Justine C. Lee
Sumun Khetpal *Editors*

Facial Feminization Surgery

Operative Techniques and Clinical Considerations

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Preface

Facial feminization surgery (FFS), defined as the set of procedures used to achieve a more feminine facial appearance to alleviate gender dysphoria, has a long history within plastic and craniofacial surgery and continues to evolve. Key plastic surgeons including Harold Gillies and Douglas Ousterhout contributed significantly to our collective understanding of anatomic differences between male and female skulls—ultimately building the foundational principles and techniques toward feminization. Their methods were rooted in systematic analysis of cephalometric and anthropometric measurements, revealing critical skeletal and orthodontic relationships that distinguishes males from females. The focus on the bony skeleton ultimately translated to modification of the anterior table of the frontal sinus and mandible for feminization of the forehead and jaw, respectively.

While precise skeletal manipulation sets the facial structure for feminization, soft tissue maneuvers complete it. Techniques such as brow lift, hairline advancement, rhinoplasty, and lip lift can be performed synergistically to bony modifications for a harmonious feminine facial aesthetic. There is further nuance in conceptualizing which features may be perceived as feminine to some and masculine to others; the inherent subjectivity—particularly with gender-diverse individuals—has contributed to the founding of the gender mosaic and fluidity within the concept of gender.

Through the evolution of FFS, we as plastic surgeons have the great opportunity to promote restoration and rehabilitation of our patients' journey and transition. Our initial consultation serves as the first step toward developing a unique bond of trust and confidence amidst vulnerability and uncertainty. We perform careful anatomical assessment while eliciting particular sources of dysphoria; we design a tailored, individualized surgical plan suited to transgender and gender-diverse individuals. We ensure proper collaboration among primary care, endocrinology, and mental health professionals for appropriate management of medical comorbidities and hormonal therapies. These foundational efforts help launch patients on their paths toward living a life of authenticity in all spheres of life.

In the operating room, the challenge stands in constant deliberation of facial harmony and critical assessment of aesthetic relationships—amidst sequential (frequently simultaneous) modification of the brow, forehead, nose, chin, skin envelope, and skeletal structures of the face; the preservation of function amidst the integration of ethnic, racial, and individualized experiences of gender dysphoria; the foresight into the processes of facial aging and the implications of surgical maneuvers on the sustainability of result; the attention to the interplay between facial structures and their combined impact on building a more feminine aesthetic.

From our first patient, our team at the University of California - Los Angeles has launched a program that has strived to deliver comprehensive care in psychological, medical, and surgical fields. From the standpoint of FFS, our journey has been one of love and creativity. From the early days of bringing in 3D Systems (Danny Brock and Mike Silver) to design modeling and planning protocols with us to customizing instruments and hardware with Stryker (Teri Yanagawa) to the commitment of our lead operating room nurses Kristine Alessandrini and Andrew Aybar who were every bit a part of this operation and its evolution through the making of the operating room protocols to the late nights (including one 7.1 magnitude earthquake in 2018) to our surgical fellows, residents, and students, this was a labor of love. We are grateful to our patients for entrusting us and honored to have been part of their journey.

To our readers—we sincerely hope you enjoy this text. We have compiled our collective lessons and learnings from years of performing facial feminization surgery. The chapters are organized by facial structure, featuring details surrounding operative techniques with clinical considerations with supplementation of case examples, photographs, and videography. In this first-ever standardized text on facial feminization surgery, we trust that our experiences may help both attending surgeons and trainees as they introduce and/or refine techniques in facial feminization surgery.

The constant evolution of plastic and reconstructive surgery has made way for the emergence of facial feminization surgery. The marriage of skeletal and soft tissue considerations, versatility of tissue handling, attention to neurovascular anatomy, and dual priority of aesthetic and functional—these principles rooted in the historical founding of our specialty—are ever more important in facial feminization. Together—with our patients, trainees, and surgeons who have enabled the publishing of this book—we seek to promote our specialty's culture of innovation and advancement in applying craniofacial surgery principles to transgender and gender-diverse patients.

Sincerely,

Justine C. Lee, MD, PhD, FACS
Sumun Khetpal, MD

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- Our trainees and staff for their meticulous care of our patients from the operating room through postoperative recovery.
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Thank you. –Justine

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Sumun Khetpal, MD, is a resident physician in plastic and reconstructive surgery at the University of California-Los Angeles (UCLA). During her residency training, she has published on multiple topics of craniofacial surgery, rhinoplasty, facial feminization, and facial aesthetics in *Plastic and Reconstructive Surgery*, *Annals of Plastic Surgery*, *Aesthetic Surgery Journal*, and *Journal of Craniofacial Surgery*. She has been invited to present her research findings at various national and regional meetings including the American Society of Plastic Surgeons and The Aesthetic Society.

She is a graduate of the Yale University School of Medicine, the Life Sciences and Management (LSM) Program at the University of Pennsylvania and the Wharton School, and Phillips Exeter Academy.

Chapter 1
Introduction

Sumun Khetpal, Sarah K. Fadich, Nghiem H. Nguyen, and Justine C. Lee

Background and History of Facial Feminization Surgery

Transgender and gender diverse (TGD) individuals have been present in societies and cultures across the world for many centuries. As discussed by the Human Rights Foundation, gender-expansive identities have been described within religious figures in Sumerian societies (androgynous priests of goddess Inanna who took on feminine names, 5000 to 3000 BC), Ancient Greece (galli priests who wore feminine attire, 200 to 300 BC), the Roman Empire (Anastasia the Patrician who fled Constantinople to dress masculinely as a monk), in South Asia (hijra, the third gender, well documented in religious and cultural texts), and in Siberia (the Itelmens recognized a third gender called the "kokchuch," eighteenth century) [1]. The notion of transition, or aligning one's gender expression, gender role, and physical embodiment with their identified gender, has been widespread for a long period and precedes the advent of modern medicine and surgery.

Moreover, the birth of modern transgender healthcare originates from Germany through the activities of a German Jewish physician Magnus Hirschfeld, also called

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the "Einstein of Sex" by Hearst newspapers in 1931 [2]. In particular, he undertook a number of political actions in pre-World War I Germany to overturn laws against homosexuality. He studied homosexuality as a medical and anthropological science, ultimately forming the Institut Fur Sexualwissenschaft in 1919 in Berlin. This institute served as the foundation for exploring sexology and embracing those who identified with different gender and sexual orientations. Ultimately, these supportive networks would enable the beginnings of gender-affirming care—medical and surgical—to the transgender and nonbinary populations.

The first known male-to-female transgender person to undergo medical procedures for their gender dysphoria was Rudolph Richter in 1922. Rudolph at that time was a housemaid at the Institute. She underwent an orchiectomy, then later underwent penectomy by Dr. Levy-Lenz and vaginal reconstruction by Dr. Gorhbrandt. Of note, however, there was an earlier documented case of a patient, Martha "Karl" Baer, who underwent rudimentary metoidioplasty in 1907. His story was discovered after being emergently treated for attempted suicide due to the discovery of his affair with a married woman. These memoirs were published under the pen name *N.O. Body.* The next known case was that of Lili Elbe, a Danish transgender woman, who underwent removal of her testicles in 1930. Within the field of gender-affirming care, hormone therapy also emerged as a possible treatment option for the alleviation of gender dysphoria; Dr. Harry Benjamin, German psychiatrist, sexologist, and author of the *Transsexual Phenomenon,* was fundamental in the development of nonsurgical gender-affirming care for the transgender and nonbinary population [3]. These early interventions preceded the development of modern genital surgery and set the stage for later advancements in gender-affirming surgery, such as facial feminization surgery (FFS).

Sir Harold Gillies, often referred to as the "father of plastic surgery," may be considered as a pioneering figure in the development of FFS. His groundbreaking work in reconstructive surgery, particularly during and after World War I, established many of the techniques and principles that form the foundation of modern plastic and reconstructive surgery today. In particular, his work with Roberta Cowell in the 1940s marked one of the earliest known instances of surgical feminization of the face for a transgender woman. Gillies' innovative techniques, initially developed for reconstructive surgery on war-injured soldiers, laid the groundwork for modern FFS procedures. Although he did not use the term "facial feminization surgery" at the time nor did he systematically document it as a specialized field, his contributions have had a lasting impact on the field. His efforts in establishing foundational methods continue to inform contemporary practice.

Modern operative FFS techniques were then significantly developed by a field pioneered by Dr. Douglas Ousterhout, a San Francisco-based craniofacial surgeon, in the 1980s. In particular, his systematic approach to classifying sexually dimorphic features led to a more standardized methodology of feminization procedures. In 1982, "Candice" came to Ousterhout's office via the referral of a colleague, Dr. Darrell Pratt, who had performed successful genital surgery. Despite the improvements in her psychological health after her surgery, Candice still experienced dysphoria as her face appeared masculine. As well-known historian Eric Plemons put it,

"The fact of her new female genitalia – the bodily site of sex difference whose transformation is often considered to instantiate, if not define 'sex change'—was secreted away behind the bounds of propriety in social life. But people did see her face" [4].

Ousterhout's research was centralized upon three sources of information: (1) assessment of sexual differences between reference male and female skulls taken from early twentieth-century physical anthropology references, (2) the application of statistical analyses taken from late twentieth-century orthodontic research drawn from the contemporaries of Dr. Edward Angle, and (3) the utilization of such morphological and metric knowledge in a dry skull collection [5–7]. Moreover, Ousterhout drew from the Atkinson Skull Library at the University of the Pacific Dental School, collaborating with Spencer Atkinson, a contemporary of Edward Angle, a pioneer orthodontist known for the development of his classification of malocclusion. Ousterhout additionally derived measurements from cephalograms that differentiated male from female skulls. With this information, he leveraged his background and expertise in craniofacial surgery to achieve skeletal relationships consistent with a feminine skull and ultimately confer a cis-feminine appearance.

Regardless of objective cephalometric and anthropometric measurements, the beholder's own perception of the feminine aesthetic has a prominent role in the ultimate outcomes after FFS. Particularly, the beholder—or surgeon—must consider ethnic, racial, and individualized experiences of gender dysphoria and approach the preoperative consultation as an opportunity to promote restoration and rehabilitation of one's journey and transition. They must combine what features promote an appearance of femininity while adhering to basic principles of facial aesthetics and craniofacial surgery (Figs. 1.1 and 1.2).

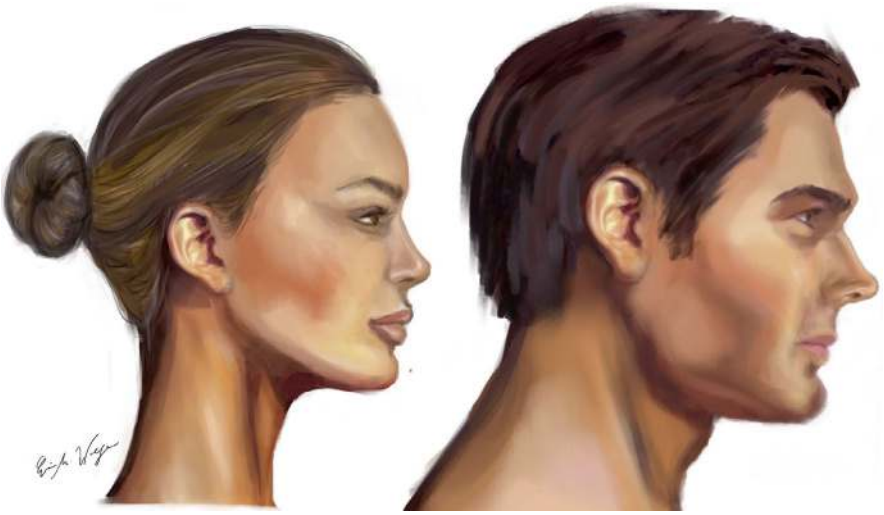

Fig. 1.1 Masculine and feminine faces on lateral view. (Copyrights retained by Dr. Erin Wolfe)

Fig. 1.2 Male and female skulls. (Copyrights retained by Dr. Erin Wolfe)

The impetus for FFS is twofold: (1) in order to alleviate gender dysphoria, defined as the incongruence between one's physical and gender identities, and in doing so (2) promote the psychological, social, and economic well-being of the transgender and gender-diverse populations as a means for improved societal function and general safety. Furthermore, discrimination, stigma, and violence significantly impact the physical, mental, and behavioral health of such populations. Compared to the general population, TGD populations suffer from more chronic health conditions and experience higher rates of health problems related to HIV/AIDS, substance use, mental illness, and sexual and physical violence, as well as higher prevalence and earlier onset of disabilities that can also lead to health issues. Such populations additionally face unique challenges and inequalities in their ability to access health insurance and adequate care, namely, via maltreatment by healthcare providers and delays in obtaining both medical and surgical treatment for the treatment of gender dysphoria.

Defining Terms

The authors find it to be important to clearly define terms in order to ensure the use of appropriate language through the text and ultimately comprehensive understanding of the context of gender-affirming care and FFS (Table 1.1) [8, 9]. The remainder of the text will incorporate the following terms:

Table 1.1 Defining terms in gender-affirming care and FFS

Term	Definition
Gender dysphoria [9]	Clinical diagnosis defined by a marked incongruence between one's experienced/expressed gender and their assigned gender, lasting at least 6 months, as manifested by at least two of the following: A marked incongruence between one's experienced/expressed gender and primary and/or secondary sex characteristics (or in young adolescents, the anticipated secondary sex characteristics) A strong desire to be rid of one's primary and/or secondary sex characteristics because of a marked incongruence with one's experienced/expressed gender (or in young adolescents, a desire to prevent the development of the anticipated secondary sex characteristics) A strong desire for the primary and/or secondary sex characteristics of the other gender A strong desire to be of the other gender (or some alternative gender different from one's assigned gender) A strong desire to be treated as the other gender (or some alternative gender different from one's assigned gender) A strong conviction that one has the typical feelings and reactions of the other gender (or some alternative gender different from one's assigned gender)
Gender euphoria	A feeling of joy or satisfaction when a person's gender identity aligns with their gendered experience rather than the gender they were assigned at birth
Cisgender	Describes a person whose gender identity aligns in a traditional sense with the sex assigned to them at birth
Gender diverse	Describes individuals with gender identities and /or expressions and includes people who identify as multiple genders or with no gender at all
Gender expression	Outward manifestation of a person's gender, which may or may not reflect their inner gender identity based on traditional expectations; incorporates how a person carries themselves, their dress, accessories, grooming, voice/speech patterns and conversational mannerisms, and physical characteristics
Gender identity	A person's inner sense of being a girl/women, boy/man, some combination of both, or something else, including having no gender at all; may or may not correspond to one's sex at birth
Nonbinary	A term used by some individuals whose gender identity is neither girl/woman nor boy/man
Biological sex	Designation as "female," "male," or "intersex" based on anatomy (external genitalia, internal reproductive organs)
Sexual orientation	Describes the types of individuals toward whom a person has emotional, physical, and/or emotional attraction
Transgender	Individuals whose gender identity does not align with their biological sex or physical identity

Growing Demand of Facial Feminization Surgery

Since the establishment of FFS in the 1980s, its demand has tremendously grown among TGD populations. According to the Center for Disease Control (CDC)'s Behavior Risk Factor Surveillance System (BRFSS) and Youth Risk Behavior Survey (YRBS), there are 1.6 million individuals who identify as transgender and nonbinary, 300,000 of whom are minors (below 17 years of age). Of the 1.3 million

adults, approximately 38.5% (515,200) are transgender women, 35.9% (480,000) are transgender men, and 25.6% (341,800) reported they are gender nonconforming. Compared to the US general population, this population is younger on average; younger individuals (ages 13 to 17) more likely to identify as TGD than adults ages 65 or older [10]. The racial and ethnic diversity of the TGD populations are generally very similar to that of the US population, with transgender youth and adults more likely to report being Latinx than Caucasian. With improvements in data collection (i.e., census reporting of gender identity) and the shift to surgery performed in major centers in the world (i.e. part of academic programs and national health services), these statistics are expected to rise and ultimately contribute further to the burgeoning demand of FFS procedures not only in the United States but also worldwide.

With such great opportunities come the imperative responsibility to optimize the care experience for these populations from the perspectives of enabling access to psychological, medical, endocrine, and if applicable surgical healthcare. While a majority of transgender individuals desire surgical transitioning, only 25% have access to gender-affirming surgery. Thus, efforts to raise awareness, amplify scientific information sharing, and emphasize formal training in the field are key action items to ultimately drive surgical innovation and patient advocacy. In doing so, our community of academic and private gender-affirming surgeons may contribute further to improving outcomes and ultimately addressing the unmet healthcare needs in these populations.

Furthermore, the psychosocial benefits of ensuring equitable and accessible gender-affirming care cannot be understated. Since 2019, we have been prospectively collecting mental health quality-of-life assessments using validated, quantitative instruments from the Patient-Reported Outcomes Measurement Information System (PROMIS), specifically assessing anxiety, anger, depression, global mental health, global physical health, satisfaction with sex life, positive affect, emotional support, social isolation, companionship, and meaning and purpose [11]. While we discuss these findings in greater depth in later chapters, this work demonstrated that in TGD patients seeking facial feminization surgery, those that completed surgery had significantly improved anxiety, anger, depression, positive affect, meaning and purpose, social isolation, and global mental health. Of importance, these findings were found even when accounting for the effects of other gender-affirming surgeries, hormone therapy, pre-existing mental health diagnoses, and socioeconomic disparities.

Closing Remarks

In the following chapters, we look forward to introducing our readers—surgeons and trainees—to the realm of FFS. Through presentation of case examples, discussion of relevant anatomy, and dedicated discussion of surgical maneuvers for feminization, we hope to unlock both clinical and technical pearls of procedures

performed for transgender and gender-diverse populations (Figs. 1.3 and 1.4). We highlight the importance of initial preoperative consultation—in hearing about the respective journeys of patients suffering from gender dysphoria and navigating the care environment for medical, endocrine, and surgical therapies. We transition to designing an optimal individualized surgical plan, discussing the operative room organization, and exploring the technical aspects of performing procedures for feminization. We close with a holistic presentation of healthcare disparities, access to care among such populations, and perspectives from those who had had prior FFS. In preparing this seminal text, we hope to provide a curated and comprehensive resource for our audience and in doing so contribute toward the psychosocial and professional well-being for TGD populations as they overcome their respective experiences of gender dysphoria.

Fig. 1.3 Preoperative (*first and third columns*) and 4-month postoperative photographs (*second and fourth columns*) of a patient who underwent full FFS. Procedures included hairline lowering; 7 mm frontal sinus setback; fat grafting to the temple and malar regions; genioplasty; gonial angle reduction; open structural septorhinoplasty with dorsal hump reduction, osteotomies, and alar contour grafts; a lip lift with dermal fat graft; and an endoscopic, transoral tracheal shave. (Copyrights retained by Dr. Justine Lee)

Fig. 1.4 Preoperative (*first and third columns*) and 5-month postoperative photographs (*second and fourth columns*) of a patient who underwent full FFS. Procedures included 2.5 mm frontal sinus setback, coronal brow lift, reduction genioplasty, fat grafting to the temple and malar regions, gonial angle reduction, mandibular angle reduction and open structural septorhinoplasty with spreader grafts, caudal septal extension graft, tip refinement sutures, and osteotomies. (Copyrights retained by Dr. Justine Lee)

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Chapter 2
Primary Care Considerations for Transgender and Gender Diverse Individuals Seeking Facial Feminization

Esther H. Kang and Amy K. Weimer

Introduction

Primary care providers (PCPs) are crucial in facilitating and delivering individualized and comprehensive care to TGD patients. As often the first point of contact within the healthcare system, PCPs play a multifaceted role in navigating interdisciplinary gender-affirming care; this often includes advocacy and leadership in developing a supportive healthcare environment for a patient population that has been historically underrepresented and underserved in medicine. In promoting access to gender-affirming care, PCPs are effectively contributing to improved psychosocial outcomes among TGD patients [1, 2].

Initial conversations in the primary care setting focus on eliciting a patient's gender narrative, sources of dysphoria, and goals for gender-affirming care. PCPs frequently introduce TGD individuals to the variety of services available, including social support, medical therapies, and/or surgical interventions. For some TGD individuals, FFS may be among their goals. If FFS is deemed appropriate, the role of the PCP is both to support the patient with surgical referrals and health insurance navigation as well as to assess readiness and health optimization in preparation for surgery, following global and local guidelines such as the World Professional Association for Transgender Health's Standards of Care (Table 2.1) [3].

If a patient elects to proceed with FFS, PCPs play a fundamental role in ensuring preoperative health optimization. The unique relationship between patients and

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Table 2.1 WPATH Standards of Care 8—summary criteria for surgery

a. Gender incongruence is marked and sustained
b. Meets diagnostic criteria for gender incongruence prior to gender-affirming surgical intervention in regions where a diagnosis is necessary to access healthcare
c. Demonstrates capacity to consent for the specific gender-affirming surgical intervention
d. Understands the effects of gender-affirming surgical intervention on reproduction and they have explored reproductive options
e. Other possible causes of apparent gender incongruence have been identified and excluded
f. Mental health and physical conditions that could negatively impact the outcome of gender-affirming surgical intervention have been assessed, with risks and benefits being discussed.
g. Stable on their gender-affirming hormonal treatment regime (which may include at least 6 months of hormone treatment or a longer period if required to achieve the desired surgical result, unless hormone therapy is either not desired or is medically contraindicated)[a]

[a]These were graded as suggested criteria

their PCPs is valuable for shared perioperative decision-making, including considerations about continuing or pausing hormone therapy in collaboration with the operating surgeon. PCPs are essential in guiding patients through the healing and recovery process during the postoperative period. Given that relationships between patients and PCPs are often longitudinal, PCPs are frequently a trusted source of support in the patient's journey and an essential collaborator for the FFS surgeon.

Gender-Affirming Primary Care and Facial Feminization Surgery

History Taking

The initial primary care visit for a TGD individual begins with obtaining a thorough history and building a prioritized list of needs and concerns. One must ensure that acute medical and mental health concerns are addressed. In terms of gender identity, we recommend that the provider cultivates an open space to explore their patient's gender journey. This can be elicited by asking the following questions: *When did they first become aware of their gender identity? What are the patient's particular sources of dysphoria? Have they socially, medically, or surgically transitioned?* Assess for sources of dysphoria and goals for gender-affirming treatment. If they have undergone gender-affirming medical therapies and/or surgeries, it is important to clearly document a timeline of interventions and understand how these therapies have facilitated their transition. As with any patient, it is important to take a comprehensive medical, surgical, mental health, family, and substance use history. One should also inquire about social and lifestyle factors, such as safety and diet, as TGD individuals are more vulnerable to housing insecurity, disordered eating, and violence of all forms [4, 5]. The above history informs collaborative next steps and may impact counseling around various gender-affirming care options (Fig. 2.1).

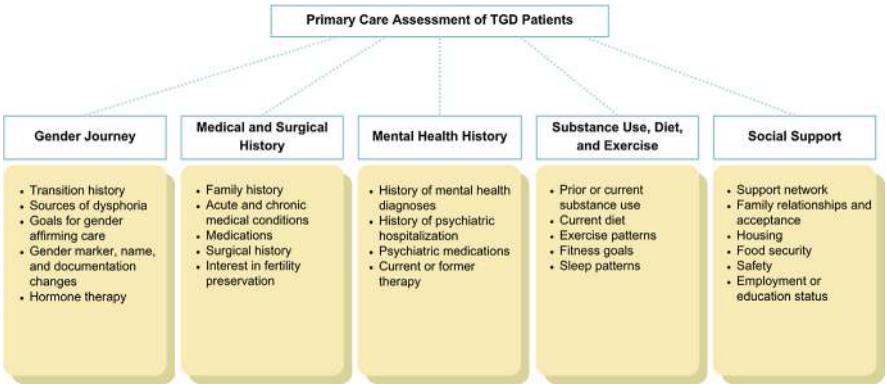

Fig. 2.1 Primary care assessment

Best Practices for Cultivating Gender-Affirming Healthcare Spaces

The first step in caring for TGD patients involves the cultivation of safe and affirming healthcare spaces. Historically, TGD individuals have faced high levels of mistreatment and discrimination within healthcare settings. Treatment refusal, harassment, lack of provider knowledge, and poor insurance coverage for care all may contribute to a mistrust of healthcare providers and institutions. Politicization of the rights of TGD people to civil liberties, including healthcare access, worsens health outcomes. Within a healthcare setting, several specific considerations can ensure patients feel seen, safe, and supported. All should ensure that a patient's correct name and pronouns are used verbally and on any written documentation. Gendered honorifics and titles, such as "sir," "ma'am," "Mr.," or "Ms.," should be avoided. Any visuals in the office, including posters, books, or pamphlets, should be visibly inclusive of all gender identities. Forms should be inclusive of all gender identities and should not assume genders of family members, including parents or partners.

In systems where TGD patients are less commonly encountered, and staff may be less familiar, it is additionally helpful to "huddle" before a given patient's arrival to reinforce the importance of gender-sensitive language and strategize about any possible difficulties the patient may encounter. Of course, any derogatory or derisive comments made by employees or other patients should not be tolerated. Any negative experience that a patient may encounter should be promptly addressed with the patient as well as the other individual(s) who may be involved. Additional training and education are often warranted (Fig. 2.2).

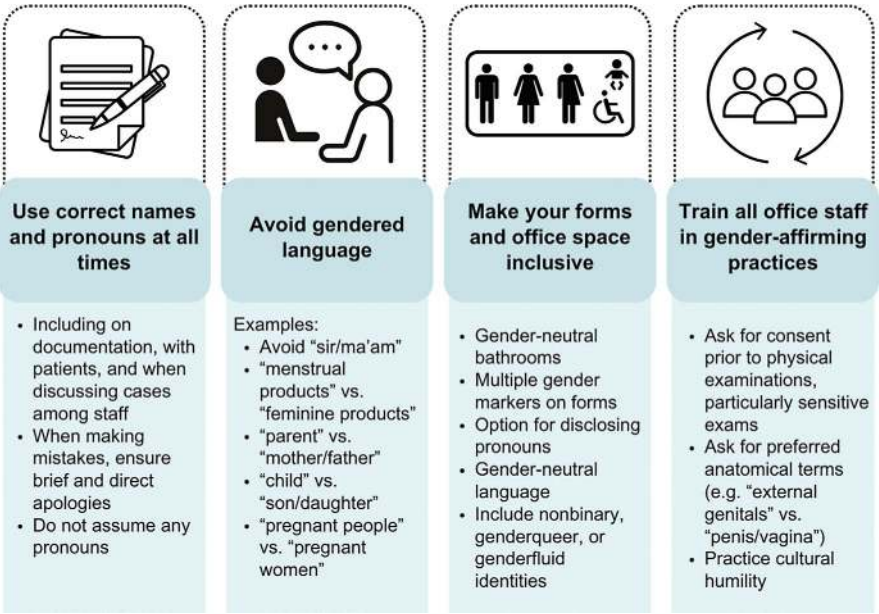

Fig. 2.2 How to make your practice space gender inclusive

Gender-Affirming Care Options

Transition-related gender-affirming care is broad and may include social transition, medical therapies, and surgeries. Treatment goals should be individualized and can evolve over time.

Common gender-affirming medical therapies and surgical interventions for transfeminine and nonbinary assigned male at birth (AMAB) individuals are summarized (Table 2.2). Gender-affirming hormone therapy (GAHT) may involve various medications depending on an individual's goals, stage of development, and concurrent medical conditions. For TGD adolescents who are at Tanner stages 2–4 (i.e., who have initiated but not completed puberty), puberty suppressants may be considered. Estradiol is the mainstay medical therapy for adults and adolescents who are seeking phenotypic feminization. It may be administered by oral, sublingual, injectable (subcutaneous or intramuscular), or transdermal routes. For some individuals, antiandrogens and/or progesterone are added as adjunctive therapies. There is limited data comparing various GAHT regimens for transfeminine and nonbinary AMAB individuals, and providers should thus prioritize shared decision-making and clinical judgment to guide their GAHT approaches. The most effective GAHT regimen is one that meets the goals of the TGD individual. Fertility preservation should also be discussed and, if desired, completed prior to initiation of GAHT. Lastly, any existing health conditions or modifiable cardiovascular risk factors, such as tobacco use, diabetes mellitus, and hypertension, should be addressed during GAHT [3].

Table 2.2 Common gender-affirming medical and surgical interventions for transfeminine and nonbinary individuals assigned male at birth

Medical therapies
Puberty suppressants (for adolescents who are Tanner stages 2–4)
Estradiol (oral, injectable, transdermal)
Antiandrogen agents (e.g., spironolactone, bicalutamide, finasteride)
Progesterone
Surgical procedures
Breast augmentation
Vaginoplasty or vulvoplasty
Orchiectomy
Chondrolaryngoplasty (“tracheal shave”)
Facial feminization—which includes but not limited to forehead contouring, hairline advancement, brow lift, rhinoplasty, genioplasty, gonial angle shaving, lip lift, and facial fat grafting
Vocal surgery
Other therapies
Hair removal
Vocal therapy

Gender-affirming procedures and surgeries, such as FFS, may also be within an individual’s transition goals (Table 2.2). One can review suggested criteria for gender-affirming surgeries as per WPATH’s SOC-8, which is the most commonly referenced guideline for the provision of gender-affirming care (Table 2.1). Of note, one must keep in mind that these guidelines are subject to change and should reference the most updated WPATH information.

Per SOC-8, the primary criterion for surgery is that “gender incongruence is marked and sustained.” For TGD adolescents younger than 18 years of age, SOC-8 also recommends that they are on GAHT for at least 12 months prior to any surgery, including FFS. In adult patients, SOC-8 provides recommendations regarding length of GAHT prior to genital or breast augmentation surgeries but does not provide similar recommendations for FFS. In addition, for some TGD individuals, systemic hormone therapy may not be within their transition goals (SOC-8) or they may have other health reasons precluding GAHT. Lastly, while SOC-8 recommends that individuals who pursue gender-affirming surgeries are followed by an experienced multidisciplinary team, they no longer include strong recommendations regarding requirements for referral letters from medical or mental health providers. Further, SOC-8 acknowledges that prior policies requiring two expert letters before GAHT initiation or surgeries were reflections of healthcare paternalism and caused unnecessary delays in care. If a referral letter is required, SOC-8 affirms that one such statement from a healthcare provider “competent to independently assess and diagnose” gender dysphoria is sufficient. It is recognized that additional letters may be requested based on specific clinical need as well as varying policies among insurance providers and surgeons. PCPs may help to ensure that these requests are not unnecessary or discriminatory and should be familiar with local resources to provide such assessments.

Next Steps in Management and Healthcare Navigation

After the initial history and patient concerns are elicited, PCPs collaborate with patients to formulate a joint care plan. PCPs can initiate or continue GAHT or refer to appropriate specialists (i.e., endocrinologists) to do so if needed. If desired by the patient and consistent with patient goals, PCPs place referrals for gender-affirming surgical consultations and other services, such as voice therapy or hair removal, and can provide assistance with insurance authorization and appeals as needed. They should screen for symptoms of depression and anxiety using standardized tools, such as the Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7) [6]. Mental healthcare referrals should be provided if additional expertise is indicated by history and/or screening tools. Patients should be connected to social work services and resources if needed. In addition to addressing these items, PCPs should optimize chronic medical conditions and ensure evidence-based preventative health screenings are addressed.

Preoperative Health Optimization and Considerations

Once FFS is authorized and scheduled, PCPs are vital in ensuring preoperative health optimization and psychosocial preparation. Substance use should be reevaluated with particular attention to current nicotine use and/or a history of opiate misuse. Signs of disordered eating should be reassessed as surgeons' offices are common sites for discussion around weight management. Education about weight management using an eating disorder-informed approach may be useful.

Appropriate psychosocial support during the postoperative period should be evaluated. This may include ensuring a safe living situation appropriate for recovery, the availability of support persons, adequate occupational leave, and support with short-term disability documentation. Anecdotally, many individuals report emotional distress to varying degrees following surgery, and this awareness may help patients navigate this period more successfully.

Perioperative Gender-Affirming Hormone Therapy

Due to the concern for increased risk of venous thromboembolism (VTE), it is common practice to recommend the discontinuation of estrogen during the perioperative period. However, systematic studies have shown that the overall VTE risk is low and the decision to stop GAHT should be a shared decision between providers and patients [7]. VTE risk is dependent on the type and route of estrogen administration**.** Conjugated estrogen has the highest VTE risk and is no longer recommended by

multiple guidelines including WPATH SOC-8, Endocrine Society. In terms of the route of estrogen administration, VTE risk is increased in direct correlation with the degree of first-pass hepatic metabolism [8]. Thus, transdermal formulations appear to yield the lowest VTE risk, and oral formulations the highest [9]. Providers may consider decreasing the dose of estrogen though one retrospective study in patients who underwent vaginoplasty did not show any significant differences in VTE development on a reduced estrogen dose [7]. The decision to hold or continue GAHT should be considered in the context of other health conditions, if any, that may predispose the patient to hypercoagulability or thrombosis. Specific historical questions should include active tobacco smoking and history suggestive of hereditary thrombophilic conditions. The decision to discontinue GAHT in the perioperative period may lead to worsening dysphoria and mental health concerns, which may adversely affect postoperative healing in other important ways [9]. Providers should take an individualized, patient-centered approach in their recommendations to continue or hold GAHT in the perioperative period [10, 11]. As an example, a healthy individual on injectable estrogen has relatively low risk for developing VTE, and it may be reasonable to continue GAHT in the perioperative period, with adherence to other typical prophylactic strategies.

Lastly, all individuals should complete a preoperative medical assessment prior to surgery. During this appointment, the PCP should provide individualized counseling regarding any needed perioperative changes to medications for chronic health conditions (e.g., diabetes medications, anticoagulants, corticosteroids).

Postoperative Care in the Primary Care Setting

PCPs play an important role in the postoperative period in guiding healing and recovery. Aside from ensuring that patients have timely follow-up with their FFS surgeons, they can also help to coordinate appropriate postoperative nutrition, pain control, and mental health services if needed. If GAHT was held in the perioperative period, PCPs work with surgeons and the patient to establish a timeline for reinitiating hormone therapy. In the long term, PCPs continue gender-affirming primary care, including appropriate guideline-directed healthcare screenings. For example, people who have been on estrogen therapy for several years should be considered for breast cancer screening based on age, personal risk factors, and family history.

Key Takeaways

- The principal role of PCPs of TGD people seeking FFS or other gender-affirming surgical procedures is to partner with and advocate for TGD individuals who are considering these interventions as a part of their transition.

- If a TGD individual is interested in FFS, PCPs help to connect them to appropriate specialists, assist with insurance authorization, and optimize perioperative health status.
- Limited systematic studies have shown that the risk of VTE is overall low for those who continue gender-affirming estrogen therapy in the perioperative period. The decision to continue or hold GAHT for FFS should be a shared decision between providers and patients.

Development of the UCLA Multidisciplinary Gender Health Program

The inception of the UCLA Gender Health Program in 2016 was driven by physicians within multiple departments who recognized gaps in healthcare for transgender and gender diverse individuals within the health system and broader community. Moved by the courage and commitment of patients seeking to live their most authentic lives, these physicians worked together to create an intentional and supportive environment free from stigma. The program is highly informed by the primary care model of the patient-centered medical home. Specialist involvement has grown rapidly and now encompasses primary care, urology, plastic surgery, endocrinology, otolaryngology, obstetrics/gynecology, psychology, psychiatry, speech and language pathology, and dermatology.

As the program was initially founded using resources already available within clinical spaces, its nascency relied on the commitment and advocacy of the involved physicians while continuing to manage their existing responsibilities. The program has since benefited from growing support from the health system leadership, developing a centralized care coordination team and research infrastructure. Insurance coverage for provided services has been an evolving challenge. State nondiscrimination laws and the passage of section 1557 of the Affordable Care Act have allowed for expanded insurance coverage of gender-affirming services though the growing politicization of the rights of transgender people threatens access to ongoing care.

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Chapter 3
Navigating the Preoperative Consultation

Allison Hu, Arya Andre Akhavan, and Thomas Satterwhite

Introduction

The preoperative consultation plays a crucial role in not only designing an individualized surgical plan but also in building a therapeutic alliance between the operating surgeon and patient. Moreover, this interaction serves as the first impression between the surgical team and the patient. In a population that has historically faced mistreatment in healthcare settings, it is paramount to build a supportive, welcoming care environment during the preoperative consultation. This sentiment should be consistent among all staff members, and a cohesive culture of respect toward the TGD community should be upheld. During the encounter, the operating surgeon should assess multiple items which include but are not limited to medical conditions that may preclude or objectively heighten risks for surgery, mental health issues that may warrant treatment before surgery, motivations of pursuing FFS, anatomic sources of gender dysphoria, aesthetic expectations in relation to physical features, support systems, and emotional readiness for surgery and postoperative recovery. In eliciting this information, surgeons are able to build a foundation for longitudinal, therapeutic alliance with their patients.

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Preoperative Consultation

Setting the Tone and Structuring the Visit

During the initial consultation, it is important to recognize the fact that TGD patients have historically faced maltreatment within healthcare settings, and any clinical experience may elicit memories of prior adverse clinical experiences. One should identify a patient by their desired pronouns. For the consultation itself, we find that open-ended questions serve as a helpful method for understanding a given patient's motivations for pursuing FFS. *What brings you into our clinic today? How can we help?* Further questions should parse into a patient's personal journey with respect to gender identity, as well as social and medical transition. *Could you tell me more about your personal journey with respect to gender?* Then, one may inquire about sources of dysphoria and understand how a given patient may view the potential roles of medical (hormonal) therapies and most relevant to our discussion, FFS. *Are there specific anatomical areas that cause you a sense of distress or discomfort due to incongruence with your identified gender?* In articulating these items, the operating surgeon can transition to a more granular discussion of particular procedures and aesthetic goals. We find that a comprehensive preoperative consultation should include the following (Fig. 3.1):

1. Listening to gender narrative (i.e., gender identity, social transition, medical (hormonal) and surgical transition)
2. Eliciting medical history (i.e., relevant screening, comorbidities that heighten risk of surgery)
3. Considering mental health and psychosocial aspects (i.e., support system, emotional readiness for surgery, and postoperative recovery phase)
4. Determining motivations of pursuing FFS and delineating anatomic sources of gender dysphoria
5. Performing an in-depth facial analysis
6. Designing an individualized and intentional surgical plan
7. Clarifying aesthetic expectations in relation to physical features and anatomy
8. Counseling patients on potential risks and complications
9. Achieving preoperative clearance
10. Navigating insurance coverage

Listening to Gender Narrative

In this portion of the visit, we recommend that the operating surgeon take time to understand a given patient's journey with respect to discovering and embracing their gender identity [1]. In terms of the patient's transition history, one may inquire about medical (i.e., hormonal) transition, surgical transition (i.e., breast, genital surgery for alleviation of gender dysphoria), and social transition. For the latter, one

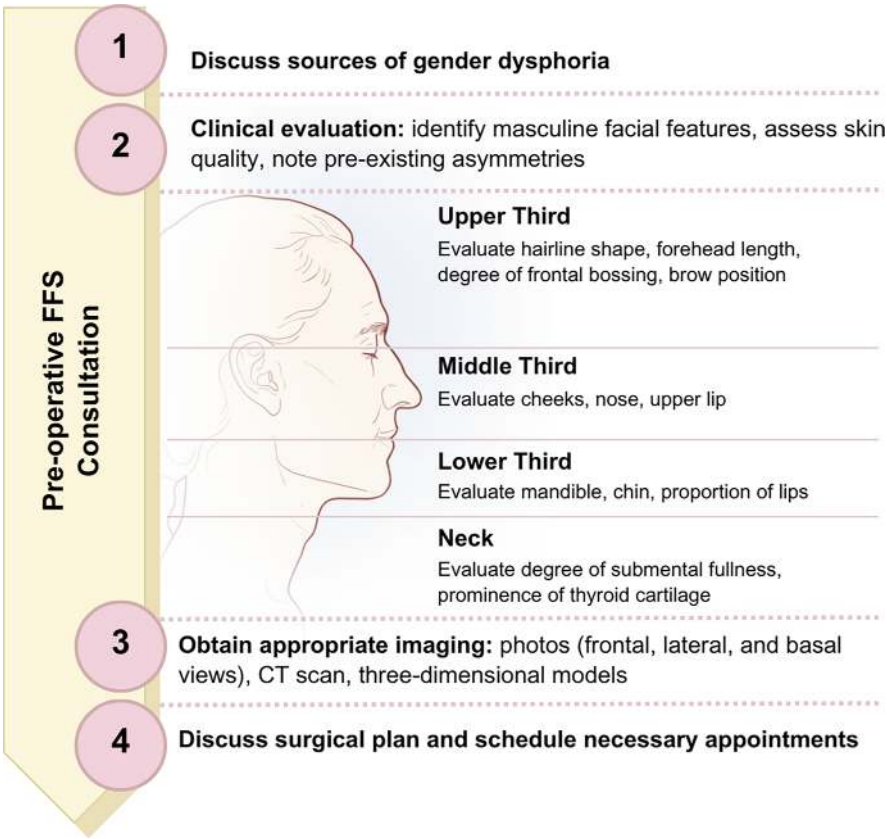

Fig. 3.1 General steps of navigating the preoperative consultation. (Copyrights retained by Dr. Elizabeth Card)

can elicit specifically how the patient has communicated and upheld their gender identity to friends and family, as well as within their communities (if relevant).

