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Editorial

Facial gender-affirming surgery: a state-of-the-art overview based on 18 years of specialised practice

Abstract

Facial gender-affirming surgery (FGAS), historically termed facial feminisation surgery, has evolved into a highly specialised field characterised by increasing technical refinement, safety, and patient expectations. Based on a consecutive cohort of 3582 patients treated between 2008 and 2025, this Special Topic paper presents a state-of-the-art overview of contemporary FGAS practice, focusing on surgical sequencing, anatomical planning, and quality standards. The manuscript is organised by facial thirds—upper, middle, lower—and the cervical region, which reflects both anatomical logic and clinical workflow. Current surgical strategies are described for each region, emphasising bone-driven structural feminisation as the foundation for predictable outcomes, followed by staged soft-tissue adaptation when required. The role of advanced diagnostic protocols, three-dimensional imaging, patient-specific cutting guides, piezoelectric instrumentation, and biologically adjunctive therapies is highlighted. Beyond technical aspects, this work underscores the importance of meticulous preoperative assessment, realistic management of expectations, and ethical responsibility in a heterogeneous and vulnerable patient population. By synthesising nearly two decades of focused clinical experience, this article aims to define contemporary standards and provide practical guidance for safe, systematic, and patient-centred FGAS practice.

Keywords: Facial gender-affirming surgery; Forehead reconstruction; Rhinoplasty; Lower jaw contouring; Chondrolaryngoplasty; Revision surgery

Introduction

Facial gender-affirming surgery (FGAS), historically termed facial feminisation surgery, has advanced substantially in technique, safety, and clinical outcomes over the past two decades. Drawing upon a large cohort of patients (n = 3582) treated between 2008 and 2025, this article provides a state-of-the-art overview of contemporary practice, procedural sequencing and quality standards in FGAS. A detailed summary of the surgical procedures performed across the cohort is provided in Table 1.

The discipline has evolved rapidly in recent years, with procedures now achieving outcome quality and safety benchmarks comparable with those of established maxillofacial and facial plastic surgical interventions.[1] Concurrent with this evolution is an unprecedented accessibility to clinical information for patients, which has heightened patient engagement and expectations.[2] Surgeons practising in this domain must consequently adopt advanced surgical techniques and standardised treatment protocols to deliver safe, reproducible, and predictable outcomes.

Despite the proliferation of surgeons offering FGAS, formalised training pathways and accredited educational programmes remain limited.[3,4] This disparity may contribute to inconsistent outcomes, a higher frequency of revision or secondary procedures following suboptimal primary surgeries, and an increased incidence of avoidable complications.[5,6] Recognising and addressing these challenges is essential for advancing care quality.

Patients seeking FGAS present a unique psychosocial profile.[7] They often have specific, high-level expectations and limited tolerance for prolonged recovery periods. For many individuals, FGAS represents a pivotal transition with profound implications for identity, social functioning and psychological well-being.[8,9] Successful outcomes are associated with high levels of patient satisfaction; however, unmet expectations can adversely affect perceived success and patient quality of life.

The aim of this special topic is to define contemporary quality standards in FGAS. For clarity, the discussion is organised around anatomical regions—upper, middle and lower facial thirds and the cervical region—while emphasising the importance of holistic assessment and tailored

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Table 1
Distribution of facial gender-affirming surgical procedures in 3582 patients.

Procedure	Number of cases
Forehead reconstruction:	
Coronal approach	2891
Hairline lowering surgery	89
Rhinoplasty	1904
Chin contouring	1419
Lower jaw contouring	1261
Adam's apple contouring	1228
Hair transplant:	
Simultaneous hair transplant[a]	1342
Deferred hair transplant[b]	61
Lip lift	563
Malar augmentation	42
Total	10,800

[a] Always performed in combination with a forehead reconstruction via coronal approach.
[b] This involves either follicular unit extraction or follicular unit strip surgery.

treatment planning. Empathic patient communication, active listening and clear alignment of clinical judgement with patient goals are fundamental to optimising outcomes. Misconceptions and unrealistic expectations are common; therefore, informed patient education and shared decision-making are critical. Failure to address patients' objectives may compromise the final outcome.

Our surgical philosophy rests on three core principles. First, preservation of individual identity while achieving maximal anatomical feminisation, targeting craniofacial configurations reflective of developmental patterns that are uninfluenced by androgens. Second, the pursuit of natural-appearing results that align with established facial aesthetic norms; exaggerated modifications are associated with increased dissatisfaction and complication rates. Third, minimisation and concealment of surgical scars, given their permanence and potential psychosocial impact.

Over recent years, clinical observation has revealed that many individuals prioritise facial feminisation before body or genital surgery,[10] which probably reflects the central role of the face in gender perception and social integration.[11] The average age of FGAS patients has also decreased, which is consistent with broader access and earlier engagement in care pathways. FGAS may also be combined safely with other gender-affirming procedures, such as breast augmentation, body contouring or vaginoplasty, provided that careful attention is paid to operative duration and the demands of recovery. Common practice in our series has been to integrate these procedures when the perioperative risk remains acceptable.

Diagnostic assessment and surgical sequencing

Before addressing the gender-related anatomical considerations and the specific surgical procedures associated with each facial third, it is pertinent to outline the diagnostic protocol that underpins contemporary FGAS.[12] A comprehensive understanding of the patient's priorities, which are often related to specific anatomical features that act as dysphoria triggers, is the cornerstone of treatment planning and is initially established through a structured sequence of clinical interviews.

This qualitative assessment is subsequently consolidated through a standardised diagnostic workflow that includes systematic photographic documentation (static and dynamic views, facial expression analysis, and video recording), three-dimensional computed tomography (CT) with volumetric reconstruction to allow detailed evaluation of skeletal anatomy (including bone thickness, frontal sinus morphology and extension), and the use of virtual feminisation tools. Virtual facial simulation enables realistic visualisation of potential surgical outcomes, facilitates patient understanding of achievable changes and inherent anatomical limitations, and plays a key role in aligning expectations with surgical reality.

Beyond its communicative value, this diagnostic framework forms the basis for accurate surgical planning, and it is frequently supported by patient-specific cutting and positioning guides, which are generated through dedicated software platforms. These tools improve precision, reproducibility, and predictability in technically demanding procedures.

In delineating surgical sequencing, we typically describe a two-phase approach. The first phase focuses on structural feminisation of bone and cartilaginous elements. The second phase addresses soft tissue adaptation and refinement when spontaneous physiological adaptation is insufficient. This staged strategy reflects the differing biological responses to skeletal reduction versus soft tissue repositioning, as well as the pragmatic need to limit prolonged anaesthesia and operative risk.

