photo documentation of preoperative and postoperative situations is also of great importance when changing a patient's face.

In our view and experience, adjunctive aesthetic procedures to orthognathic surgery are beneficial for achieving great patient satisfaction. We believe that implementing these in an orthognathic practice helps in being more perceptive of all one's orthognathic patients' aesthetic aspects and the postoperative results. Finally, they lead to even more personal fulfillment after performing the orthognathic surgery.

CLINICS CARE POINTS

- There are roughly four factors involved in facial aging: loss of volume (deflation), displacement of tissues, loss of elasticity, and skin changes. Orthognathic advancement surgery of either jaw increases the facial volume, thus having an antiaging effect on younger patients and a rejuvenating effect on older individuals.
- Fat grafting studies have reported between 25% and 80% long-term volume retention. This variable amount of volume retention is one of the major disadvantages of the technique and often necessitates repeated surgical procedures, so called touch-up procedures.
- To enhance volume retention of the grafted fat, several fat-enrichment strategies are being investigated, including adding: adipose

tissue derived stromal cells; tissue stromal vascular fraction; cellular stromal vascular fraction; and nanofat, microfat, and platelet-rich plasma or fibrin to the grafted fat. Even though some studies show a promising beneficial effect of these additives regarding volume retention, high-quality research, with proper volumetric measurements, is lacking.

- The advantage of hyaluronic acid (HA) fillers over fat grafting is the constant and predictable volumetric effect, which is fairly equivalent in all the soft tissue layers. Therefore, HA fillers are indicated more for the lips than fat grafting and may be more effective for subtle defects, such as an A-frame deformity of the upper eyelid, marionette lines, prejowl depression, and mental creases.
- A bony osteotomy performed at a younger age is beautiful during the first few decades, but can become unfavorable as the patient ages because of a certain loss of soft tissue volume and elasticity. This is obvious for large maxillary impactions, leading to invisibility of the upper teeth, and for mandibular setbacks in people with poor chin-neck definitions, leading to submandibular excess. Large chin advancements may help to create a prejowl depression once jowling starts at a later age.
- When looking at a face, the eyes are the first and most looked at feature. Eye-tracking studies confirm this; age judgements are made on preferential attention toward the eye region. Eye region aesthetic surgery is therefore one of the most effective interventions to enhance facial aesthetics, with blepharoplasty of the upper eyelids being one of the most commonly performed procedures.
- Care must be taken not to change the facial aspects of a patient in an overextensive way because it may even result in psychological problems for the patient in adapting to the facial changes.
- When in doubt whether to advocate an adjunctive aesthetic procedure or whether it is desired, it is much safer to refrain from doing it during the primary orthognathic surgery and plan it as a second-stage procedure after evaluating the outcome together with the patient.

DISCLOSURE

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