Eliciting Relevant Medical History

In addition, assessing the patient's general health status and any preexisting health conditions or risk factors must be performed. Diabetes, particularly when uncontrolled, increases the risks of poor wound healing and infection. Previous facial traumas—whether soft tissue and/or bony in nature—can similarly affect wound healing potential, alter surgical technique, and may subject patients to alternative risks and clinical outcomes. The presence of a pacemaker or defibrillator can affect the type of electrosurgery, closure, or the dressing used. Oscillations in weight—whether intentional or unintentional—may compromise ultimate aesthetic outcomes.

A standard review of social history, allergies, and medications, including vitamins and herbal supplements, should also be performed. Tobacco and nicotine not only increase the risk of thrombosis in patients receiving hormone treatment but also has been associated with worse overall complications, wound healing, tissue necrosis, postoperative infection, and the need for surgical revision [2, 3]. A history of alcohol or other substance abuse also carries risks of wound healing issues, bleeding, and the potential noncompliance with postoperative instructions. Other drugs that impair wound healing include steroids, immunosuppressants, and anti-inflammatory medications. Medications that can increase bleeding such as nonsteroidal anti-inflammatory drugs (NSAIDs) or anticoagulation should be noted.

Certain medications may need to be stopped prior to surgery as well. Recent studies have found no increase in the rate of venous thromboembolism (VTE) among TGD individuals undergoing surgery while maintaining hormonal treatment compared to those whose treatment was discontinued preoperatively. If on a higher concentration of hormones, patients may decrease the dose or stop the medication; this decision should be made on a case-by-case basis. Although lacking evidence, some clinical recommendations for gender-affirmation surgeries have included cessation of hormone therapy for 1 to 4 weeks before and after surgery to mitigate the risk of VTE [4]. Because of associated risks of poor outcomes and wound healing issues, surgeons recommend stopping the use of tobacco and nicotine products at least 2 months prior to FFS. Marijuana use should stop 1 week prior to surgery.

Considering Mental Health and Psychosocial Aspects

While often overlooked, a patient's social background and social support are vital to ensuring a smooth postoperative recovery and favorable aesthetic outcomes following FFS. The operating surgeon should take note of a patient's support network. Furthermore, addressing all psychosocial and psychological issues with appropriate multidisciplinary teams is absolutely paramount prior to performing FFS.

Determining Motivations of Pursuing FFS and Delineating Anatomic Sources of Dysphoria

After understanding medical, social, and psychosocial components of health, the operating surgeon can transition toward understanding a given patient's motivations for considering FFS. Moreover, at the end of the discussion, the patient should have a clear understanding of the results that can be expected given his or her original condition and the limitations of the surgery. Ultimately, the groundwork for a successful surgery is setting realistic goals established by both the surgeon and the patient.

Performing an In-depth Facial Analysis

The operating surgeon should also conduct a thorough physical examination and analysis of the patient's craniofacial structures and geometry. This includes facial anthropometrics, assessing size and shape of the facial structures, ascertaining baseline neuromuscular function, and evaluation of the skin quality. Ethnicity and patient age should be taken into consideration as "standard" measurements reported in the literature are based on Caucasian profiles. Key clinical examination features are detailed.

In terms of facial analysis, one may refer to the overview of the anatomical differences between the cis-male and cis-female face and associated facial feminization procedures delineated (Table 3.1). The senior author refers to a specific template for comprehensive evaluation of facial features (Fig. 3.2).

In terms of the various FFS interventions, it is recommended to be systematic during discussion. In the upper face, surgery may be performed to advance the hairline, elevate the eyebrows, and reduce the prominence of the brow. In the midface, rhinoplasty can be performed to increase the nasofrontal and nasolabial angles, reduce the dorsum and radix, refine the nasal tip, and narrow the alar base. Zygomatic reduction, cheek implants, or fat transfer can be performed in order to enhance malar definition [5]. In the lower face, the prominence of the chin and squareness of the jaw may be adjusted via genioplasty and mandible contouring, respectively. The lip can be lifted and filled. For feminizing neck contour, chondrolaryngoplasty can be performed to reduce the tracheal prominence [6]. Of note, each anatomic component and corresponding surgical options for feminization will be discussed in the subsequent chapters.

Preoperative photographs are standard to visualize anatomy at appropriate angles and with respect to adjacent structures. Dual flash photography or three-dimensional imaging sessions can also be used for computer simulations to analyze certain anatomical parts as an educational tool if within the surgeon's style of care.

Complete diagnostic imaging, such as computed tomography (CT) scans, can be used to map the bony framework. For patients who require bony reconstruction, a fine-cut, non-contrast CT scan of the face from the vertex to the hyoid bone is particularly important. This allows for a detailed survey and visualization of the bony structures of the face and understand key anatomic structures, namely, the forehead, brow ridge, and jaw, within the context of the patient's broader craniofacial morphology. These details facilitate a collaborative discussion between the operating surgeon and patient in designing an optimal and individualized operative plan. Virtual surgical planning (VSP) may further assist with anatomical mapping of the face and demonstrate expected results by developing prefabricated cutting guides and models that facilitate planning, reduce operating time, and improve outcomes. Please see the designed VSP chapter for further details [7–9].

Table 3.1 Anatomic differences between masculine and feminine facial features

Facial feature	Masculine	Feminine	Procedure
Hairline	Higher "M" shaped hairline	Lower "O" shaped hairline	Hairline advancement
	Presence of bitemporal recession	Absence of temporal recession	Hair transplant
	Long non-hair bearing forehead (6–8 cm)	Short non-hair bearing forehead (~5 cm)	
Forehead	Larger, broader frontal bone	Smaller frontal bone	Anterior table setback
	Larger frontal sinus	Smaller frontal sinus	Brow recontouring
	Flat and retroclined frontal bone on lateral view	Gentle curve from frontonasal junction to hairline on lateral view	
	Sloped with concavity superior to supraorbital ridge	Round/convex without concavity superior to supraorbital ridge	
	Prominent projection of supraorbital ridge	Minimal projection of supraorbital ridge	
Temples	Temporal hollowing	Temporal fullness	Temporal fossa augmentation.
Brow	Flat eyebrows	Curved eyebrows	Brow lift
	Sit at supraorbital ridge	Lateral limbus peaks superior to supraorbital ridge	
Orbits	Prominent supraorbital bossing/lateral orbital hooding	No supraorbital bossing/lateral orbital hooding	Supraorbital recontouring
			Lateral orbital recontouring/ ostectomy
	Less round	Rounder	
	Small aperture	Wide aperture	
	Sagittal position of the orbit with respect to the brow ridge ≥10 mm posterior	Sagittal position of the orbit with respect to the brow ridge <10 mm posterior	
Eyes	Increased intercanthal distance	Decreased intercanthal distance	Lateral canthopexy
	Elevated supratarsal crease (8–11 mm)	Low supratarsal crease (6–9 mm)	Upper and lower blepharoplasties
Nose	Nasofrontal angle ~130°	Nasofrontal angle ~145°	Reduction rhinoplasty (dorsum and radix reduction, tip refinement and rotation, osteotomies, alar base reduction)
	Radix at upper lid crease	Radix at mid-pupillary line	

(continued)

Table 3.1 (continued)

Facial feature	Masculine	Feminine	Procedure
	Wide and prominent dorsal hump with straight dorsal lines	Narrow and small dorsal hump with curved dorsal lines	
	No supratip break	Concavity or supratip break	
	Increased nasal tip projection	Decreased nasal tip projection	
	Wide alar base	Narrow alar base	
	Nasolabial angle ~90°–95°	Nasolabial angle ~100°–105°	
Midface	Flatter, lower and less prominent zygomatic arch	Higher and more projecting zygomas	Reduction malarplasty
	Decreased triangulation with chin	Increased triangulation with chin	Fat grafting
	Low midface	Elevated midface	Zygomatic implants
Lips	Thinner lips	Fuller lips	Dermal or filler lip augmentation
	Decreased upper vermillion height	Increased upper vermillion height	Lip lift
	Increased distance from nasal base to vermillion	Decreased distance from nasal base to vermillion	
	Tooth show in repose ~2 mm	Tooth show in repose ~4 mm	
Mandible	Acute, sharp, and prominent gonial angle	Attenuated, soft, and less defined gonial angle	Gonial angle reduction
	Wide gonial width	Narrow gonial width	Masseter neurotoxin injection
Chin	Broad and tall, “boxy”	Narrow and short	Chin recontouring
	Wide	Pointed	Reduction genioplasty
	Increased projection	Less projection	
Laryngeal prominence	Increased projection of thyroid cartilage	Decreased projection of thyroid cartilage	Chondrolaryngoplasty
	Acute angle (~90°)	Obtuse angle (~120°)	

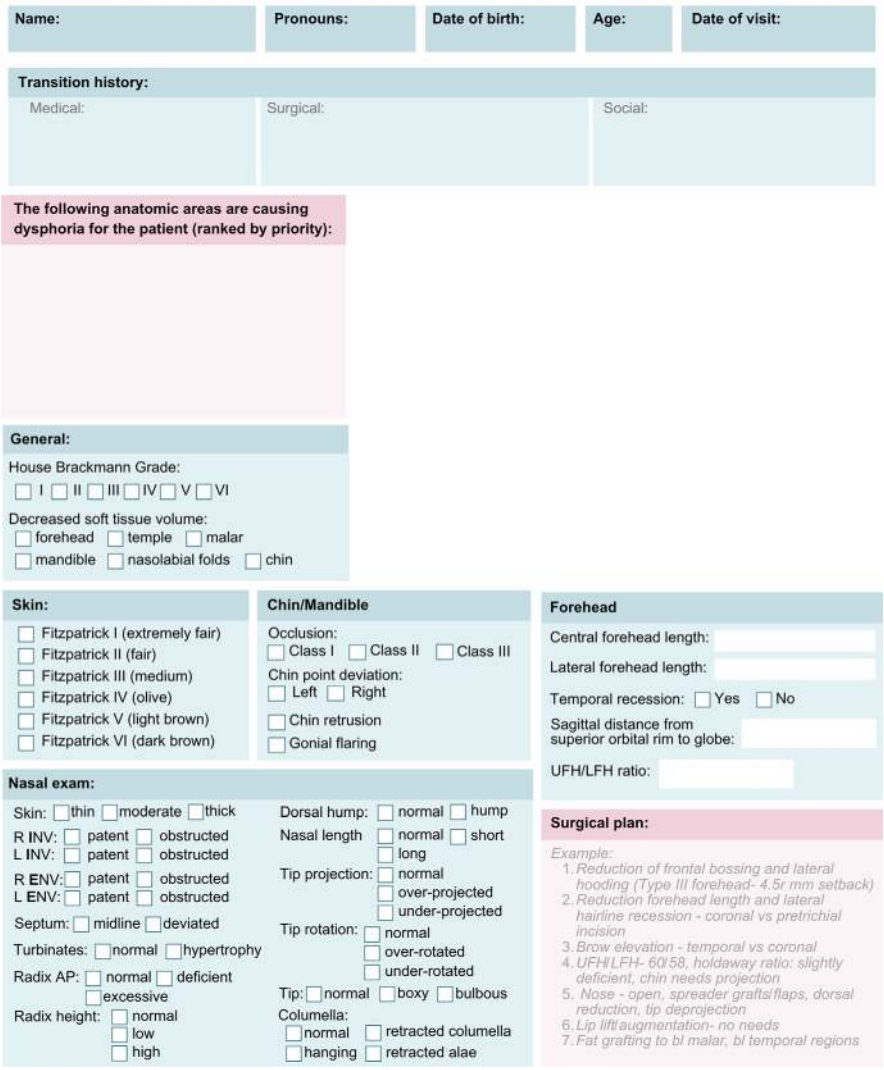

Fig. 3.2 Facial analysis form. (Adapted from initial surgical consult from JCL)

Designing an Individualized and Intentional Surgical Plan

Successful FFS not only requires thorough understanding of a patient's preoperative anatomy and limitations but also the design and execution of an individualized surgical plan. No FFS procedure is the same. Some patients may be displeased with one anatomic component of the face, while others may desire feminization of multiple anatomic components. Of course, FFS exists for the alleviation of

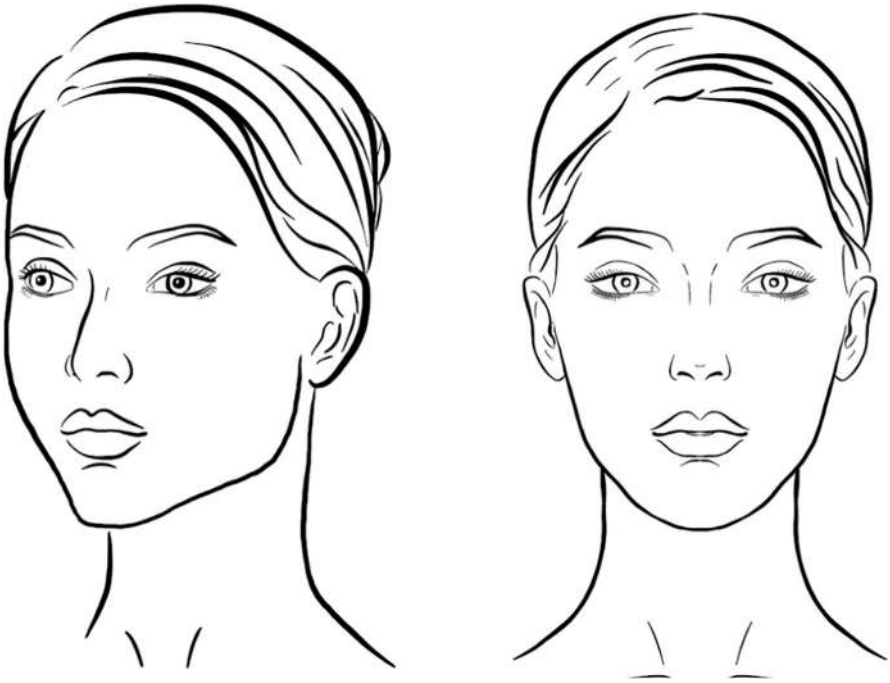

Fig. 3.2 (continued)

gender incongruence and should address features that exacerbate dysphoria in patients. However, one cannot understate the importance of achieving facial congruence during FFS. Furthermore, isolated feminization of the nose amidst a cis-masculine-appearing jaw may be preferred by a given patient; regardless, attention should be paid toward general aesthetic principles in facial surgery and should be openly discussed with patients. In addition, the operating surgeon should recognize how ethnic identity may ultimately impact FFS. *Does a patient want to preserve their ethnic identity? Is a certain aesthetic achievable given a patient's preoperative anatomy and soft tissue envelope?* Finally, one must ensure that functional results are not compromised amid aesthetic ideals. *Does a patient favor a feminine nose that could narrow the nose to the point of destabilization and collapse? Could mandibular osteotomies in fact feminize the result but risk injury to the mental nerve? Could overreduction of the mandible contribute to a presentation of jowling and ultimately the perception of an aged appearance?* Furthermore, it is paramount to understand aesthetic expectations of patients and articulate whether these can be achieved given preoperative physical features and anatomy (Fig. 3.3).

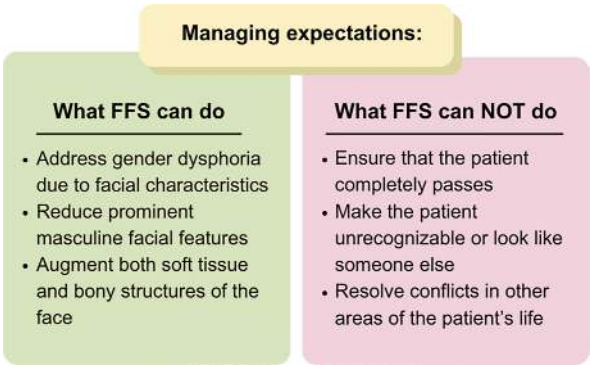

Fig. 3.3 Managing expectations in facial feminization

Counseling Patients on Potential Risks and Complications Following FFS

Patient education and the informed consent process is a critical part of the surgical procedure. During the preoperative consultation, a full discussion of the proposed procedure, including the risks and benefits, are important prerequisites that must be accomplished prior to FFS.

Risks include any medical, psychological, mental, and social factors that may complicate the surgical or postoperative recovery phase. The surgeon should review the likelihood of those risks based on clinical evidence, judgment, and prior experience. Patients should have the opportunity to refuse the procedure if any of the discussed risks are intolerable.

Objectively, common adverse effects for FFS include temporary swelling and bruising. Wound dehiscence is possible but can often be treated with local wound care. While every surgical incision results in a scar, poor scarring can be prevented or treated with steroid injections, topical ointments, avoiding direct sun exposure, applying sunscreen postoperatively, and refraining from smoking. There is a risk of bleeding and hematomas of 5–8%. Some patients may develop postoperative infections and may need to remain on antibiotics. Asymmetry is always possible and the surgeon should identify any asymmetries prior to surgery.

Less common complications include blood clots and injury to surrounding structures. Venous thromboembolism and pulmonary embolism (PE), albeit life-threathening, are rare and can be seen in <0.1% of patients. They can be prevented with early ambulation or sequential compression devices. Numbness to varying degrees from nerve stretching, neuropraxia, or trauma may occur. There can also be loss of voice, permanent hoarseness, or changes in voice after tracheal shave from nerve injury, but this is exceedingly rare. Facial paralysis is often temporary and permanent paralysis is very rare. Hair loss is similarly a rare but a known risk. Patchy hair loss can happen and can take up to 9 to 12 months to grow back given the long cycle of hair development. If patients want to undergo hair transplantation, it is recommended they begin 1 year following FFS.

Preparing for Surgery

Patients should also be counseled on what to expect during the preoperative preparation to postoperative recovery phases. Patients will obtain baseline medical labs and electrocardiogram (ECG) for medical clearance. The anesthesiology team will effectively risk stratify patients by their American Society of Anesthesiology (ASA) status and perform their specific evaluation ahead of FFS. During preoperative consultation, the operating surgeon should specify details regarding hospitalization and postoperative recovery.

Video Consultations

With the advent of COVID-19, telemedicine visits were necessary to continue providing patient care and have now become a standard form of care in certain specialties. Although video-based consultations are more limited than in-person visits, a highly qualified facial feminization expert can still make a skilled analysis of the patient's facial features and propose an appropriate treatment plan. To optimize the telemedicine visits, patients may be asked to send photographs including frontal view, lateral view, and three-fourth view of the face, with a neutral expression, moderate lighting, and without glasses or heavy makeup. However, some patients who have several questions or voice cosmetic concerns would likely benefit from in-office preoperative consultations to streamline the actual surgery day and alleviate patient and provider concerns.

Navigating Insurance Coverage

The surgeon and administrative team typically submit the surgical case for insurance authorization between 90-180 days prior to the surgical date to balance the timing of authorization decisions with the expiration of such decisions as well as surgical scheduling. Some surgeons who do not work under insurance can provide a cost estimate or quote as a reference. The surgeon may ask for letters of necessity and additional letters of support as mentioned above. Photos are frequently requested on submission to insurance companies as well. See chapter on Access to Care for details.

Concluding Thoughts

The preoperative consultation is a vital step in establishing a relationship between the operating surgeon and patient and in designing an optimized, individualized plan for facial feminization. This chapter serves to help orient surgeons toward the

fundamentals of this process—including performing facial analysis; eliciting important medical, surgical, and social history; navigating the insurance landscape; and ultimately, preparing patients for the day of surgery, hospitalization, and their recovery. This initial meeting is a cornerstone of the facial feminization surgical journey, and its importance for the operating surgeon and the patient cannot be understated.

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Chapter 4
The PREFACE Program: Prehabilitation for Facial Feminization Surgery

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Introduction to Prehabilitation

Prehabilitation, a growing focus in surgical care, aims to optimize the physical and psychological readiness of patients prior to surgery to improve postoperative outcomes. By addressing key areas such as physical activity, nutrition, mental health, and smoking cessation, prehabilitation programs aim to improve preoperative fitness and resilience [1]. These interventions are typically delivered by multidisciplinary teams and are tailored to specific surgical procedures, incorporating structured exercise plans, nutritional counseling or supplementation, and psychological support to mitigate preoperative anxiety [2, 3]. Among exercise-based interventions, programs often include supervised or unsupervised aerobic and resistance training to enhance cardiovascular and muscular endurance [4]. High-intensity interval training (HIIT), strength training, and moderate-intensity endurance exercises are commonly incorporated. Additionally, nutritional prehabilitation programs may involve supplementation or meal provision to address nutritional deficiencies and optimize metabolic status. Lastly, psychological interventions often incorporate cognitive-behavioral therapy, guided imagery, breathing exercises, and other techniques to reduce anxiety and improve mental resilience [5].

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Prehabilitation programs can be either unimodal, focusing on a single aspect such as exercise or nutrition, or multimodal, integrating multiple components for a comprehensive approach to surgical preparation [6]. Whether unimodal or multimodal in design, prehabilitation interventions have demonstrated efficacy in reducing postoperative complications, hospital length of stay (LOS), and improving quality of life (QoL) measures across various disciplines, including orthopedic, abdominal, cardiothoracic, and gynecological surgery [7–9]. Our group recently reviewed the impact of prehabilitation interventions on surgical outcomes in a meta-analysis and meta-regression. One of our major findings was that psychotherapy-based prehabilitation interventions reduced hospital LOS as well as postoperative pain, anxiety, and depression regardless of surgical context [10]. Additionally, when evaluating the role of exercise and nutrition prehabilitation programs, they reduced LOS as well as complications.

Despite these benefits, the widespread implementation and integration of prehabilitation into routine surgical care remains limited. This is largely due to the fact that many prehabilitation programs are designed for specific surgeries, often prioritizing one component over others. However, emerging evidence suggests that multimodal prehabilitation programs, integrating exercise, nutrition, and psychological support, may yield greater benefits than single-component approaches [4]. Currently, there is no standardized protocol for implementation, leaving significant variability in program design and delivery. Establishing a standardized, evidence-based framework could enhance the effectiveness and accessibility of prehabilitation across surgical disciplines.

Shortcomings of Standard Preoperative Education

While prehabilitation programs focus on optimizing physical, nutritional, and psychological health before surgery, they may not necessarily include comprehensive surgical education. This presents a significant gap as preoperative education programs that include information about the surgical procedure, perioperative process, and postoperative care have shown to effectively reduce anxiety, improve adherence to recovery protocols, and improve overall surgical outcomes [5]. While preoperative counselling should ideally cover all aforementioned aspects, limitations in time during clinical visits and/or staffing usually preclude extensive discussions. Further, although print materials are typically provided for patients, the information provided is not always read or remembered by patients. This method of delivering information may not fully engage patients or maximize their comprehension, particularly for those undergoing surgery for the first time. Many patients experience heightened anxiety and cognitive overload during preoperative surgical consultations, making it difficult to process and retain critical information. As a result, unanswered questions, uncertainty, and general anxiety may persist, potentially affecting their confidence and preparedness for surgery [11].

However, targeted preoperative educational interventions, typically incorporating multimedia components such as videos, websites, and mobile applications, have demonstrated success in reducing anxiety and opioid use [12–15]. These tools have been successfully implemented across various surgical specialties such as prostate, dermatologic, otolaryngologic, and endocrinology surgeries to improve patient knowledge, satisfaction, and perceived helpfulness while reducing anxiety [16–19]. Additionally, the integration of artificial intelligence (AI) chatbots into perioperative care have also emerged as innovative tool, offering educational resources, addressing patient concerns, and sending automated reminders with a meta-analysis demonstrating their effectiveness in improving patient knowledge and satisfaction [20]. Anecdotally, we have encountered patient mistrust of AI in delivery of surgical information or answering simple perioperative questions. While there may be a lag in buy-in from patients, it is clear that the future of surgery and clinical care overall will include more technology and not less.

Relevance of Preoperative Education and Prehabilitation in Gender-Affirming Surgery

Both multimedia preoperative educational interventions and prehabilitation programs have been shown to be effective in reducing preoperative anxiety. This is particularly important given that most surgical patients, regardless of clinical diagnoses, experience anxiety prior to surgery [21]. The impact of anxiety on postsurgical outcomes is gaining attention as it has been reported to influence pain, opioid use, and wound healing, as well as length of stay, complications, and readmission rates [22–26]. This is especially relevant for surgical populations that have a high prevalence of preexisting mental health diagnoses, such as transgender and gender-diverse individuals [27, 28]. To date, there is a paucity of research exploring the implementation of both prehabilitation and multimedia preoperative educational programs for TGD individuals undergoing gender-affirming surgery (GAS).

As we will discuss further in the **Outcomes** chapter, our group recently published the first prospectively collected, quantitative study assessing mental health quality-of-life (QoL) outcomes in TGD patients undergoing FFS, using 11 instruments from Patient Reported Outcomes Measurement Information Systems (PROMIS). The findings revealed that preoperative anxiety levels among TGD individuals were one standard deviation worse than the national mean, while depression, positive affect, global mental health, and social isolation were half a standard deviation worse [28]. While FFS was independently associated with postoperative improvements in QoL, our findings highlighted the importance of baseline psychological functioning on recovery. Specifically, preoperative depression was identified as an independent predictor of worse postoperative mental health QoL outcomes, including lower global mental health, increased anxiety, and reduced meaning and purpose [29]. These results suggest that the baseline psychological well-being of

patients will dictate the magnitude of the benefits that FFS can provide for patients with gender dysphoria.

Beyond baseline psychological status, recovery from FFS presents unique challenges, particularly for TGD individuals who may already experience heightened levels of anxiety, depression, and social stress [30]. The postoperative period often involves not only physical healing but also psychological and social recovery. In the initial postoperative time frame, patients may face difficulties with pain management, swelling, prolonged healing times, and emotional distress, all of which can be exacerbated by preexisting mental health conditions. This common experience, along with the high prevalence of mental health comorbidities, demonstrates the potential value of a tailored educational prehabilitation program that integrates comprehensive surgical information as well as the physical and psychological aspects of surgical recovery for TGD individuals undergoing FFS.

Rationale of PREFACE

Despite the advantages prehabilitation may offer, uptake of such interventions has remain limited. Prehabilitation may require significant resources, multidisciplinary coordination, and institutional investment, posing challenges to widespread adoption, particularly in resource-limited settings. While multimedia educational endeavors have been undertaken to improve patient engagement and comprehension on surgery and postoperative recovery, very few of these endeavors have chosen to also suggest prehabilitation interventions. This gap demonstrates an opportunity for an approach that combines surgical education with structured prehabilitation strategies.

This gap is particularly significant for TGD individuals undergoing gender-affirming surgery, a population that has a high prevalence of mental health comorbidities that could greatly benefit from structured preoperative support. Existing models of psychological prehabilitation in other surgeries have demonstrated benefits, but they are largely designed for orthopedic, abdominal, and cardiothoracic procedures, which do not account for the unique needs of TGD patients undergoing gender-affirming surgery. Furthermore, current prehabilitation frameworks often lack community-centered engagement and fail to address the social and emotional aspects of gender-affirming surgery, which are critical components of comprehensive patient care.

To address these shortcomings, we created the Prehabilitation for Facial Gender-Affirming Surgery (PREFACE) program. This multimedia-based educational prehabilitation program is designed to provide comprehensive, patient-centered surgical information while incorporating general prehabilitation strategies to optimize both physical and psychological readiness for surgery. The program delivers perioperative guidance via a program guidebook, instructional videos, and a mobile application featuring an AI-powered postoperative chatbot (Fig. 4.1). By combining

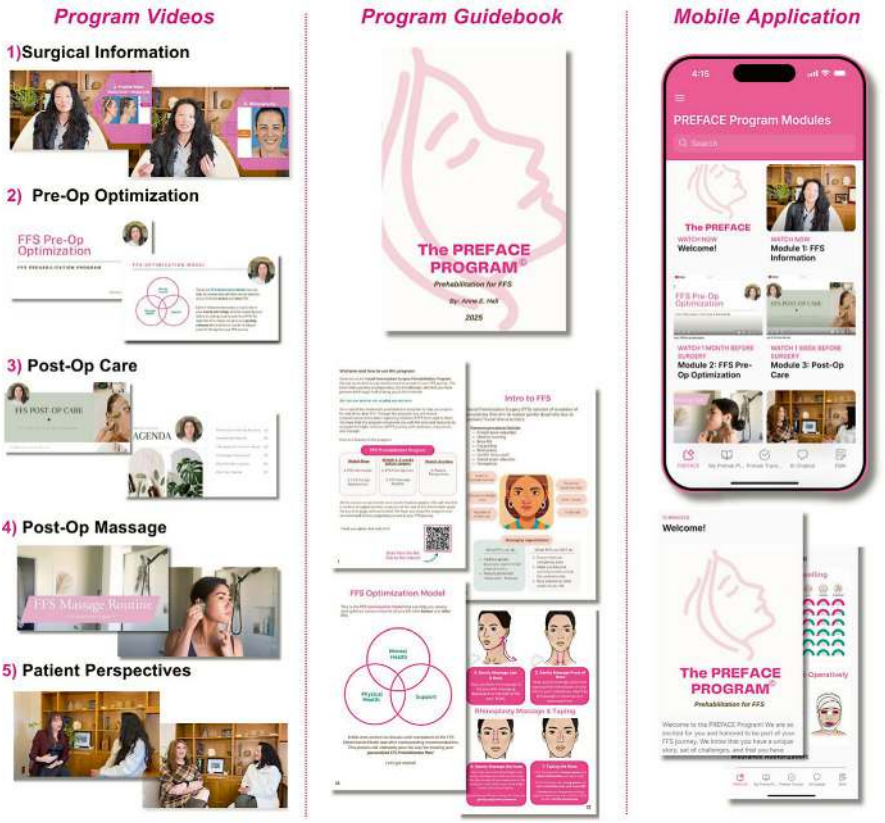

Fig. 4.1 PREFACE program components. This figure illustrates the three modalities through which the PREFACE Program is delivered: instructional videos, a program guidebook, and an interactive mobile application. Each component plays a distinct role in enhancing learning accessibility, engagement, and patient comprehension, providing structured support throughout the surgical journey. (Copyrights retained by JCL)

surgical education with standard prehabilitation strategies, PREFACE aims to equip patients with the information they need to have a successful surgical experience, foster a sense of community and support, and improve patient engagement. Unlike traditional prehabilitation programs, which often require in-person sessions, PREFACE leverages digital tools to enhance accessibility while still maintaining a structured approach. Through its multimedia format, patients can engage with educational content at their own pace and preference.

Furthermore, PREFACE was designed to be scalable, and adaptable, ensuring that all FFS patients, regardless of geographic location or insurance status, would have access to high-quality preoperative preparation.

Development of PREFACE

The PREFACE Program was developed following the American College of Surgeons Quality Improvement Framework, integrating insights from systematic reviews, theoretical frameworks, and stakeholder feedback [31]. The development process (spearheaded by AEH and JCL) included contributions from a multidisciplinary team of specialists that included gender health primary care physicians, clinical psychologists, an anesthesiologist, a surgical care coordinator, a graphic designer, an AI consultant, and previous FFS patients. This diverse group provided critical input to ensure the program comprehensively addressed both clinical and patient-centered needs.

Systematic reviews and meta-analyses were conducted on psychological-based, exercise, and nutritional prehabilitation interventions, as well as surgical educational materials and the use of AI chatbots in surgical care [10]. These systematic reviews informed components of the program and guided the integration of innovative tools, ensuring the PREFACE program was grounded in both clinical efficacy and patient-centered design. Theoretical frameworks, including social cognitive therapy and behavior change principles, informed the development of strategies to enhance patient engagement and foster active participation in surgical preparation [32].

The development process was implemented in two phases. Phase 1 included the creation of a program guidebook and video modules, while Phase 2 expanded the program to include a mobile application featuring an AI postoperative chatbot. Semi-structured interviews with FFS patients during Phase 1 provided insights to refine program content and ensure it met patient needs. This iterative, phased approach ensured the PREFACE Program was co-designed with patients, emphasizing shared responsibility between patients and the healthcare team to optimize surgical readiness and recovery [33]. Over a 3-month period, the team conducted regular strategy meetings to refine and evaluate each component, resulting in a clinically effective and scalable prehabilitation model.

PREFACE Components

Program Content

The PREFACE program covers five key topics: surgical information, preop optimization, postoperative care, postoperative massage, and patient perspectives (Fig. 4.2).

The video modules cover each of the five topics in depth, presenting critical information in an engaging, easy-to-understand format. Each video module ranges from 15 minutes to 1 hour in duration. The program guidebook complements the video modules, offering a written resource with detailed explanations, checklists,

Fig. 4.2 The PREFACE program timeline. This figure illustrates the timeline of the PREFACE Program as well as the components that comprise each module. The program guidebook follows this timeline providing comprehensive information, illustrations, and writing activities for patients to take notes and participate. All the information is further integrated into the mobile application. (Copyrights retained by JCL)

timelines, and supplementary resources. It serves as both a standalone resource and a supplement to the multimedia content.

The mobile application integrates all the video modules and program materials into a single, interactive platform. It also highlights additional features including a prehabilitation journal, where patients can set their personalized goals, a prehabilitation tracker, to help them monitor daily metrics such as total daily steps, protein take, water intake, sleep duration, sleep quality, and much more. The application summarizes these data points allowing patients to visualize their progress and remain motivated to work toward their goals. The app features an AI chatbot powered by LangChain technologies, providing real-time, accurate responses to patient inquiries based on the primary surgeon's discharge instructions and protocols, ensuring safety and relevance.

FFS Optimization Model

As part of the program development process, the FFS Optimization Model was established to guide the preoperative and postoperative components of the PREFACE program (Fig. 4.3). Given that most prehabilitation programs focus solely on active interventions to optimize specific aspects of patient health, we aimed to integrate these principles into a model that educates patients on addressing each component for preoperative preparation and postoperative recovery. This model addresses three core domains critical to surgical success: physical health, mental health, and support systems. Physical health encompasses strategies to promote physical activity, increase protein intake, and enhance sleep hygiene. Mental health focuses on reducing anxiety and stress through therapy, medication adjustments, and cultivating a nonjudgmental, patient, and adaptable mindset to help manage expectations. Lastly, support systems involve identifying trusted individuals they can rely on for support during the surgical process, optimizing the home environment for recovery, and developing personalized self-care strategies to build emotional resilience.

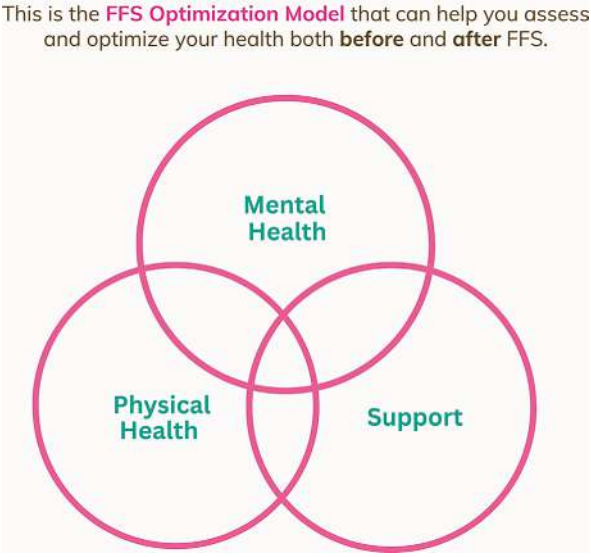

Fig. 4.3 FFS optimization model. This model illustrates the key areas patients can optimize both before and after FFS, including physical health, mental health, and social support. The program includes specific recommendations on how patients can further optimize each aspect. (Copyrights retained by JCL)

The FFS Optimization Model was integrated into the PREFACE Program's Preop Optimization and Postop Care modules (Fig. 4.3). This approach aimed to foster patient engagement while addressing multidimensional aspects of health to maximize surgical readiness and recovery outcomes.

Program Implementation and Patient Engagement

Following design and formulation of the program, we assessed the implementation of the program as well as its outcomes. In terms of implementation, we offered this program to patients during preoperative appointments which ranged between 1 day (for patients traveling long-distances) to 4 months preoperatively. Universally, we found that patients were interested in receiving the program book and/or access to the application and video modules.

Assessing Outcomes

The PREFACE Program was evaluated using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) framework to assess its feasibility, scalability, and adaptability. RE-AIM is a frequently used tool that evaluates public health interventions and quality improvement projects [34]. The quantitative and qualitative outcomes assessed included administrative records, patient surveys, and semi-structured interviews with clinical staff and patients (Fig. 4.4).

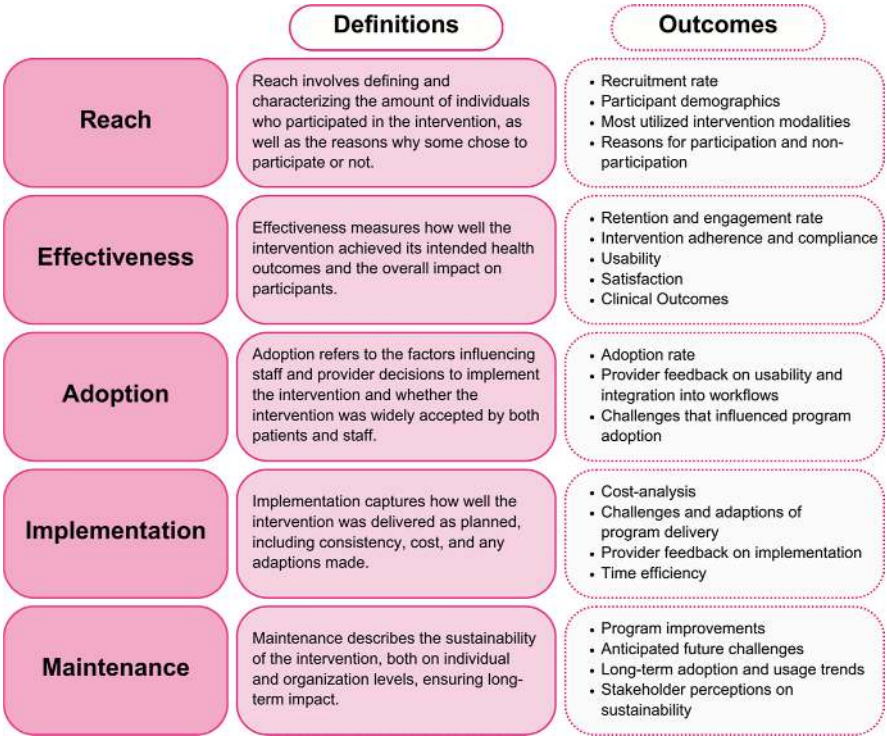

Fig. 4.4 PREFACE assessment utilizing the RE-AIM framework. This figure outlines each component of the RE-AIM Framework for evaluating quality improvement projects and highlights the specific outcome measures used to evaluate the PREFACE Program. (Copyrights retained by JCL)

Additionally, we assessed the impact of this multimedia prehabilitation educational program on key surgical outcomes including LOS, complications, readmissions, revisions, and opioid use as well as patient-reported psychosocial outcomes. At the time of this writing, long-term outcomes are not yet available for reporting. However, our early findings have shown that patients who received the program reported lower pain scores and used less opioids compared to patients prior to implementation of the program. Further, our administrative records also showed fewer patient messages within the first month after surgery through the electronic health record portal, suggesting that patients were potentially better equipped for surgery.