Figs. 1–4 present representative cases of primary FGAS, illustrating the application of diagnostic assessment and surgical sequencing to individualised combinations of procedures. Postoperative images span multiple time points, from the early postoperative period (8 days) to long-term follow up (up to 2 years).

The upper facial third

Forehead feminisation

Feminisation of the fronto-naso-orbital complex is a key determinant in the perception of gender, as widely reported in the literature.[13–17] Consequently, the vast majority of patients seeking FGAS require some degree of modification in this anatomical area, representing 83% of cases in our database. Feminisation of the upper third of the face, in addition to the hairline, requires consideration of multiple anatomical structures, including the frontal bone surface, the frontal bossing and supraorbital ridge, the frontomalar buttresses, the temporal ridges, and the frontonasal transition.

Fig. 1. Preoperative and 8-day postoperative clinical views following facial gender-affirming surgery. Procedures included forehead reconstruction, rhinoplasty, chin contouring, and Adam's apple contouring. Published with the patient's consent.

Fig. 2. Preoperative and 2-month postoperative clinical views following facial gender-affirming surgery. Procedures included forehead reconstruction with simultaneous hair transplantation, rhinoplasty, and Adam's apple contouring. Published with the patient's consent.

Fig. 3. Preoperative and 1-year postoperative clinical views following facial gender-affirming surgery. Procedures included forehead reconstruction with simultaneous hair transplantation, rhinoplasty, lower jaw and chin contouring, and Adam's apple contouring. Published with the patient's consent.

Fig. 4. Preoperative and 2-year postoperative clinical views following facial gender-affirming surgery. Procedures included forehead reconstruction, rhinoplasty, and lower jaw and chin contouring. Published with the patient's consent.

Surgical access and hairline management

Our clinical approach has evolved through several stages. Initially, cases were routinely approached via a trichophytic incision at the hairline.[18] While outcomes were generally satisfactory, the resultant scar in a highly visible location often became a concern over time, with patients expressing a desire for improved concealment. Despite multiple attempts to reshape the hairline naturally using this approach, we concluded that consistently aesthetic and natural results were not achievable.

With increasing experience and patient feedback, the incision site has been moved progressively further back. The hairline approach is now reserved for patients with a naturally rounded hairline who specifically desire forehead shortening (hairline lowering surgery) and decline hair transplantation. These patients must be counselled regarding the potential need for subsequent hair restoration or alternative treatments in cases of poor scar healing or visible scarring.

Redefinition of the anterior hairline represents another critical component of FGAS.[19] The integration of hair transplantation techniques with coronal access to the frontal region constituted a pivotal advancement. In patients with mild to moderate temporal recession (M-shaped hairlines), this combined approach allows complete feminisation in a single-stage procedure. After more than 1300 cases over a 10-year period using this technique, we have confirmed its viability and graft survival and currently consider it the gold standard.

For patients with more pronounced recession requiring a greater number of follicular units than can be harvested from a coronal strip, follicular unit extraction (FUE) may be performed concurrently (in single-forehead or short combined procedures) or staged as a second intervention to optimise density and shape.

The standard coronal approach provides excellent scar concealment and facilitates brow repositioning through a dual technique (skin strip resection and placement of resorbable fixation anchors). However, it carries a slightly higher risk of hypertrophic scarring due to increased wound tension, although the incidence remains low (<2% in our series).[6] Currently, incisions are planned in the occipital region below the crown, avoiding hair whorls that complicate closure and concealment. This posterior approach offers four advantages: complete scar coverage by downward-growing hair; higher follicular density, facilitating strip harvesting when hair transplantation is combined; shorter circumference, which results in a shorter scar and reduced operative time, and; lower wound tension, which reduces the risk of hypertrophic scars, and improves camouflage if scarring occurs.

The main drawbacks include increased early postoperative discomfort related to dorsal decubitus positioning, a less pronounced immediate brow-lifting effect, and more technically demanding brow anchoring.

Dissection and haemostasis

Following the incision, dissection is performed above the subgaleal plane, extending laterally to the frontomalar sutures and from the frontonasal suture posteriorly to the coronal suture. Preservation of this extended flap ensures adequate osseous vascularisation and serves as a therapeutic reserve in the event of complications involving the posterior frontal sinus wall or diploic space.

Scalp bleeding is managed using controlled hypotension, cold compresses, and judicious electrocautery, which avoids proximity to hair follicles to prevent thermal injury and alopecia. Closure with interrupted sutures allows improved haemostatic control, although it is more traumatic to follicles and slower than staple closure.

Fronto-naso-orbital reconstruction

Classic techniques for fronto-naso-orbital reconstruction remain valid. However, in our experience, the majority of cases are optimally managed through osteotomy of the anterior frontal sinus wall combined with global frontal bone contouring using high-speed burs. Across nearly 3000 cases, this approach has proven to be one of the safest and most predictable procedures, yielding consistent and reproducible outcomes across our surgical protocol.

We generally recommend global volume reduction of the frontal bone with high-speed burs, combined with osteotomy of the anterior sinus wall to achieve the required setback. Cases amenable to shaving alone are exceedingly rare (<1%). Shaving-only techniques are limited to setbacks of 2–3 mm, constrained by the average thickness of the anterior sinus wall (3 mm ± 0.7),[20] and frequently result in suboptimal aesthetic outcomes. Even in cases with solid sinuses, we favour osteotomy-based reconstruction, as exposed cancellous bone demonstrates unpredictable resorption.[21]

After setback, redefinition of the superior orbital rim is achieved through shaving. This increases upper eyelid exposure at rest, thereby enlarging the lid-to-brow distance, which is a critical feature in feminising the gaze. Brow repositioning is then performed, elevating the brow 0.5–1 cm above the newly defined orbital rim. Among multiple techniques described, resorbable bone-anchoring devices have proven to be safe, efficient, and reproducible.[22]

Frontal sinus reconstruction

Reconstruction of the frontal sinus is a critical determinant of surgical success. The routine use of cutting guides has simplified the procedure and appreciably reduced complications by optimising osteotomy design and minimising the need for extensive mesh reconstruction.

We do not recommend routine manipulation of the sinus mucosa beyond preserving its integrity. When mucosal resection is unavoidable, its regenerative capacity renders the intervention low risk. Prior to fixation of the anterior wall, patency of the naso-frontal duct must be confirmed by removing residual bone fragments that may obstruct drainage.

Fixation is performed using titanium osteosynthesis hardware. In most cases, two 1 mm low-profile miniplates secured with four micro screws provide adequate stabilisation. For gaps exceeding 2 mm or areas of structural weakness, titanium mesh (0.6 mm thickness) combined with micro screws is recommended. Autologous bone particulate harvested during burring, enriched with leukocyte- and platelet-rich fibrin (L-PRF), is placed beneath the mesh to promote osteogenesis.[23] Ongoing studies from our group are evaluating the regenerative potential of this material alone or combined with mesh.

In large defects with complete loss of anterior wall integrity, calvarial bone grafts are preferred to restore native architecture and reduce reliance on titanium mesh.

Complications and secondary procedures

The complication profile observed in our series demonstrates a very low incidence of adverse events, supporting the safety and predictability of forehead reconstruction in FGAS.[5] These findings should be interpreted cautiously, as they derive from a single-centre cohort. Moreover, reporting a single global complication rate may be misleading due to heterogeneity in aetiology and clinical relevance.

In our cohort, the surgical reintervention rate was 0.92%, corresponding to 14 reoperations among 1510 forehead reconstructions. Follow up spanned 5 years (2020–2024), with a minimum of 12 months. Only complications requiring surgical intervention were included. The most common acute complication was postoperative haematoma, requiring evacuation in fewer than 1% of cases.

The second most common indication for reoperation was hypertrophic scarring, typically managed surgically after a minimum interval of 10–12 months.

The most feared complication is frontal sinus mucocele. Four cases were observed, all successfully treated surgically. These cases shared extensive reconstructions with large mesh segments and very thin anterior walls, suggesting that calvarial grafts may be preferable in such scenarios.

The majority of secondary procedures performed by our team address complications or suboptimal reconstructions initially carried out elsewhere. Most aesthetic revisions require a more aggressive approach, combining anterior wall osteotomy with extensive bony contouring. Complex reconstructions are managed using autologous calvarial grafts with computer-assisted planning and guided harvesting (Figs. 5–7). In very large defects, custom titanium or polyether ether ketone (PEEK) implants may be required.

Associated periorbital aesthetic procedures

The forehead and periorbital region are treated as a single aesthetic unit. Brow repositioning often provides partial rejuvenation; therefore, upper eyelid dermatochalasis should be reassessed post elevation. When redundant skin persists, simultaneous upper blepharoplasty may be performed. Alternatively, blepharoplasty may be deferred to a second stage based on shared decision making.

In patients with significant brow ptosis, frontal feminisation alone may be insufficient. A secondary endoscopic or open brow lift may be performed, often combined with additional periorbital procedures such as upper or lower blepharoplasty, canthoplasty, or midface lift when indicated.

Future perspectives

Machine learning offers potential for the development of predictive algorithms capable of optimising frontal reconstruction strategies preoperatively, balancing aesthetic contour, functional integrity, and minimisation of titanium hardware.

While current shaving and osteotomy guides already offer advantages over unguided approaches, further refinement is required to improve efficiency and cost-effectiveness, enabling routine clinical implementation.

Looking ahead, robotic assistance may allow highly precise execution of shaving and osteotomy phases, further improving reproducibility and standardisation of frontal reconstruction techniques.

The middle facial third

Overview and timing of midface feminisation

Nasal feminisation is among the most frequently requested procedures in FGAS and has a substantial impact on overall outcomes, as the nose is a critical determinant of gender perception.[24] Furthermore, reduction of fronto-orbital volume often renders the nose a more prominent facial feature. When patients express uncertainty regarding nasal surgery, we recommend deferring the procedure for several months following other facial feminisation interventions to allow reassessment of the global perceptual impact. As is well understood, prevention is preferable to revision.

At the level of the zygomaticomaxillary complex, this principle becomes even more relevant. The malar regions are among the few facial areas directly influenced by hormone replacement therapy through fat redistribution.[25] Consequently, it is not advisable to surgically address this area until at least 6 months after initiation of hormone treatment.

In addition, volumetric reduction and reshaping across multiple facial regions alter spatial relationships, making precise prediction of required midface volume challenging. For this reason, zygomatic interventions are generally preferred as secondary procedures. When patients harbour reservations, temporary augmentation with resorbable fillers (hyaluronic acid or calcium hydroxyapatite) may be used as a diagnostic tool prior to fat grafting or implant-based augmentation.