Clinical Implications and Future Directions

Our quality improvement project emphasizes a key component of gender-affirming care: centering the needs, experiences, and overall well-being of TGD patients and helping them have a better experience in their gender transition. Given the

discrimination TGD individuals often face within the healthcare system, it is imperative to develop patient-centered, inclusive interventions that not only aim to enhance surgical outcomes but also improve overall quality of life [35]. By integrating prehabilitation principles within an accessible, comprehensive multimedia-based preoperative education model, PREFACE represents a proactive step toward reducing disparities and optimizing both the surgical experience and postoperative recovery for patients undergoing FFS.

Additionally, our program serves as an innovative model within preoperative care, bridging the gap between traditional surgical education and prehabilitation. By incorporating multimedia tools, including videos, a written guidebook, and a mobile application with an AI-powered chatbot, PREFACE demonstrates that surgical education can adapt to the evolving digital health landscape and better serve a population that is well versed with digital technologies. Furthermore, the increasing interactivity of digital media reinforces the necessity of providing surgical education in an engaging, patient-centered format that maximizes learning and retention. Future research can further explore the scalability and adaptability of multimedia-based prehabilitation programs across other gender-affirming procedures. Additionally, studies can evaluate the long-term impact of digital prehabilitation interventions on key surgical metrics, as well as patient-reported interventions.

Conclusion

This chapter discusses the background of prehabilitation and the rationale of the PREFACE Program. In its development and early implementation, the PREFACE Program demonstrates how leveraging technology to provide comprehensive, patient-centered surgical education has the potential to redefine gender-affirming surgical care and set a precedent for the integration of digital health tools in preoperative education.

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Chapter 5
Virtual Surgical Planning in Facial Feminization Surgery

Brendan J. Cronin, Anne E. Hall, and Justine C. Lee

Introduction

As with all types of facial reconstruction, FFS entails a combination of skeletal and soft tissue maneuvers. The skeletal maneuvers can essentially be thought of as the structural changes, for which precision is paramount as incorrect or imprecise structural plans would prohibit any chance of a great result [1–6]. At our institution, we developed the protocol for utilizing virtual modeling and virtual surgical planning (VSP) with intraoperative guides specifically to assist us in performing the first FFS case at UCLA [7, 8]. Since that time, we have continued to refine our protocol for all subsequent cases.

The increasing prevalence of FFS can be attributed to the expansion of health insurance coverage of such procedures in both state and federal laws. While California was the second state in the United States to include gender-affirming care in health insurance law in 2013, the change in federal law under Section 1557 of the Affordable Care Act to include gender identity in gender nondiscrimination for health insurance in 2016 was a major push in improving access to

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gender-affirming care [9, 10]. As a result, our practice and practices of other craniofacial surgeons who were traditionally performing pediatric craniofacial surgery received a sudden and dramatic increase in TGD patients seeking FFS.

Thus, as an academic community, we are actively developing protocols to safely perform a surgery that was once foreign to us. While the senior author developed our virtual modeling/VSP protocol in partnership with Danny Brock (3D Systems, Rock Hill, South Carolina), Mike Silver (3D Systems, Rock Hill, South Carolina), and Teri Yanagawa (Stryker, Kalamazoo, Michigan), others were developing other protocols also in collaboration with industry partners (i.e., Jim Bradley with KLS-Martin, Jacksonville, Florida). The primary rationale when we developed these protocols was to rehearse the surgery ahead of time and reduce uncertainty in the operating room as FFS was truly in its infancy. During this period of time, none of the operating surgeons were trained in FGAS despite strong experiences in craniofacial surgery for other diagnoses. Thus, rehearsing of the surgical maneuvers was essential for confidence in performing safe surgery without concern for entry into the cranial vault and/or worry of accidentally planning an osteotomy over the inferior loop of the mental nerve.

These protocols were also subsequently propagated by respective industry partners to any surgeon who seeks to perform the FFS. This ultimately provided junior surgeons or those new to FFS with a reasonable starting point for conceptualizing and executing osteotomies in FFS.

Considerations for Using VSP

Within our institution, there has never been a case with skeletal maneuvers where VSP has been foregone although certainly it is possible to perform skeletal manipulations using traditional techniques. As the experience evolved over time, the major benefit of using VSP and intraoperative guides is a reduction in time that would otherwise be spent ensuring that the planned osteotomies and reductive maneuvers are accurately transferred to the patient. For the purposes of full-face FFS, faster operative time in the skeletal work translates to not only improved precision and safety for the patient but also increased time and reduced fatigue in perfecting aesthetics in soft tissue work, particularly rhinoplasty.

Certainly, some surgeons choose not to employ VSP during FFS. The major consideration with VSP is the significant cost associated with planning and guide manufacturing, which may affect specific practice settings or institutions. In particular, without health insurance coverage, VSP and intraoperative guides may be cost-prohibitive for patients as a purely out-of-pocket expense for the procedure [10–12]. This specific limitation underscores the importance of advocacy in an effort to

equalize FGAS procedures to other reconstructive facial procedures. Additionally, there are some surgeons who argue that the usage of VSP reduces artistry. We would respectfully disagree as using VSP is no different from the planning any artist would do for hyperrealistic artwork.

Planning the Procedure

Planning of facial skeletal reconstruction requires a baseline accurate clinical and facial assessment. After determining which facial features are to be addressed with FFS, the operating surgeon may introduce the concept of VSP to their patient during the initial consultation. Furthermore, VSP begins with obtaining a high-resolution (0.6 mm to 1.0 mm cuts), non-infused computed tomography (CT) scan from the hyoid to the vertex of the skull.

At our institution, our method of planning employs virtually modeling all osseous maneuvers on a cisgender female skull [7]. By superimposing the 3D-reconstructed CT scan of the patient's skull on a scaled reference skull, the precise areas of reduction at the forehead, gonial angles, and chin are identified (Fig. 5.1). Surgical maneuvers are then designed to correct the differences for the specific anatomical dimensions of the forehead and jaw.

Of note, the senior author has frequently been asked how we chose which female skull to use and/or whether we use a normalized reference. Simply, the answer is no. When we initially created the protocol, we referenced a completely anonymous skull of a cisgender female with no demographic information, scaled it to the size of the patient's skull, and planned accordingly. One important note is that nearly every virtual plan measured identically to the plan that was anticipated based on clinical measurements and assessment, emphasizing that VSP is not meant to supplant but to confirm clinical acumen. Subsequently, we have ultimately expanded to including several cis-female skulls for modeling.

The idea of a normalized reference skull and the potential establishment of racially and ethnically congruent reference skulls are still a work in development by our research team. At the moment, modifications of the surgical plan for racial and ethnic differences occur in a less scientific manner based on clinical judgment and discussions in the initial consultation period. Similarly, nonbinary individuals also may require a more customized surgical plan beyond standard planning methods.

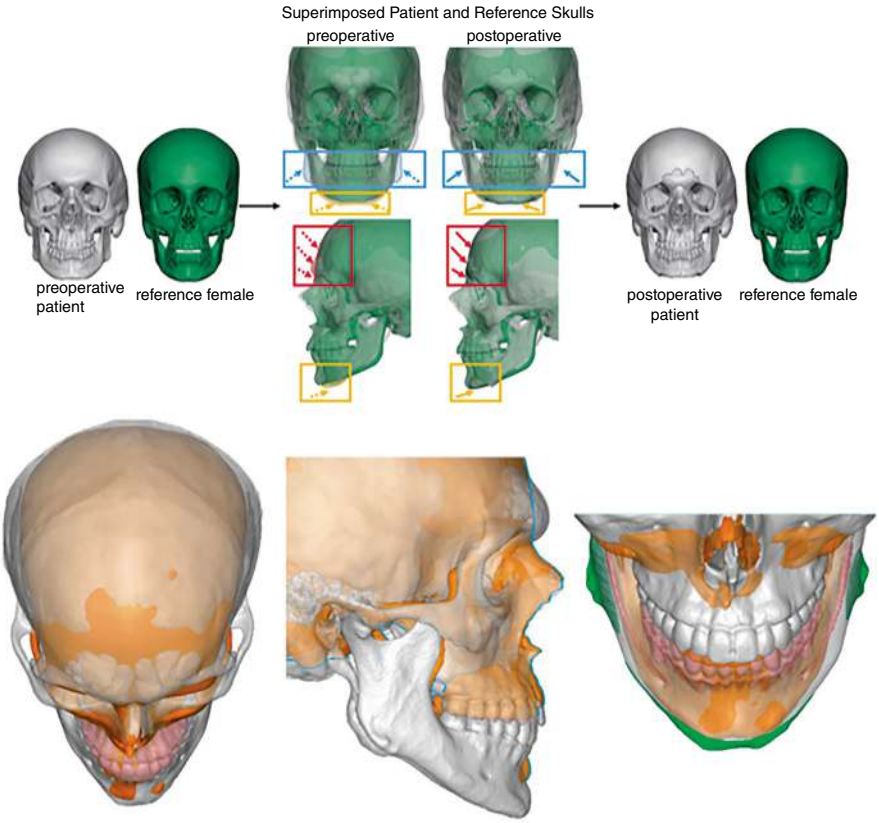

Fig. 5.1 Modeling osseous maneuvers on a female skull. Superimposed reference and patient skulls identify the precise areas of reduction at the forehead (red dotted line), gonial angles (blue dotted line), and chin (yellow dotted line). The reference skull (orange "mask") is scaled relative to the patient skull (white "mask") based on the position of the nasion and overlap of the anterior aspect of the maxilla and zygomatic arches. Vertical position is set via alignment of the infraorbital rims and apex of the skull. Horizontal position is set based on symmetry of the zygomatic arches. The images are "zeroed" and the volumetric difference between patient and reference skull is mapped (green). (Copyrights retained by JCL)

Guide Design

The typical guides that we developed for FFS focus on the forehead and the mandible. For the forehead, we typically use a guide that outlines the anterior table of the frontal sinus which may be separate or integrated into the "porcupine" guide. Custom cutting guides are 3D printed in accordance with virtually planned maneuvers (Fig. 5.3).

Custom Guides and Algorithm for Anterior Table of Frontal Sinus Setback

- **Guides**
  - Osteotomy guide (Figs. 5.2 and 5.3).
    - Outlines the periphery of the frontal sinus, seated via footplate extensions into the superior orbit.
  - Depth guide or "porcupine" guide (Figs. 5.2 and 5.3).
    - Contains evenly spaced drill hole guides along the frontal bar and forehead lateral and superior to the frontal sinus boundaries.
    - Seated via footplate extensions into the superior orbit.

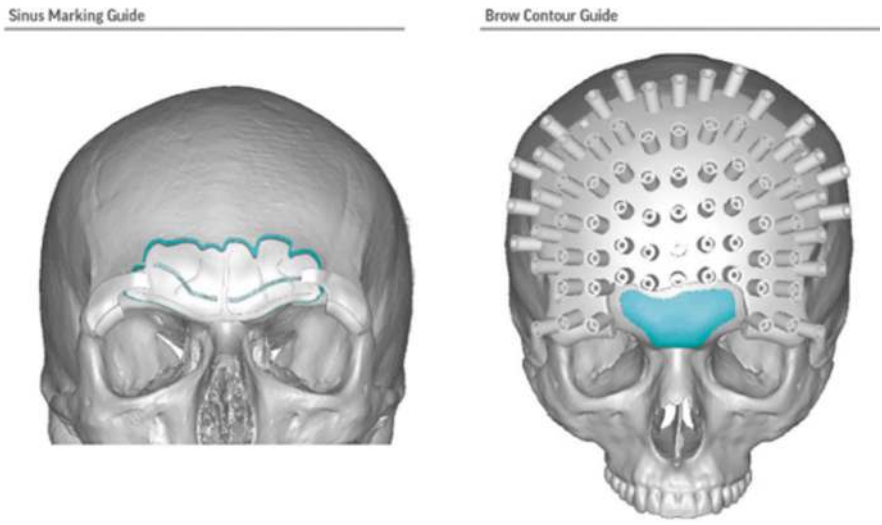

Fig. 5.2 Prefabricated custom guides for anterior table setback. Our custom guides for anterior table setback include a frontal sinus osteotomy cutting guide and a brow contour guide with sleeved depth holes spaced at regular intervals. Both guides are positioned via footplate extensions into the superior orbit and secured with screws. (Copyrights retained by JCL)

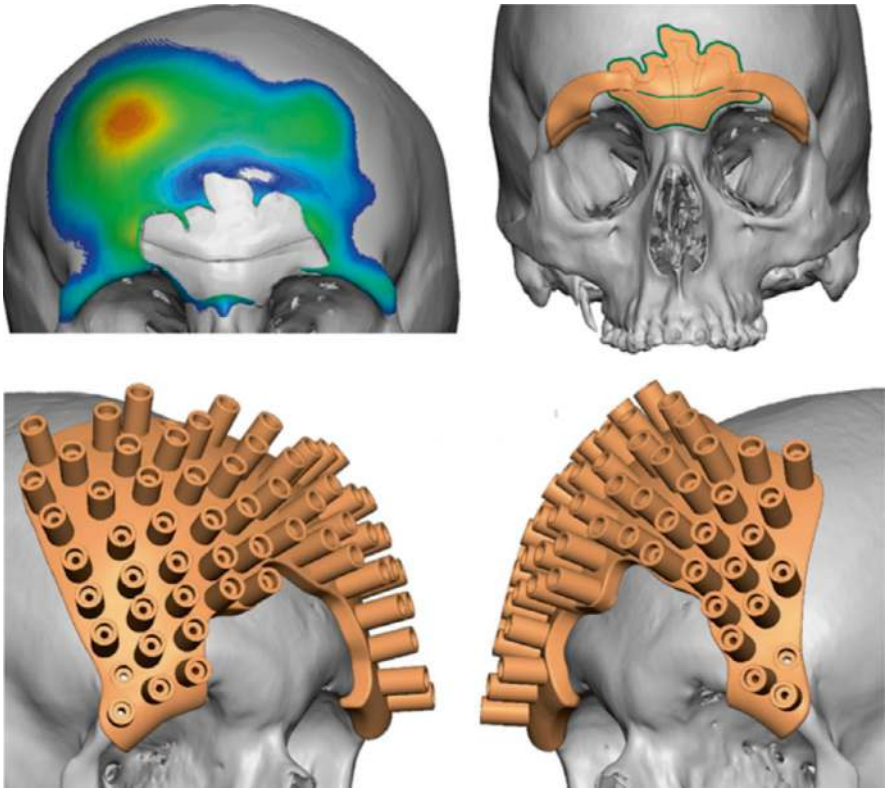

Fig. 5.3 Frontal bone contour and "porcupine" depth guide. 3D reconstruction of preoperative computed tomography scan with heat map demonstrating the thickness of the anterior table to be removed as determined by volumetric difference between scaled patient and reference skulls (above left) accompanied by sinus marking guide and porcupine guide with sleeved depth holes. The sleeve height varies according to the thickness of the planned anterior table contouring. (Copyrights retained by JCL)

- **Algorithm**
  - Type III forehead—Frontal sinus osteotomy + burring (porcupine guide).
  - Type I and Type I+ foreheads—Burring (porcupine guide) only.

Custom Guides and Algorithm for Gonial Angle Reduction

- **Guides**
  - Cutting guide (Fig. 5.4).
    - Utilizes a custom molded splint of the mandibular molars or external oblique ridge to appropriately position the guide along the inferior margin of planned mandibular angle resection.

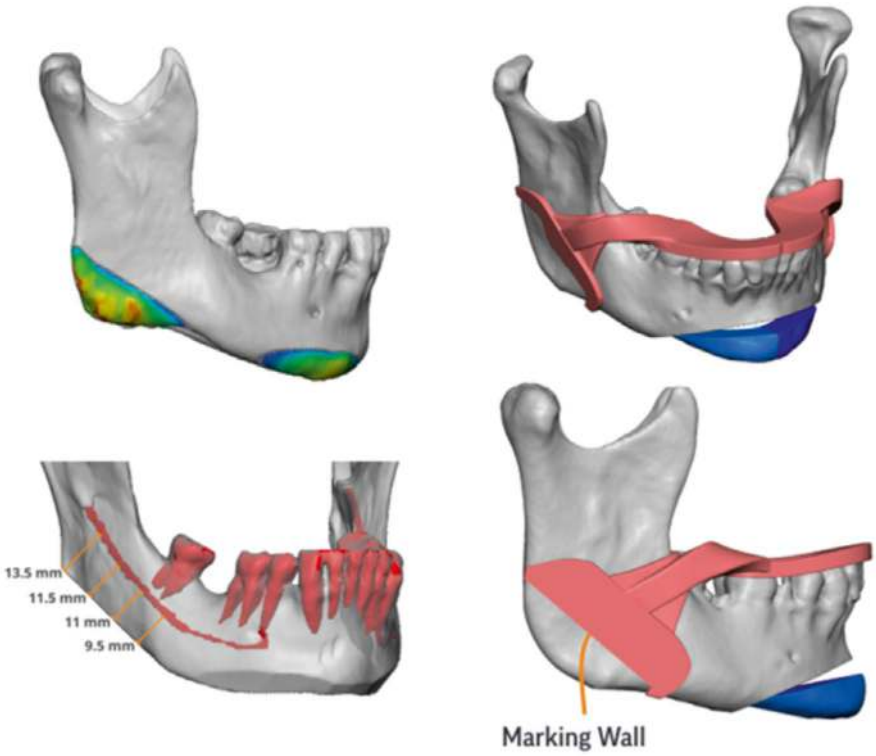

Fig. 5.4 VSP and cutting guide for gonial angle reduction. The excess height and projection of the mandibular angles (top, left) as well as the course of the inferior alveolar nerve in relation to planned ostectomy (bottom, left) are virtually planned. The gonial angle cutting guide is seated via the mandibular dentition and the contour of the inferior mandibular border. The marking wall delineates the ostectomy line to achieve the planned resection. (Copyrights retained by JCL)

    - The course of the inferior alveolar nerve is mapped and a 4–5 mm margin maintained to protect from inadvertent injury.
  - Freehand burring.
    - A heat map highlighting gonial angle contours is generated using CAD. Prominences are then reduced with burring alone without guide-directed ostectomy.
- **Algorithm** (Fig. 5.5).
  - Moderate/severe gonial angle and lower facial width with freehand burring.
    - Avoids large intraoral incisions and periosteal exposure required to seat a cutting guide.
    - Preserves the inferior aspect of the gonial angle to optimize soft tissue draping.

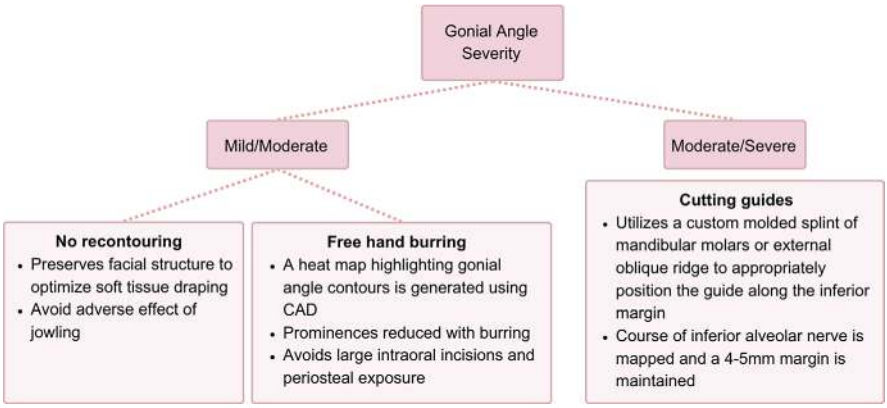

Fig. 5.5 Algorithm for approach to gonial angle reduction

– Mild gonial angle/lower facial width—no recontouring (preserves facial structure to optimize soft tissue draping and avoid adverse effect of jowling).

For the chin, in the case of moderate to mild masculine features or those without need for significant chin repositioning via genioplasty, we use burring alone. Rasping of the chin is directed via guides with preplanned holes outlining the areas of bone to be removed. Note that we designed these guides with the same idea as how we designed the porcupine guide – in a "connect the dots" manner to maximize precision and speed. After drilling the holes, a power rasp is used to reduce the bone.

In patients who require more aggressive chin manipulation (severe masculine features, inadequate or excessive chin projection, abnormal Holdaway ratios), multiple different methods of osteotomies are all feasible. In our early experience, we primarily utilized a two-piece genioplasty with a T shaped cutting guide. In this pattern, a horizontal osteotomy is combined with a central wedge ostectomy. The lateral segments are then plated together. However, as our experience increased over time, we have found that this procedure was not necessary for the majority of patients. Additionally, given the multiple osteotomies, the potential for patients to see or feel step-offs may be higher, not to mention the increased need for healing of the multiple osteotomy sites. Hence, our practice since approximately 2021 was to predominantly a standard horizontal osteotomy complemented with lateral reductions when skeletal discrepancies mandate moving the chin. In lower lying nerves, we have sometimes used a trapezoidal osteotomy to avoid the inferiorly nerve loop below the mental foramina. This osteotomized segment is then slid into position (typically anteriorly and/or inferiorly). The latter is not a common situation. For the purposes of illustrating the least versus the most aggressive genioplasties, we will focus on the guides for recontouring and the two-piece osteotomy and positioning.

Custom Guides and Algorithm for Chin

- **Guides**
  - Reduction genioplasty may be performed via oscillating rasp (1) or osteotomies with plate fixation (2).
  - (1) Rasping guides (Fig. 5.6):
    - Two L-shaped guides are seated in the mandibular dentition, drill holes mark the depth and extent of osseous reduction, and the chin is recontoured with an oscillating power rasp.
  - (2) Osteotomy guides (Fig. 5.6):
    - Two-piece reduction genioplasty defined by a T-shaped guide with preplaced holes for pre-osteotomy drilling and post-ostectomy plating.
- **Algorithm**
  - Symmetric facial height, normal Holdaway ratio, mild chin width/features with rasping.
  - Any need for chin repositioning (i.e., insufficient or excessive lower facial height, chin retrusion or prominence, abnormal Holdaway ratio)—single- or two-piece genioplasty.

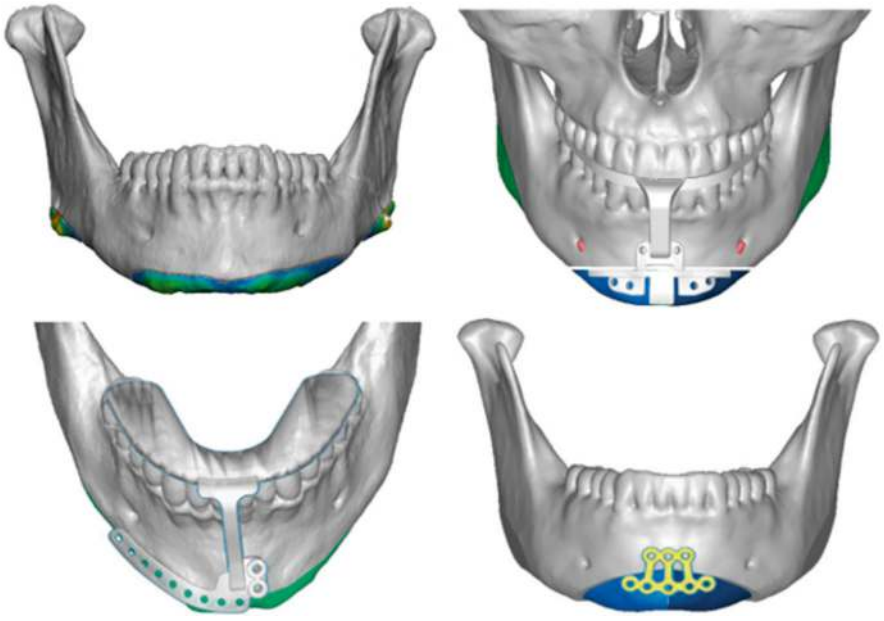

Fig. 5.6 Chin reduction/repositioning via burring or two-piece osseous genioplasty. (Copyrights retained by JCL)

- One-piece genioplasty + plate fixation: most indications requiring repositioning can be addressed with one-piece genioplasties. Note that the narrowing occurs with lateral reduction similar to recontouring.
- Two-piece genioplasty + plate fixation: maybe useful for extremely wide chins that can benefit from a large central wedge resection. Additionally, this technique is useful for a prominent cleft chin where resection of the clefted bone may be the best method for reducing width and correcting the cleft simultaneously.

VSP: Case Examples

Case I: Type I Forehead

Preoperative CT demonstrates an Ousterhout type I forehead with no frontal sinus and thick anterior table (Fig. 5.7a). Note the acute nasofrontal angle, significant supraorbital bossing/glabellar prominence, and a low, hooded sweep of the superolateral orbits visible on the 3D reconstruction.

As described above, the magnitude of frontal setback and fronto-orbital recontouring is determined via VSP with a virtual "reference" skull. Heat maps demonstrate the magnitude of contour/height difference in each area (Fig. 5.7b). This

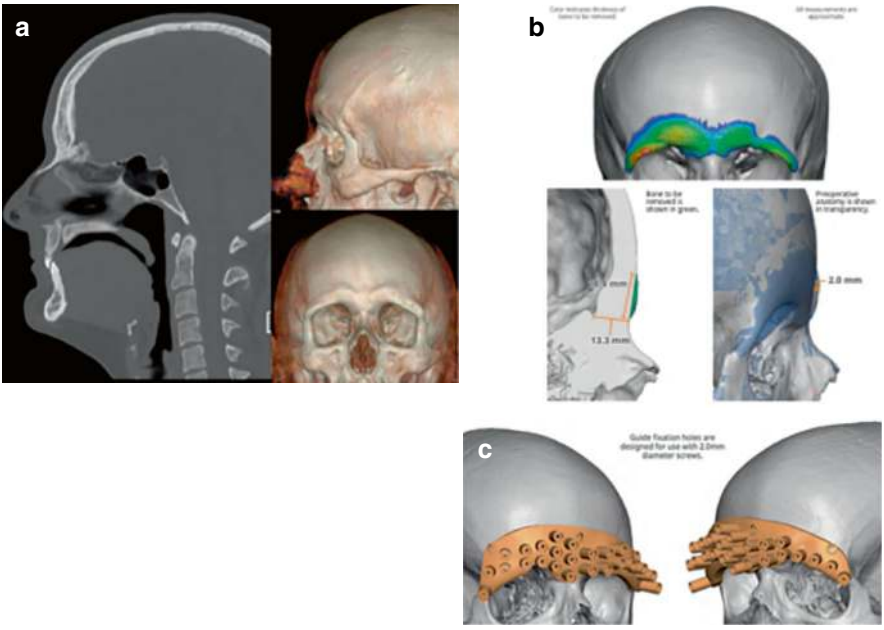

Fig. 5.7 VSP for type I forehead. **a**: pre-operative CT scan with Ousterhout type I forehead with no frontal sinus and thick anterior table; **b**: Heat map that demonstrates the magnitude of contour/height difference in each area; **c**: Porcupine guide for planned setback. (Copyrights retained by JCL)

Fig. 5.8 Pre- (left panel) and postoperative (right panel) photographs of patient with type I forehead. (Copyrights retained by JCL)

figure shows the specifications of frontal setback including magnitude of setback. Given the lack of a frontal sinus and a sufficiently thick anterior table, setback is planned using a porcupine guide for bony recontouring (Fig. 5.7c).

Postoperative photographs (Fig. 5.8, right panel) demonstrate a smooth feminine contour of the forehead with an obtuse nasofrontal angle with no supraorbital bossing and raised and "opened" superolateral orbits.

Case II: Type 1+ Forehead

Some patients have a small or unilateral frontal sinus and a thick anterior table such that the defect created from burring the anterior table to the desired contour would be smaller than the defect created by osteotomizing and setting back the anterior table of frontal sinus in entirety. In these cases, which we call type I+ foreheads, burring with split calvarial bone grafting of anterior table defects can produce an

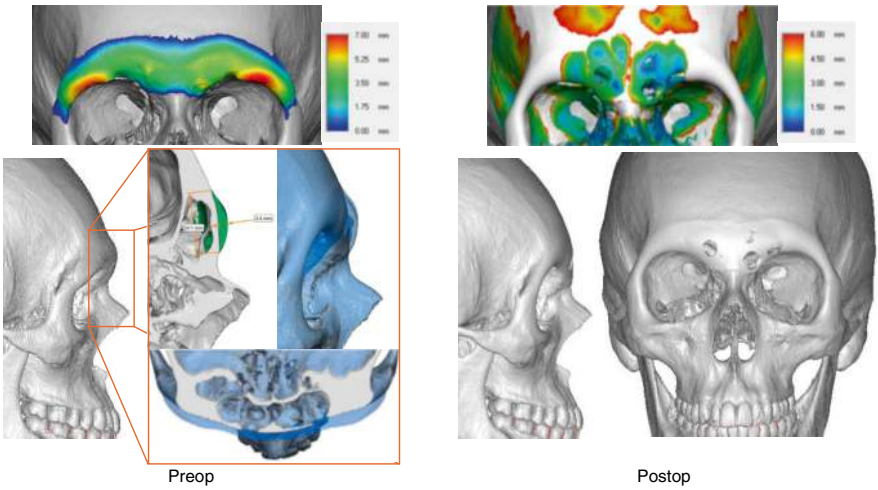

Fig. 5.9 Type I+ forehead demonstrating the presence of frontal sinuses in the setting of a thick frontal bone. While it is possible to osteotomize to set back the frontal bone, the thickness of the bone can be clearly seen on the preop frontal heatmap (left upper) and cross-sections (left lower) to be 3.4 mm or greater at the areas of maximal prominence. The type I+ forehead is a type I forehead with intentional entry into the frontal sinus (bony gaps seen in postop plan) which are reconstructed with split calvarial bone graft. The rationale for this method is this patient is that the osteotomy sites created by a formal type III setback is likely to be greater in area than these bony gaps. (Copyrights retained by JCL)

excellent result (Fig. 5.9). In this patients, frontal sinuses were patent and a thick anterior table was present that measured 3.4 mm or greater in the areas of greatest prominence. While a formal anterior table osteotomy and setback is possible, the bony defects caused by the osteotomy would likely be greater in area that a defect caused by intentional entry into the frontal sinus to achieve the level of reduction indicated.

Case III: Type 3 Forehead

Preoperative CT demonstrates an Ousterhout type III forehead with a frontal sinus and thin anterior table (Fig. 5.10). Note the acute nasofrontal angle, significant supraorbital bossing/glabellar prominence, and a low, hooded sweep of the superolateral orbits visible on the 3D reconstruction.

As described above, the magnitude of frontal setback and fronto-orbital recontouring is determined via VSP with a virtual "reference" skull. Heat maps demonstrate the magnitude of contour/height difference in each area (Fig. 5.10).

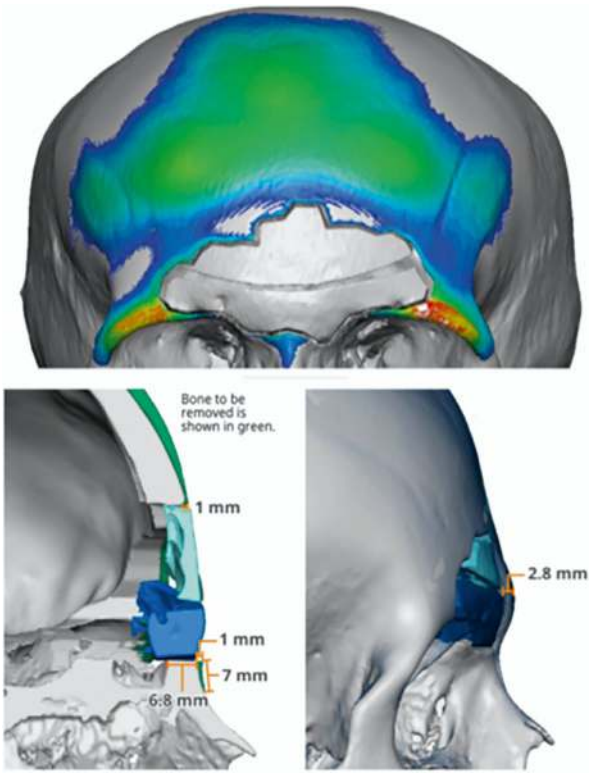

Fig. 5.10 VSP for type III forehead. (Copyrights retained by JCL)

Pre- and postoperative photographs (Fig. 5.11) demonstrate a smooth feminine contour of the forehead with an obtuse nasofrontal angle with no supraorbital bossing and raised and "opened" superolateral orbits.

Case IV: Gonial Angles–Ostectomy

We now show VSP for ostectomy of the gonial angles. Preoperative CT demonstrates increased bigonial width and gonial flaring (Fig. 5.12a). Heat maps demonstrate the magnitude of contour/height difference in each area (Fig. 5.12b) and the specifications of gonial angle reduction including the magnitude of planned ostectomy. Regardless of whether recontouring only or ostectomies of the gonial angles are performed, the amount of reduction is always planned. However, guiding is reserved for more specific cases where the larger incision would be worth making. In the cases where a significant amount of the mandibular body must be resected or when asymmetries are likely to happen, guiding is useful. However, we rarely find the need to guide and we typically find that recontouring using rasping of the gonial angles is sufficient to reduce the width of the face with substantially less risk for jowling (Fig. 5.12c).

Fig. 5.11 Pre- (left panel) and postoperative (right panel) photographs of patient with type III forehead. (Copyrights retained by JCL)

Case V: Gonial Angles–Recontouring

Preoperative CT demonstrates mild to moderate gonial flaring (Fig. 5.13). Heat maps demonstrate the magnitude of contour/height difference in each area (Fig. 5.13). As discussed above, these are cases when no guiding is performed. However, the estimates in reduction from the preoperative surgical plan guides the visual estimates of the bony reduction intraoperatively.

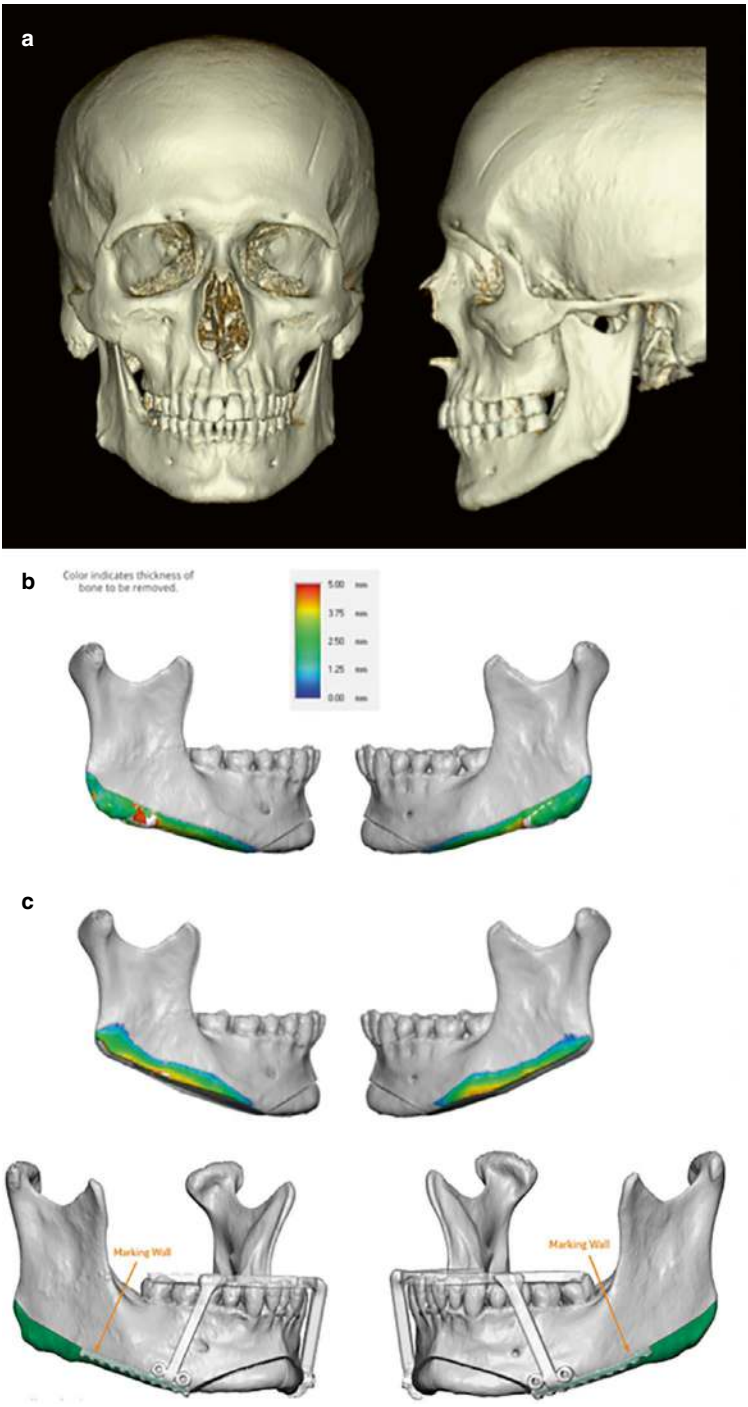

Fig. 5.12 VSP for ostectomy of the gonial angles. Preoperative CT demonstrates increased bigonial width and gonial flaring (Fig. 5.12a). Heat maps demonstrate the magnitude of contour/height difference in each area (Fig. 5.12b) and the specifications of gonial angle reduction including the magnitude of planned ostectomy. Given the significant gonial flaring, reduction is planned using an ostectomy guide and completed with an oscillating saw (Fig. 5.12c). (Copyrights retained by JCL)

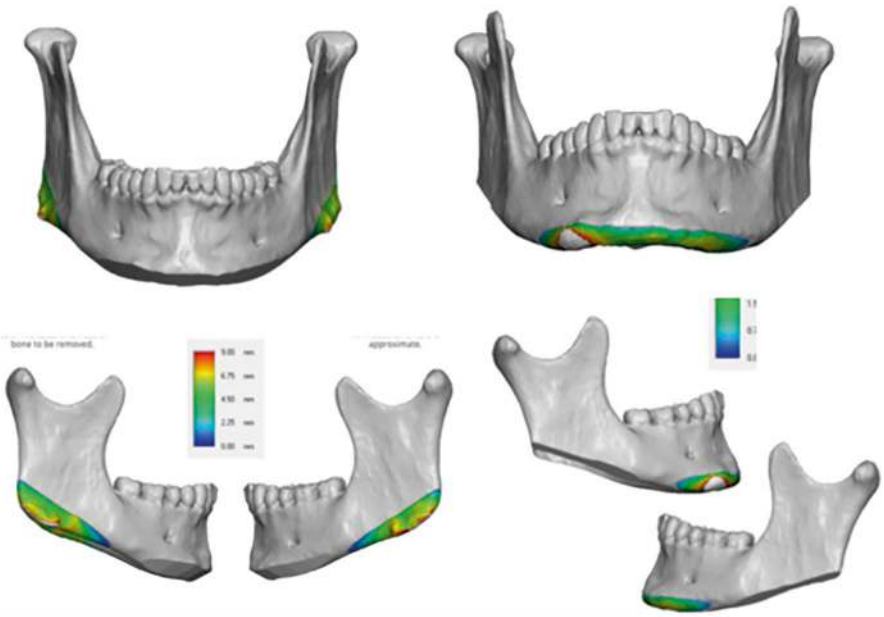

Fig. 5.13 VSP for gonial angle recontouring

Case VI: Chin–Genioplasty

There are several situations in which a genioplasty is indicated (Fig. 5.14). In this figure, a patient with a retrusive, vertically short, and asymmetrical chin (upper panel), a patient with a protrusive, vertically short, and asymmetrical chin (middle panel), and a patient with a wide chin (lower panel) are depicted. In two of the cases, two-piece osseous genioplasties were used to reduce the width of the chin (4 mm central segment ostectomy), whereas a one-piece genioplasty with lateral reduction was performed in the patient depicted in the middle panel. While the upper two panels show patients who have clear dentoskeletal discrepancies, the lower panel is a patient with normal dentoskeletal relationships but required a sizable reduction in the width of the lower face. In the postoperative photographs of the patient from the lower panel (Fig. 5.15), the combination of the chin and gonial angles reduction demonstrated a change in a more square lower face to one that is tapered.