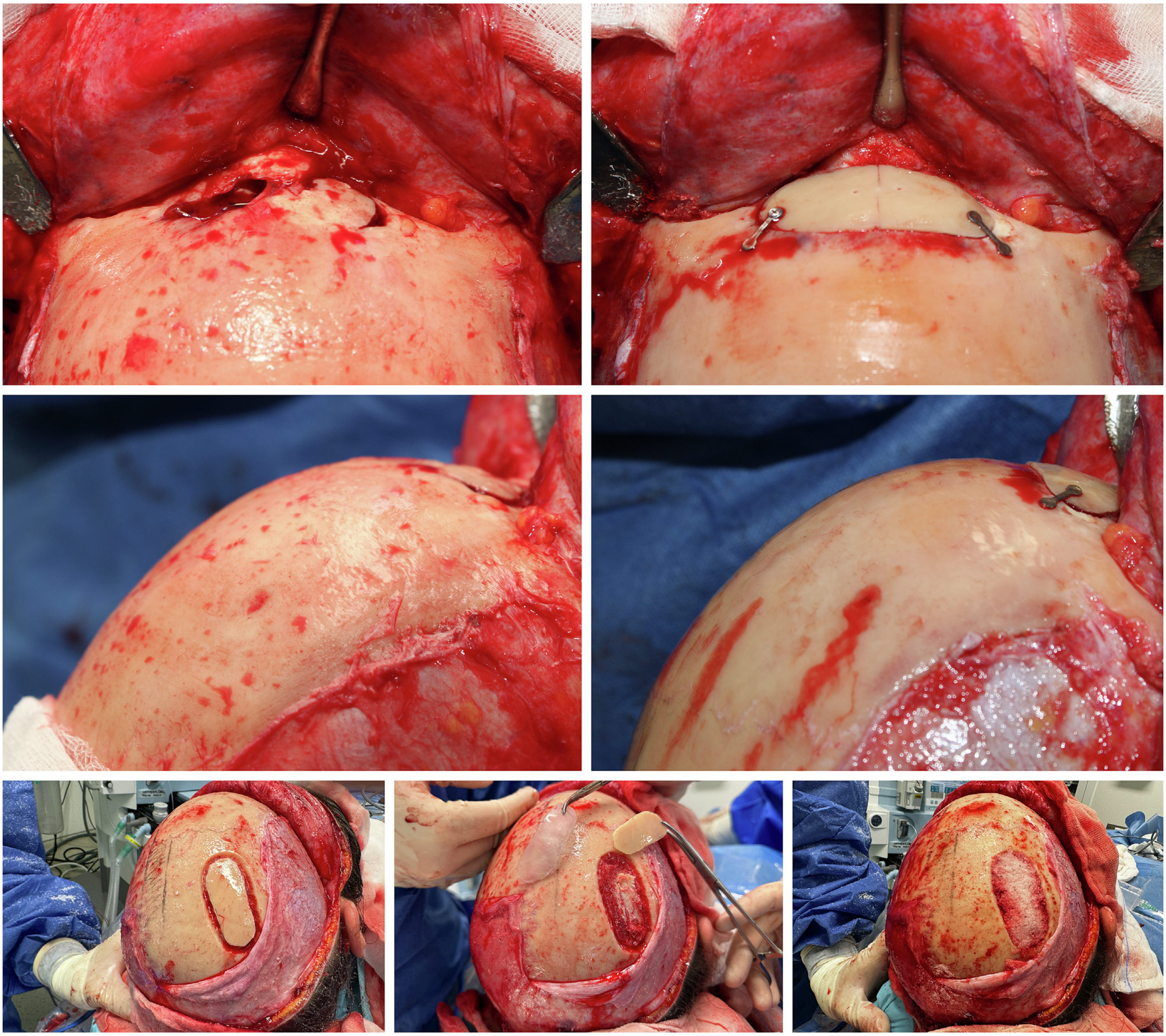

Fig. 5. Secondary frontal sinus reconstruction. Case 1. Failed primary surgery performed elsewhere, with partial resorption of the anterior wall of the frontal sinus. (Top and middle rows, left) Intraoperative views showing a defective anterior wall of the frontal sinus. (Top and middle rows, right) Reconstruction using a parietal calvarial bone graft shaped by controlled greenstick fracture and secured with two titanium miniplates to restore anterior contour. (Bottom row, left) Ultrasonic marking of the donor graft guided by a patient-specific surgical template matching defect curvature and dimensions. (Bottom row, centre) Guided harvesting of the graft. (Bottom row, right) Donor site coverage using autologous bone particulate and leukocyte- and platelet-rich fibrin.

Malar bone reduction

Techniques for malar bone reduction are well described in the literature and form part of routine practice for many surgeons, particularly in Asian phenotypes.[26,27] Our experience in this domain is limited.

In white patients, malar volume reduction is infrequently required. When clearly indicated, the most predictable approach consists of an intraoral osteotomy performed under computer-assisted planning, using patient-specific cutting guides and miniplate fixation to accurately reproduce the virtual surgical plan.

In keeping with our surgical philosophy, malar volume reduction is avoided unless unequivocally necessary. Excessive reduction may compromise midface support and have unfavourable long-term consequences with respect to facial ageing.

Cheek augmentation

Autologous fat grafting

For patients requiring conservative volumetric augmentation, autologous fat grafting is our preferred approach.[28] Common donor sites include the lateral hips (flanks), inner thighs, and suprapubic region. Fat is centrifuged and enriched with L-PRF prior to infiltration.

Typically, 5–10 cc of microfat per zygomatic region is injected using a uniform, multiplanar microdroplet technique

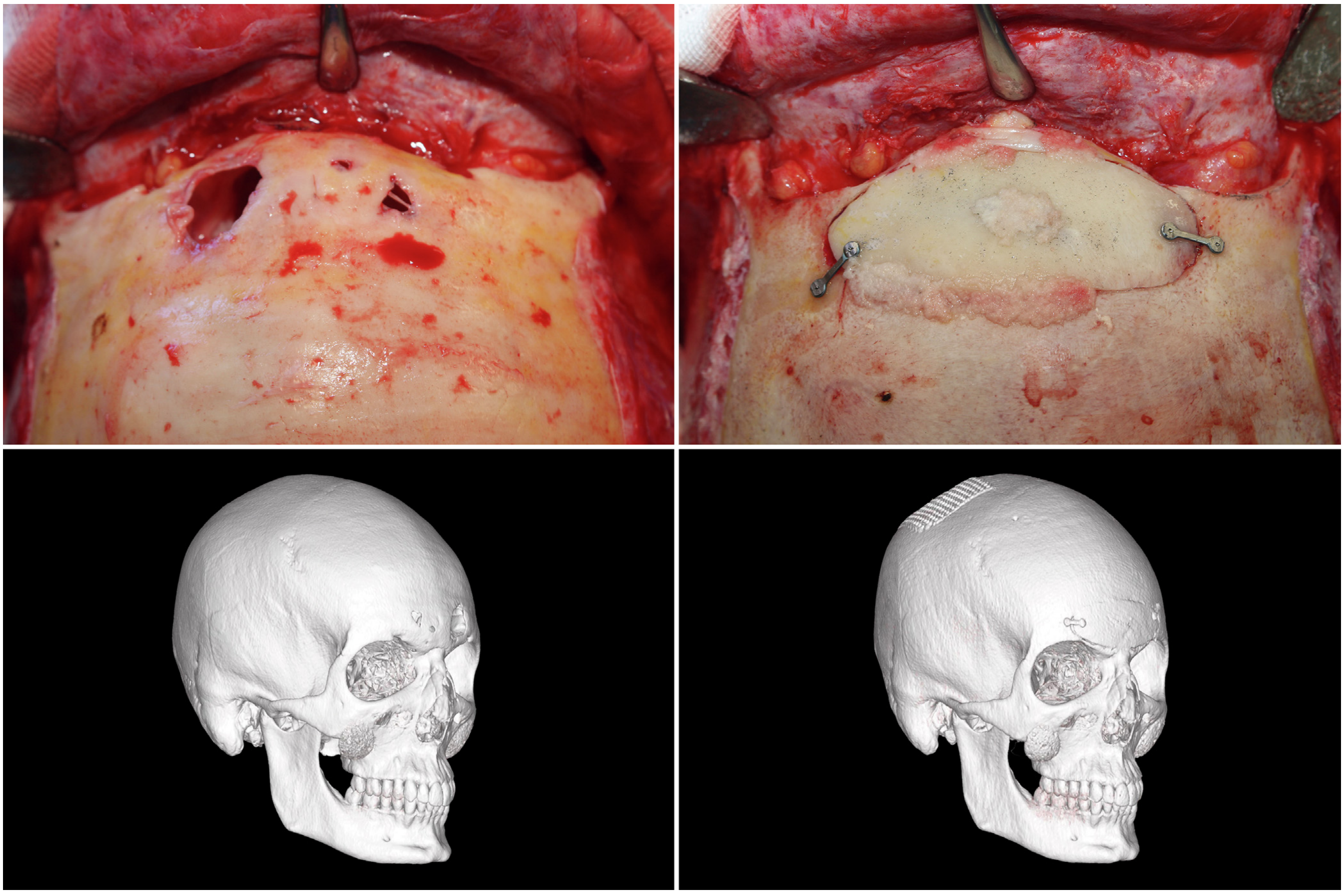

Fig. 6. Secondary frontal sinus reconstruction. Case 2. Failed primary surgery performed elsewhere, with partial resorption of the anterior wall of the frontal sinus. (Top row) Intraoperative views before reconstruction (left) and after reconstruction with a parietal calvarial bone graft secured with titanium miniplates (right); residual defects were filled with autologous bone particulate and leukocyte- and platelet-rich fibrin. (Bottom row) Three-dimensional computed tomographic reconstructions demonstrating restoration of frontal bone surface continuity and sinus contour.

within the malar area, avoiding the infraorbital rim. Extension toward the zygomatic arch may be performed to enhance lateral projection when required. The goal is to increase malar prominence relative to frontal projection and to achieve a wider bizygomatic dimension compared with the bigonial width (approximately 1:0.8). When indicated, procedures are concluded with nanofat infiltration in the tear trough region to improve skin quality or achieve a rejuvenating effect.

Patient-specific implants

In patients requiring or desiring significant volumetric augmentation, patient-specific implants may be considered as a primary option. PEEK is commonly used due to its inert properties and is secured with two to three screws per side via an intraoral approach.[29]

PEEK implants have proven safe and highly predictable,[30] provided three fundamental principles are respected: rational implant design avoiding excessive volume; adequate subperiosteal dissection while avoiding muscular insertions that may mobilise the implant; and rigid passive fixation. The use of placement guides has facilitated accurate positioning. Over more than ten years of experience using PEEK implants as our preferred material, no implant-related complications have been observed when these principles are followed.

Buccal fat pad removal

Although not routinely performed, excision of the buccal fat pad may accentuate the transition between the malar region and mandibular contour. This procedure serves primarily an aesthetic rather than feminising purpose; however, in the context of FGAS, it may assist in refining a globally voluminous face.

The procedure is highly predictable and associated with minimal morbidity.[31] It is performed through a 3–4 mm intraoral vestibular incision, followed by closure with resorbable sutures. In our experience, the excised buccal fat pad yields high-quality fat suitable for lipotransfer, primarily to the malar region, with an average yield of 6–8 cc of purified fat.

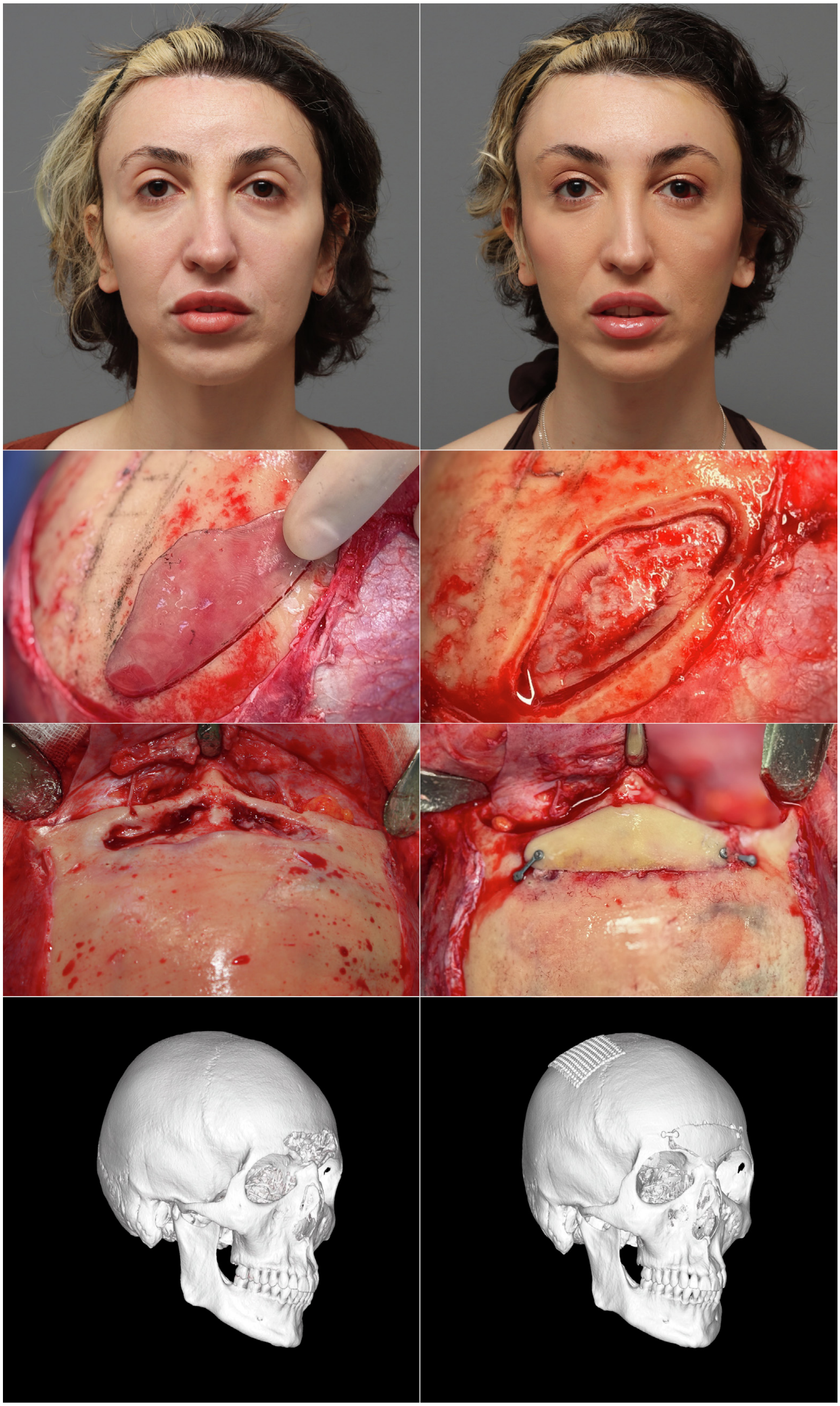

Fig. 7. Secondary frontal sinus reconstruction. Case 3. Failed primary surgery performed elsewhere, with complete resorption of the anterior wall of the frontal sinus. (Top row) Preoperative and 8-day postoperative clinical views. (Second row) Application of a patient-specific surgical guide to define graft dimensions and curvature. (Third row) Reconstruction of the anterior wall using a parietal calvarial bone graft secured with titanium fixation. (Bottom row) Three-dimensional computed tomographic reconstructions confirming restoration of anterior wall architecture and frontal bone surface continuity. Published with the patient's consent.