Case VII: Chin–Contouring

In many patients, dentoskeletal relationships are normal and the main issue is reduction in width and size (Fig. 5.16). Heat maps demonstrate the magnitude of contour/height difference in each area (Fig. 5.16). This shows the specifications of chin

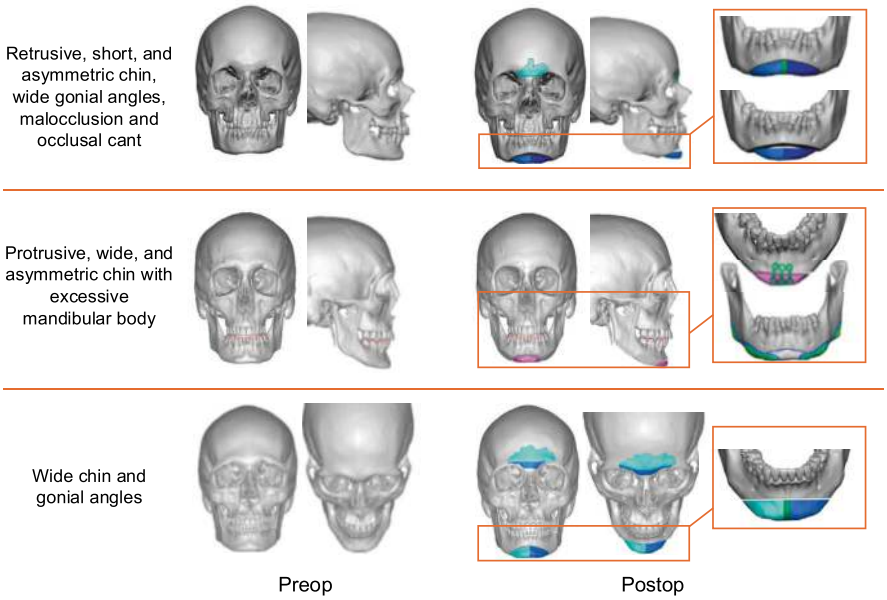

Fig. 5.14 Three different examples with pathology that would benefit from genioplasties. The upper panel shows a patient with class II malocclusion and a retrusive, short, and asymmetric chin. In this case, a two-piece osseous genioplasty was performed to lengthen, advance, and narrow the chin simultaneously. The middle panel consists of a patient with a short yet slightly protrusive chin with asymmetry of the mandibular body. A one-piece osseous genioplasty with lateral reduction was combined with a reduction of the mandbular body. The lower panel illustrates a patient with normal dentoskeletal relationships but with a wide chin and gonial angles. A two-piece genioplasty was performed with gonial angles reductions. (Copyrights retained by JCL)

reduction including the distance of the planned reduction from the mental nerve. Given the increased chin width with no need for reduction of chin height or increased chin projection, reduction is planned using a contouring guide and completed with an oscillating rasp (Fig. 5.16).

Outcomes and Complications

A minority of studies have examined the use of VSP and cutting guides in facial feminization surgery, especially in vivo. Although small in number or lacking control groups, these studies have consistently demonstrated improved safety, operative efficiency, and accuracy with these techniques. Gray et al. demonstrated improved accuracy, decreased operative times, and decreased rates of intradural violation and inferior alveolar nerve injury of FFS maneuvers on cadavers compared to the control group [13]. Accuracy was assessed by comparing planned movements and post-simulation 3D CT reconstructions of the cadavers. Guides seemed to be most

Fig. 5.15 Preoperative (left panels) and 4.5 months postoperative (right panels) photographs of a patient who underwent a two-piece osseous genioplasty and gonial angles reduction illustrating the change in lower facial width. During the same operation, she also received a 4.9 mm type III setback with hairline advancement, recontouring of the superior orbital rim, brow lift, fat grafting to the temples and malar regions, and a quaternary rhinoplasty including removal of previous radix augmentation graft, autologous rib cartilage spreader grafts and columella strut, osteotomies, and alar base resections. (Copyrights retained by JCL)

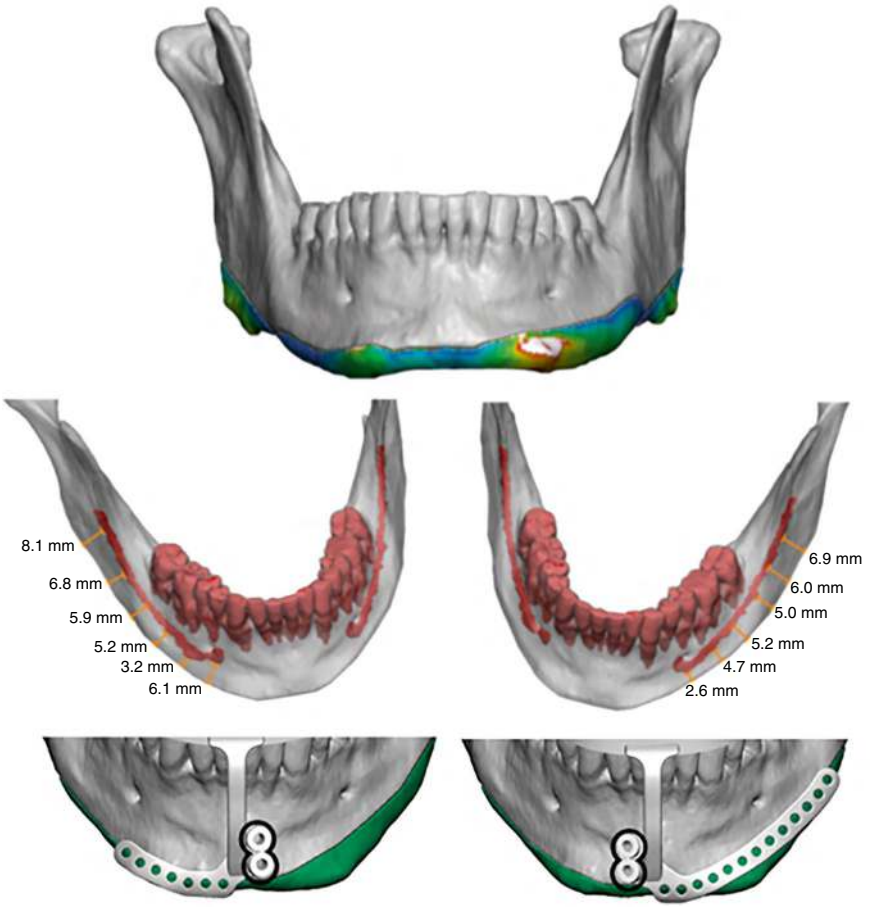

Fig. 5.16 VSP for chin recontouring. (Copyrights retained by Dr. Justine Lee)

effective in the forehead and least so in the gonial angle ostectomy, likely due to challenging visualization and access in this region. Tawa et al. showed VSP to be both safe, though they had no control group, and accurate, with high rates of patient satisfaction [14]. Escandon et al. performed a systematic review of the use of 3D surgical planning in facial feminization surgery [15]. They identified 10 total studies, of which 3 groups employed VSP without the use of cutting guides while another 4 groups utilized VSP and prefabricated cutting guides. Overall, the authors concluded VSP had promising outcomes in regard to surgical accuracy and minimizing morbidity but cautioned that prospective controlled data is lacking. Similar to prior work, our group has experienced no intraoperative or postoperative complications with our process of VSP and 3D cutting guides. In regard to operative efficiency, no available studies provide in vivo comparisons with and without VSP.

Assessing operative efficiency in FFS is especially challenging due to the variable nature and number of procedures performed on a case-by-case basis; however, operative times of up to 12–16 hours have been described [2, 13]. We have found our average operative duration to be more in the 6- to 8-hour range though this obviously varies based on the number of included maneuvers.

Conclusion

VSP and patient-specific cutting guides enable safe and efficient translation of preoperative plans into intraoperative execution in facial feminization surgery. Use of reference cisgender female skulls provides a standardized framework for guiding osseous modifications, including forehead setback, brow recontouring, gonial angle reduction, and genioplasty. These guides improve anatomic precision by delineating critical landmarks and providing real-time feedback during contouring. However, cisgender female reference anatomy may not align with the goals of nonbinary or gender-diverse patients, highlighting the need for individualized planning centered on patient-specific anatomy and aesthetic goals.

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Chapter 6
Feminizing the Upper Third of the Face: Forehead, Hairline, Orbits, and Brows

Joseph W. Mocharnuk, Catherine A. Wu, and Miles J. Pfaff

Introduction

In his seminal 1987 paper, Dr. Douglas Ousterhout described key anatomic differences between male and female foreheads, establishing the foundation for modern forehead feminization surgery [1]. The forehead remains one of the most commonly performed procedures in facial feminization due to its central role in gender perception. Sexual dimorphism of the upper face involves not only the frontal bone, but also the supraorbital rims, orbital contour, and brow position. Surgically modifying these structures can have a substantial impact on facial harmony and gender congruence. This chapter reviews the relevant anatomy of the forehead and frontal bone, highlights important preoperative considerations, summarizes operative techniques, and discusses postoperative management and potential complications.

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Anatomy and Preoperative Considerations

Forehead

The cis-masculine forehead features extensive supraorbital bossing bordered superiorly by a flat area that extends upward to the convex curvature of the upper forehead [1]. In contrast, the cis-feminine forehead is characterized by less supraorbital bossing, less flattening, and continuous mild curvature for a relatively rounder appearance (Fig. 6.1). Ousterhout proceeded to describe three groups defined by their forehead contours, degree of "deformity," and the treatments necessary to correct them – a paradigm that would later be modified into four distinct forehead types [2]. The four forehead types are as follows (Fig. 6.2):

Type I—a forehead with an absent frontal sinus or alternatively with sufficiently thick bone overlaying the frontal sinus so that burring alone is enough to correct the forehead. This type of forehead tends to occur in approximately 3–5% of the population.

Type II—a relatively rare forehead type that involves patients with mild brow bossing and a deficiency just above the brow which augments the appearance of bossing. Thus, this correction simultaneously reduces the brow bone and augments the deficiency above the brow bone.

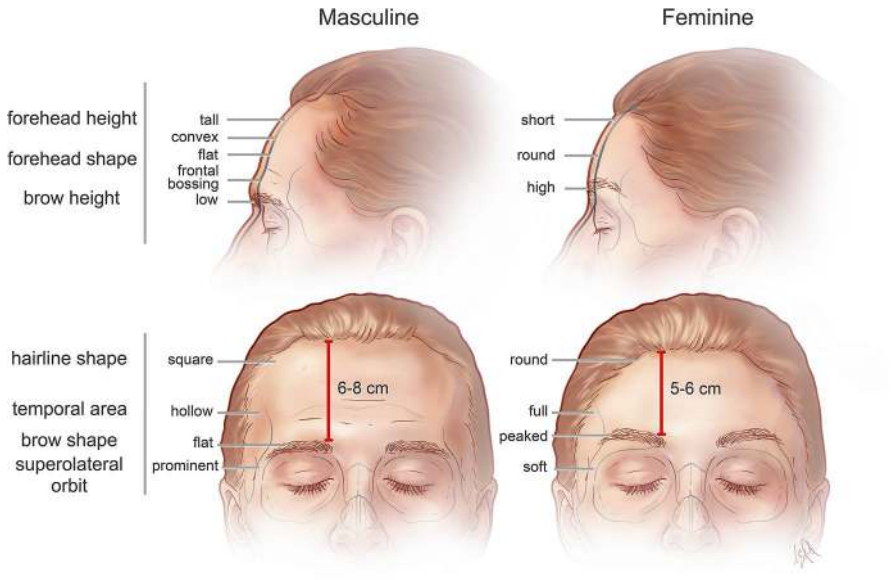

Fig. 6.1 Differences between upper third of face between males and females. (Copyrights retained by Dr. Elizabeth Card)

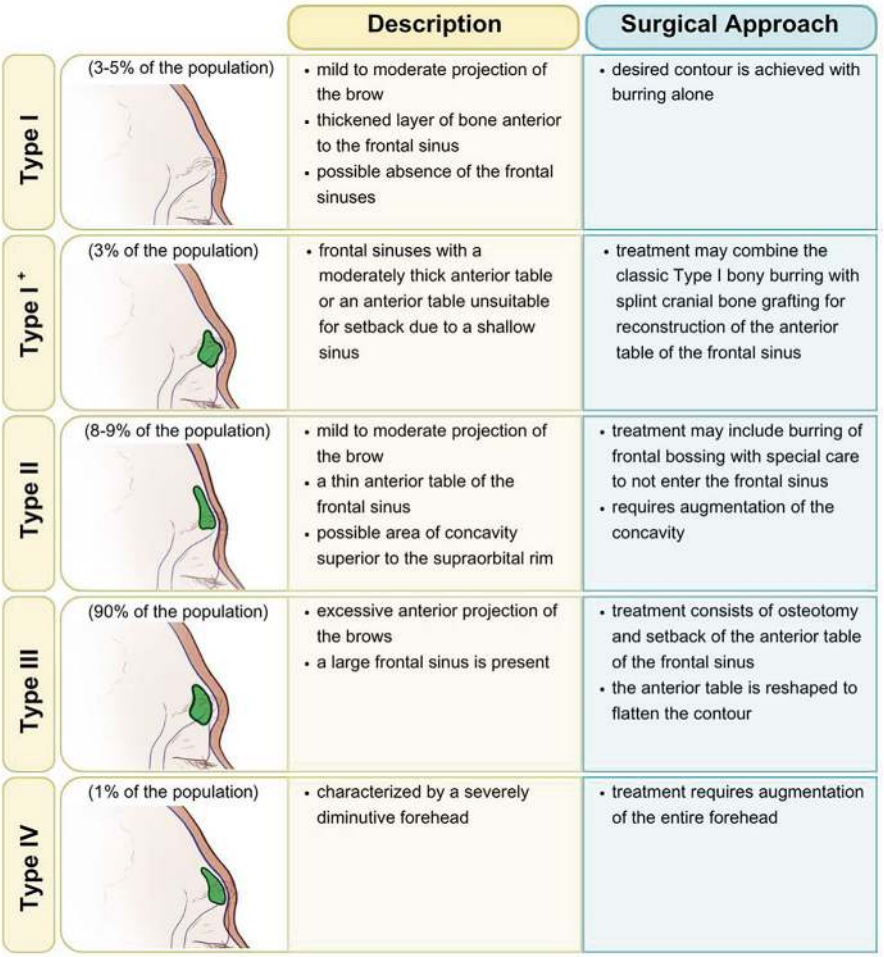

Fig. 6.2 Ousterhout classification based on CT and illustration. (Copyrights retained by Dr. Elizabeth Card)

Type III—the most common forehead type, occurring in 80–90% of patients. Prominent bossing across the top of the brows, and that bossing is overly projected. A frontal sinus is present.

Type IV—an uncommon forehead type that is characterized by minimal brow bossing and a severe slope of the frontal bone such that the supraorbital region is the most prominent, yet cannot be reduced further. Augmentation is indicated in this forehead type. Regardless of the material type, care should be taken to avoid having the implant sit directly underneath the incision as this leads to a higher rate of infection and removal.

The senior author has additionally acknowledged an additional cohort of patients that do not necessarily fall into Ousterhout's four categories. Moreover, there are patients with frontal sinuses with a moderately thick anterior table or an anterior table unsuitable for setback due to a shallow sinus. This intermediate morphology has been classified as the novel "type I+" approach, which combines the classic type I bony burring with split cranial bone grafting for reconstruction of the anterior table of the frontal sinus.

Either a CT scan or a plain film can help identify the anatomy of the frontal sinus.

Hairline

The hairline is an important feature for gender identification within the upper third of the face [3]. Hairline appearance is multifactorial and encompasses the quality of a patient's hair, the shape of their hairline, and whether they wear a wig. A typical cis-masculine hairline has an M-shaped or square-shaped pattern compared to the more rounded shape often seen in cis-feminine hairlines. Additionally, the masculine forehead is on average longer (approximately 6 to 8 centimeters) than the feminine forehead (approximately 5 to 6 centimeters). Feminization of the hairline may require rounding out the shape of the hairline, optimizing hair density, and changing the height of the hairline [4]. Hairline advancement can help to shorten the forehead and eliminate areas of hair loss, especially along the temporal recesses.

Temples

Male faces often feature noticeable hollowing in the temporal region compared to female faces which typically have fuller temples. This may require filling of the temporal region, either with fat grafting, filler, or implants.

Eyebrows, Orbits, Eyelids, and Eyes

Furthermore, the surgeon must consider anatomical differences in eyebrow, orbit, eyelid, and eye morphology among males and females. Male eyebrows are generally straighter and flatter than female eyebrows, which are comparatively more curved with a peak at the lateral one-third of the brow. Additionally, male eyebrows tend to sit at or even below the supraorbital rim, whereas female eyebrows typically sit above the supraorbital rim. At the superolateral aspect of the supraorbital rim, male orbits are more prominent, creating a hooded effect that often requires reduction. Feminizing the eyebrow often involves lifting the brow and reducing the superolateral bony orbit. Women typically have a shorter intercanthal distance than men.

Furthermore, there are significant interethnic aesthetic differences that should be noted during preoperative evaluation [5, 6]. Similarly, while forehead recontouring changes the orbital rims already, surgeons may consider soft tissue modifications such as a lateral canthopexy to achieve a more feminine appearance, as well as upper and lower blepharoplasties which can be especially impactful in older patients [7].

Operative Technique

Incision and Exposure

The position of the hairline is a key determinant when considering incision options. For those who do not need hairline advancement, a coronal incision is often the first operative step. Conversely, for those who do need hairline advancement, an incision should be made along the anterior border of the hairline centrally and extending backward into the hair-bearing scalp at the temples before curving down to the ear [2]. This technique allows for excision of a strip of forehead skin and advancement of the scalp forward and leaves open the option for future scalp and/or hairline advancement if warranted. In either case, the incision within the hair-bearing scalp should be made either as a wave or as a zigzag; a straight-line incision creates a noticeable parting of the hair, whereas hair falls in all directions around a wavy or zigzag scar thereby concealing it (Fig. 6.3).

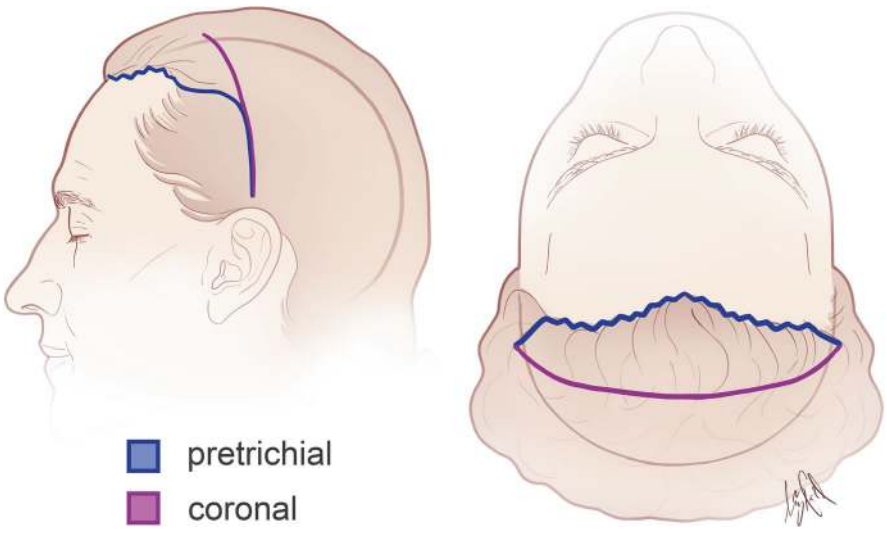

Fig. 6.3 Scalp incisions. (Copyrights retained by JCL)

Once the incision is made, scalp flaps are raised both anteriorly and posteriorly. The posterior dissection approach can be either subgaleal or subperiosteal; galeotomies can be utilized in situations where more scalp advancement is required [8]. Dissection should be continued to the occiput for maximal advancement of the hairline and a tension-free closure. Anteriorly, dissection is carried in the subperiosteal plane over the forehead and down to expose the nasofrontal junction, superior orbital rims, and zygomaticofrontal sutures [9].

Regardless of approach, it is essential that the surgeon preserve the scalp vascular plexus in the connective tissue layer and be wary of the frontal branch of facial nerve which lies superficial to the deep temporal fascia in the temporal region, as well as the supraorbital and supratrochlear nerves [10] (Fig. 6.4).

When a supraorbital foramen is encountered, an inferior osteotomy may be made to allow the supraorbital nerve to be moved down into the orbit for additional exposure of the supraorbital rim. Note that there are many instances where a notch is encountered and no osteotomy is necessary. There are also some instances where multiple foramina are found on the same side and multiple osteotomies are necessary when the neurovascular bundles are equally dominant in size.

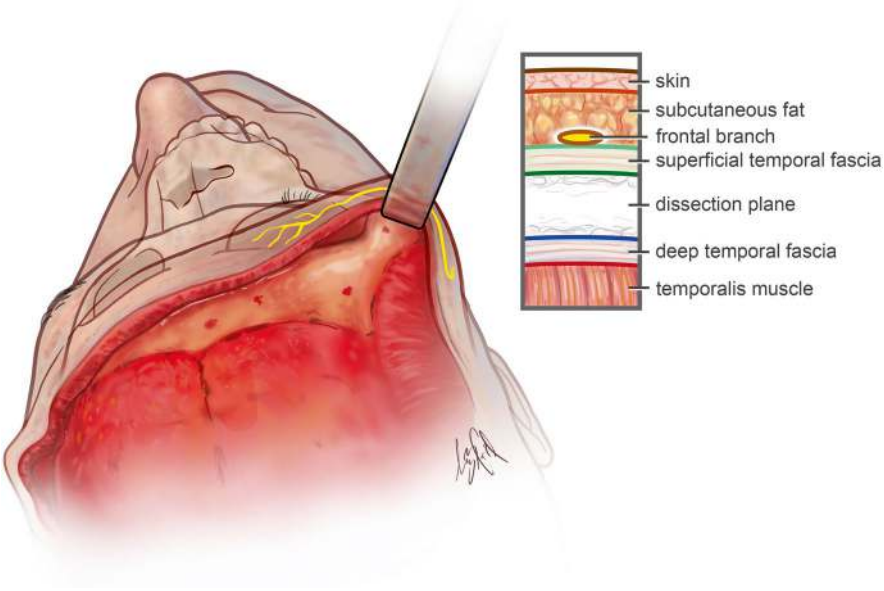

Fig. 6.4 Path of the frontal branch of the facial nerve. (Copyrights retained by Dr. Elizabeth Card)

Frontal Sinus Setback

The Ousterhout type III foreheads are defined by the need for setback of the anterior table of the frontal sinus. In general, the surgeon can make use of VSP with preprinted custom guides which identify the outlines of the brow, frontal sinus, and cut lines [11]. Alternatively, the boundaries of the frontal sinus may be identified intraoperatively. The frontal sinus can be transilluminated and the borders marked. Another technique is to use transillumination to identify the frontal sinus and drill a hole through the anterior table to allow insertion of one prong of a forceps. The prong of the forceps within the sinus is used to probe the borders of the frontal sinus, and the prong outside the skull is used to guide marking of the outline of the sinus. Once the border has been marked, osteotomies are performed with a bone saw to raise the anterior table of the frontal sinus. Care should be taken to minimize trauma to the mucosa and to the nasofrontal outflow tract.

At this point, a burr may be used to reduce frontal bossing and shape the forehead as desired. The anterior table is replaced in its new position. The anterior table itself may be shaped with burring or by cutting and replating pieces together to create the desired contour, and further burring or bone grafting using bone dust or fragments may be performed to smooth the junction between the anterior table and the surrounding brow [12].

Reattachment of the anterior table is done with the help of miniplates and screws, which may be permanent or dissolvable. Suture and/or wires can also be used. Care must be taken to ensure that the nasofrontal outflow tracts are not obstructed by the anterior table during the setback. For type II and type IV foreheads, bone grafting, synthetic material (methyl methacrylate, polyethylene), or hydroxyapatite can also be considered above the brow ridge to achieve a smoother forehead contour and fill any defects in the anterior table bone flap. Thin shaves of calvarial bone graft and a pericranial flap are the senior author's preferred method for contour and defect correction. Further, we do not place any synthetic augmentation material on the forehead and instead elect to use only autologous bone and/or fat grafting if needed.

Superior Orbital Rim

The superolateral aspects of the superior orbital rims may be reduced via osteotomies or burring. If VSP is used, custom cutting guides can be created to guide osteotomies or burring to ensure the desired amount of reduction is achieved. Care must be taken to avoid injury to the globe during this process. A malleable may be inserted into the orbit between the globe and the area being reduced to protect the globe.

Addressing the Brow

While the frontal bone and supraorbital ridge may account for the bulk of the brow prominence, the soft tissue overlying the brow can also contribute to perceived frontal bossing. Total or subtotal corrugator resection can be performed in select patients with prominent soft tissue to help reduce brow prominence. The surgeon must be aware of the amount resected and the possibility of postoperative contour irregularities that can occur if inadequate or incomplete muscle resection is performed.

Brow Lift

A brow lift is typically performed simultaneously with hairline advancement. A variety of techniques can be used including implant-based fixation methods including absorbable suture anchors, bone tunnel suture fixation, fascial purchase, or suture fixation to a screw anchored into the calvarium [12–14]. It is important to note that a brow lift will occur simply due to the repositioning of the soft tissues after reduction of the superior orbital rims. However, many patients will benefit from more lift than the skeletal reduction can provide. When the hairline is advanced, few additional maneuvers are necessary as the non-hairbearing forehead resection is quite effective. In patients with severely ptotic brows or in patients approached through a coronal incision, additional maneuvers may be beneficial. A simple subperiosteal dissection down the zygoma to the inferior orbital rim is an easy and fast maneuver to release the soft tissues for more temporal lift. Should a stronger and more secure lift be necessary, the senior author's preferred technique involves suspension of the brow using a bone channel drilled in the outer cortex in the frontal bone (Fig. 6.5).

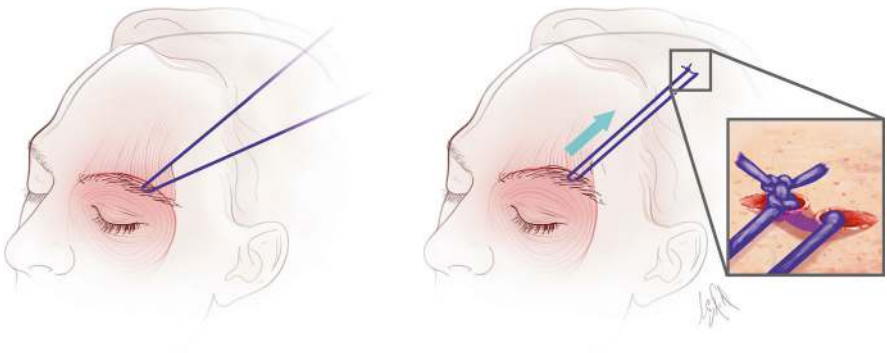

Fig. 6.5 Illustration of bone channels for brow lift. (Copyrights retained by Dr. Elizabeth Card)

Hairline Advancement, Hair Transplantation, and Closure

If hairline advancement is desired, a strip of non-hair-bearing forehead skin is excised. This may be done in such a way as to round out the hairline. The scalp is then advanced from posterior to anterior to reduce the length of the forehead. The galea may be scored if necessary to facilitate advancement of the scalp. The scalp is then closed in layers, taking care to approximate the galea. Within the hair-bearing scalp, skin closure may be accomplished with sutures or with staples; some surgeons may prefer staple closure due to its speed and being less strangulating to the tissue. Skin closure over non-hair-bearing skin is ideally accomplished with a small permanent suture, which is removed in clinic, though an absorbable running subcuticular suture may also be used.

If hairline advancement is insufficient due to lack of adequate hair-bearing scalp or if the patient desires a hidden coronal scar, hair transplant may be considered. Timing of hair transplant is controversial. Some authors advocate simultaneous hair transplantation at the time of hairline advancement or brow feminization while others believe that staging of the transplant improves graft take [3, 8]. In general, our advice to patients is usually to allow surgery to happen first to maximize the outcomes of hair transplant. We recommend delaying hair transplant until about 6 months after surgery so that shock hair loss can subside and the areas of alopecia are more clear.

Temporal Fossa Augmentation

Augmentation of the temporal fossa may be required to correct temporal hollowing. This may be performed with fat grafting, HLA fillers, or implants. The senior author prefers fat grafting to the temporal region as well as any other areas of the face to be performed at the beginning of the case prior to the development of soft tissue swelling which occurs during manipulation of the tissue. However, these may be performed at any time most convenient to the surgeon's workflow.

Complications

Serious complications are fortunately rare after forehead feminization. More common complications include temporary supraorbital numbness, wound breakdown, and contour irregularity [15]. Other complications include temporary frontal branch paresis, upper eyelid edema and chemosis, telogen effluvium, hematoma, seroma, infection, and poor scarring. Rare but more serious complications include dural injury, CSF fistula or leak, nasofrontal outflow tract obstruction, and mucocele [3].

Surgical Pearls

- As with any surgical procedure, preoperative evaluation is paramount and should include patient assessment (overall health, support, and anatomical features) and management of expectations.
- Preoperative imaging is necessary for proper planning and can include a computed tomographic scan of the head or plain film.
- Virtual surgical planning is not necessary, but the operative plan should be formulated prior to the day of surgery.
- The approach to the frontal bone and brow should be guided by the patient's own goals as well as their anatomy. Hairline recession and thinning is an important factor that must be taken into consideration when planning the incision type. The same principles of aesthetic surgery of the brow apply to FGAS: A traditional pre-trichial coronal approach has the potential to significantly shorten the forehead while a traditional coronal approach will move the hairline slightly posteriorly given the redraping that will occur over a reduced facial skeleton.
- Always ask the question: Can the anterior table of the frontal bone be burred down to an appropriate position without osteotomies? If so, the less invasive approach should always be undertaken.
- Opening the orbital aperture via orbital contour along the frontoorbital bar should not be overlooked. This will help open and soften the eyes.
- Soft tissue contributions to brow prominence should not be overlooked. Corrugator resection can always be considered; however, contour irregularities can occur if not properly approached.
- Temporal hollowing correction will help round out the upper face and provide for a softer and more feminine appearance.
- If osteotomies of the nasal bone are necessary in a combined rhinoplasty case, access to the nasal bones for direct osteotomy can be achieved through the coronal incision.

Concluding Remarks

This chapter discusses the key objectives and presents relevant case studies in the feminization of the forehead, orbits, eyebrows, and hairline (Figs. 6.6 and 6.7). While feminization often entails reduction of frontal bossing, hairline advancement, and brow lift, there are important nuances that one must consider in addressing the forehead. In writing this chapter, we hope to provide plastic surgeons and trainees with useful clinical and technical pearls in their approach to the upper third of the face for feminization (Video 6.1).

Fig. 6.6 Preoperative (*first and third columns*) and 1-year postoperative photographs (*second and fourth columns*) of a patient who underwent full FFS. Procedures performed included a 4.5 mm frontal sinus setback, temporal brow lift, reduction genioplasty, gonial angle reduction, dermal fat graft to the upper lip, fat grafting to the temporal areas and cheeks, and open septorhinoplasty with spreader grafts, septal extension graft, tip refinement sutures, osteotomies, and inferior turbinate reduction. (Copyrights retained by Dr. Justine Lee)

Fig. 6.7 Preoperative (*first and third columns*) and 3.5-year postoperative photographs (*second and fourth columns*) of a patient who underwent staged FFS. Procedures performed in the first stage included open structural septorhinoplasty with bilateral inferior turbinate reduction and reduction genioplasty. Procedures performed in the second stage included a 7 mm frontal sinus setback, temporal brow lift with bone channels, upper lip lift, dermal fat graft to the upper lip, and fat grafting to the temporal areas and cheeks. (Copyrights retained by Dr. Justine Lee)

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Chapter 7
Approaching Rhinoplasty for Feminization

Sumun Khetpal, Yasmine Ibrahim, and Tommy Liu

Introduction

With the burgeoning demand for FFS, the nose plays a critical role in the perception of femininity and is often the central focus of the initial consultation. One may erroneously associate feminization of the nose with "reduction rhinoplasty"; however, each patient requires an individualized approach to assess their respective anatomy, determine which elements confer a masculine appearance, and address these with various maneuvers to achieve an appearance in alignment with one's gender identity and ethnicity. This chapter discusses the anatomic considerations between feminine and masculine noses, provides a structured approach toward the preoperative consultation and the management of patient expectations, outlines various technical maneuvers for the nasal subunits (tip, dorsum, alae) used for feminization, presents considerations for preservation rhinoplasty in the transfeminine population with

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case examples, reviews considerations with respect to ethnicity and preservation of ethnic identity amid feminizing rhinoplasty, and finally, seeks to understand complications and indications for performing revision rhinoplasty as associated cases.

Sexual Dimorphisms in Nasal Anatomy

Often regarded as the centerpiece of the face, the nose exhibits several anatomic features that have been traditionally classified as sexually dimorphic; as a result, the appearance of the nose may contribute to both internal and external perceptions of gender.

Albeit exceptions, on frontal view, the feminine nose conjures images of a narrow bony vault, narrow and curved dorsal aesthetic lines, small tip with narrow tip-defining points, a narrow alar base, and a shorter upper lip with more vermillion and incisor show in repose. On lateral view, females have shorter nasal length, less projected nasal dorsum and tip, more prominent supratip break, larger upper lip, and a less prominent chin [1, 2]. Objectively, the nasofrontal angle is approximately 134 degrees in Caucasian females and 130 degrees in their male counterparts [3]; the nasolabial angle is approximately 95–110 degrees and 90–95 degrees in feminine and masculine Caucasian noses, respectively [4]. On basal view, the feminine nose has less nasal tip projection, rounder nostrils, and minimal alar flare. In contrast, the masculine nose is often distinguished by straight and relatively wide dorsal aesthetic lines on frontal view, with its dorsum beginning with a more projected radix and proceeding inferiorly in a straight line without a supratip break on lateral view. The masculine nose may additionally have wider nasal bases and less defined tip-defining points [5, 6]. The skin envelope of the masculine nose is thicker and, thus, may obscure changes made to the underlying nasal framework.

Preoperative Consultation and Assessment

In order to determine the appropriate plan and ensure successful execution of rhinoplasty among TGD patients, a thoughtful and comprehensive assessment of the nose should be performed by the surgeon. As discussed in the prior chapter, the preoperative consultation should touch upon relevant medical and surgical history, medications, and social history and additionally include a full facial assessment to determine patient goals for facial feminization.

With respect to the nose, the surgeon may elicit generalized goals (i.e., narrow the tip, straighten the dorsum) in order to gain a holistic perspective of their patient's motivation for the rhinoplasty. Furthermore, we advocate for a systematic approach toward evaluation of the nose—from functional and aesthetic perspectives. Relevant information including prior rhinoplasty (ideally with detailed operative reports) and fillers, as well as history of nasal trauma, presence of nasal airway obstructive

symptoms, and requirements for antihistamines, nasal sprays, or other decongestants, should be recorded. We proceed with a generalized nasal assessment of the following: intranasal exam, followed by evaluation of the septum (i.e., deviation), alar shape and position, nasal base, quality of nasal skin, nasal length, radix position and height, alar/columellar relationship, tip (i.e., rotation, projection, shape), dorsum, as well as nasofrontal and nasolabial angles. The discussion should then shift toward understanding which nasal features or combinations thereof contribute to the patient's perception of a more masculine appearance and thus lead to gender dysphoria. The remainder of the exam should proceed with evaluation of frontal, lateral, and basal views of the nose [7] (Fig. 7.1).

Frontal View

On frontal view, it is important to begin with a general assessment of facial proportions, particularly the facial thirds, to assess how the nose appears in relation to the other facial features. Moreover, the nose should be centered on a straight line from the midglabella to the midline of Cupid's bow [8]. Baseline facial asymmetries including nasal deviation, soft tissue clefts, occlusal cant, and symmetry of the nasal bones and ala should be documented and incorporated into the discussion. The anterior nasal spine and central incisors may be used as reference points to assess symmetry. Attention should be paid to the quality of the skin. Cis-masculine skin is often thicker and may obscure the nasal framework, albeit feminizing hormone therapy will change the quality of the skin in a manner that varies from individual to individual.

In evaluating the nose, we often begin with the bony vault. This should measure from 70% to 80% of the normal alar base width [3, 5]. We then proceed to the mid-vault, which is fundamental in ensuring the patency of the nasal airway; we conduct an intranasal exam with a speculum in order to visualize the size of the inferior turbinates. A Cottle maneuver is performed via lateral traction along each side of the cheek followed by inspiration to evaluate for collapse of the internal nasal valve, defined as the angle between the caudal septum and upper lateral cartilages. From an aesthetic perspective, the mid-vault may be described as wide, narrow, or even collapsed from prior aggressive dorsal reduction or excessive resection of the upper lateral cartilages. The dorsal aesthetic lines are then examined; these should have a smooth, symmetric path beginning at the supraorbital ridges bilaterally, diverging slightly at the keystone area, and ending at the tip-defining points. Of note, in feminine noses, the distance between the dorsal aesthetic lines should be equivalent to the width between the tip-defining points, while this distance is wider in masculine noses [3, 5].

The nasal tip is then evaluated and classified as bulbous (rounded, ill-defined), boxy (rectangular appearance), or pinched; the tip-defining points can also be assessed for symmetry. Furthermore, it is critical to examine patients in both repose and upon animation as the tip may particularly droop and provide insight for

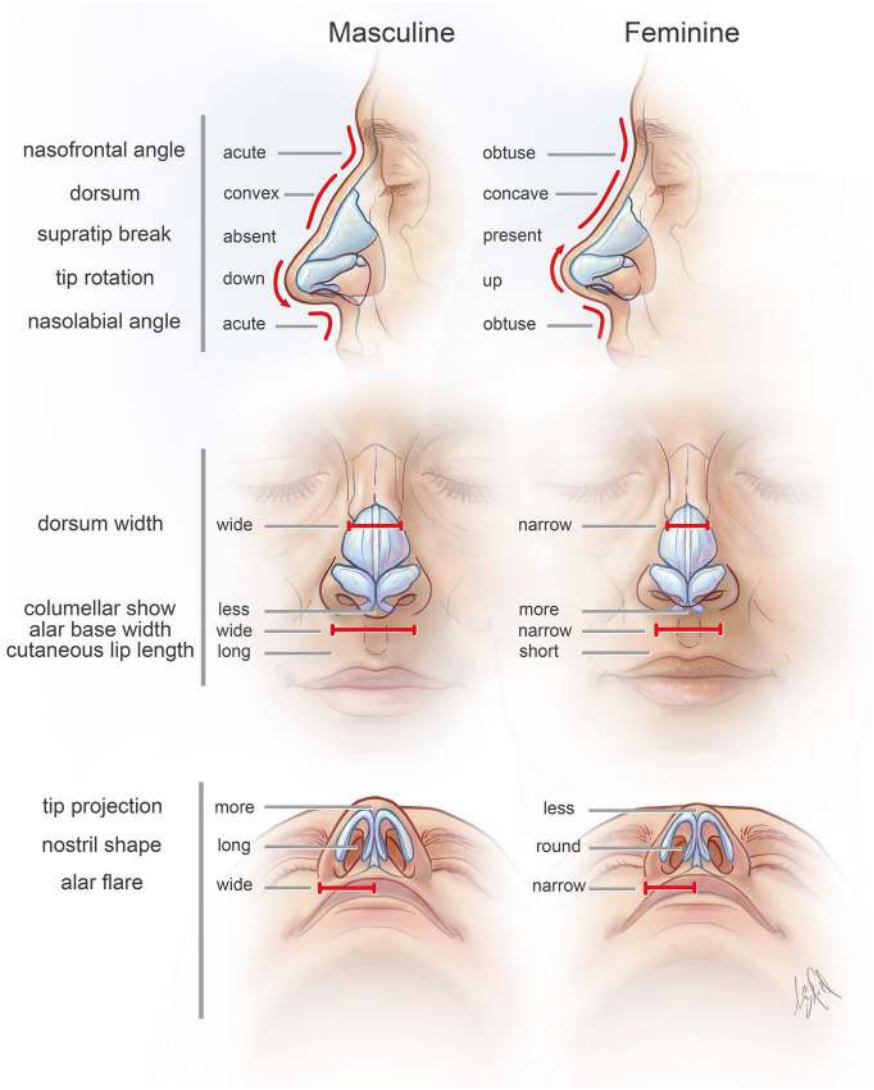

Fig. 7.1 Anatomic differences between masculine and feminine noses. (Copyrights retained by Dr. Elizabeth Card)

alternative maneuvers or techniques necessitated intraoperatively. We then transition to the alar region; the alar rims and columella should create a smooth outline, resembling a seagull in gentle flight [9]. The columellar show in feminine noses is typically greater than that in masculine noses. The width of the alar base should equal the intercanthal distance [3, 5]. Finally, the upper lip is evaluated in conjunction with the nasal appearance as it may influence the perception of nasal proportions. The cutaneous upper lip length, on average, is 3 millimeters greater in men compared to women [10]. During the process of facial aging, the lip length increases

beyond its aesthetic ideal (one third of the lower third of the face) [11]. Moreover, such patients may benefit from a concurrent lip lift via a bullhorn technique which will be described in a subsequent chapter on soft tissue considerations in FFS.

Lateral View

On lateral view, the nasofrontal angle is assessed, ideally measuring 134 degrees in Caucasian feminine noses and 130 degrees in masculine noses [3]. The radix lies between the upper lid eyelashes and the supratarsal fold but varies by ethnicity [12–14]. The radix typically projects about 15 millimeters anterior to the medial can- or 11 millimeters anterior to the corneal plane [15]. Nasal length varies with the radix; higher radix positions confer longer nasal lengths, while lower radix positions confer shorter nasal lengths. The ratio of the nasal length to tip projection ideally measures 1: 0.67 [4, 14, 16]. The dorsum is then analyzed for its contour, particularly for the presence of a dorsal hump and if so, if it is cartilaginous or bony in nature. Continuing caudally, the absence or presence of a supratip break is assessed. The lateral relationship between the columella and the alae are then assessed for the presence of a hanging columella, addressed with trimming of the caudal septum, or retracted alae, addressed with alar contour grafts. The tip projection and rotation are then examined. Nasal tip projection is measured from the tip of the nose to the most posterior point of the alar-cheek junction. Fifty to sixty percent of the tip projection should lie anterior to a vertical line drawn along the most projecting portion of the upper lip [4, 14, 16].

Nasal tip rotation is assessed by measuring the nasolabial angle [4]. Albeit exceptions, patients undergoing feminization frequently seek deprojection and increased rotation of the tip; details of such preferences should be discussed given their inherent subjectivity, as well as consideration of both ethnic and familial features.

Basal View

On basal view, the outline of the nose should resemble an equilateral triangle, with the nostrils being symmetric with a teardrop motif [4, 14]. The columella should be smooth and symmetric with slight curvature. The alar base width should approximately measure the intercanthal distance [3, 5], with careful attention to evidence of alar flare (defined as the alar rim projecting laterally); in females, a slight alar flare can be desirable in some patients (typically <2 mm), while in males, a slightly greater alar flare is more common (up to 3 mm) [17, 18]. We caveat these measurements with the fact that the majority of these measurements were performed in Caucasians and may not necessarily apply to every ethnicity.

General Technical Considerations

Open Versus Closed Approach

After understanding the patient's functional and aesthetic goals, we can consider whether these are best achieved via an open or closed approach. Nasal airway obstruction are always addressed simultaneously with feminizing rhinoplasty. Note that the majority of our patients seeking feminizing rhinoplasty request reductive procedures. With this in mind, we always address septal deviation and enlarged inferior turbinates even when patients do not report subjective nasal airway obstruction. Given the length of the full face procedure, the senior author (JCL) always performs inferior turbinate reductions as outfractures, albeit more extensive treatment can also be undertaken. In contrast, external nasal valve obstruction is not pre-empted but addressed with cartilage grafting only when obvious collapse is present preoperatively. Osteotomies may be performed to narrow the nasal width and correct nasal bone asymmetry noted on frontal view. In terms of the change in tip aesthetics, we have found that cadaveric rib cartilage grafting as well as autologous sources of bone from the ethmoid, split calvarium, or harvested from the mandibular reductions have been invaluable in controlling tip positioning. While

Fig. 7.2 Preoperative (*first and third columns*) and 1-year postoperative photographs (*second and fourth columns*) of a patient who underwent full FFS. Key procedures performed included 7.5 mm frontal sinus setback, temporal brow lift, fat grafting to the temple and malar regions, one-piece lengthening osseous genioplasty, bilateral mandibular angle osteotomies, open structural septorhinoplasty with bilateral spreader grafts, septal extension graft, bilateral alar contour grafts, tip refinement sutures, and osteotomies. (Copyrights retained by Dr. Justine Lee)

Fig. 7.3 Preoperative (*first and third columns*) and 1.5-year postoperative photographs (*second and fourth columns*) of a patient who underwent partial FFS. Key procedures included reduction genioplasty, gonial angle reduction, fat grafting to the temporal and malar regions and an open structural septorhinoplasty with spreader grafts, septal extension graft, tip refinement sutures, osteotomies, and inferior turbinate reduction. (Copyrights retained by Dr. Justine Lee)

using autologous septal, ear, or rib cartilage can be done, again, we have found that the timing of surgery as one full face surgery (typical practice in 95% of patients of the senior author, JCL) to generally favor the former sources. Additionally, note that many of our patients may have encountered nasal fractures from violence in addition to all other etiologies. Hence, septal fractures have been frequently found. We present three case examples of patients who underwent rhinoplasties for feminization (Figs. 7.2, 7.3, and 7.4).

Structural Versus Preservation Techniques

One of the key evolutions in the field of rhinoplasty as well as our personal practices (TL and JCL) is the usage of preservation rhinoplasty over structural approaches over time [19–24]. First coined by Rollin K. Daniel, preservation rhinoplasty is a concept rather than a particular technique [25]. This concept is to maintain as much of the favorable native nasal structures as possible. Depending on the anatomic goals and preferences for feminization of the nose, patients may be candidates for preservation rhinoplasty; specifically, patients with stronger cartilages may not warrant a structural tip approach, while those with weak cartilages may require a restructuring of the tip [26].

Fig. 7.4 Preoperative (*first and third columns*) and 1 year postoperative photographs (*second and fourth columns*) of a patient who underwent full FFS. Key procedures performed included 2-mm frontal sinus setback (Type 1+), coronal brow lift, reduction genioplasty, gonial angle reduction, fat grafting to the temple and malar regions, dermal fat graft to the upper lip, open septorhinoplasty (dorsal preservation style) with septal extension graft, tip refinement sutures, osteotomies, inferior turbinate reduction, and dermal fat graft to the radix

Patients with an isolated cartilaginous hump may be treated with a septal strip resection; widened dorsums may be addressed with lateral and intermediate osteotomies (i.e., push- or letdown). Ultimately, preservation rhinoplasty adheres to the following fundamental principles: (1) elevation in a subperichondrial/subperiosteal plane with preservation of supporting ligaments if possible, (2) preservation of the nasal dorsum to avoid the open roof deformity and necessitated reconstruction, and (3) preservation of the alar cartilages with minimal excision and shaping using sutures. These principles can be applied to both open and closed approaches. We have found that some of the major advantages to the preservation approach is reduced contour abnormalities of the dorsum which can commonly be found after the structural approach due to the extensive maneuvers undertaken to stabilize the nose. Additionally, there may be somewhat reduced postoperative edema. The hybrid structure-preservation approach, popularized by Toriumi et al., has gained traction in its particular emphasis of maintaining dorsal elements while performing grafting techniques to ensure favorable tip aesthetics [26–29]. This is also our preferred technique in the majority of patients as grafting confers greater control of the nasal tip. Further, we emphasize that the preservation and structural principles do not need to ever be used in isolation as they are not mutually exclusive. Rather, they serve as options for which the operating surgeon can choose from to maximize results in individual patients.

The Aging Nose

While the goals of rhinoplasty in the transfeminine population lie in achieving a cis-feminine aesthetic, age-related changes of the nose that may complicate the procedure. In particular, age-related changes include ptosis of the nasal tip, formation of a more acute nasolabial angle, unmasking or accentuation of a dorsal hump, and nasal lengthening [30, 31]. These changes are related to diminished skin elasticity, atrophy of support structures, and ossification of the fibrocartilaginous framework. Such changes may contribute to the development of obstructive symptoms via internal or external valve collapse. Given these unique anatomical changes, even greater emphasis should be placed on providing structural support via cartilage grafts.

Ethnicity

In addition to achieving a feminine appearance of the nose, there are anatomic features associated with particular ethnicities that one may consider during rhinoplasty. For example, Asian patients typically present with thicker soft tissue envelopes with abundant fibrofatty tissues, weaker and smaller cartilages, an underprojected dorsum, a bulbous and poorly defined tip, and wide alar bases [14, 32]. Alternatively, African-American patients often present with thicker skin with fibrofatty tissue, weak cartilages, and wide alar bases [13, 33, 34]; Middle Eastern noses may be characterized by prominent arching dorsums, wide bony vaults, droopy and bulbous tips, and narrow nasolabial angles [35]. Hispanic (Latinx) noses are often thick-skinned and bulbous, with flimsy cartilages and poor tip projection and rotation; the degree of alar flaring is highly variable [36, 37]. These are certainly not definitive as a high degree of variation does exist in the nasal features within given ethnic groups. However, in holistically considering these natural, ethnically inclined characteristics, it is important to understand how such features are perceived in relation to a given patient's gender identity and how these should be addressed—whether preserved, altered, minimized, or augmented—during rhinoplasty. As a rule of thumb, the majority of Asian-descent and African-descent feminizing rhinoplasties benefit from radix/dorsal augmentation, not reduction. The reasoning behind this is that the visual narrowing of the nose cannot be achieved with reductive maneuvers and osteotomies in an underprojected dorsum. Additionally, the soft cartilages that make up the wide nasal tip compounded by the fibrofatty tissue will typically require increased projection with grafting to achieve narrowing and definition of the tip. Ethnic nuances will be discussed in greater depth in a subsequent chapter.

Staging

While the senior author often combines rhinoplasty with other facial procedures in a single-stage reconstruction, there are instances in which staging the rhinoplasty is preferred. Furthermore, if patients have multiple medical comorbidities or are of a certain age, a shorter duration of anesthesia may be preferred to ensure safety of the procedure. Other surgeons may prefer to reserve the rhinoplasty for a later stage from a technical perspective. These decisions are subject to the operating surgeon's preferences, as well as the patient's.

Relevant Anatomy and Corresponding Technical Maneuvers

Dorsum

When evaluating the aesthetic of the dorsum, one must consider the placement of the nasofrontal angle and generalized frontonasal transition, the position of the radix, symmetry and contour of nasal bones, dorsal aesthetic lines, as well as the presence and composition of a dorsal hump (i.e., whether bony and/or cartilaginous). Dorsal reduction is typically achieved through component hump reduction, septal strip excision or overlap as a preservation-stye reduction, or a combination of the two [3, 29, 38–40]. Toriumi et al. reported that V-shaped dorsal humps are more amenable for dorsal preservation, while their S-shaped counterparts require further modification of their articular and cartilaginous surface to ensure smooth contour [29, 40]. However, the senior author's personal experience is that we nearly always do a combination of both. While we default to dorsal preservation in most cases, we nearly always rasp down the transition between the nasal bones and the upper lateral cartilage to minimize the chances of having contour abnormalities after healing. Osteotomies (low-to-low, low-to-high) may be performed either percutaneously or via any of the internal approaches per the surgeon's preference. Upper lateral cartilages may have asymmetries that may be corrected with spanning sutures. Dorsal spreader grafts can be utilized to emphasize the dorsal aesthetic lines and to address internal nasal valve collapse, albeit a degree of widening of the dorsum will occur and patients should be counseled on this possibility. As stated earlier, dorsal augmentation is likely to be needed during feminizing procedures for certain ethnicities. The options for augmentation range widely from diced cartilage to alloplastic implants. However, in the setting of a one-stage full face surgery, the senior author's preference is to use dermal fat graft of a galeal fat graft harvested from the excised tissue from the forehead. We have found this option to be very forgiving in contour abnormalities with excellent long-term results. While we have certainly used diced cartilage wrapped in fascia (Turkish delight), we tend to reserve that option for patients who have a need for more augmentation (e.g. saddle nose). Attention should be directed to the frontonasal transition, especially if the forehead is addressed (via burring or setback of the anterior table of frontal sinus), as the radix may need to be repositioned or augmented to suit the dorsal contour.

Risks of excessive dorsal resection include creation of an open roof deformity, which may warrant osteotomies or placement of spreader grafts for correction, or a saddle nose deformity, which would require augmentation via cartilage grafts.

Tip

While there are exceptions, the cis-feminine nasal tip is characterized by decreased projection but increased rotation relative to that of a cis-masculine one. Patients may additionally present with a droopy, bulbous, or boxy tip. General contributions to nasal tip aesthetics include the geometry and makeup of the lower lateral cartilages, the ratio of the lateral to medial crura, position of the footplates, lateral crural resting angle, and position of the caudal septum. In more recent literature, the aesthetic nasal tip can be further conceptualized as a series of polygons delineated by precise breakpoints—specifically delineated by Cakir et al.—including the glabellar polygon, dorsal bone polygon, dorsal cartilage triangle, lateral bone polygons, upper lateral polygons, dome triangles, lateral crus polygons, intercostal triangle, facet polygons, infralobular polygon, columellar polygon, and footplate polygons [41]. In order to delineate these different surfaces and enhance contours, particular tip-refining maneuvers including cephalic trim/turnover, auto-rim grafts, lateral crural steal, tip-defining sutures (intradomal, interdomal, transdomal), medial crural overlay, and resection of the caudal septum may be performed. In addition to sutures, cartilage grafts—namely, caudal septal extension graft, columellar strut graft, tip/shield graft—may be utilized to alter tip projection and rotation [42]. Some patients may request for a supratip break, which can be accomplished via resuspension of Pitanguy's ligament.

Alae

When assessing the alar subunits of the nose, it is important to assess both their functional and aesthetic components. Specifically, the function of the external nasal valve can be easily evaluated with inspiration—with malfunction defined as collapse upon inspiration. In terms of aesthetic considerations, attention should be given to the alar-cheek junction, the alar-tip transition, as well as natural contour of the caudal edges of lateral, middle, and medial crura that shape the nostril; alar notching and retraction must be diagnosed and addressed. Alar asymmetries and collapse may indicate the need for rebuilding the cartilaginous structure via alar rim, auto-rim, lateral crural strut, or other alar contouring grafts. The alar base width, which is typically 2 millimeters greater than the intercanthal distance, may require narrowing via alar base reductions (i.e., Weir excisions). With the alae specifically, it is important to consider a given patient's ethnic identity and particularly how they may want to preserve or conceal aspects with their nasal appearance.

Columella

The columellar region should be assessed in conjunction with the nasal tip, and its continuance into the upper lip. The cartilaginous framework beneath the columellar skin is characterized by the medial crura and, to some extent, the caudal septum. To reduce an overhanging columella, resection of the caudal septum may be performed. Again, analysis of the columella and alae as a unit should be performed to distinguish between a hanging columella versus retracted alae as the technical approach is distinct. A simple way to diagnose the difference is to draw or visualize a line bisecting the nostril from anterior to posterior on the lateral view. A hanging columella is present if there is generally more nostril show below the bisecting line, where as alae retraction is present if there is more nostril show above the bisecting line. The nuance is that it is possible for both to be simultaneously present. In addition to the columella-alae relationship, the columella-lip relationship should be assessed. Specifically, in the setting of a simultaneous lip lift which is discussed in a later chapter, it is essential that the columella is not pulled down.

Septum

Addressing the septum requires the application of both functional and aesthetic principles. We highly recommend correcting septal deviation at the time of feminizing rhinoplasty to minimize the potential of symptomatic nasal airway obstruction upon reductive maneuvers performed in most patients. To further improve nasal airway obstructive symptoms, removal of bony spurs, turbinate outfracture, and microdebridement are often useful. As all rhinoplasty texts and surgeons have emphasized, a straight nose can only be achieved with a straight septum. Hence, it is absolutely imperative that the operating surgeon evaluates the nose obsessively, multiple times to ensure that the nose is as straight and midline as possible. While a septoplasty, resection of the bony spurs, and osteotomies contribute greatly to correction of deviation, we would emphasize that assessing the relationship of the septum on the anterior nasal spine is also important. When deviated, a few simple maneuvers can re-center the septum. For example, there is sometimes a small curve of cartilage that can be trimmed at this junction. Occasionally, the anterior nasal spine is deviated and a greenstick osteotomy with a 2mm osteotome can be used to mobilize the bone. Note that stabilization of the septum with a 3-0 PDS suture to the periosteum or a drill hole at the midline is recommended to secure the septum in place.

Cartilage Sources

A variety of cartilage sources have been used for construction of cartilage grafts during rhinoplasty; these include autologous ear or costal cartilage, cadaveric fresh frozen-irradiated costal cartilage, and finally, autologous septal cartilage. As we discussed earlier, autologous septal cartilage is not always sufficient for our patients. Hence, while we use it as much as possible, larger grafts such as septal extension grafts frequently require cadaveric rib cartilage. In terms of outcomes (i.e., resorption, warping, infection, contour irregularity), several studies have affirmed that autologous and homologous costal cartilage share comparable rates and, thus, are viable and safe options for grafting longitudinally [43]. We recommend discussing all possible sources with the patient to ascertain whether they may strongly object to any of the donor sites or cadaveric rib cartilage. Should there be no objections, we recommend decision-making based on need for maximally stabilizing the nose (if unstable) and maximally achieving the aesthetic and feminization goals of the patient.

Achieving Congruence with Other Facial Structures

The nose has a unique relationship with other facial features that are also altered with facial feminization. In particular, the frontonasal transition may be softened with forehead contouring and setback of the anterior table of the frontal sinus; however, the radix is often positioned higher—at the lash line—in females, compared to the supratarsal crease seen in males. This may warrant radix repositioning to achieve a more cis-feminine appearance in some patients and also requires attention toward its effect on the perception of nasal length. The nasofrontal angle is also wider in females (average 134 degrees), compared to that of males (130 degrees) [3].

In transitioning to the lip region, attention to upper lip length should be paid in order to determine whether the patient may benefit from a concurrent lip lift. The senior author utilizes the bullhorn technique that enables access to the nose via an incision at the base of the columella, with simultaneous lip lift through excision of upper lip skin. We have yet to devitalize a columella using this approach. Note that we have never used and strongly object to using parallel incisions (one at the columella, one below) when performing a simultaneous lip lift and rhinoplasty. We do believe that this is where complications will arise in this procedure.

Finally, we must consider the relationship between the nose and chin, particularly its position. In facial aesthetics, Ricketts recommended using the E-line, which assesses the overall alignment of the nose, lip, and chin; this line is marked by following the nose tip point (pronasale) to the most prominent chin point [44]. In addition, Steiner evaluated the soft tissue (ST) profile and popularized the S-line, outlined from the pogonion to the columella [45]. These relationships must be preserved during the course of facial feminization.

Complications and Revisions

Complications from rhinoplasty have been well documented and may include contour irregularities, nasal airway obstructive symptoms, saddle nose deformity, pollybeak deformity, infection, and generalized asymmetries [46]. There may be incongruence of patient expectations and postoperative appearance of their nose. This is one of the most common reasons for revisions in facial feminization surgery in the senior authors experience. The operating surgeon should be prepared that revisions will occur and the rates will be generally on par with those reported for the cisgender population.

Concluding Remarks

This chapter outlines the fundamental goals of feminization with respect to the nose. While it is impossible to fully capture the nuances that should be calculated in performing a rhinoplasty, much less a feminizing rhinoplasty, we hope that the chapter has served as both a primer to analysis and technique as well as a glimpse into some of the thoughts, discussions, and evolutions that we have had over the years in feminizing surgeries (Video 7.1).

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Chapter 8
Performing Genioplasty for Feminization

Sumun Khetpal, Harsh Patel, Nghiem H. Nguyen, and Justine C. Lee

Introduction

Skeletally, the two major areas for feminization are the forehead and the mandible, including the chin and gonial angles. As such, the mandible is of paramount importance in facial feminization surgery. However, many nuances in mandibular contouring require thought as well as a conscientious objective assessment of the skeletal relationships between the mandible and the rest of the craniofacial skeleton.

While the feminine chin is generally shorter, narrower, and less projected, one may erroneously associate feminization of the chin and jaw as explicitly "reductive"; in reality, each patient requires a unique approach to evaluate their respective anatomy, determine which aspects particularly confer a masculine appearance and how these features of the lower third of the face relate to the rest of the face, and ultimately, determine which various maneuvers may be performed to achieve an appearance in alignment with one's gender identity and ethnicity. This chapter aims

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to (1) deconstruct the anatomy of the jaw and chin, from both soft tissue and bony perspectives, (2) understand the anatomic differences between the lower third of feminine and masculine faces; (3) provide a systematic approach toward approaching the preoperative consultation with discussion of key examination maneuvers; (4) share helpful insights in managing expectations with special considerations of facial aging; (5) discuss complications associated with such procedures and the indications for pursuing revision genioplasty; and (6) present relevant case examples via photographs, video footage, and illustrations to conceptualize the anatomy and the transition from cis-masculine to cis-feminine facial appearance.

Anatomic Sexual Dimorphism of the Mandible

The chin and jaw possess several anatomic features that may be regarded as sexually dimorphic and, therefore, warrant attention during feminization. Masculine mandibular features include increased mandibular body height, prominent gonial angles with greater lateral splay, and increased bigonial width. In contrast, feminine mandibular features are characterized by reduced mandibular body height, more obtuse gonial angles (typically >125°), and decreased bigonial width [1–3]. Moreover, the male chin is broad, tall, and wide with greater protection and masseter bulk in contrast to the shorter and less projected feminine chin. Anthropometric proportions of the chin have been measured by Farkas with the average distance from the labiomental fold to pogonion to be 16.9 +/− 3.6 mm for men and 17.3 +/− 2.3 mm for women [3]. While exceptions exist (e.g. skeletal discrepancies, congenital differences), the general concepts of mandibular feminization involve a reduction of bigonial width and a reduction of chin width and projection.

Preoperative Consultation and Clinical Assessment

Congruent with the cardinal rule of all patient care, the most important aspect in surgical decision-making for the lower face is what the patient says as triggers for their dysphoria. Similar to all other parts of the face, we do not operate on the lower face if this is not part of a patient's dysphoria. Typically, a patient will tell us statements such as "I feel like my chin is too big" or "My jaw is too prominent." In these circumstances, it is highly useful to probe the patient in terms of understanding what exactly does that mean to them. For example, a "big" chin may mean anterior projection to some patients, whereas it may mean length to others. A prominent jaw may mean excessive width on frontal view to some patients, whereas it may be the angular appearance on lateral view to others (note that the latter concern is more rare while the former is the more common complaint).

In transitioning to the objective physical examination, we recommend a comprehensive approach that includes cephalometric, dental, and aesthetic assessments. Starting with the cephalometric and dental assessment, baseline dentoskeletal disharmony (e.g. retrognathia, prognathia, vertical maxillary excess), occlusion,

incisal show in repose and smiling, missing or loose teeth, and the presence of dental caries and gingival disease should be catalogued. If there is malocclusion, orthognathic surgery should be considered prior to FFS to restore normal occlusion prior to further contouring. **See Orthognathic Chapter for further details**. A skeletal evaluation is subsequently performed, particularly examining the bony prominence of the mandible including gonial splay, mandibular body prominence, chin vertical height, chin width, upper and lower facial heights, Holdaway ratio, and sagittal projection for determination of prognathism or retrognathism.

The soft tissue is then analyzed, particularly the skin envelope, mimetic muscle thickness, masseter muscle bulk at rest and with masticatory effort, submandibular glands and degree of prominence, and evidence of prior soft tissue augmentation (fillers) or scarring. Furthermore, the degree of generalized facial aging, marked by evidence of soft tissue ptosis, perioral rhytids, nasojugal grooving, jowling, as well as rough skin texture and quality, informs the need for additional facial procedures (i.e., fat grafting, staged face or neck lift) for optimal results. Should facial aging exist, we recommend a thorough discussion with the patient as skin laxity and soft tissue ptosis may be exacerbated with the reduction of the mandible as well as blunt the visualization of these maneuvers.

To further optimize surgical planning and execution, CT imaging of the craniofacial skeleton is often performed in advance of the operation. Particularly, VSP accounts for key anatomical landmarks and structures and allows for production of surgical cutting guides, splints, and models that facilitate osteotomies and bony mandibular contouring in a safe, efficient fashion. Finally, during the initial consultation, surgical risks of genioplasty should be discussed, including but not limited to wound dehiscence, infection, osteomyelitis, dental injury, nonunion or malunion of the bone, and sensory nerve neuropraxia. With the exception of neuropraxia, all of these potential risks are exceedingly low. All patients should be informed that temporary sensory neuropraxia in the cranial nerve V3 distribution is normal and the total or near-total resolution may require a year or more.

Operative Considerations

Incisional Approach

In designing the incisions, it is important to note and mark key intraoral anatomical landmarks, including Stensen's duct and the course of the mental nerve, to prevent iatrogenic injury. Particularly, the mental nerve exists lateral to the symphysis near the apices of the first and second premolars. Prior to exiting the mental foramen, the mental nerve courses 4.5 mm (+/− 1.9 mm) inferior and 5 mm (+/− 1.8 mm) anterior to its actual exit of the foramen. Furthermore, in an anatomic study of 50 dry specimens, at the level of the second premolar, the inferior alveolar nerve courses 4.3 mm (+/− 1.3 mm) from the buccal cortex, 4.2 +/− 1.3 mm to the lingual cortex, 9.4 +/− 1.4 mm from the inferior border, and 21.3 +/− 2.8 mm from the alveolar crest [1, 4–6]. In addition, the incision should be placed wide within the gingival mucosa in order to ensure that there is an adequate cuff of mucosa for closure. Note

that we typically do not cross the canine on either side with the mucosal incision because a superficial branch of the mental nerve is typically found very close to the mucosa at that level. The incision will stretch during the dissection so that this is unnecessary at the time of the incision. Furthermore, the senior author (J.C.L) prefers to utilize three separate incisions in order to assess the bilateral gonial angles and the symphysis; these are connected in the subperiosteal plane in order to preserve a cuff to protect the mental nerve and ultimately reduce incisional burden. Some surgeons perform wide exposure from angle to angle, which is also reasonable, although this will require a longer time to close. After finalizing the incision placement, local anesthetic medication (i.e., 0.25% bupivacaine with 1:200,000 epinephrine) is then injected for its analgesic and vasoconstrictive effects.

Dissection

Gonial Angles

A lower gingivobuccal incision is made with electrocautery on cut with a 7 mm cuff near the last molar down to bone (Fig. 8.1). Dissection is performed using an Obwegeser elevator to expose the gonial angles. A J stripper is then used to elevate the tissues off the inferior border of the mandible. If contouring of the inferior mandibular border or body itself is required, the dissection may extend mesially toward the mental nerve to allow for adequate exposure. This technique is performed bilaterally.

Next, a channel retractor is placed to protect the soft tissues inferior and lateral to the gonial angles. The gonial angle is then clearly visualized and is addressed using a power rasp, reciprocating saw, and/or oscillating saw. Our preferred method, when possible, is to use the power rasp as this is both easy to use and control. The only downside is that the power rasp does not reach the inferior border as easily and is therefore less ideal when it requires substantial reduction. The reciprocating saw is ideal when a sizable lateral flare is present. This is also simple to use to

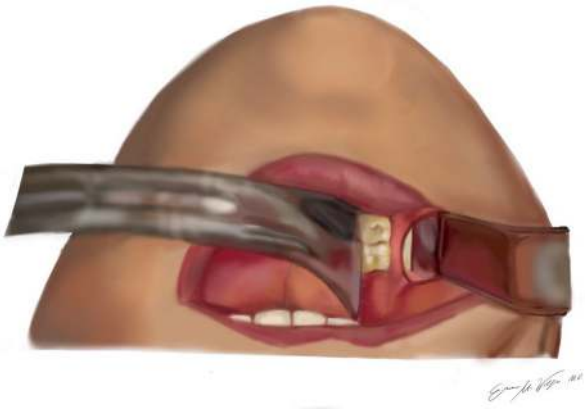

Fig. 8.1 Approach toward gonial angles. (Copyrights retained by Dr. Erin M. Wolfe)

tangentially osteotomize the angle. The benefit of this method over the power rasp is that the bone from the gonial angles can then be use as graft material elsewhere. Typically, the power rasp is still necessary to smooth the edges after osteotomy. Lastly, the oscillating saw is useful for inferior border reduction although more cumbersome to use. We would like to add that some surgeons choose to use the piezoelectric saw to perform these osteotomies. While this is not our typical practice, this is also a valid method. Our only caution is that timing is important from the standpoint of surgeon fatigue, hence the operating surgeon should use the most efficient and effective tool in their hands. In addition to bony contouring, patients with prominent masseters may benefit from direct excision or botulinum injection in addition to bony contouring.

Genioplasty

Similar to the gonial angles, a gingivobuccal incision approximately 7 mm away from the lower incisors is made with electrocautery on cut through the mucosa and the mentalis muscle down to bone. To avoid the superficial branches of the mental nerve, we recommend placement of this incision between the canines. Next, an Obwegeser elevator is used to elevate the soft tissues in the subperiosteal plane over the chin and laterally down to the inferior border below the mental foramina.

Once adequate exposure is achieved, one may alter the height, width, and position of the chin through a multitude of maneuvers. Multiple maneuvers, which include T-shaped osteotomy, the oblique mandibular chin-body osteotomy, reduction mentoplasty, and the home plate-shaped sliding osteotomy, have been described for chin contouring in feminine patients; these have been adapted for facial feminization. The ultimate type of genioplasty for a given patient depends on their baseline cephalometric proportions and whether prominence or deficiency exists in the horizontal, vertical, and/or sagittal dimensions. The current surgical approach for the senior author (J.C.L.) is to achieve a 1:1 ratio between upper facial height (nasion to A point) and lower facial height (A point to menton). Alloplastic augmentation with silicone implant may be an additional surgical option for patients requiring projection but is not favored by the senior author given associated complications of implant displacement, implant extrusion, bony resorption, and infection.

Sliding or osseous genioplasty was introduced by Trauner and Obwegeser in 1957 and Converse and Wood-Smith in 1964, respectively, for advancement of the chin [7, 8]. However, these techniques were later modified to involve osteotomies for reduction of chin height by Hohl and Epker (1976) and McBride and Bell (1980) [9, 10]. Later in 1987, Wolfe described methods for addressing the vertical length of the chin by either an ostectomy of the chin between the mental foramina and the inferior border for shortening or the addition of an interpositional calvarial bone graft for lengthening [11]. Variations of these techniques have been useful in our experience when necessary. With respect to lengthening, given that we frequently have bone from split calvarium and/or the gonial angles reduction, the interposition technique is an outstanding method for maximizing bony contact and union. Lee et al. coined the V-lined osteotomy, which entails removing a central vertical bony

segment as well as triangular segments along the inferior mandibular borders bilaterally [12]. For broad, wide chains, Hirohi et al. proposed a home plate-shaped sliding osteotomy for narrowing genioplasty among the East Asian population; while this was performed on cisgender patients, similar principles may be applied to feminization of the chin in TGD patients [13]. Finally, Wang et al. compared the indications and outcomes between total inferior border osteotomy and T-shape genioplasty [14]. This retrospective study found that compared to the T-shape genioplasty, the total inferior border ostectomy is well suited for a longer, wider, and more asymmetrical chin as this technique is helpful in narrowing the chin and addressing any underlying asymmetry. We predominantly used the T-shaped osteotomy early in our experience. However, the drawbacks of this pattern are both the need to secure and heal multiple segments as well as the stepoff between the native mandible and the segments. Hence, we have converted largely to recontouring the chin or sliding genioplasty with lateral reductions of the chin. However, we still find the T-shaped osteotomy useful whxen a strong cleft chin is present. Various methods for genioplasty are summarized (Fig. 8.2).

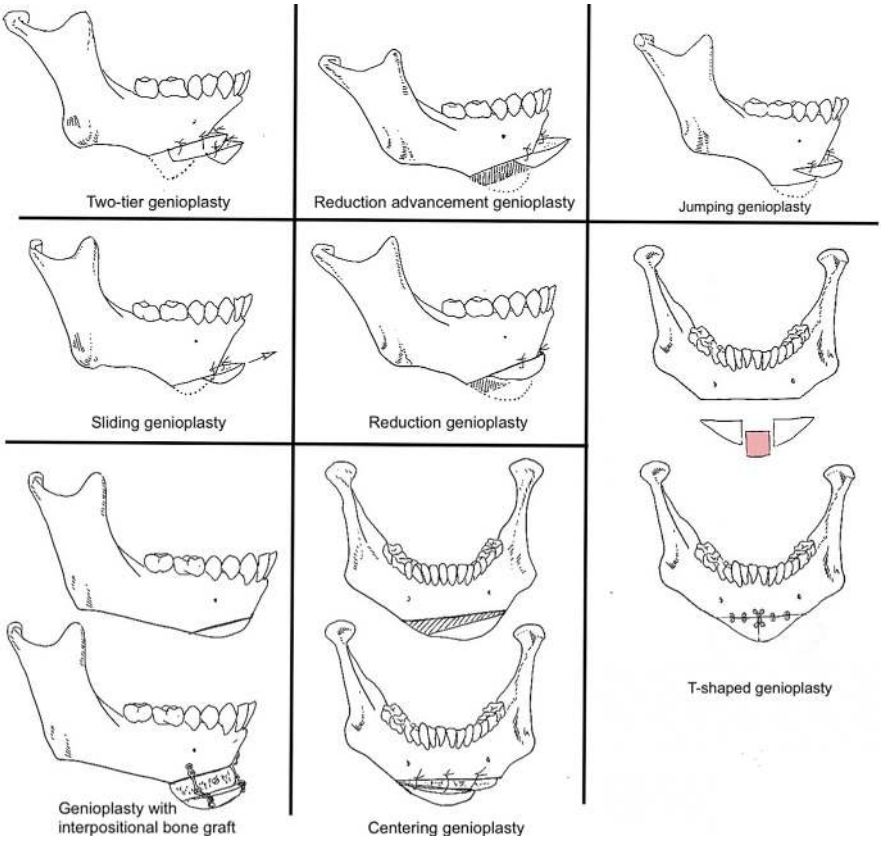

Fig. 8.2 Various methods of genioplasty. (Copyrights retained by Dr. Erin M. Wolfe)

When performing osteotomies, care must be taken to avoid ligation of the mental nerve. In a foundational anatomic and radiographic case series published by Ousterhout in 1992, he found that mental nerve injury did not occur when osteotomies were placed at least 6 mm below the mental 3. During these aforementioned maneuvers, it is important to recognize that the anterior-posterior dimension (i.e., projection) can also be altered as some patients may require advancement or setback in addition to changes in height and width of chin.

Closure

When the procedure is complete, the incision should be thoroughly irrigated with antibiotic solution and hemostasis should be achieved. The genioplasty incision requires resuspension of the mentalis muscle (typically performed with 3–0 Vicryl) in order to avoid the witch chin's deformity and exacerbation of soft tissue ptosis [10]. The mucosal closure then may proceed, with care taken to ensure a watertight seal, as saliva pools in the lower gingivobuccal sulcus and may predispose to infection if optimal closure is not achieved. The steps for genioplasty are summarized (Fig. 8.3).

Case Series

The ensuing cases will exhibit effective approaches for addressing specific clinical concerns related to chin contour, encompassing considerations of chin height, width, and projection. Of note, these examples include patients with normal occlusion and thus would not benefit from orthognathic surgery (Figs. 8.4 and 8.5).