Rhinoplasty in facial gender-affirming surgery: principles and techniques

Rhinoplasty in FGAS, developed through nearly two decades of cumulative experience and a large consecutive case series, is grounded in meticulous preoperative assessment and individualised surgical planning. This process integrates physical examination, three-dimensional CT imaging, and patient-specific factors including age, ethnicity, skin thickness and quality, skeletal anatomy, and clearly defined aesthetic objectives.[32]

The primary aim of feminising rhinoplasty is to modify or eliminate nasal characteristics commonly perceived as masculine while achieving a result that lies within the feminine aesthetic spectrum and remains harmonious with the overall facial framework. Depending on the initial anatomy, this may involve global reduction of nasal volume, refinement of dorsal aesthetic lines, and enhancement of nasal tip projection, rotation, and definition. Preservation or improvement of nasal airway function remains a fundamental priority throughout all stages.[33]

An open rhinoplasty approach is employed in most cases following tumescent local anaesthetic infiltration. A standardised stepwise protocol is applied, including supraperichondrial and sub-superficial musculoaponeurotic system (SMAS) dissection, osseous contouring with piezoelectric instrumentation and high-speed diamond burs, and lateral and medial osteotomies. These osteotomies are performed using piezoelectric devices and, when indicated, patient-specific three-dimensional cutting guides. L-PRF membranes are routinely incorporated to assist haemostasis, facilitate soft-tissue adaptation, and camouflage minor contour irregularities.

Structural and preservation rhinoplasty: a complementary approach

Structural rhinoplasty has historically formed the foundation of our practice and remains essential in cases requiring substantial modification of nasal support or projection. However, the progressive incorporation of dorsal preservation techniques has proven advantageous in selected reductive procedures.

Preservation strategies maintain the native dorsum and keystone area, facilitating smoother contour transitions, reducing structural disruption, and aligning with contemporary rhinoplasty principles that prioritise functional integrity and long-term aesthetic stability. Structural and preservation approaches are not viewed as mutually exclusive but rather as complementary tools within a flexible, anatomy-driven surgical framework.

Control of nasal tip projection, rotation, and long-term stability is achieved through a combination of cartilage grafting—most commonly septal extension grafts or columellar struts—together with lateral crural tensioning, medial crural overlap, and dome refinement using suture techniques. This structured approach provides predictable aesthetic outcomes with a low rate of secondary intervention and stable mid- to long-term results.

Application of technology in planning and surgical execution

Since October 2020, CT-based virtual planning and routine use of customised three-dimensional cutting guides generated with Nemotec software (Nemotec, Biotech Dental) have been incorporated into our rhinoplasty workflow. These tools have increased precision and symmetry during osteotomies, reduced interoperator variability, and improved reproducibility, particularly in complex or revision cases.

Piezoelectric instrumentation is systematically employed for all osseous work, enabling high-precision sculpting and lateral, transverse, and oblique medial osteotomies with minimal soft-tissue trauma. This approach has been associated with reduced postoperative oedema and ecchymosis, as well as a lower incidence of haemorrhagic complications requiring early reintervention.

In parallel, platelet-derived products—specifically L-PRF membranes—have been routinely used since 2020 to enhance haemostasis, promote soft-tissue redraping, and act as a biological interface between the nasal skin envelope and the reconstructed osteocartilaginous framework.[34]

The lower facial third

Conceptual framework of lower facial feminisation

Achieving harmonious, symmetrical, and predictable outcomes requires meticulous individualisation of each case to feminise the lower facial third without generating surgical stigmata. The effective use of patient-specific cutting guides and ultrasonic instrumentation, as documented in previous publications,[35,36] constitutes two fundamental tools in achieving this objective.

Feminisation of a typically masculine mandible involves modification—most often reduction—across three spatial planes: vertical height, transverse width, and anteroposterior projection, in addition to changes in overall morphology. For conceptual clarity, the mandible–chin complex is considered a composite entity comprising three distinct anatomical regions: the gonial angles, the mandibular body, and the chin. Each of these regions represents a target for surgical modification and must be evaluated independently in all three dimensions.

The principal surgical techniques employed include burring, which is particularly useful for contour modification, and cutting techniques (osteotomy with or without ostectomy). From a practical standpoint, cutting techniques are primarily used to reduce vertical height at the gonial angles, mandibular body, and chin, with emphasis on the basal border, whereas burring techniques are used for volumetric reduction, including width and projection when indicated.

The overarching objective is to transform a square, excessively robust lower face into a smaller, rounded U- or V-shaped configuration. While a feminine gonial angle is often cited as ranging between 120° and 130°,[37] rigid adherence to numerical values is discouraged. Feminine facial aesthetics encompass a broad morphological spectrum, including angular or even square forms, all of which may be perceived as attractive. Appropriate proportions must therefore be assessed in the context of the entire facial framework, guided by clinical judgement and patient-specific goals.

Gonial angle modification

Defined gonial angles measuring approximately 90°–110°, typically associated with masculine features, frequently coincide with square facial forms; consequently, the objective is often to increase the magnitude of the angle. Conversely, excessively obtuse angles exceeding 130° may suggest developmental anomalies and are often associated with dolichocephalic profiles, elongated faces, or hypermentonism.

In the transverse plane, gonial angle resection may achieve a reduction of 0.5–1 cm in total facial width at this level.[37] This excludes cases of flared or everted angles, which are generally secondary to masseteric hypertrophy.[38] Ideally, the bigonial width should represent approximately 75%–80% of the bizygomatic width to avoid elongated or overly square facial forms.

Beyond width and convergence profiles, the gonial angle contributes to posterior facial height. While sharp jawlines are sought by many women and may be perceived as attractive or androgynous, some patients desire a softer contour. In such cases, the aim is to achieve a smooth, rounded transition from below the earlobe—never extending the vertical cut limit beyond this upper boundary—toward the mandibular body. Overly aggressive resections in this region result in unfavourable aesthetic outcomes and must be avoided.

Mandibular body contouring

Reduction of mandibular body width is typically achieved through high-speed burring, although its impact on facial appearance is generally less pronounced than angle or chin modification. Careful assessment of whether vertical height reduction of the mandibular body is required is essential to avoid undertreatment.

A common error is to address only the gonial angles and chin while leaving excessive vertical dimension along the mandibular body, thereby preventing complete feminisation. Conversely, indiscriminate vertical reduction must be avoided, as it often provides minimal aesthetic benefit while incurring significant functional compromise (Fig. 8). Such overtreatment may involve detachment of a substantial proportion of the mylohyoid muscle fibres and disruption of the mandibular ligament required for surgical access.

Chin feminisation

The chin represents a critical determinant in gender perception. A typically masculine chin is square and wide, often characterised by prominent paramedian tubercles and increased vertical height. The initial assessment focuses on determining whether vertical reduction is required at the midline or whether reduction should be concentrated at the paramedian level. This decision directly influences the detachment and reattachment of musculature, including the mylohyoid, digastric, and other muscles inserting at the genial region.

Resection of the paramedian tubercles generally narrows the chin; however, this is usually supplemented by high-speed burring to achieve a more significant modification in shape. Anteroposterior projection must also be evaluated. Excessive projection is typically managed by burring, whereas setback mentoplasty is rarely recommended due to potential aesthetic consequences, such as submental fullness,

Fig. 8. Mandibular body over-resection with exposure of the inferior alveolar nerve.

Fig. 9. Extended (mini-wing) genioplasty. Three-dimensional computed tomographic reconstruction illustrating osteotomy extension beyond the mental foramen, maintaining jawline continuity without a visible or palpable step deformity.

and functional concerns related to reduced muscular support and possible airway compromise.

Projection deficiency is addressed through advancement genioplasty, with the option to modify vertical height concurrently to meet patient-specific requirements. Routine T-osteotomy is avoided due to disadvantages shared with contouring procedures, including soft-tissue ptosis, as well as risks such as bone fragment necrosis and the need for extensive osteosynthesis. Additionally, T-osteotomy creates proximal steps that require secondary basal contouring.

We rarely recommend standard trapezoidal mentoplasty, as it frequently produces palpable or visible steps along the jawline. Instead, we favour an extended genioplasty (mini-wing type), in which the osteotomy extends at least 1 cm beyond the vertical line passing through the mental foramen, resulting in a flute-like termination. This approach ensures continuity of the jawline and reduces step formation (Fig. 9). It generally involves a shorter vertical reduction than traditional sliding genioplasty.

Two specific challenges must be considered. First, when basal height removal is combined with advancement, only the anterior and posterior cortices remain, creating a zone of medullary fragility and increasing the risk of an unfavourable split. Second, the posterior extension of the osteotomy may advance a greater portion of the mandibular body, increasing transverse width, which is an effect that may be undesirable depending on mandibular morphology.

When appropriately indicated, telescopic genioplasty offers a powerful method for narrowing the chin and achieving a highly feminine contour.[39] It is particularly suitable for rounded, shapeless chins following contouring and may serve as an alternative to contouring in cases with adequate vertical height requiring only modest advancement and V-shaped reshaping. In such cases, the procedure may be performed via a minimally invasive approach with reduced downtime.

Intraoral cervical musculature repositioning

Intraoral repositioning of cervical musculature is considered a crucial step in minimising soft-tissue sequelae following mandibular contouring. Although it does not eliminate the risk of postoperative ptosis, analysis of our internal database over the past five years indicates a substantial reduction in secondary soft-tissue procedures, from approximately 5% to around 1%. These findings derive from an internally collected cohort and should be interpreted with appropriate caution.

The primary muscles affected include the mylohyoid, anterior bellies of the digastric muscles, and the mentalis. Assessment begins with evaluation of the digastric muscles. When vertical height reduction is minimal, ptosis is uncommon. However, reductions of 3 mm or more typically require detachment, resulting in muscle descent.

In all contouring cases, at least one midline anterior suspension is performed, anchoring the mylohyoid with or without the digastric muscles. A triple anterior suspension may be indicated in cases with substantial height reduction and elongated, ptotic digastric bellies. This approach effectively minimises submental fullness. Posterior suturing to reposition the mandibular ligament yields less predictable results and does not reliably prevent jowl formation; if performed, anchoring the periosteum at the vertical line between the second premolar and first molar is recommended.

Combination with orthognathic surgery

As in any patient presenting with dentofacial deformities, orthognathic surgery may be performed concurrently with or sequentially to FGAS.[40] The primary limiting factor is operative time, as combining comprehensive feminisation with orthognathic procedures may result in excessive anaesthesia duration and increased postoperative risk.

When a combined approach is indicated, staging based on patient priorities is often advisable. A common sequence involves upper facial procedures—such as forehead reconstruction, rhinoplasty, and hair transplantation—followed by a second stage addressing the lower face and neck, including orthognathic surgery and lower jaw contouring.

When maxillary osteotomy is included, rhinoplasty is ideally performed as the final or a later-stage procedure, although this sequence may be adapted according to individual circumstances. If contouring and orthognathic surgery are performed in the same session, basal ostectomy should be undertaken first. This avoids interference from osteosynthesis material and facilitates subsequent bilateral sagittal split osteotomy by allowing a more controlled split within cancellous bone.

Future perspectives

Mandibular contouring surgery remains limited by the need for extensive surgical access, periosteal dissection, and operative times constrained by the cutting efficiency of piezoelectric instrumentation. Advances in cutting technology are expected to improve efficiency.

Ideally, future developments will include smart cutting instruments capable of real-time navigation based on preoperative planning, rapid execution, and reduced bulk, enabling minimally invasive approaches and reducing the need for extensive dissections.

Soft-tissue laxity following skeletal reduction remains an unresolved challenge, as it represents an inherent physical consequence of these procedures. While intraoral osseous suspension techniques have improved outcomes, they do not achieve regional rejuvenation, and current adjunctive technologies such as radiofrequency or high-intensity focused ultrasound (HIFU) have yet to demonstrate sufficient corrective efficacy.

The neck

Cervical evaluation and preoperative counselling

Cervical evaluation during the diagnostic phase and appropriate pre-surgical counselling are essential components of FGAS. Certain cervical anatomical patterns may limit the achievable outcomes of mandibular contouring or thyroid cartilage reduction procedures.