Other Facial Features

While this chapter focuses on the feminization of the chin and jaw, it is important to recognize how the lower third of the face harmonizes with the rest of the face—particularly with respect to the nose, lips, submental, and neck regions. Beginning with the nose, several methods have been implemented to determine the ideal anatomic relationship between the nose and chin. The Rickett's E line is a line drawn from the pronasion to the soft tissue pogonion; the upper lip should be approximately 4 mm from the line, while the lower lip is ideally located 2 mm from the line. Steiner's S line is a line drawn from the soft tissue pogonion to the midpoint of the columella, and the lips should fall on this line [1–3]. The Holdaway ratio, defined as the ratio between the respective distances of mandibular incisor and hard tissue pogonion

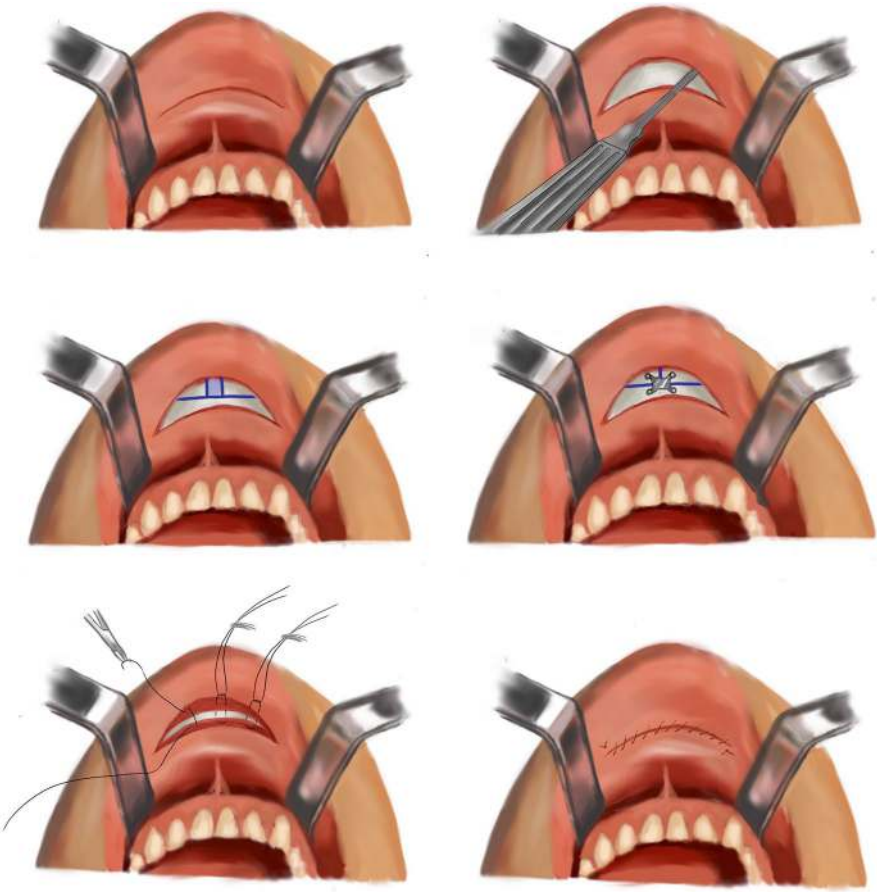

Fig. 8.3 Surgical approach and technique for genioplasty in facial feminization. (Copyrights retained by Dr. Erin M. Wolfe)

from a line drawn from the nasion to the supramentale, has also been described as having an ideal value of one. Ultimately, the balance between nasal and chin projection should be carefully considered during facial feminization.

The relationship between the chin and neck cannot be understated. The hyoid particularly plays a crucial role in the definition of the cervicomental angle. In a blunt cervicomental angle with a retrusive chin, a sliding genioplasty for advancement of the chin not only harmonizes the facial proportions but improves the definition of the cervicomental angle. At times, there may be excessive submental and neck volume. In these cases, we have harvested fat from the neck for fat grafting to assist in improving the cervicomental angle. Note that when a chondrolaryngoplasty is planned, which we universally perform via an intraoral, endoscopic "scarless" approach, we do not do submental fat harvest to prevent any issues on perfusion of the skin flap. Additionally, we are very careful to separate rejuvenation procedures

Fig. 8.4 Preoperative (*first and third columns*) and 1-year postoperative photos (*second and fourth columns*) of a patient who underwent full FFS. Key procedures included 3.5 mm anterior table setback, coronal brow lift, reduction genioplasty, mandibular angle reduction, fat grafting to malar and temple regions, sliding genioplasty with lateral reduction, and open septorhinoplasty with bilateral spreader grafts, septal extension graft, tip refinement sutures, osteotomies, and inferior turbinate reduction. (Copyrights retained by Dr. Justine Lee)

from gender-affirming procedures. Thus, fat graft harvest from the neck is never a standard liposuction but simply harvest for transfer.

Another key consideration of bony contouring of the chin and jaw lies in the impact on soft tissue and muscle. Aggressive mandibular reduction will cause jowling. However, the challenge to surgeons is that there is no standardized definition of "aggressive" as it varies depending on the elasticity of the skin for each patient. Thus, this is a pure judgment call. Ultimately, if the operating surgeon chooses to attempt to achieve a reduction of the mandible and chin that is non-proportional to the rest of the face, the potential for jowling will be high. In our practice, we attempt to avoid generating unnatural anatomy by modeling all patients on cis-female skulls that have been scaled to the size of the patient's skull. In the event that jowling does occur, rhytidectomy (facelift) or neck lift may be warranted – on a cosmetic basis – in order to address these effects [11, 12]. Thus, preoperative discussion of the potential desire for future facelift or other skin and tissue-tightening procedures is warranted, especially in patients with multiple risk factors such as advanced age and existing skin damage or laxity.

Fig. 8.5 Preoperative (*first and third columns*) and 3-month postoperative photographs (*second and fourth columns*) of a patient who underwent full FFS. Key procedures performed included 3 mm frontal sinus setback, coronal brow lift, reduction genioplasty, gonial angle reduction, fat grafting to the temple and malar regions, and open septorhinoplasty (dorsal preservation style), with cephalic trim, tip refinement sutures, osteotomies, and inferior turbinate reduction. The procedures combined resulted in considerably refined feminine contours. (Copyrights retained by Dr. Justine Lee)

Complications and Revisions

Complications of genioplasty are rare, but may include infection, neurosensory deficits often secondary to mental nerve injury, hematoma, nonunion or malunion of the bone, bone necrosis, ptosis of the mentalis muscle, and irregular mandibular contours. Moreover, infections and mental nerve injury are the most frequently reported complications of genioplasty procedures in the literature. The mental nerve is vulnerable during bony manipulation of the mandible, injury of which can lead to paresthesias of the lower lip and chin. In general, paresthesias and numbness are typically temporary although the timing of recovery may be prolonged to a year or more for full recovery. Occasionally, we have encountered patients at the one-year postoperative visit with some point numbness of the chin, although we have not yet had a case of complete numbness. As with all other facial units, undercorrection is the most common indication for revision, with all patients undergoing chin revision desiring further reduction for feminization. Although width (i.e., horizontal

prominence) can be adequately addressed with burring alone, prominence in the vertical dimension often requires osteotomy to achieve full correction as does sagittal prominence or deficiency. Additionally, patients with preexisting facial asymmetries or undiagnosed microsomia should be made aware that these asymmetries may persist after their feminization procedures.

Conclusion

This chapter outlines the fundamental goals of feminization with respect to the chin and mandible. While feminization often entails the shortening, narrowing, and deprojection of the chin, the ultimate type of genioplasty for a given patient depends on their baseline cephalometric proportions and whether prominence or deficiency exists in the horizontal, vertical, and/or sagittal dimensions.

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Chapter 9
Orthognathic Considerations in Facial Feminization

Arhana Chattopadhyay, Tommy Liu, Elizabeth B. Card, and Wayne Ozaki

Introduction

It is important that FFS surgeons recognize that dentofacial deformities are relatively common; in fact, an estimated 5% of people in the United States and United Kingdom have clinically significant jaw–teeth discrepancies that may benefit from surgical correction. Dentofacial deformities are defined by malocclusion resulting from disharmony in the size and/or position of the maxilla and mandible and/or abnormal tooth positioning within the dental arches. These deformities can result in functional problems, such as sleep apnea, chewing disturbances, temporomandibular joint (TMJ) disturbances, or pain as well as aesthetic incongruities like facial asymmetry or excessive gingival show [3, 4]. Furthermore, without careful consideration of preexisting dentofacial deformities in patients, standard FFS maneuvers may even exacerbate facial disharmony and provide inadequate correction for patients seeking a feminine appearance [5]. In this chapter, we outline our approach

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to the preoperative evaluation of patients, delineate surgical considerations specific to the FFS patient, and finally describe case examples of patients undergoing both orthognathic surgery and FFS.

Preoperative Evaluation

When malocclusion is suspected during an FFS consult, a thorough history, physical exam, and set of photographs and radiographs should be obtained in order to establish a specific diagnosis and facilitate surgical planning (Fig. 9.1). Symptoms of TMJ dysfunction, such as condylar pain, joint clicking, and jaw deviation on opening, should be assessed [6]. Patients who snore at night may be referred for a sleep study to assess for obstructive sleep apnea [7] .

Next, the status of dentition, including any missing teeth, crowding, and tooth inclination, should be evaluated. Occlusion, which refers to the overlap and interdigitation of maxillary and mandibular teeth, should be thoroughly described [9]. The Angle classification can be used to describe occlusion in the anteroposterior dimension in the sagittal plane (Table 9.1) [10]. Vertical maxillary height deficiency or excess can be assessed based on incisor show at repose, while a transverse jaw size discrepancy may be indicated by a posterior crossbite [8].

Imaging is useful for both evaluation and virtual surgical planning. If virtual surgical planning is being used, a cone beam CT is obtained and can be reformatted into a panorex and lateral cephalogram. A panorex is useful for evaluating the status of the TMJ, the condyles, and the mandible. A lateral cephalogram reveals sagittal relationships and can be used for skeletal cephalometric analysis [11]. Cephalometric analysis evaluates the anteroposterior and vertical relationships of the mandible and

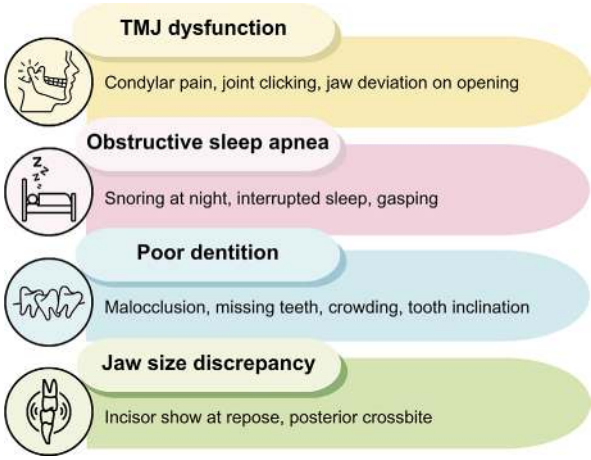

Fig. 9.1 Orthognathic considerations for FFS

Table 9.1 Angle's classification of malocclusion

Normal	Mesiobuccal cusp of the maxillary first molar aligns with the buccal groove of the mandibular first molar
I	Mesiobuccal cusp of the maxillary first permanent molar occludes with the mesiobuccal groove of the mandibular first permanent molar Misalignment of maxillary and mandibular arches
II	The molar relationship shows the mesiobuccal groove of the mandibular first molar is DISTALLY (posteriorly) positioned when in occlusion with the mesiobuccal cusp of the maxillary first molar associated with retrognathia
Division I	Large overjet from proclined maxillary teeth
Division II	Maxillary central incisors are retroclined in compensation. Deep overbite
III	Mesiobuccal cusp of the maxillary first permanent molar occludes DISTALLY (posteriorly) to the mesiobuccal groove of the mandibular first molar associated with prognathia

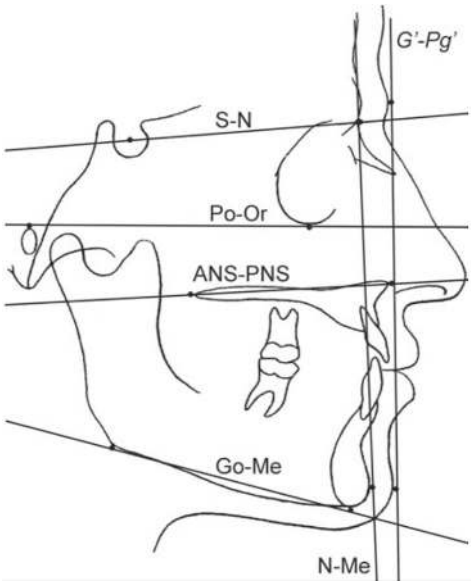

Fig. 9.2 Sample lateral cephalometric tracing

the maxilla with the cranial base and with one other and can help guide orthognathic treatment [10]. A sample lateral cephalogram with cephalometric landmarks and tracings is illustrated (Fig. 9.2).

Understanding soft tissue anthropometrics is crucial in the FFS patient. Farkas et al. found key differences in facial height and width measurements in North American men and women [12]. Upon comparison of Caucasian men and women, most notable are differences in zygomatic and gonial width, upper and lower face

height, and alar base width (Fig. 9.3 and Table 9.2). [8] Surgeons should thus be aware that orthognathic movements resulting in a wider, longer face can result in a more masculine appearance in patients undergoing FFS. Thus, the authors recommend staging orthognathic surgery prior to FFS in anticipation of these anatomical changes.

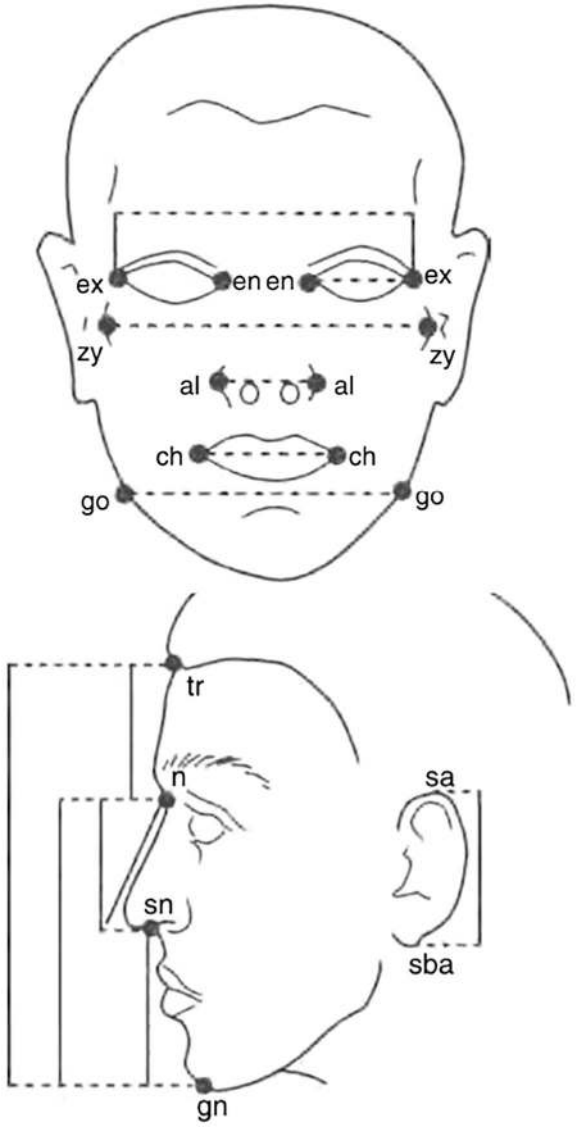

Fig. 9.3 Facial soft tissue anthropometric reference points

Table 9.2 Anthropometric differences between men and women [12]

	Male	Female
Zygomatic width (zy-zy)	137 mm (4.3)	130 mm (5.3)
Gonial width (go-go)	97 mm (5.8)	91 mm (5.9)
Forehead height (tr-n)	70 mm (6.4)	63 mm (6.7)
Lower face height (sn-gn)	72 mm (6.0)	66 mm (4.5)
Nasal base width (al-al)	35 mm (2.6)	31 mm (1.9)
Nasolabial angle	99 mm (8.0)	99 mm (8.7)
Nasofrontal angle	131 mm (8.1)	134 mm (1.8)

Timing of Treatment

Once the need for orthognathic surgery in the FFS patient has been established, treatment should be properly planned and sequenced. During initial consultations, it is important to set appropriate expectations about the duration of treatment with the patient, who may be anxious to proceed with FFS surgery to address gender dysphoria. It may be helpful to emphasize that orthognathic treatment can dramatically improve aesthetics and lay the groundwork for a superior FFS result [8, 13].

Third molars may be extracted either 6 months prior to or at the time of orthognathic surgery [14]. Traditionally, patients undergoing orthognathic surgery require orthodontia both preoperatively to properly align the arches and correct dental compensations for malocclusion in order to maximize skeletal movements and postoperatively to fine-tune occlusion [15]. Alternatively, some patients may be candidates for a surgery-first approach with postoperative orthodontia only [16]. Although data suggests that the surgery-first approach may shorten overall treatment time in select patients with no overall increase in complications, patients should be counseled that postoperative orthodontia still requires an average of 45 weeks to complete [17, 18].

Further surgery-first approach is more difficult to predict and determine final occlusion. The authors advocate waiting at least 6 months after completion of postoperative orthodontics to undertake FFS although upper face surgery may be considered earlier if the upper and lower face FFS procedures are staged. The authors do not recommend performing mandibular orthognathic surgery and mandibular angle shaving procedures simultaneously. Of course, mandibular orthognathic surgery and a genioplasty are often performed together. Furthermore, it is possible to perform isolated Le Fort I osteotomies for maxillary adjustment in addition to feminizing jaw contouring. However, patients with malocclusion often require manipulation of both the maxilla and mandible, and often the chin; this warrants staging of orthognathic surgery prior to feminizing genioplasty and gonial angle reduction. In addition, rhinoplasty should not be performed at the time of orthognathic surgery given its effects of nasal proportions and aesthetics.

Surgical Techniques

The primary surgical techniques in orthognathic surgery include Lefort I osteotomy and bilateral sagittal split osteotomy (BSSO) and, when performed in conjunction, are termed bimaxillary surgery [19]. Osseous genioplasty is an adjunctive procedure discussed in a separate chapter. Bimaxillary surgery can correct malocclusion through advancement, setback, and rotation of the maxilla and the mandible. Traditionally, the maxilla is addressed during surgery prior to the mandible although some surgeons may opt to perform the BSSO first [20].

A key consideration during surgical planning is the anticipated effect of orthognathic surgery on facial features that may either feminize or masculinize the face. We discuss the effects of orthognathic maneuvers on facial length, chin prominence, and nasal prominence.

Facial Length

As previously mentioned, an increased facial height is generally a masculine trait [12]. "Long-face syndrome" is the appearance of an excessively long facial profile, particularly the lower third of the face, that can occur due to vertical maxillary vertical excess, posterior vertical mandibular vertical deficiency, and/or anterior mandibular vertical excess [8]. It can manifest as an anterior open bite with lip incompetence and mentalis strain [21]. In these patients, shortening the face, for example, through Lefort I impaction in patients with maxillary vertical excess, not only improves overall facial aesthetics but also feminizes the face [22–23]. Conversely, lengthening the face, for example, through maxillary downgrafting to correct vertical maxillary deficiency, may improve facial aesthetics overall but could result in a more masculine-appearing profile, which surgeons should be aware of when planning orthognathic surgery prior to FFS [24].

Chin

A masculine chin is broad, tall, wide, and projected compared to a feminine chin which is narrow, pointed, short, and tapered [5]. Orthognathic surgery can have profound effects on chin projection. The occlusal plane angle is the angle between

SN (sella-nasion) and the occlusal plane. Patients with a steep occlusal plane angle can have a weaker lower third of the face associated with under-projection of the mandible. Maneuvers such as counterclockwise rotation of the mandible, for example, to address vertical maxillary excess, or mandibular advancement can result in increased chin projection [8]. In order to mitigate these masculinizing orthognathic maneuvers, surgeons may plan for a setback genioplasty at the time of FFS.

Nose

Masculine noses tend to have a decreased nasofrontal angle, decreased nasolabial angle, and wider alar base compared to feminine noses [1]. These anthropometric standards are important to consider when performing Lefort I advancement, which tends to decrease the nasofrontal angle (masculinizing), increase the nasolabial angle (feminizing), and widen the alar base (masculinizing) [25]. The widened alar base can often be ameliorated by an alar base cinch suture during the time of orthognathic surgery, which is particularly important in patients who desire a feminine-appearing face [8]. These patients may ultimately require an alar base reduction depending on their evaluation after recovery from orthognathic surgery.

Concluding Remarks

Preexisting dentofacial deformities and their surgical correction are important to consider when performing facial feminization surgery. Particularly, preoperative consultation should review TMJ dysfunction, obstructive sleep apnea, poor dentition, and jaw size discrepancy. Prior history of orthognathic surgery should be considered, surgical timing of orthognathic surgery in relation to FFS, and finally, the ultimate effect on nasal, chin, and general facial aesthetic proportions. We provide a key case example that exhibits a staged FFS procedure with forehead contouring and brow lift followed by orthognathic surgery and rhinoplasty (Fig. 9.4).

Fig. 9.4 Courtesy of Dr. Liu. Preoperative (first and third columns) and 1-year postoperative photos (second and fourth columns) of a patient who underwent staged FFS with Dr. Tommy Liu. Key procedures in the first stage included type 3 frontal setback and coronal brow lift. Second stage procedures included a LeFort I (4 mm anterior advancement, 3 mm vertical impaction), BSSO, and chin contouring. Third stage procedures included fat grafting to the malar, temple, upper lip, and lower lip and an open septorhinoplasty (low-strip pushdown dorsal preservation, dorsal osteoplasty to convert an S to V hump, structured polygon tip-plasty) with bilateral septal extension grafts, bone dust to radix for camouflage, and bilateral inferior turbinate submucous resection

Critical analysis of the result from Dr. Liu: She has a residual dorsal hump, and her dorsal aesthetic lines are too wide at mid vault. If I were to do her surgery today, I would add bilateral shoulderectomies (slicing the excess prominence off the mid vault dorsal aesthetic lines, then reapproximating the upper lateral cartilages to the septal T to narrow and lower projection of the cartilaginous dorsum)

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Chapter 10
Performing Chondrolaryngoplasty for Facial Feminization

Chris T. Zhao, Ryoko Hamaguchi, and Abie H. Mendelsohn

Introduction

Chondrolaryngoplasty (tracheal shave) was initially described by Wolfort and Parry in 1975 and further modified by Wolfort in 1990 [1]. This operation serves to reduce the prominence of the thyroid cartilage – commonly referred to as the Adam's apple – a feature that is socially and culturally associated with a male gender presentation. Anatomically, the anterior lamina of the thyroid cartilage enlarges and projects anteriorly during typical physiologic male puberty, resulting in a more prominent laryngeal contour compared with postpubescent female neck anatomy. Moreover, the anterior borders of the thyroid cartilage create a sharper angle in males, which accentuates the more anterior position of the laryngeal prominence.

Historically, chondrolaryngoplasty was performed through a cervical skin incision with subperichondrial exposure of the thyroid lamina, followed by careful reduction of the anterior cartilage. Over time, however, additional surgical techniques have been developed to minimize visible scarring and expand surgical options, including transoral and remote-access transcutaneous approaches.The purpose of this chapter is to (1) to understand preoperative considerations, including

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contraindications, aging considerations, and patient expectations prior to surgery; (2) to highlight anatomic factors of the physiologic male sex characteristics of the neck contour; (3) to discuss various operative techniques performed during chondrolaryngoplasty, including transcutaneous, transoral, and endoscopic transoral approaches; (4) to review the potential risks and complications associated with chondrolaryngoplasty; (5) to elucidate how chondrolaryngoplasty may be performed in coordination with other facial feminization procedures versus as an individual operation. In preparing this chapter, we hope to provide surgeons with both technical and clinical considerations when performing chondrolaryngoplasty in the context of feminization.

Preoperative Consultation

Surgical Indications

During initial consultation, it is important for the surgical team to understand the indications for chondrolaryngoplasty in a given patient. The discussion should review the patient's personal experience of gender dysphoria and discomfort, notably as it pertains to their experience with their prominent thyroid cartilage [1–3]. The proposed surgical procedure can help achieve a more feminine neck contour or a less masculine contour. This distinction is a critical aspect which the provider must give specific attention to as TGD individuals within their own unique journey of gender transitioning do not uniformly seek a more feminine presentation [3]. Ultimately, there is no objective grading system to determine the necessity of chondrolaryngoplasty. The decision is based on the patient's dysphoria and discomfort. Therefore, objective appearance is not included in surgical candidacy. For instance, some TDG may demonstrate only mild thyroid prominence, demonstrate cervical adipose tissue prominence, or maintain cervical facial hair all of which may serve to obscure objective appreciation of the typical "Adam's apple." Nonetheless, they may present with severe dysphoria, even more substantive of other TGD individuals who demonstrate objectively large and prominent thyroid cartilage notches. Therefore, it is important to listen and understand each individual's motivations for pursuing surgical consultation. Ultimately, chondrolaryngoplasty has demonstrated to offer TGD patients a more confident and comfortable standing in social interactions, ultimately improving overall quality of life and psychosocial well-being [2].

However, despite the importance of these discussions, objective assessment of gender dysphoria and confirmation of the patient's mental health capacity to tolerate the stress of surgery are essential. While it is common for TGD to have been evaluated by mental health specialists prior to surgical consultations, it is critical to confirm this aspect of care. Permission should be sought to create open dialogue with the patient's mental health specialist as well as obtaining documentation confirming

the diagnosis of gender dysphoria, the presence and treatment of mental health diagnoses, as well as the appropriateness of proceeding with surgical intervention. Lastly, the practice of regular pre- and postsurgical photo documentation is recommended for the benefit to both surgeon and patient toward accurate assessment and evaluation of surgical outcomes.

Anatomic Considerations

During the preoperative consultation, the surgeon should analyze the anatomy of each patient. Particularly, they should carefully palpate both the thyroid and cricoid cartilage, highlighting the differences of these two structures in a manner understandable for the patient. Moreover, chondrolaryngoplasty targets the more prominent thyroid cartilage, the peak of which is formed by the fusion of the cartilaginous quadrilateral laminae, creating a pyramidal-shaped structure of the thyroid notch [4]. In contrast, the cricoid cartilage, located inferiorly, is a complete ringed cartilage that provides the foundation of the larynx and maintains the consistent diameter which is critical for airway patency [5]. Moreover, during the palpation and education, focus should be on the cricoid cartilage, which is not a gender-dominant feature of the neck. Cricoid cartilage visibility is seen commonly in both cis- and trans women and is not addressed during the "tracheal shave." An upfront discussion of this critical anatomic basis of chondrolaryngoplasty will focus expectations following surgery (Figs. 10.1 and 10.2).

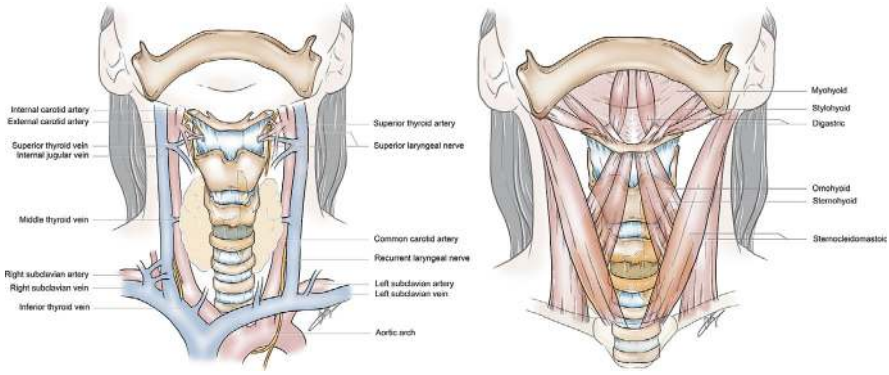

Fig. 10.1 Anatomic considerations of chondrolaryngoplasty (anterior view). (Copyrights retained by Dr. Ryoko Hamaguchi)

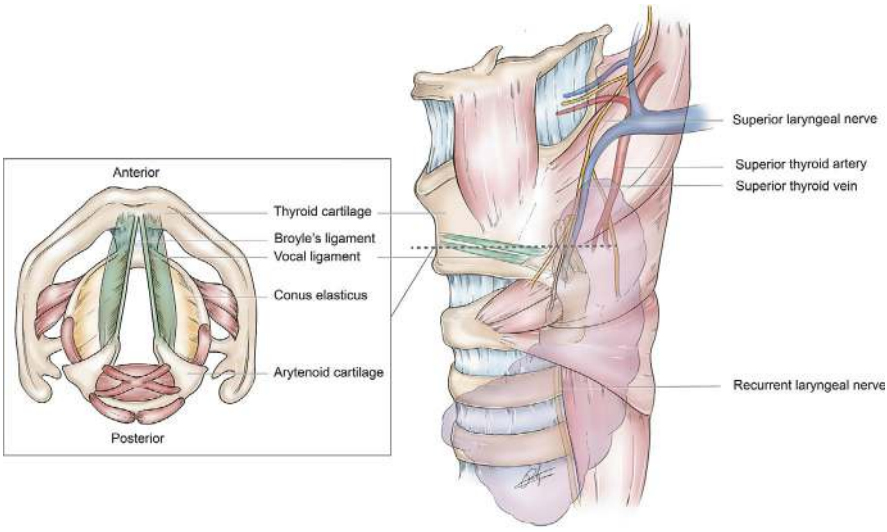

Fig. 10.2 Anatomic considerations of chondrolaryngoplasty (sagittal view). (Copyrights retained by Dr. Ryoko Hamaguchi)

Aging Considerations

In addition to analyzing the extent of the laryngeal prominence, aging-related changes must also be considered in order to achieve optimal results. Concerns include decreased skin tone and elasticity leading to sagging skin, deep wrinkles, and a less defined neck contour. Additionally, age-related fat redistribution can lead to the accumulation of submental fat, further obscuring the cervicomental angle [6, 7]. In order to achieve desired aesthetic results specific to the neck contour, chondrolaryngoplasty may be combined with other procedures distinct from gender-affirming goals, such as neck lift, submental liposuction, or skin resurfacing [6–10].

Contraindications and Limitations

There are only a few contraindications that should preclude certain patients from chondrolaryngoplasty. First, patients with medical comorbidities that are not suitable for general anesthesia are not candidates for chondrolaryngoplasty. Similarly, patients with severe mental health diagnoses may similarly be unsuited for the stresses of surgery and postoperative recovery. Therefore, comprehensive preoperative medical and psychologic evaluations should be carried out when appropriate. Finally, pediatric and adolescent gender-diverse patients are not appropriate candidates for chondrolaryngoplasty consideration. This age requirement is set in order to allow for the completion of laryngeal cartilage growth. The larynx, including the

thyroid cartilage, continues to grow and develop into late adolescence [11]. Performing this surgical procedure before growth is complete can risk ongoing growth and recurrence of the gender-dominant "Adam's apple." As such, this surgery is not appropriate for younger patients.

Regarding limitations of the surgery, patients who have undergone recent neck soft tissue surgery (liposuction, neck lift) should wait at least 3 months prior to receiving chondrolaryngoplasty. Residual swelling and inflammation from the previous surgery may obscure anatomic landmarks, making dissection more challenging and increasing the risk of injuring nearby structures. Patients with underlying midline cervical pathology (most commonly seen with untreated thyroglossal duct cysts) should have these anatomical abnormalities identified and managed either prior to or combined with chondrolaryngoplasty as appropriate.

Perioperative Management

In terms of surgical planning, depending on the approach utilized, the procedure can require between 20 and 90 min of surgical time. The more complex approaches and techniques are usually performed with general anesthesia though for direct open approach, local anesthesia with or without sedation is certainly a well-described strategy. Postanesthesia care does not necessitate additional safeguards or requirements about the protocols for the level of surgical anesthesia, particularly ensuring adequate pain control, initial PO intake, and absence of dyspnea [3]. In cases where intraoperative challenges or even complications have occurred, overnight observation should be considered.

Perioperative Considerations

Selection of the anesthetic technique for chondrolaryngoplasty is guided by the operative approach, with prior descriptions ranging from local anesthesia and IV sedation to general anesthesia using either a laryngeal mask airway (LMA) or endotracheal intubation. While standard anesthesia risk stratification recommendations would follow depending on anesthesia choice, patient age, and comorbidities, no additional surgical specific preparations are required.

When chondrolaryngoplasty is performed without additional concurrent gender-affirming procedures, use of general anesthesia via laryngeal mask airway (LMA) may be practiced when the open cervical incisional approach is performed. The option for LMA typically provides several advantages over endotracheal intubation, but with chondrolaryngoplasty, the LMA is particularly helpful allowing for intraoperative indirect laryngoscopy needle localization of the vocal cords [12]. Indirect laryngoscopy can be performed with an LMA in place, facilitating accurate placement of the localization needle which has been suggested to reduce the risk of vocal cord injury [13]. Additionally, the LMA is associated with a lower incidence of

hypoxemia and postoperative cough postoperatively compared to endotracheal intubation, making it an attractive airway option for certain surgical scenarios [13].

In contrast, general anesthesia with oral endotracheal intubation is required when either a longer operating time will be needed or when additional laryngeal manipulation will be required. Such scenarios include when chondrolaryngoplasty is performed along with facial feminization reconstruction and when transoral (transvestibular) approaches are performed requiring the highest level of airway safety as endotracheal intubation provides a secure airway by passing through the vocal cords and into the trachea, preventing aspiration and allowing for controlled ventilation. It also facilitates positive pressure ventilation, which can be crucial in maintaining adequate oxygenation and ventilation during more complex surgeries. While the endotracheal tube may cause some postoperative discomfort, such as sore throat or transient hoarseness, its benefits in providing a secure and controlled airway often outweigh these drawbacks [14, 15]. However, it is not uncommon for surgeons who perform open cervical incisional approaches to similarly feel that endotracheal intubation is the preferred airway option. In these cases, needle localization of the vocal cords can still be accomplished via suspension direct laryngoscopy prior to establishing the sterile surgical field.

The use of paralytics, or neuromuscular blocking agents, is routinely requested to minimize patient movement when stimulating the sensitive airway afferent nerve pathways during chondrolaryngoplasty. Additionally, when utilizing complete muscle relaxation, paralytics allow the surgeon to perform unfettered strap muscle dissection with cautery which is of critical importance during the transoral approach.

Surgical Techniques

Chondrolaryngoplasty can be performed as a stand-alone surgical procedure or in combination with other gender-affirming procedures. However, most applicable for the transvestibular approach, a unique opportunity exists when combining this approach with transvestibular genioplasty. When combined with other FFS procedures, chondrolaryngoplasty can be completed at any convenient point in the surgical agenda. Chondrolaryngoplasty may also be performed concurrently with voice feminization surgery (VFS) which provides gender-affirming adjustments in vocal pitch and quality. In the author's experience, when combined, the VFS is performed first to offer cartilage stability which is a fulcrum point during suspension laryngoscopy utilized in most VFS surgical techniques.

Vocal Fold Localization Techniques

There have been two techniques described for vocal fold localization during chondrolaryngoplasty. In order to achieve optimal gender-affirming outcomes, precise localization of the vocal cord attachment (Broyles ligament) is essential to ensure preservation of vocal function and to minimize risk of vocal cord injury. The two commonly practiced techniques are needle localization and the anatomic landmark. While a given surgeon's preferred method is primarily based on expertise and experience, we find that plastic surgery and general otolaryngology trained surgeons typically utilize the needle localization technique whereas laryngology and advanced voice trained surgeons will opt for the less invasive anatomic landmark technique.

The needle localization technique can be performed via direct or indirect laryngoscopy. Using indirect laryngoscopy, the patient is induced into general anesthesia using an LMA with bronchoscopy adapter for the ventilation circuit. Through this adapter, a flexible fiberoptic laryngoscope is used to visualize the vocal cords. An assistant is asked to hold the endoscope visualizing the vocal cords while the operating surgeon uses a needle (typically 25 gauge) through the thyroid cartilage directly to cause deformation, or even piercing, of the laryngeal mucosa. This needle serves as a visual guide for the surgeon to continuously readjust the level of cartilage position until the needle exits the larynx just superior to the level of the vocal cords. Monitor the position of the vocal cords relative to the surgical instruments during the reduction of the thyroid cartilage [16, 17]. Needle localization is even more critical in cases where the anatomy is complex or when previous surgeries have altered normal landmarks [12, 18, 19]. When flexible laryngoscopes are not available, this technique can be adapted to a direct laryngoscopy approach. When viewing the larynx directly, endotracheal tube is required as opposed to an LMA. Direct laryngoscopy is performed in the typical manner, ideally achieving suspension laryngoscopy. Under direct visualization, the needle localization can demonstrate the level just superior to the vocal cord attachment, or Broyles ligament.

The anatomic landmark technique is particularly valuable to reduce the time and resources, and when performed, appropriately avoid potential inaccurate localization with needle placement. This alternate involves palpation of specific points on the thyroid cartilage and surrounding structures to estimate the position of the vocal cords, which laryngologists will perform routinely during such laryngeal framework surgeries such as type I thyroplasty. Framework surgery commonly asks laryngeal surgeons to incise the thyroid cartilage by understanding the precise level of Broyles attachments using the superior-inferior measurements of the lateral thyroid ala (or wall). It has been well established over the decades that Broyles ligament will insert into the inner thyroid cartilage at the height of 3/8ths when measuring from superior to inferior. Alternatively, the attachment is just inferior to the midpoint of the superior-inferior length of the thyroid cartilage, when measuring the distance using the lateral ala. This is critical aspect of this technique as if the midline height of the cartilage is used, this technique will be erroneously too inferior all but guarantee injury. By using key landmarks, including the thyroid notch, the midline of the thyroid cartilage, and the cricothyroid membrane, the surgeon can

make educated estimations about the location of the vocal cords without direct visualization [20]. When first attempting the anatomic landmark localization technique, surgeons may consider combining it with their typical method of ensuring vocal cord safety (such as needle localization) over the first several surgeries to ensure comfort with this alternate technique.

Importantly, localization techniques can be applied to the surgeon's preferences independent of the chondrolaryngoplasty approach. Specifically, needle localization can be performed readily with open or transvestibular approaches. However, importantly, with the transvestibular endoscopic-assisted approach, full length of the thyroid ala is visualized and provides excellent exposure to apply the anatomic landmark localization technique.

Incisional Approaches

When using a direct surgical approach for chondrolaryngoplasty, the choice of incision site balances desired aesthetic outcomes with surgical access. The two primary options are the direct overlay incision and the superiorly displaced incision. The decision often depends on factors such as the patient's anatomy, skin quality, and personal preferences regarding scar visibility versus optimal cartilage reduction.

The direct overlay incision is made directly over the thyroid cartilage prominence. This approach offers the advantage of a shorter incision length, typically 3–4 cm, which can be beneficial for minimizing visible scarring. It provides the most direct access to the thyroid cartilage, allowing for precise reduction and contouring [3, 21]. However, the trade-off is that the scar may be more noticeable due to its central location on the neck. This can be a concern for patients who prioritize minimal visible scarring or those with a history of hypertrophic or keloid scar formation.

In contrast, the superiorly displaced incision is placed higher on the neck, often in a natural skin crease [12]. This approach requires a longer incision, typically 4–5 cm, but offers superior camouflage of the resulting scar. The incision is often placed in the submental crease or a high cervical skinfold, which would conceal scars more effectively. This technique may also allow for improved access to the lateral aspects of the thyroid cartilage, facilitating a more comprehensive reduction of the margins. Some surgeons find that this approach provides better visualization of the superior thyroid notch, which is critical for achieving optimal feminization of the neck contour.

Transoral Approaches

The transoral approach to chondrolaryngoplasty offers a scarless alternative to traditional external incisions and can be performed using either direct visualization or endoscopic visualization techniques.

Direct visualization involves accessing the thyroid cartilage through the oral cavity, typically by making an incision in the lower gingivobuccal sulcus [22, 23]. The incision extends to the retromolar trigone bilaterally which exposes the buccal and inferior mandible surfaces. The dissection then transitions to the neck subplatysmal plane, advancing toward the thyroid prominence. Visualization is achieved entirely with headlights and retractors. The strap muscles are divided in the midline raphe, ultimately revealing the thyroid cartilage [24]. With clear visualization of the thyroid cartilage, precise cartilage reduction can be performed. Limitations include significant postoperative swelling given the extensive retraction of muscles, as well as difficulty in resecting the distal thyroid cartilage. The latter limitation may result in incomplete cartilage reduction and may necessitate additional maneuvers or adjustments during the procedure [25, 26].

Endoscopic visualization utilizes a flexible or rigid endoscope to enhance surgical field visualization; this can be performed with or without insufflation [14]. During insufflation, carbon dioxide gas provides a greater potential space between the subplatysmal plane and thyroid cartilage and surrounding structures. Despite this key advantage, the use of insufflation requires careful monitoring of the patient's airway and cardiovascular status given increased pressure within this cavity. On the other hand, the non-insufflation method reduces this risk and relies on natural tissue planes and retraction to create a working space, ultimately providing a more limited view of the surgical field [27].