Two clinical scenarios are particularly relevant. First, patients with a high hyoid bone and closed cervicomental angle. In these cases, even complete reduction of the thyroid cartilage projection may result in persistent airway prominence with a visible cervical break. By contrast, patients with a lower hyoid bone typically achieve more favourable results due to improved soft-tissue continuity between the neck and

Fig. 10. Submental approach for thyroid chondroplasty**.** Nine-month postoperative clinical view with the neck in hyperextension, demonstrating a well-healed submental scar with minimal aesthetic impact. Published with the patient's consent.

mandible. Secondly, patients with retrognathia and/or a heavy neck ('turkey neck'). In the presence of excessive cervical soft tissue, mandibular or tracheal reduction alone will have limited impact unless combined with soft-tissue repositioning procedures.

Clear communication of these anatomical limitations prior to surgery is critical. Failure to do so may lead patients to misinterpret inherent anatomical constraints as surgical shortcomings.

Thyroid chondroplasty (Adams apple contouring)

From a technical standpoint, the incision and surgical approach should be distant from the thyroid notch. A submental approach is preferred, utilising a maximal incision length of 1.5 cm with minimal long-term aesthetic impact (Fig. 10). Intraoral approaches, despite avoiding an external scar, are considered excessively invasive and less justifiable.[41]

The submental approach allows infraplatysmal tunnelling and blunt dissection of the musculature attached to the hyoid bone, providing safe access to the thyroid cartilage. Cartilage reduction is achieved through a combination of contouring with a diamond bur at the cartilage body to reduce projection and cutting at the superior border to reduce height. Cutting is performed using a cold scalpel in cases of normal or weak cartilage, or a piezoelectric instrument when calcification is present.

Careful attention must be paid to the depth of burring to avoid injury to the vocal cord insertions. For surgeons early in their learning curve, accurate localisation of the vocal cord level can be facilitated by fine-needle methylene blue marking under video laryngoscopic guidance at the time of intubation, providing a simple and reliable intraoperative landmark.

Secondary tracheal shave procedures require caution. Preexisting scar tissue significantly reduces predictability and increases the risk of vocal cord injury. Revision surgery should therefore be undertaken only when clearly justified by clinical indications.

Neck lift and management of cervical soft-tissue laxity

Neck treatments may be performed as primary interventions or as secondary procedures following mandibular contouring, depending on the severity of soft-tissue laxity.

In younger patients with mild laxity, less invasive modalities such as HIFU or radiofrequency may be considered. Since 2022, simultaneous mandibular contouring and vertical reduction have been implemented in selected patients. Although preliminary observations are encouraging in certain cases, outcome data are still being collected, and definitive conclusions cannot yet be drawn.

For moderate to severe laxity, surgical intervention remains the only effective option. Assessment should determine whether excess tissue is predominantly submental or located posteriorly in the jowls. Submental laxity may be addressed with platysmaplasty or more comprehensively with a neck lift when glandular, muscular, and adipose components are involved. In cases combining submental excess with perimandibular jowling and poor angle definition, a combined submental and rhytidectomy approach is advisable. The extent of incision depends on patient age and the target areas for repositioning.

In older patients undergoing staged treatment—typically structural feminisation followed by rejuvenation—platysma plasty or neck lift may be combined with thyroid chondroplasty to reduce the number of surgical approaches and overall operative time.[42] When these procedures are not combined, careful evaluation of scar tissue between the incision and the thyroid notch is essential, as adhesions and fibrosis may compromise flap elevation and lead to unfavourable aesthetic outcomes during the first 6–12 postoperative months.

Specific considerations in cervicofacial lifting in transfeminine patients

Cervicofacial lifting in transfeminine patients differs significantly from that in cisgender individuals. These patients frequently present with more voluminous facial structures, including a robust musculoskeletal framework (such as the sternocleidomastoid and masseter muscles), larger parotid glands, and thicker, often fibrotic skin and subcutaneous tissues. These characteristics are frequently related to prior hair removal procedures such as electrolysis or laser depilation.

Parotid and submandibular gland reduction is often performed as part of cervicofacial lifting in this population. Additionally, a history of mandibular contouring surgery may compromise the structural integrity of the SMAS, rendering deep-plane techniques more technically demanding. Similar challenges arise following prior tracheal shave procedures, particularly when the platysma and infrahyoid musculature have been disrupted.

In most transfeminine patients, a reduction neck lift or facelift is required to achieve satisfactory cervical definition and aesthetic outcomes.

Treatment sequencing

A minimum interval of six months is recommended between the skeletal feminisation phase and subsequent soft-tissue repositioning procedures. When lower jaw contouring has been performed, a longer interval, ideally close to 12 months, is preferable, as perimandibular muscle function typically normalises within 8 to 12 months postoperatively.

In cases where the necessity for soft-tissue repositioning is uncertain, particularly in younger patients without rejuvenation requirements, it is advisable to wait a full year before making a definitive decision.

Combining mandibular contouring surgery with a facelift is generally discouraged, except when only limited work on the chin or gonial angles is required. Comprehensive mandibular contouring induces significant inflammation, reducing the precision of subsequent facelift procedures. Staging these interventions ensures more reliable outcomes and minimises the risk of compromising results.

Synthesis and perspectives

Over the past nearly two decades, our team has focused exclusively on FGAS, enabling the progressive refinement of techniques across all key anatomical regions—from the forehead and nose to the lower jaw, chin, and neck. This extensive clinical experience has underscored the central importance of meticulous preoperative planning, individualised surgical strategies, and the integration of evolving technologies, including three-dimensional imaging, patient-specific guides, and biologically adjunctive therapies.

While individual procedures have demonstrated predictable and stable outcomes, the marked heterogeneity in patient anatomy, functional considerations, and aesthetic goals reinforces the necessity for tailored approaches and cautious interpretation of early or preliminary results. The continued maturation of this subspecialty depends not only on technical proficiency, but equally on scientific rigour, ethical responsibility, and comprehensive patient engagement. Surgeons must address patients' holistic needs and long-term well-being, rather than approaching FGAS as a sequence of isolated procedural innovations.

Collectively, the experience and principles outlined in this work aim to contribute to a safe, systematic, and ethically grounded practice of FGAS. By emphasising anatomical understanding, thoughtful sequencing, and patient-centred decision-making, this synthesis offers practical guidance and conceptual frameworks for both current and future practitioners in this evolving field.

Ethical approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. As a retrospective analysis of clinical practice, formal ethical approval was not required under local regulations. All patients provided informed consent for the use of their clinical data and images.

Conflict of interest

We have no conflicts of interest.

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