From the senior author's experience, the endoscopic visualization technique offers several advantages over direct visualization. The magnified view provided by the endoscope allows for more detailed and precise manipulation of the thyroid cartilage, reducing the risk of inadvertent injury to surrounding structures such as the vocal cords and recurrent laryngeal nerve. Additionally, the use of endoscopic instruments can facilitate more delicate and controlled cartilage reduction, potentially improving the aesthetic outcomes [24].

Author's Surgical Approach

The standard approach toward genioplasty is performed via a lower labial incision. With the aid of 4 mm 30° endoscope and curved spatula Bovie, the strap muscles were dissected to expose the length of the thyroid cartilage. The superior-inferior dimension of the cartilage is measured; the Bovie is then used to make the midpoint of this dimension to ensure minimal risk to the vocal folds. The superior portion of the thyroid cartilage, including the notch and anterior lateral ala, is then resected both sharply and with surgical burr. This was performed until both visual and palpable flattening of anterior cervical deformity is appreciated. The labial incision is then closed, ensuring proper suspension of mentalis and subsequent closure of the mucosa. Two case examples of such patients are included (Figs. 10.3 and 10.4).

Fig. 10.3 Preoperative (first and third columns) and 1-year postoperative photographs (second and fourth columns) of a patient who underwent full FFS. Key procedures performed included bilateral coronal brow lift; fat grafting to the temple and malar regions; reduction rhinoplasty with dorsal hump reduction, spreader flaps, cephalic trim, and osteotomies; and a tracheal shave. (Copyrights maintained by Dr. Justine Lee and Dr. Abie Mendelsohn)

Complications

When performing chondrolaryngoplasty, there are several complications that may arise. Some centers employ ultrasound guidance or intraoperative laryngoscopy to enhance accuracy and minimize risks. Direct visualization of the vocal cords with flexible laryngoscopy and intraoperative needle localization of the anterior commissure can help direct the extent of resection, increase safety, and avoid devastating postoperative voice complications.

Meticulous distinction between these cartilages is essential to ensure that only the appropriate portion of the thyroid cartilage is reduced, preserving critical laryngeal functions while achieving the desired aesthetic outcome [28]. Failure to properly identify the level of the true vocal folds can lead to destabilization of the anterior commissure and significant changes in pitch, vocal range, intensity, and vocal quality [29].

There are a number of complications that patients may endure following chondrolaryngoplasty. These include the following:

Fig. 10.4 Preoperative (first and third columns) and 1-year postoperative photographs (second and fourth columns) of a patient who underwent full FFS. Key procedures performed included 3-mm anterior table setback, bilateral coronal brow lift, reduction genioplasty with trapezoidal osteotomy, mandibular angle reduction, fat grafting to the temple and malar regions, and closed rhinoplasty with dorsal hump reduction, osteotomies, and inferior turbinate reduction and a tracheal shave. (Copyrights retained by Dr. Justine Lee and Dr. Abie Mendelsohn)

1. *Vocal ligament transection.* The anterior attachment point of the vocal cords, otherwise known as Broyles ligament, connects to the inner surface of the thyroid cartilage. It is this attachment point which provides the basis of vocal fold vibration and sound production. Using the vocal cords after disruption of this attachment point would be similar to playing a guitar after cutting the wires. During chondrolaryngoplasty, the surgeon removes the prominent cartilage superior to (or above) this critical attachment point. Broyles ligament can be disrupted if the surgeon continues the cartilage removal below this anatomic landmark. This complication should be exceedingly rare. While rates of this complication have not been published, estimates should be an incidence of less than 1%. Postoperatively, the disruption of Broyles ligament will cause immediate and severe hoarseness. Additional symptoms may include elevated level of throat pain, feeling of airway obstruction, dysphagia (difficulty swallowing), and stridor (noisy breathing). In rare instances, subcutaneous emphysema (air trapped under the skin) can also occur.

   Management depends on the timing of identification of the injury. In the best scenario, Broyles ligament disruption is identified either intraoperatively or

immediately postoperatively. If so, the patient should undergo immediate reparative attempts at resuspension of Broyles ligament. Some surgeons advocate for open repair attempts via laryngofissure while some have described resuspension via endoscopic approach. While it is likely that some permanent voice dysfunction results, the vast majority of the impact can be addressed if repaired before scarring occurs. However, for delayed diagnosis cases, the management will depend on thorough laryngeal examination. For limited ongoing structural diathesis, voice therapy may assist rehabilitating vocal function. In more severe cases, where significant anatomic derangement is identified, open surgical repair may be required, which, following the maturation of scar tissue, would most likely require open laryngofissure with soft tissue reconstruction. In all, while Broyles ligament disruption is a rare complication of chondrolaryngoplasty, it represents the most catastrophic surgical complication.

2. *Skin tethering*. This scarring complication occurs when the dermal layer adheres either directly to the laryngeal cartilaginous skeleton or its surrounding myofascial layers. When it occurs, it not only results in severe aesthetic sequelae causing puckering skin, along with pulling during swallowing and speaking. Functionally, the pulling on the laryngeal mobility, skin tethering generally leads to dysphagia by restricting laryngeal elevation during swallowing and chronic throat discomfort. Skin tethering often results from incomplete reapproximation of the surgical plane between the dermis and the deep cervical fascia. Most importantly, the reapproximation of the platysma layer can prevent excessive scar formation from the dermis to the larynx. Initial management involves conservative measures like massage and steroid injections to soften the scar tissue. For more severe cases, surgical revision may be necessary though the recurrence risk is significant as the scar tissue frequently reestablishes across natural fascial planes. Adjunctive techniques such as fat grafting or insertion of artificial planes (e.g., acellular dermal matrices) can improve outcomes. Prevention strategies are to be stressed during open approaches which include careful dissection, maintaining proper surgical planes, appropriate multilevel surgical closure, and early postoperative mobilization. Compressive dressings should be used judiciously to provide support without promoting adhesions.
3. *Laryngotomy* is a serious potential complication of chondrolaryngoplasty [22]. It involves inadvertent entry into the airway during the procedures. In general, when encountered, laryngotomy is created within the supraglottis and does spare the vocal folds directly. However, the opening of the airway does result in acute airway edema (potentially requiring emergent re-intubation or even emergent tracheostomy). Ideally, a laryngotomy is identified intraoperatively, and as such, immediate direct repair is required. To perform the repair, the edges of the mucosa should be carefully approximated and sutured (the authors recommend inverted horizontal mattress sutures with 3–0 Vicryl). It is recommended to close the defect over a passive drain (rubber band or Penrose drain) to facilitate the drainage and prevent the formation of subcutaneous emphysema, hematoma, or seroma, as well as to reduce postoperative swelling.

Following the repair, the patient should be observed in a hospital setting for at least 24 hours to monitor for any signs of airway compromise, infection, or other complications. When chondrolaryngoplasty is performed via a transoral approach (with or without use of endoscopic visualization), the surgery should be immediately converted to an open approach via a cervical dermal incision site to provide the necessary exposure for surgical repair. If the laryngotomy is not recognized until the postoperative period, conservative management of pressure dressings and inpatient observation may be appropriate depending on the clinical status of the patient. Prolonged hoarseness and discomfort are common following a laryngotomy, with symptoms potentially lasting 2–4 weeks as the tissues resolve the significant edematous change.

Of note, patients with previous chondrolaryngoplasty attempts, neck surgery, or history of radiation carry a higher risk as anatomical planes may be scarred and fascial planes obscured. Notably, the presence of subcutaneous emphysema during the early post-chondrolaryngoplasty period must be interpreted as diagnostic of inadvertent laryngotomy causing air to dissect into the soft tissues of the neck and chest. While often self-limiting, severe subcutaneous emphysema cases can lead to airway compression or mediastinitis and should be treated aggressively.

4. *Dysphonia.* Changes to the sound quality or volume is a common short-term postoperative experience following chondrolaryngoplasty. Dissection and resection of the thyroid cartilage cause edema and inflammation in the peri-laryngeal soft tissue [3]. This edema affects the vocal folds leading to temporary changes in voice quality though the duration of the voice change. In addition to surgical edema, other causes include minor trauma to the vocal folds from intubation during general endotracheal anesthesia. Patients may experience 1–2 weeks of mild or moderate decrease in voice quality and volume. However, severe or distressing vocal changes such as a weak or raspy voice or temporary hoarseness in the immediate postoperative period should be evaluated immediately to evaluate for concern of Broyles ligament transection. Initial management involves in-office laryngoscopy to ensure the absence of structural damage. Therefore, supportive care with optimal vocal hygiene recommendations for a minimum of 3 weeks to allow for spontaneous improvement. Patients are advised to rest their voice, stay hydrated, and avoid vocal strain.

   Most cases of postoperative hoarseness resolve within 1–2 weeks as the edema subsides and the tissues heal. Studies have shown that up to 96% of patients experience resolution of hoarseness within 20 days [28]. If the dysphonia persists beyond a few weeks postoperatively, muscle tension dysphonia should be considered, which is a condition where excessive muscle tension affects voice production. Muscle tension dysphonia can develop postoperatively and requires treatment with voice therapy by an experienced speech-language pathologist (SLP).
5. *Surgical site infection* risk is higher in transoral chondrolaryngoplasty compared to the traditional transcervical approach as even with surgical site sterilization, ongoing bacterial contamination is more likely than with aseptic techniques

[23]. Yet comparative published rates of surgical sites infections following transcervical or transoral approaches are unavailable [2]. While offering the advantage of a scarless external result, the transoral procedure introduces unique challenges in maintaining asepsis due to the inherent bacterial colonization of the oral cavity. Preoperative counseling should include a thorough discussion of risks and benefits of the transoral technique; it is important for the surgeon to weigh aesthetic advantages of a scarless approach against the increased risk of infection.

6. *Mental numbness and change in mentum appearance* can occur due to the anatomical proximity of the mental nerves to the surgical field and the unique challenges posed by the transoral route [24]. Moreover, during a transoral approach, dissection and manipulation of tissues in the gingivobuccal sulcus and submental region can inadvertently lead to some degree of temporary disturbance to the mental nerves, which provide sensation to the chin and lower lip. The process involves making incisions in the mucosa, dilating the subplatysmal plane, and carefully navigating around these nerves. This can lead to temporary paresthesia of the lower lip and chin. While typically transient, resolving within 30 days in most cases, this numbness can be a source of significant discomfort and concern for patients and permanent numbness is rare. The manipulation of tissues and the creation of incisions within the oral cavity during a transoral approach can lead to changes in the contour and symmetry of the chin, which may be magnified by postoperative swelling and edema.
7. *Persistent prominence of the thyroid cartilage* after chondrolaryngoplasty can be a source of dissatisfaction for patients [3]. To evaluate the extent of residual cartilage, imaging studies such as computed tomography (CT) imaging provides detailed visualization of the cartilage superior to the level of the vocal folds and helps in planning any necessary revision surgery [19]. Addressing residual prominence inferior to the vocal folds remains a surgical challenge without a clear solution. Surgeons must carefully balance the need for further reduction with the risk of compromising vocal function.

Conclusion

Chondrolaryngoplasty has been fundamental in addressing gender dysphoria among TGD patients. Moreover, there are several methods toward vocal cord localization and incisional approaches (i.e., direct, transoral) in performing this procedure. In the preoperative consultation, attention should be paid toward anatomic considerations, particularly aesthetic goals, aging considerations, as well as discussion of contraindications. Complications of chondrolaryngoplasty include skin tethering, disruption of Broyles ligament, laryngotomy, temporary hoarseness, surgical site infection, mental numbness, persistent prominence of thyroid cartilage, as well as dysphonia or voice changes. While these complications are quite rare, the procedure has tremendous impact on quality-of-life measures among many TGD patients and requires astute qualification of an otolaryngologist to perform safely.

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Chapter 11
Understanding the Soft Tissue in Facial Feminization

Nirbhay S. Jain, Kaavian Shariati, and Nicholas T. K. Do

Introduction

FFS relies not only on attention to skeletal architecture but also on careful consideration of soft tissue structures including facial muscles, subcutaneous fat, ligaments, and skin quality. Furthermore, gender-affirming surgical procedures can modify bony contours—namely frontal bossing through anterior table of frontal sinus setback and prominent chin through genioplasty and gonial angle shaving. Beyond bony structures, the modification of the soft tissue contours can be performed for the purpose of facial feminization. Beginning with the upper third of the face, corrugator resection and temporal augmentation may be performed in order to obtain a softer, rounder cis-feminine aesthetic. Within the middle third, buccal fat excision and malar augmentation may be performed to widen the midface. Finally, the lower third may be contoured with lip fillers, submental liposuction, and chemical denervation of the masseters to soften the lower face. It is important to recognize that

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while many such techniques may help achieve a cis-feminine aesthetic, they additionally may contribute to restoring a youthful appearance in overcoming the natural forces of aging.

Review of Facial Anatomy

The face is a complex interplay of bony and soft tissue structures, the latter of which consists of a network of vessels, nerve, the intricate facial musculature, and glands in support of mastication such as the parotid gland and submandibular gland with their associated ducts.

Fascial Layers of the Face

Traditionally, the face has five general layers: skin, subcutaneous tissue, musculoaponeurotic layer, loose areolar tissue, and deep fascia/periosteum. The musculoaponeurotic layer includes the superficial musculoaponeurotic system (SMAS) and the muscles of fascial expression. The SMAS is a continuation of the temporoparietal fascia and galea aponeurotica of the scalp and platysma of the neck, extending from the zygomatic arch to the platysma at the border of the mandible. Lateral to the lateral canthus, the SMAS is considered fixed and medially, the SMAS is much more mobile. The SMAS invests the muscles of facial expression medially and provides the aponeurotic tissue through which the muscles insert on the skin and allow for facial movement.

A loose areolar plane lies beneath the SMAS and contains the deep fat compartments medially, including the buccal fat pad. Through this layer travels the facial nerve branches as well as the parotid duct and facial vasculature.

Finally, the deepest layer is the periosteum, which is continuous with the parotidmasseteric fascia in the lateral face, deep temporal fascia and periosteum of the scalp, and deep cervical fascia of the neck.

Nerves

The face is innervated by cranial nerve V for sensation and cranial nerve VII for facial expression. Furthermore, cranial nerve V has three core branches: V_1 (ophthalmic) provides sensation to the superior third of the face, with major branches being the supraorbital and supratrochlear nerves. V_2 (maxillary) supplies the midface; major branches here include the, infraorbital, zygomaticofacial, nasopalatine/sphenopalatine, anterior superior alveolar, and greater palatine nerves. Major branches of V_3 (mandibular) include the inferior alveolar nerve and mental nerves.

Cranial nerve VII emerges out of the stylomastoid foramen deep to the deep fascia and branches between the superficial and deep lobes of the parotid gland into its five branches. The most superior branch is the frontal or temporal branch, which follows the path of Pitanguy's line, extending from approximately 1 cm below the tragus to 1 to 1½ cm above the lateral brow. At the level of the zygomatic arch, the frontal branch transitions to run on the underside of the temporoparietal fascia, placing it at risk during a subgaleal dissection. The frontal branch mainly innervates the frontalis muscle. The next branch is the zygomatic branch, which traverses deep in the deep fat pads to provide eye closure through innervation of the orbicularis oculi. Inferior to the zygomatic branch is the buccal branch, which has a high level of redundancy. Again traveling deep in the deep fat plane, the buccal branch is often tested with activation of the buccinator or with the zygomaticus major. The marginal mandibular branch is the fourth branch. Approximately 20% of cases, the marginal mandibular nerve lies 1 cm inferior to the mandibular border; of the 80% of cases that cross the mandibular border, 80% course posterior to the facial artery and then transition anterior to the facial artery superiorly. The marginal mandibular is best assessed with lip pursing and full denture smile through activation of the depressor anguli oris and mentalis muscles. Finally, the cervical branch innervates the platysma, which can be evaluated through full denture smile.

Vasculature of the face is an interplay of the terminal branches of both the external and internal carotid arteries. The facial artery is the dominant blood supply to the midface and mandible, with major branches including the angular artery, superior labial artery, and columellar artery. The superficial temporal artery and lingual artery, both also off the external carotid, provide blood supply to the forehead and tongue, respectively. The major vessel to the nose is the sphenopalatine artery, a branch of the maxillary artery, which is itself off of the external carotid. These vessels interconnect with the ophthalmic artery in the midface and within the Kiesselbach plexus in the nose through the anterior ethmoid vessels.

Facial Fat Compartments

The fat compartments lie between the skin and the fascial layers of the face, which provide contour and bulk to the face. Between the skin and the SMAS layer are the superficial fat pads, which are separated by septae, known as the superficial retaining ligaments. Critical fat pads in this layer include the malar fat pad, a triangular collection of fat pads including the infraorbital fat pad, medial cheek fat pad, and nasolabial fat pad with its base at the nasolabial fold and apex at the zygomatic arch [1–3].

Deep fat pads are located between the SMAS and deep fascia of the face, separated by the stronger deep retaining ligaments. These fat pads allow for gliding of the muscles of facial expression over the deeper fascia. The facial nerve lies on top of most deep fat pads, with the critical exception of the buccal branch, which lies within or deep to the buccal fat pad for most of its pathway. Deep fat pads also have separate lobes that modify the shape and contour. Critical fat pads here include the

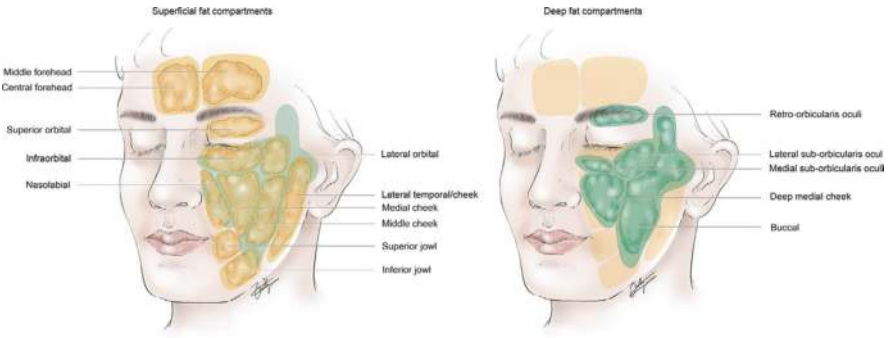

Fig. 11.1 Superficial and deep facial fat compartments. (Copyrights retained by Ryoko Hamaguchi)

suborbicularis oculi fat, the deep medial cheek fat, and the buccal fat pad. Superficial fat provides specific contouring effects to the cheek and midface. Fat can be located by inspection and examination. Careful delineation of these fat pads help to identify deeper anatomic structures as well. Both the deep and superficial fat pads are illustrated (Fig. 11.1).

Infraorbital fat is typically visible. This fat is also known as the malar mound. It exists at the boundary of the eyelid and cheek in the region of the orbicularis oculi. Deep to the orbicularis oculi in this region is the suborbicularis oculi fat (SOOF) as well as the infraorbital nerve bundle. This bundle specifically exists at the junction of the lid-cheek crease and nasojugal crease. The transverse facial artery courses at the inferior malar mound as well.

The nasolabial fat pad is the most medial of the superficial cheek. Its medial border is the cheek and upper lip border. The pad as a whole lies adjacent to medial cheek fat and superior to superficial jowl fat. Its compartment is made of fascia that surrounds facial artery perforators, which is at risk if manipulating this fat pad.

These fat pads transition to the superficial jowl, which defines the boundary between the cheek and chin and lies on top of the buccal fat pad. Thickness of this fat pad defines the depth of the cheek-chin crease, which is also affected by deeper fat pads as detailed before.

Superficial fat compartments do vary in thickness, which results in the development of transition zones where facial nerve branches are at risk during cheek flap elevation. Compartments are also not always located perpendicular or in the same depth of plane; several fat pads included in the superficial fat pad classification overlap each other. Typically, these zones exist at the border between fat pads. The most famous of these zones is McGregor's patch, at the junction of the lateral temporal cheek compartment, the lateral cheek compartment, and the malar mound. Here, the zygomaticus major is adherent to skin and is a common region for buccal branch of the facial nerve injury. Further, these regions of transition zones represent areas of fixation. Though they act as ligaments and need to be released in facial redraping, they are actually dense fascial adherents, and not true ligaments.

The suborbicularis oculi fat (SOOF), which lives deep to the inferior orbicularis oculi, provides the shape of the upper cheek and malar prominence. It lies on the orbital rim and zygomatic arch with a smaller, medial lobe and a larger lateral lobe. Adequate fat here provides the desirable arch and "high" cheekbones. The lateral SOOF extends past the lateral eyelid but does not cover the orbital rim. It in fact lies on the inferior aspect of the rim, running down the maxilla and on top of the periosteum. A lack of SOOF results in hollowing around the zygoma. Critical structures intertwined with the SOOF are the infraorbital and zygomaticofacial nerves. The infraorbital nerve travels through the medial SOOF while the zygomaticofacial nerve is in the lateral SOOF. Boundaries of the SOOF include the orbicularis retaining ligament, which defines its inferior border. Loss of the SOOF can also result in worsening scleral show and exposure keratitis.

The deep medial cheek fat also helps define cheek contour, especially anterior projection of the central cheek. It extends from the lower eyelid to the cheek in a triangular shape, helping to define the nasolabial crease and the tear trough. It lies medial to the zygomaticus major muscle and the deflection of the maxilla and on top of the maxillary periosteum. Inferiorly this runs into the jowling fat pads and positioning of the deep medial cheek fat can affect the cheek-chin boundary and the development of jowling. This structure, along with the SOOF, is a significant driver of the contour of the cheek in both the masculine and feminine face.

Immediately adjacent to the deep medial cheek fat is the buccal fat pad, lateral to zygomaticus major and the maxillary deflection. Descent of this structure provides the classic jowling. The buccal fat pad exists within its own capsule and is extensive in nature. It has become a popular target for fat pad reduction in order to improve the shape of the cheek and decrease jowling. The fat pad often contains the buccal branch and the parotid duct within it, placing both structures at risk during surgical dissection. The boundary of the lower jowl and cheek helps define the zygomaticus major as well, which is also at risk during this dissection. The buccal fat pad is more widespread however, than classically described, extending from the upper mandible to the temporal region. Deep to the fat pad lies the masseter muscle.

The buccal fat pad exists in lobes. The most clinically important lobe is the inferior lobe, as the parotid duct and buccal branch of the facial nerve are superior to this while the facial artery and marginal mandibular branch are inferior; thus, this lobe is safe to manipulate. Additional lobes include the anterior, where the parotid duct and buccal branch live, as well as the intermediate lobe which surrounds the maxilla and the posterior lobe, which defines the masticatory space around the temporalis and contains several extensions, including the superficial buccal and deeper pterygoid, superficial temporal, and deep temporal extensions.

The interplay of muscles of facial expression and fat pads is critical. The retaining ligaments that separate out the fat pads provide structure to the face and discrete "units" for the muscles of expression to mobilize. Further, the superficial retaining ligaments function as insertion of the muscles into the skin, providing anchors for skin motion with and over the SMAS and also niduses for stigmata of facial aging, such as rhytids.

Ligamentous Support in the Face

As described above, the face has multiple retaining ligaments which provide structure and subdivide the facial fat into its distinct compartments, as well as attenuate with aging causing the deflated appearance of the elderly face. Each ligament has a deep retaining section which, after traversing the SMAS, divides into smaller retaining ligaments that form the retinacular cutis and insert onto the skin. Retaining ligaments can be classified as osteocutaneous or fasciocutaneous depending on its origin. Many ligaments have been described; for aesthetic purposes, the critical ones are the temporal, orbitomalar, zygomatic, masseteric, and mandibular ligaments.

Gender-Specific Considerations in Soft Tissue and Methods of Addressing Differences

Forehead Contour

Many of the differences in forehead anatomy between the stereotypically male and female are bony in nature; however, some soft tissue differences do appear. Typically, the male forehead has an M-shaped hairline, with approximately 6–8 cm of distance from brow to the hairline. This is contrasted by the female who has a rounder hairline with approximately a 5-cm distance from brow to hairline. The temporal fossa on a male is typically hollower, as compared to a female, with more prominent corrugator muscles as well.

Hairline and forehead modifications typically require a pre-trichial browlift, which allows for shortening of the brow-hairline distance and contouring of the hairline to provide the rounder appearance. While the senior author does not practice this, some studies have suggested utilizing filler to smoothen the contours of the forehead and achieve a gentler, rounder cis-feminine appearance. Botulinum injections may be performed to soften forehead rhytids. To further reduce the prominence of the forehead, corrugator reduction can be performed at this time with direct resection or with denervation via botulinum toxin injections. For eyebrow position, botulinum toxin may be injected just below the lateral brow in the orbicularis complex for a lateral brow lift, or into the procerus and corrugators for a medial brow lift. Temporal augmentation via fat grafting may be performed to address hollowing.

Malar Width and Projection

Similar to the forehead, the female malar width is often wider than that of the male, which produces the characteristic heart-shaped face, in comparison to the more egg-shaped male face. This includes a prominent zygoma, which can be achieved with

various options of volume augmentation with fat or fillers, as well as a narrower cheek to increase the apparent width of the zygoma, which is often addressed with a buccal fat pad reduction. Of note, the senior does not perform any bony contouring or implant-based procedures of the midface, and resorts to fat grafting of the cheek for a cis-feminine appearance. Furthermore, one should consider the effects of hormone therapy on the malar fat pad; Lee et al. discovered that its volume increased significantly over 2 years of estrogen therapy [4].

Upper Lip

Like other areas of the face, the female lip is more volumized than that of the male, thus warranting augmentation. Furthermore, the male lip is routinely less projected relative to the E-line and S-line when compared to the female lip. This can be address by fat grafting, filler, or dermal grafting—the latter of which is performed by the senior author. In addition to the considerations of volume, the philtrum in a female lip is approximately three times the upper labial height; this is shorter than that of a male. The senior author often performs a Bullhorn technique for lip lift, and utilizes the same incision for the patient's open rhinoplasty (Fig. 11.2).

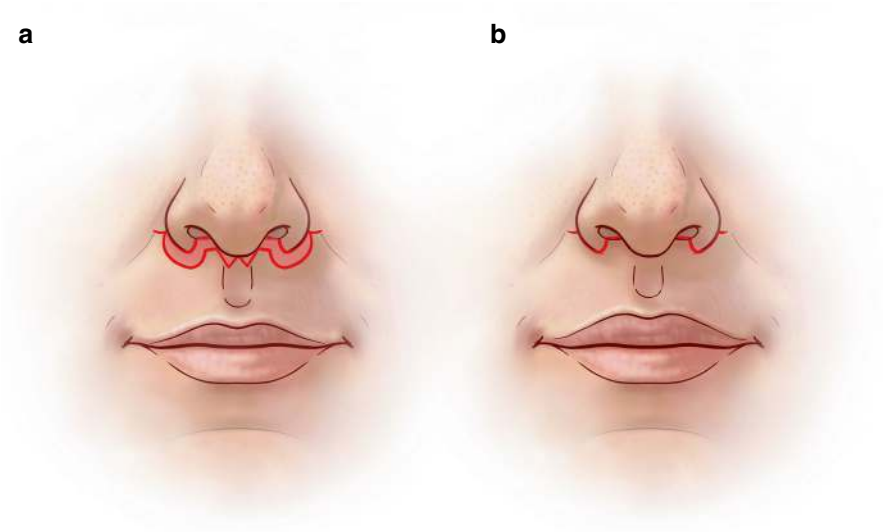

Fig. 11.2 Bullhorn lip lift—incisional technique. (Copyrights retained by JCL)

Mandible and Chin

In order to establish the heart-shaped face of the female, a narrowed mandible is often desired. While bony reduction is often the primary measure to achieve this contour, further refinement may be accomplished with botulinum toxin-based denervation and subsequent atrophy of the masseter muscle. Care should be taken to not inject too anterosuperiorly as this may chemodeinnervate the risorius, thus causing an asymmetric smile. Several studies have suggested that injection of filler may be appropriate augmenting the pogonion, however, should be avoided within the mentalis as this flattens and widens the chin contour.

As mentioned, bony manipulation of the chin is necessary to taper the mandible to the desired point and reduce the squareness of the jaw. After bony manipulation, there may be soft tissue excess resulting in jowling, which may mandate a staged suction lipectomy and neck lift. Patients should be counseled regarding these possible anatomic changes after facial feminization, and be attuned to the chance of requiring further procedures to address them.

Pan-Soft Tissue Thickness of the Face

Beyond visually apparent soft tissue architecture, the aforementioned subsurface tissue components and their dimensions are relevant to gendered appearance. Indeed, in addition to the individual contributions of muscles, fat compartments, and fascial layers, their collective overlay and draping over craniofacial skeletal structures further contributes to sex-suggestive morphology. Males broadly display greater soft tissue thickness across most facial regions, including the forehead, periorbital, nasal, perioral, chin, and lateral mandibular or parotid regions. Among the landmarks falling within these regions, those with the most profound magnitude of male-favored sexual dimorphism include the upper and lower lips, mid-philtrum, mid-masseter, and the occlusal line. Conversely, females are seen to exhibit greater thickness in the infraorbital, buccal, and zygomatic regions, seemingly aligned with expected to house deep fat pad compartments. Body mass index (BMI) and age are also seen to influence thickness, while age trends vary by region, BMI is directly proportional to thickness across the face. Though sexual dimorphism in thickness is significant across all regions in younger, low BMI adults, these differences broadly diminish with increased age and BMI (Fig. 11.3).

These findings highlight soft tissue zones which may be targeted by volume augmentation to better approximate feminine proportions, such as the buccal and zygomatic regions. However, they also identify regions wherein sex-specific subsurface depth and projection of visible anatomy are seemingly dichotomous, and therefore may warrant particular precaution in conceived approaches to volume

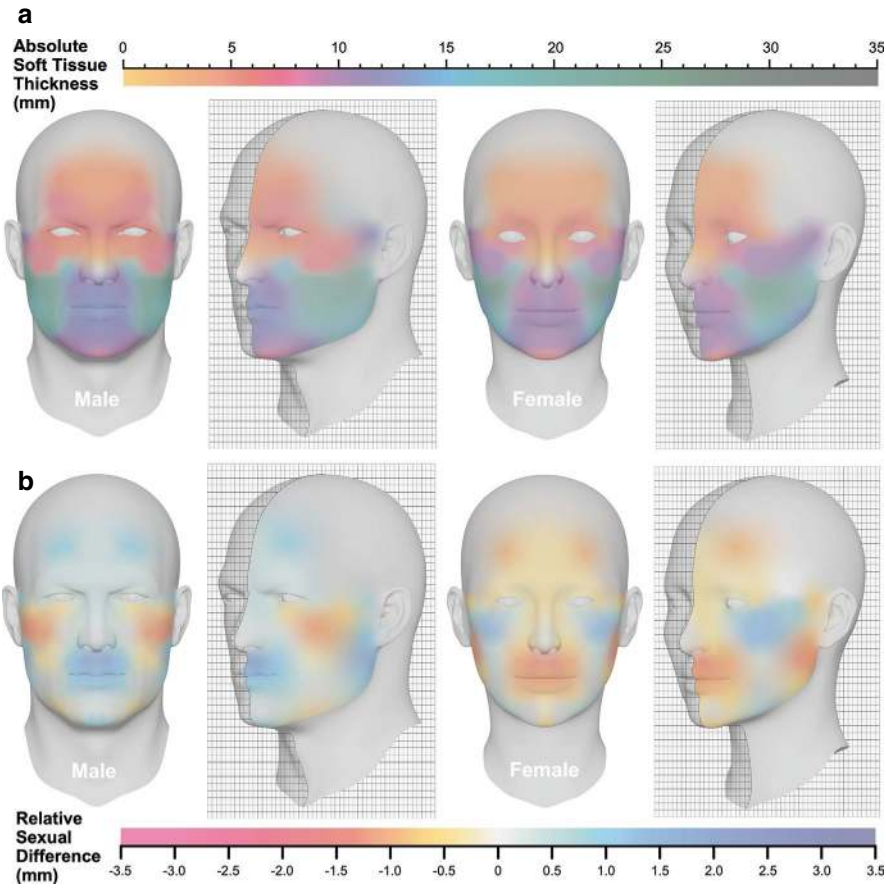

Fig. 11.3 Sex-Specific Facial Soft Tissue Thickness. (**a**) Absolute soft tissue thickness (mm), encompassing multiple age, BMI, and ethnic categories. (**b**) Relative difference in soft tissue thickness when compared to opposite sex (mm), colored at all points of significant sexual dimorphism ($p < 0.05$). Gray regions are unmeasured or non-significant. (Copyrights retained by Kaavian Shariati)

manipulation. For example, when augmenting apparent lip volume to achieve a more feminine appearance, one may consider how this is reconciled procedurally with greater overall soft tissue depth deep to the male lip surface. Further, as many notably sexually dimorphic points are co-localized with regions frequently targeted by osseous modification, it may be worthwhile to consider how soft tissue can be alternatively manipulated in those areas to achieve the intended aesthetic goals.

Methods of Volume Augmentation

Volume augmentation requires surgical intervention and can be divided into alloplastic and autologous methods.

Alloplastic Methods

Alloplastic methods of volume augmentation utilize foreign material to provide increase in volumes of various facial compartments.

By far, the most common method of this is injectable fillers, most commonly hyaluronic acid. Hyaluronic acid is not a permanent lift but is a relatively safe and reliable method for increasing the volume of targeted areas. The average length of effect is approximately 6–12 months. These fillers come in various densities and elastic moduli, providing different characteristics and abilities to lift tissue with volume. However, though this is considered a safe and reliable technique, care must be taken with injection, Often, injection is done in the pre-periosteal plane, which allows for avoidance of the Tyndall effect and bluish hues to the skin. Injection in a blood vessel can lead to blindness and the need for administration of hyaluronidase urgently. Overfilling can lead to skin breakdown and ulceration. As with any injection, there is a risk of infection with administration. Brand examples include Restylane and Juvederm. Other forms of fillers include poly-L-lactic acid (Sculptra) which is most commonly used in HIV-induced lipodystrophy as well as calcium phosphate injections, which is considered to be nearly permanent.

Along with fillers, permanent implants can be placed to provide volume augmentation. These are typically made from porous polyethylene (MEDPOR) or polyether-ether-ketone (PEEK). Benefits of implants include the need for one intervention for the effect, instead of repeated injections, as well as customizable design. However, implants do have a higher risk of infection due to the more intensive surgery needed for placement, as well as risk malposition as facial aging takes effect.

Autologous Methods

Autologous methods of volume augmentation focus on the transfer of fat and dermis-fat constructions. Traditional fat grafting involves liposuction from any source on the body, followed by fat processing, and reinjection. Fat grafting usually has 50–60% take from one administration; no method of processing has been definitively proven to be superior than any other technique, though depositing the fat in controlled, small, and slowly developed aliquots does improve grafting take .

At our institution, the senior author favors fat harvesting under handheld suction from the abdomen using a tumescent solution and a superwet technique. This fat is then processed in a centrifuge at 3000 rpm and then injected in 1 cc aliquots over multiple passes.

Dermal grafting involves a direct skin-fat excision that is de-epithelialized and inserted into desired area. This is typically done to the lip for upper lip augmentation at our institution (Video 11.1).

Considerations of Facial Aging

In the facial feminization population, facial aging is still evident and can be addressed through soft tissue manipulation. Though an in-depth discussion is outside of the scope of this text, the basic principles are delineated below.

Stigmata of Facial Aging

Facial aging can be ascribed to two main processes: attenuation of the facial ligament structure and volume deflation of the fat compartments. As the face ages, the volume of the facial compartments decrease, ultimately resulting in lax skin. With concomitant attenuation of the ligaments, the facial structure and remaining fat compartments descend, causing the deflated appearance and deepening of the fold's characteristic of the aged face. This also amplifies rhytid formation, as gravity and loss of skin elasticity causes deepening of the skin.

Classic stigmata of facial aging include temporal hollowing, brow ptosis, and hooding of the eye with fat pad descent. The tear trough deepens and joins the lid-cheek junction. The malar fat pad descends, creating a "baggy" appearance of the midface. The cheek and zygoma flatten as a result. The nasolabial crease deepens and descends. Descent of the masseteric fat pads results in jowling, which extends into the neck.

Addressing Facial Aging

Facial aging must be addressed through an individualized approach, not via a standardized approach. Thus, resection of lax and excess skin alone will not rejuvenate a face without restoration of volume.

Classic targets of skin excision include the browlift, blepharoplasty, and facelift/necklift combination. Importantly, the facelift requires release of the deep retaining ligaments to allow mobility of the soft tissue for a long result. Accompanying these excisional procedures is also manipulation of the fat pads, such as redraping the orbital fat pads in the lower blepharoplasty or reattaching the malar fat pad during a facelift. Occasionally, the subcutaneous plane is used to release deep rhytids of the face; superficial rhytids are often best treated with nonsurgical rejuvenation such as peels, lasers, or dermabrasion.

Much like feminization, treating volume deflation in aging is by volume replacement with fillers, implants, or fat. Traditional targets include the malar region and nasolabial fold. Fillers can also be used to address deeper rhytids as well.

Conclusion

This chapter reviews the key principles of feminization with respect to soft tissue—including ligaments, subcutaneous tissue, and the overlying skin envelope that contributes to our perception of gender and age. We discuss gender-specific differences by anatomic region and present particular techniques for feminization. We consider important nuances to consider with respect to the distribution of fat between male and female faces. In discussing the technical and clinical pearls through anatomy and case examples, we hope to equip plastic surgeons and trainees with helpful points for their approach toward the soft tissue for feminization (Figs. 11.4 and 11.5).

Fig. 11.4 Preoperative (*first and third columns*) and 4-month postoperative photographs (*second and fourth columns*) of a patient who underwent full FFS. Key procedures performed included frontal sinus setback, coronal brow lift, bilateral lateral canthopexies, fat grafting to the temple and malar regions, open septorhinoplasty with bilateral spreader flaps, septal extension graft, tip refinement, osteotomies, genioplasty, and gonial angle reduction. (Copyrights retained by Dr. Justine Lee)

Fig. 11.5 Preoperative (*first and third columns*) and 5-month postoperative photographs (*second and fourth columns*) of a patient who underwent full FFS. Key procedures performed included 2-mm frontal sinus reconstruction (Type 1+), coronal brow lift, reduction genioplasty, gonial angle reduction, fat grafting to the temple and malar regions, dermal fat graft to the upper lip, open septorhinoplasty (dorsal preservation style) with septal extension graft, tip refinement sutures, osteotomies, inferior turbinate reduction, and dermal fat graft to the radix. (Copyrights retained Dr. Justine Lee)

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Chapter 12
Ethnic Considerations During Facial Feminization

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Introduction

When consulting with diverse populations of patients seeking FFS, it is highly recommended for surgeons to recognize and account for potential ethnic and racial variations in facial measurements and proportions. Although race is broadly defined and exists along a spectrum, acknowledging baseline phenotypic differences fosters patient-centered discussions about preserving specific ethnic features. This approach not only respects each patient's cultural identity but also guides the planning and execution of surgical interventions tailored to the unique needs and aesthetic goals of diverse racial groups. Moreover, a systematic review and meta-analysis by Wen et al. found that among 38 studies, there were significant differences in nasofrontal angle, nasofacial angle, nasolabial angle, forehead height, zygomatic width, and total facial height between facial groups of African American, Asian, and Caucasian patients [1]. Another systematic review and meta-analysis by Kurian et al. also

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found that Japanese and Chinese cisgender women have larger mandibular widths compared to Caucasian women [2]. In general, the majority of anthropometric studies tend to determine measurements from either photographs or direct caliper. One major limitation of these methods is inability to account for osseous versus soft tissue contributions to overall face shape. Thus, our group's study in 2024 conducted anthropometric measurements of four major racial groups (African American, Asian, Latinx, and White) based on facial computed tomographic scans from transgender women seeking FFS [3]. Seven out of twelve absolute lower face measurements revealed significant differences between at least two racial groups, which are summarized (Fig. 12.1). Additionally, we summarize the significant differences in relative facial proportions, which includes upper facial height to lower facial height ratio (UFH/LFH), zygoma width to total facial height, and mandible width to total facial height (Fig. 12.2). This chapter will expand upon our group's observations and provide recommendations for ethnic considerations when performing FFS for ethnically diverse patient populations.

Forehead

While cisgender African American males have been shown to have a shorter forehead height compared to their Caucasian counterparts, the opposite has been observed among females [4]. In general, cisgender African American and Asian

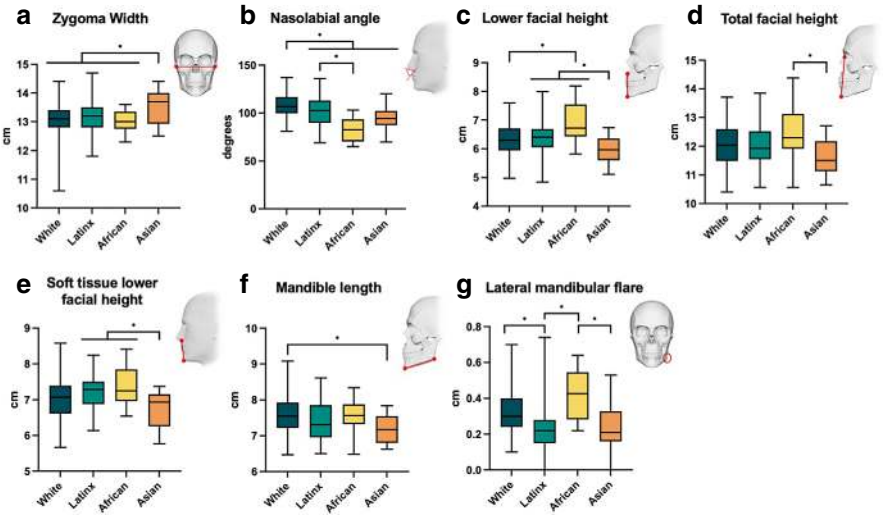

Fig. 12.1 Box and whisker plots of absolute lower face measurements with racial variation. (**a**) Zygoma width. (**b**) Nasolabial angle. (**c**) Lower facial height. (**d**) Total facial height. (**e**) Soft tissue lower face height. (**f**) Mandible length. (**g**) Lateral mandibular flare. *Significantly different at $p < 0.05$. (Copyrights retained by JCL)

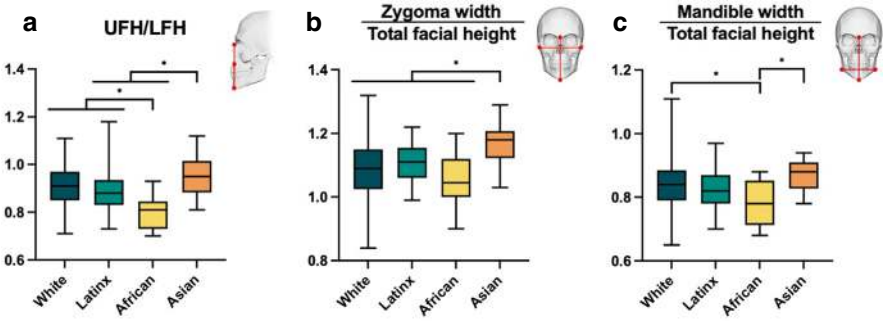

Fig. 12.2 Box and whisker plots of relative lower face proportions with racial variation. (**a**) UFH/LFH. (**b**) Zygoma width/total facial height. (**c**) Mandible width/total facial height. *Significantly different at $p < 0.05$. (Copyrights retained by JCL)

females have been shown to display greater forehead height than cisgender White females [1, 5–7]. This may imply that Caucasian patients require more significant hairline advancement during FFS. While forehead height has been suggested to be one of the most significant facial proportion variabilities among different ethnicities, other factors including age at surgery and extent of hormone therapy also influence forehead measurements [8–12]. Taken together, this highlights the importance of tailoring forehead reduction procedures during FFS to achieve feminization as part of an individualized approach.

Other notable differences reported in the literature include greater forehead inclination in African American females and less supraorbital prominence in Asian individuals when compared to Caucasian females [6, 13, 14]. Our group's work with CT and VSP measurements has demonstrated that Caucasian individuals tend to have significantly greater brow protrusion than Latinx or Asian individuals, with trends of magnitude revealing a stepwise decline from Caucasian to African American, Latinx, and then Asian individuals. These findings are consistent with the existing data, which similarly highlights a stratified trend in brow protrusion where Caucasian and African American populations tend to have more pronounced brow projections compared to Asian populations [4, 14, 15]. Thus, greater globe to forehead distance is often predictive of a higher need for frontal sinus setback in Caucasian individuals in order to achieve traditional feminization of the supraorbital prominence. Further, while our group identified ethnic variation in brow protrusion, this observation may not be associated with a corresponding variation in operative approach for FFS. We found no significant variation across ethnicities in the final magnitude of frontal bone reduction, implying that the degree necessary is similar across groups despite baseline differences in protrusion. This is consistent with prior data collectively suggesting that the magnitude of sexual dimorphism in this parameter is proportional across ethnicities [1, 4, 6, 14, 16].

Zygoma Width

Traditionally, much of the FFS literature distinguishes between a flatter broad zygoma for males and a prominent yet narrower zygoma for females [17]. Although not universally indicated, feminization malarplasty may involve reduction techniques to medialize the zygomatic complexes and reduce midface width, or placement of intraoral malar implants and fat grafting to increase soft tissue triangulation. Our group observed that Asian transfeminine populations tend to have larger absolute and relative zygomatic width compared to other racial groups [3]. This finding has previously been reported in cisgender populations as well [18]. Our group recommends that in order to feminize the face, it is important to keep in mind the relative proportions of the entire face, rather than reducing any single aspect of the face alone. For example, reduction of the midface without mandibular considerations or genioplasty may inadvertently make the facial height appear relatively longer and more masculine, compared to a more desirable rounder and feminine face. Thus, any procedures to reduce the midface should always keep in mind the overall zygomatic width to total facial height ratio. Compared to osseous reduction, augmentation of the malar region through fat grafting is often preferred during FFS to minimize the risk of soft tissue ptosis from extensive lateral reduction of facial width. However, patients with a naturally heart-shaped facial proportion, such as Asian individuals, may already have sufficient cheek prominence and not require additional zygomatic augmentation.

Nose

Feminizing rhinoplasty typically focuses on reducing overall nasal size while enhancing the nasofrontal and nasolabial angles. However, due to consistent interracial variations across genders, addressing the nose in feminizing rhinoplasty for ethnically diverse TGD individuals often presents one of the most complex challenges in FFS. Although reduction rhinoplasty is commonly performed in Western Caucasian populations, other ethnic populations may require augmentation in order to maintain overall facial harmony [19]. A comprehensive understanding of nasal characteristics unique to different racial groups can thus enhance facial harmony while preserving ethnic identity (Fig. 12.3). Much of the literature reports that African American individuals tend to have significantly decreased nasolabial angles, which is consistent among both cisgender females and males [1, 2, 4, 20–22]. Heir et al. discuss in great detail the variations in surgical techniques that may occur between three different types of African noses, as initially categorized by Ofodile [23, 24]. Typical "African" noses with a wide and low nasal dorsum, bulbous tip, and short columella may consider greater dorsal augmentation, tip grafting, columellar grafting, and grafting to the nasal spine and maxilla. "Afro-Caucasian" noses with higher and narrower bridges, less flared alae, and medially inclined nostrils

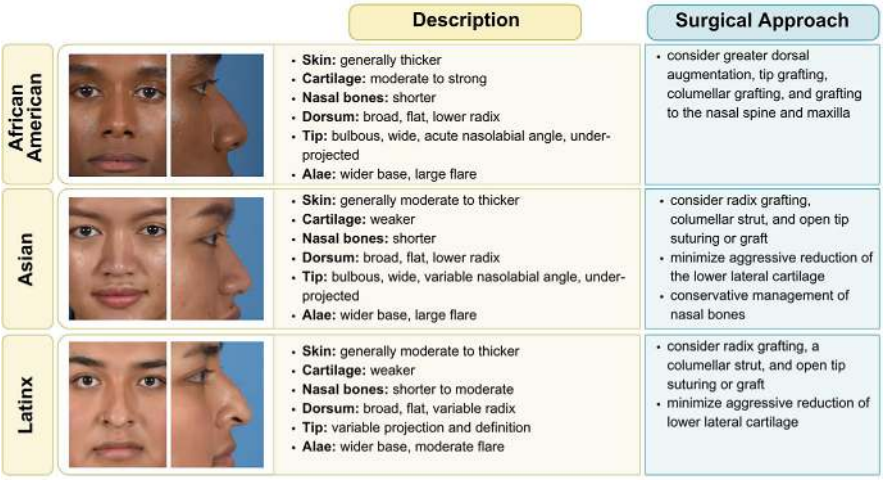

Fig. 12.3 Nasal morphological differences among racial groups. A summary of common differences in skin quality, cartilage, nasal bones, dorsum, tip, and alar differences between African American, Asian, and Latinx noses, as well as surgical approaches. (Copyrights retained by JCL)

may consider hump reduction, osteotomy and infracture, and an appropriate amount of alar cartilage excision. "Afro-Indian" noses with a high and wide bridge, bulbous tip, and greater tip projection may consider a larger amount of alar cartilage excision and more extensive defatting relative to other nose types.

In general, noses of Latinx heritage, or "mestizo noses", are described to have a thick sebaceous soft-tissue envelope, a relatively small osseocartilaginous vault, minimal tip support, a short, hidden columella, and a broad alar base with round nostrils [25–27]. Daniel discusses Hispanic rhinoplasties based on structural variation rather than geographical origins alone, as the term "mestizo" can refer to various origins from Mexico, Central America, or South America, with a broad range of nasal characteristics [28]. He discusses three types of nasal classifications. Type I involves a high radix, a high dorsum, and a nearly normal tip, often referred to as a Castilian nose, which may be treated with functional reduction rhinoplasty, minor tip changes, and conservative dorsal reduction. Type II (Mexican American), which involves a low radix, normal dorsum, and a dependent tip may be treated with radix grafting, a columellar strut, and open tip suturing. Daniel then describes Type III, which involves a broad base, thick skin, and a wide tip deformity, as the typical Mestizo nose. He addresses Type III noses with minimal dorsal alteration but maximal lobular reduction and an open-structure tip graft.

Similar to other racial groups, Asian nasal phenotypes also vary broadly depending on East Asian, South Asian, or Southeast Asian heritage. Nevertheless, much of the literature describes typical Asian noses to include the following features: thick sebaceous skin; a deep, low, and inferiorly set radix; short, broad, and flat nasal bones; wide horizontal ala; and an acute nasolabial angle. Many experts recommend avoiding aggressive reduction of the lower lateral cartilage when refining the nasal

tip in populations with more delicate cartilaginous structures. Such an approach can inadvertently result in loss of tip projection, counterrotation (ptosis), nasal obstruction, and long-term contour irregularities [29]. It is thus important to set realistic expectations in order to balance feminization techniques with consideration and preservation of ethnic features. For extensive tip work, external incisions and skeletonization is often required for the external approach and visualization of the underlying anatomy. In the majority of ethnic rhinoplasties, a columellar strut is required to provide the proper foundation and support required for proper nasal tip reconstruction. Because Asian patients tend to have low nasal bones, conservative management of nasal bones is also essential, as there is high risk of asymmetric nasal fractures when performing osteotomies. Oftentimes, dorsal augmentation and grafting of the radix may be required as opposed to reduction or osteotomy. Overall, it is important to recognize that certain nasal characteristics, such as a low nasal bridge or a thick bulbous tip, may not require correction during FFS, as they may reflect features inherent to an individual's ethnicity and are commonly observed within cisgender female populations.

Facial Height

Addressing facial height proportion is perhaps one of the more straightforward and commonly performed adjustments in FFS, as it can be effectively modified through both hairline lowering and genioplasty procedures. In general, absolute and relative lower facial height tend to be longer in African American individuals and smaller in Asian individuals, when compared to Caucasian individuals [3, 7, 30, 31]. Studies with cisgender populations have consistently indicated that the lower face to total facial height ratio is a sexually dimorphic trait across races, with males typically exhibiting a greater relative lower facial height [32–34]. Villavisanis et al. performed a study in which 1087 individuals rated 827 diverse facial photos on their level of masculinity-femininity and attractiveness [35]. Their findings revealed that among female photos, masculinity was associated with increased lower third facial height ratio. Meanwhile, among male photos, femininity was associated with increased middle third facial height ratio. Thus, it is especially pertinent in the TGD population to focus on achieving balanced facial ratios as opposed to absolute measurements alone. During FFS, forehead reduction or hairline lowering, while feminizing the upper face, may also increase the relative lower facial height and inadvertently cause the lower half of the face to appear more masculine overall. Our findings of ethnic differences in relative facial height suggest that African American patients may benefit from greater vertical chin reduction compared to Asian patients in order to achieve a more feminine facial height ratio, especially when coupled with hairline lowering procedures.

Mandible

Our group previously found no racial differences in absolute mandible width. However, we did observe that Latinx race was significantly associated with decreased lateral mandibular flare compared to other racial groups [3]. FFS approaches often aim to osteotomize or contour the mandibular angle for a softer rounded appearance. Although TGD individuals may benefit from gonial contouring to reduce lateral flare, it is possible that Latinx individuals may require less need for extensive mandibular interventions. While an angulated and square mandible is generally seen as contributing to a more masculine face shape, racial differences in mandibular contour are underreported [36, 37]. Studies within aesthetic surgery literature on Caucasian or Asian patients tend to favor a narrower mandible for femininity [38, 39]. However, Latinx and African American preferences in aesthetic surgery literature are notably lacking. In general, taking a more conservative approach in mandibular contouring can help to avoid soft tissue ptosis and jowling within the lower face.

Facial Soft Tissue Thickness

While much of the focus in FFS is placed on osseous manipulation and visibly apparent soft tissue structures, the collective depth of the various soft tissue layers as they drape over the skull architecture also influences appearance. In addition to patient factors including body mass index (BMI), age, and sex, ethnic background also influences the subsurface dimensionality of soft tissue, thus contributing to overall facial contour and shape [40–42]. In our systematic review of facial soft tissue thickness (FSTT) across standardized craniometric landmarks, we compared interethnic FSTT differences regardless of sex, in addition to interethnic variability in the magnitude of male-female FSTT dimorphism (Fig. 12.4). Among the populations assessed (Caucasian, African American, East Asian, South Asian, and Middle Eastern), African American adults were seen to demonstrate the greatest pan-facial soft tissue thickness. However, additional trend complexity was yielded when comparing individual facial regions. In the perioral and lip area, South Asians and East Asians demonstrate significantly greater depths than Caucasians. Elsewhere in the periorbital area, East Asians were seen to exhibit significantly greater FSTT relative to Caucasian, African American, and Middle Eastern individuals.

Variability was also seen in the relative sexual differences across ethnic groups. In the buccal region, for instance, female FSTT was significantly greater than male FSTT among Caucasians, while the opposite trend was seen for South Asian individuals. However, certain facial regions were found to feature similar trends of

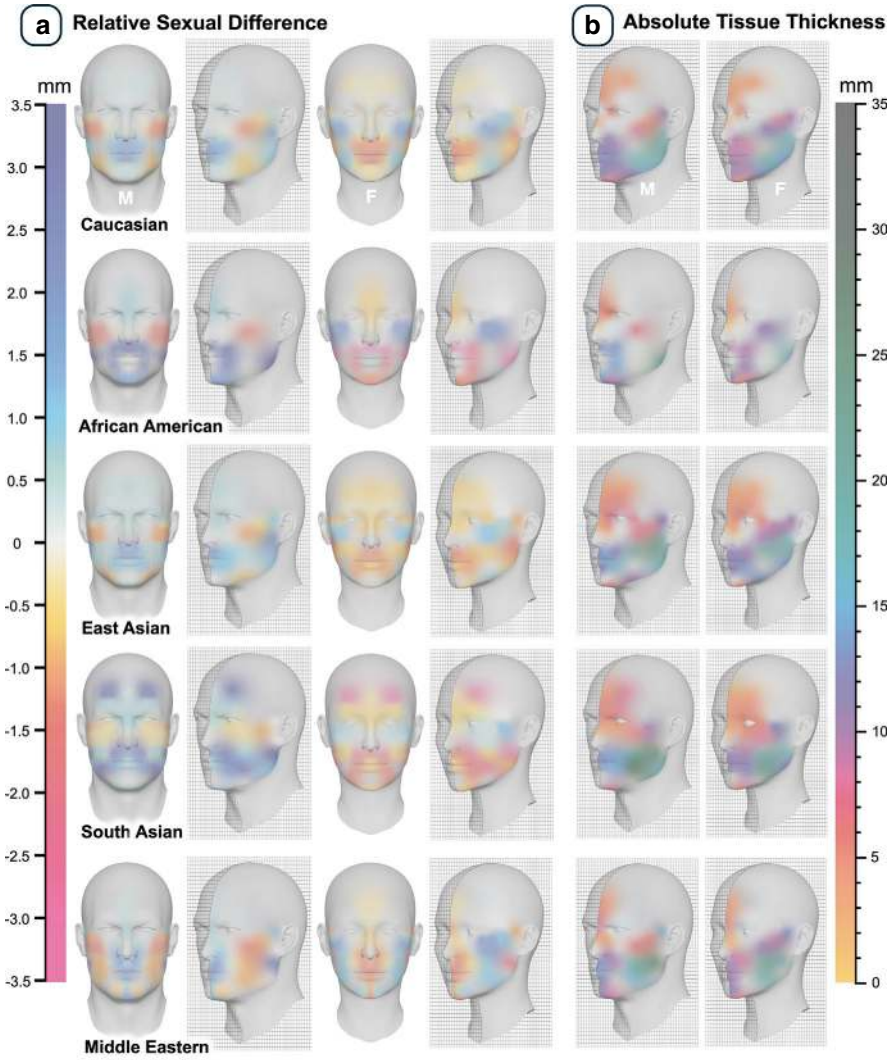

Fig. 12.4 Ethnic variability of facial soft tissue thickness. (**a**) Relative difference in soft tissue thickness when compared to opposite sex (mm), colored at all points of significant sexual dimorphism ($p < 0.05$). (**b**) Absolute soft tissue thickness (mm), encompassing multiple age, BMI, and ethnic categories. Gray-colored regions are unmeasured or are not significantly different between males and females. (Copyrights retained by Kaavian Shariati)

sexual dimorphism regardless of ethnicity. For example, the zygomatic region was among the few where females in each ethnic grouping demonstrated greater FSTT compared to male counterparts. While males generally feature greater FSTT, the magnitude of collective sexual dimorphism across facial landmarks varies significantly between ethnic groups. The absolute magnitude of male-female dimorphism in pan-facial soft tissue thickness is significantly greater in African American and South Asian individuals compared to Caucasian and East Asian individuals. Compared to Caucasians, African American and South Asian individuals demonstrate dimorphism that is particularly male-favored, with males exhibiting depths that are more consistently and profoundly greater in magnitude relative to females.

The contributions of male-female FSTT dimorphism to gendered appearance may be targeted by FFS interventions. The inter-ethnic variability of this male-female dimorphism, as well as in overall and regional FSTT, may further introduce dimensionality relevant to gendered appearance, thus highlighting additional considerations for patient-specific feminization. For example, in FFS-seeking patients who identify as African American or South Asian, aesthetic outcomes may be particularly improved with intraoperative soft tissue manipulation involving more significant debulking to address the greater magnitude of male-female difference. Alternatively, proportionality of facial features may be better approximated by more extensive delivery of fillers or fat grafting to classically prominent regions in females. In another example, baseline ethnic difference in the perioral and lip regions implies that certain groups, such as Caucasians, may be overall benefited by more dramatic lip augmentation, while East Asians with greater baseline thickness may be more appropriately treated with conservative approaches.

Conclusion

Overall, ethnically sensitive approaches and shared decision-making during FGAS can minimize the need for extensive interventions. We have included cases for representation of various ethnic background for facial feminization (Figs. 12.5, 12.6, and 12.7). In order to set realistic patient expectations, we advise against facial morphing technology that does not accurately depict what can be realistically achieved within the operating room. Furthermore, TGD patients of color may choose to bring in photos of their biological mothers, aunts, or other female family members in order to discuss how to achieve a feminine face while still preserving important ethnic features. Although ethnicity is a crude approximation for phenotypic variation, acknowledgment of baseline ethnic differences in facial proportions can allow FFS surgeons to better address which adjustments are achievable for each individual patient.

Fig. 12.5 Preoperative (*first and third columns*) and three-month postoperative photos (*second and fourth columns*) of an African American patient who underwent full FFS. Key procedures included 3 mm anterior table setback, fat grafting to malar and temple regions, sliding genioplasty with lateral reduction, and open septorhinoplasty with dorsal augmentation with dermal fat graft, and septal extension graft, tip refinement sutures, and osteotomies. The procedures combined resulted in a significantly enhanced feminine appearance and correction of right hemifacial microsomia

Fig. 12.6 Preoperative (*first and third columns*) and 1-year postoperative photos (*second and fourth columns*) of an Asian American patient who underwent full FFS. Key procedures included a 4 mm anterior table setback, coronal brow lift, reduction genioplasty, mandibular angle reduction, fat grafting to malar and temple regions, and closed rhinoplasty with dorsal reduction

Fig. 12.7 Preoperative (*first and third columns*) and 1-year postoperative photos (*second and fourth columns*) of an Latinx patient who underwent full FFS. Key procedures included a 4.5 mm anterior table setback, coronal brow lift, bilateral otoplasty, reduction genioplasty, mandibular angle reduction, fat grafting to malar and temple regions, and open septorhinoplasty with spreader flaps, septal extension graft, tip refinement sutures, osteotomies, and alar contour grafts

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Chapter 13
Addressing Facial Feminization in the Non-Binary Population

Peter C. Ferrin and Blair R. Peters

Introduction: The Scope of Facial Gender-Affirmation Surgery (FGAS)

The prevalence of patients seeking FGAS is increasing as both the scientific community and the public more widely recognize its benefits [1]. FFS represents the majority of FGAS procedures that are performed but has also become the dominant terminology used to refer to the broader field of FGAS as a whole [2]. In fact, FFS is frequently used as a catch-all to describe the entire spectrum of possible FGAS procedures, often erasing the visibility of the needs of patients seeking masculinizing facial surgery or those with gender identities outside of transfeminine. The use of the term "FFS" as an all-encompassing concept equivalent to FGAS has become so widely adopted that many individuals are not aware that facial surgery for the purposes of gender affirmation is available beyond strictly feminizing procedures and a transfeminine gender identity. It is true that the majority of referrals and cases in FGAS are performed with a goal of facial feature feminization due both to the profound impact of testosterone on the facial skeleton as well as a greater patient and public awareness of the availability of FFS [3]. However, increasing numbers of patients under the TGD umbrella are seeking both facial masculinization surgery (FMS), as well as facial gender-affirming surgery beyond or even "in between" full masculinization or feminization [3]. Therefore, the term "Facial Gender-Affirming Surgery" provides a more inclusive term covering the spectrum of procedures that can be performed to help an individual achieve a gender-congruent facial appearance [4]. The purpose of this chapter is to discuss an individualized approach to FGAS beyond just the binary of feminization versus masculinization and to provide strategies that can be used to approach each case of facial gender-affirmation surgery specific to individual goals and needs, regardless of gender identity.

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The Dominance of FFS

In general, estrogen has a less powerful effect on facial structures than testosterone [5–9]. Although transfeminine people who take exogenous estrogen therapy will develop some degree of fat redistribution in their facial fat compartments, this will do little to change the underlying skeletal framework. In transmasculine individuals on hormone therapy, testosterone will increase skin thickness, cause significantly increased facial hair growth, and has more powerful effects on the facial skeleton, all of which can lead to a more pronounced masculinization of facial features [10]. Although variable between individuals, this masculinization due to testosterone can be so powerful that many transgender individuals on testosterone therapy do not pursue additional facial masculinization via surgical intervention. In contrast, the skeletal changes brought on by testosterone-driven pubertal changes will not be well masked by estrogen therapy, especially in slender individuals with less facial fat volume. Although choices in gender expression such as hair style, make-up, and presentation can affect social perception, many transfeminine people may seek facial gender-affirming surgery to effectively meet their goals of gender expression and presentation.

Facial appearance strongly affects how an individual is perceived in society, and having facial features that are gender incongruent can be a source of profound external dysphoria and impaired psychosocial well-being. In addition, as an individual's facial appearance is the primary way they present themselves to the world, dysphoria related to facial features may be amplified by how society reacts to these facial features [11]. In these individuals, FGAS is associated with improved quality of life and excellent patient satisfaction post-operatively [12–20].

Despite the significant body of evidence that FGAS alleviates dysphoria, improves quality of life, and is medically necessary, insurance coverage for FGAS procedures has lagged significantly behind that of chest and genital surgery; this has ultimately created a large backlog of people waiting to access this medically necessary care [21, 22]. This is in part because FGAS is not a single operation but rather a host of possible operations which involve both bone and soft tissue reconstruction aimed at addressing different specific facial features that may be causing dysphoria; as a result, tracking outcomes is more difficult due to the inherent heterogeneity and has given rise to some confusion about whether different aspects of FGAS should be considered medically necessary versus aesthetic. There are also general guidelines for facial alterations that will achieve more feminine features, though comparatively little information exists regarding surgical techniques for facial masculinization and face and transgender-specific patient-reported outcome measures are generally lacking [23–25]. The body of literature and outcomes for FGAS are dominated by studies on facial feminization. Outcome studies are important drivers of insurance-based coverage for gender-affirming surgical care and there is a need for studies reporting on outcomes of facial masculinization procedures and affirming facial surgery for non-binary and gender diverse patients. For these reasons, facial feminization has dominated the early era of FGAS.

The Binary Bias and Modern Approaches to Gender-Affirming Care

Medical care has always been influenced by social norms. At its core, the world we live in has been structured around a rigid binary model of gender as well as gender expression. This rigid "male or female" model and the social roles and expectations attached to those roles are exclusionary to many and are not at all reflective of the diversity of the human experience. This so-called "binary bias" affects not just how we are socialized, but how medicine as a field, including models of gender-affirming care—have been structured [26–28].

Gender identity is a deeply personal and individual experience with many gender identities both within and well beyond a binary model. However, the field of gender-affirming surgery has been structured in a way that inherently reinforces a binary-only model of gender. Medical treatments and surgical procedures have traditionally been referred to as "masculinizing" and "feminizing" only; in fact, many CPT codes used to bill for procedures are themselves gendered. This framework has significant limitations and is exclusive of many transgender people who identify as non-binary, gender fluid, or gender queer; therefore, it is not structured to encompass all the people it is supposed to help. Binary language has reinforced the idea that a transition is always linear, progressing from social transition to medical transition with hormone therapy and finally to surgical transition. This linear transition has been assumed to always be from one binary gender to the other as reflected in the terminology "male-to-female" (MTF) or "female-to-male" (FTM). Although this model captures some experiences with gender identity and transition, many are left out by this overly narrow model (Fig. 13.1).

Modern models of gender-affirming care recognize that gender identity is unique to each person. Many individual experiences with gender identity and transition will

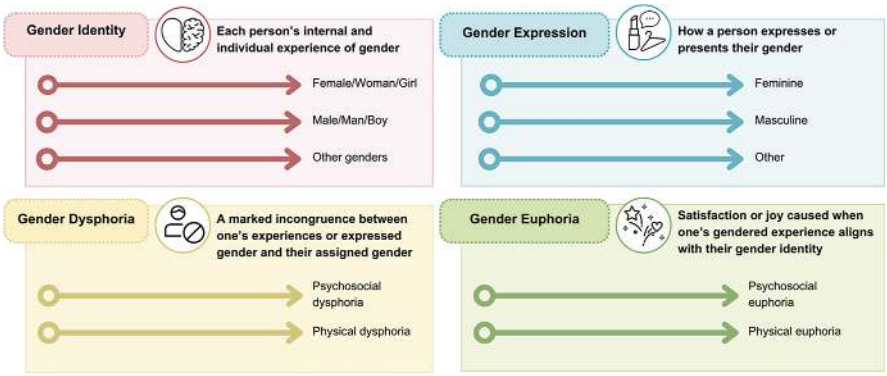

Fig. 13.1 Conceptual overview of gender identity, expression, dysphoria, and euphoria. This figure summarizes definitions and distinctions of gender identity, gender expression, gender dysphoria and gender euphoria. All characteristics are presented as spectra to emphasize their fluid and individual nature

then vary, defying categorization into a binary model. If the individual experience with identity and transition is unique, so will the experiences of gender dysphoria and gender euphoria. It is wrong to assume that each transgender person will be dysphoric from the same features. Despite this, our models of FGAS have in many ways reinforced a binary only model of gender by approaching surgical care through a lens of cis-heteronormativity and the reinforcement of Eurocentric white beauty standards. In other words, FGAS has mainly focused on changing the appearance of an individual's face from what is considered stereotypically attractive male to stereotypically attractive female or vice versa. There is no doubt that this more binary model of care is critically important and represents a desired outcome to many people in the transgender community. However, this model is absolutely not inclusive of all people and often excludes those with a non-binary or gender diverse identity. In fact, 20–26% of all TGNC individuals identify as non-binary, gender queer, or gender diverse [29, 30]. In addition, though studies show that a minority of TGNC individuals seek affirming surgeries, those that do often seek surgical options that are approached through a non-binary lens, deviating from outcomes that would be referred to as traditionally masculine or feminine [29, 31, 32]. What an individual needs to diminish their dysphoria or increase their euphoria and affirm their gender identity will be highly individualized. Not all transgender people were "born in the wrong body", just as not everyone wants to medically transition. The types of surgical procedures will also vary between individuals, even those with similar gender identities. Ultimately, the goal of gender-affirming surgery is to relieve dysphoria and to affirm an individual in their body. As surgeons, our role is to utilize our surgical toolbox to address dysphoria and areas needing affirmation, while minimizing overall surgical risk. Our guiding principle as gender-affirming surgeons is to help an individual physically actualize their internal sense of self.

The scientific literature is increasingly recognizing the need for individual approaches to surgical affirmation. There are numerous reports of gender-affirming chest surgery techniques that do not involve a full mastectomy, as well as techniques that do not involve maintaining the nipples [33]. Genital procedures are increasingly varied. Historically binary procedures such as phalloplasty are now available with numerous options including with or without urethral lengthening, and with or without vaginectomy [34]. Many transfeminine individuals seeking genital surgery choose to forgo the surgical creation of a neovaginal canal and instead opt for vulvoplasty or a range of other gender-affirming genital procedure options [35]. Previously, surgical options that did not aim to achieve a "completely" male or female appearance such as those described above were referred to as "nonbinary" surgical procedures. Although a higher proportion of individuals who identify under the non-binary umbrella are opting for modified surgical options, many binary transgender people will choose these alternatives as well [33]. Ultimately, the reasons for these choices are individual and highly varied, but often represent a desire to achieve improved embodiment (aligning body image with gender identity), easier or faster postoperative recovery, or a desire to only address features that actively drive dysphoria while minimizing surgical risk by not surgically addressing areas that do not cause dysphoria [35]. It is increasingly recognized and understood that

anatomy does not define gender identity. People are increasingly making informed choices for themselves regarding their surgical transition goals, and their surgical and gender care teams should empower them to achieve these goals, especially when they so often involve less surgical risk or lower complication profiles.

The Facial Gender Mosaic

Despite advances in chest and genital surgery and increasing availability of individualized options, FGAS lags behind in its recognition of individual goals and priorities. It is critical to understand that there is no single feature that inherently dictates whether a face is feminine or masculine [24]. Even the most feminine faces will have masculine features. Ultimately, every face is a "gender mosaic" made of many constituents which individually may be perceived as more or less masculine or feminine [11]. There are facial features more strongly perceived as masculine and those more strongly perceived as feminine. The way that all of these features combine and interact together and with choices in gender expression (hair, makeup, clothing, etc.) informs how gender is perceived from facial and overall appearance.

This mosaic model is a helpful tool to approach facial surgery consults. Even in cases where individuals present wanting "full facial feminization", the procedures offered will likely differ between patients. Each face is unique and it is important to understand which features can be altered to shift the facial appearance toward a more feminine or masculine presentation and to share this information with patients during their preoperative visits. Other critical factors such as race and ethnicity must be considered, in addition to familial characteristics. Ultimately, what is important is how the patient feels about their face, not how we as surgeons do. We must also recognize the racial bias that exists in both society and facial surgery, that tends to define aesthetic "ideals" as white eurocentric outcomes which may not match what is ideal to the patient. Most existing data about facial analysis and quantifiable differences between male and female facial structures have been conducted in predominantly white populations which makes this data inherently biased and, therefore, not applicable to all patients [24].

Approaching the Facial Gender-Affirming Surgery Consultation

The most important principle in an affirming facial surgery consultation is to understand an individual's goals and priorities, in addition to which aspects of their face they like and which aspects cause dysphoria. This is important regardless of an individual's gender identity given the amalgam of procedures that fall within the spectrum of FGAS. This discussion should factor in their individual gender identity, the timeline of their transition including whether they have socially transitioned, history of or plans for medical transition (including plans to not medically

transition), and goals for gender expression and presentation. It is important to remember that some individuals seeking FGAS may have socially transitioned, whereas others may seek FGAS prior to socially transitioning for a variety of reasons. It is also important to discuss any prior exposure to exogenous hormones, or the desire for hormone therapy in the future, as hormones cause alterations in facial appearance and the role of how these alterations may impact surgical outcomes should be a thoughtful consideration especially for patients who are not seeking a "completely binary" transition.

More people under the non-binary umbrella are presenting for FGAS. The approach to an FGAS consultation for individuals who identify under the non-binary umbrella should maintain the same core principles as an FGAS consultation for individuals who identify as transmasculine or transfeminine, with an emphasis on understanding a patient's specific causes of dysphoria and definition of a successful outcome. Often, goals are not to fully feminize or masculinize a face but rather to address specific characteristics that cause an individual dysphoria or interfere with their desired gender presentation. However, it is also important to recognize that non-binary people may also want more conventional outcomes from facial surgery. Gender expression and presentation are different from gender identity. The two must be understood as distinct.

Gender identity is each person's internal and individual experience of gender. Gender expression is how a person publicly expresses or presents their gender. This can include behavior and outward appearance such as dress, hair, makeup, body language, and voice. Gender identity and gender expression may not always align, or they may be fluid. It is perfectly valid for a non-binary identifying person to undergo FFS. It is also completely valid for a binary trans woman to only want certain aspects of her face surgically addressed, or even to have a more androgynous facial appearance. It is, therefore, imperative to understand non-binary patients' goals and desires in order to deliver a facial outcome that is congruent with their gender expression and their expectations.

Surgeons can assist in this process by introducing the concept of the gender mosaic. Highlighting a patent's pre-existing facial features that are in line with their goals for gender presentation can also be helpful and affirming, and can help facilitate discussion about realistic outcomes and achieving balance between addressing dysphoria and pre-existing facial features. It is also important to consider the spectrum of masculinization or feminization that can be achieved from each individual component of FGAS based on the patient's anatomy, especially if a patient desires a more androgynous appearance. For example, just because a patient might have a prominent brow ridge and wants it reduced does not mean that they necessarily want it reduced to the same degree as patients seeking maximal forehead feminization might. This may mean a patient that would require a frontal sinus setback for optimal forehead feminization, may benefit from and be more pleased with frontal burring only. That patient may in fact have a goal for brow projection that lies somewhere in between their current forehead shape and the most feminine or masculine-appearing forehead that is surgically feasible. An individual desiring an increase in facial fat volume may require only smaller volumes of fat grafts to achieve their

goals then typically used in facial feminization fat grafting. When having conversations about FGAS goals, it is important to discuss the degree of change that can be achieved versus the degree of desired change with each individual component of the overall FGAS operation.

As our understanding of gender continues to evolve, our language must do the same. FGAS is more than just feminization. Like chest and genital surgery, facial surgery should be personalized to meet individual goals. Gender identity does not necessarily define goals for facial surgery. Understanding your patient, their gender identity, and their gender presentation will guide surgical planning. The following case examples highlight the concept of the facial mosaic and how patients may choose specific components of FGAS while deliberately not choosing to address others in order to achieve ideal embodiment and simultaneously minimize surgical risk (Figs. 13.2 and 13.3).

Fig. 13.2 Preoperative (*first and third columns*) and 1-year postoperative revision photographs (*second and fourth columns*) of a patient who underwent staged FFS. Patient wanted a more androgenous appearance and to keep certain masculine features. Key procedures performed in the first stage included 2 mm frontal sinus setback, bilateral brow lift, hairline lowering, bilateral lateral canthopexies, fat grafting to the malar regions and upper lip, reduction genioplasty, closed rhinoplasty with osteotomies, Weir excisions, and inferior turbinate reduction. Second stage procedures forehead scar revision, temporal brow lift revision, rhinoplasty revision with left lateral osteotomy and derma fat graft to the upper lip. The procedures combined resulted in markedly refined androgenous appearance

Fig. 13.3 Preoperative (*first and third columns*) and 1-year postoperative photographs (*second and fourth columns*) of a patient who underwent staged FFS. Patient wanted to have a more feminine appearance after undergoing FFS with prior surgeon. Key procedures performed in the first stage included tissue expander placement to lower the hairline and chin implant via the submental approach. Procedures in the second stage with Dr. Lee included 4 mm anterior table setback, septorhinoplasty with osteotomies and inferior turbinate reduction, and upper lip lift. Procedures in the third stage with Dr. Lee included scar revision with revision brow lift, revision rhinoplasty with spreader grafts and dorsal rasping, and fat grafting

Conclusion

FGAS comprises multiple procedures that can be combined in different ways to alter many aspects of a patient's facial appearance. This is performed to help patients achieve a gender presentation and expression that better aligns with their gender identity. The concept of a gender mosaic is a useful tool to help both surgeons and patients identify which specific facial features should be surgically addressed to best meet a patients' desired facial surgery outcomes. When approaching surgical consultations for TGD people, it is critical for surgeons to check our own "binary bias". The surgical plan that we deliver is not solely about what we as surgeons want or think a patient needs. We are treating the way a person feels about themselves. Therefore, our outcomes are not always defined by what we think, but what the patient does. Detailed discussions of gender identity, dysphoria, and surgical goals facilitate shared decision-making and alignment on a personalized surgical plan that reflects each patient's individual needs.

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Chapter 14
Managing Anesthesia During Facial Feminization

Christine T. Nguyen-Buckley

Introduction

The safe delivery of anesthesia is challenging during FFS for multiple reasons. First, anesthesiologists need to recognize physiologic effects from hormone therapy and plan for managing an airway with possible previous surgical instrumentation amid a complex craniofacial procedure. In addition, they must embrace a patient-centered gender-affirming approach to care and embody this mindset through the course of a given patient's hospitalization. This chapter aims to do the following: (1) discuss pre-operative considerations specific to the anesthesiology team (i.e. building rapport with patients, review of medical history, relevant medications); (2) highlight intra-operative considerations with respect to potential medication interventions, airway management, hemodynamic management, and pain management; (3) touch upon potential complications and management; and finally (4) provide guidance on the process of emergence from anesthesia. In writing this chapter, we hope to not only address anesthesiologists involved in FFS procedures, but also summarize considerations for plastic surgeons assembling a designated anesthesia team for FFS.

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Pre-operative Considerations

While pre-operative anxiety is commonly experienced by patients prior to surgery, patients presenting for FFS have unique concerns. The TGD community contains patients who have been marginalized and underserved [1]. Many patients have experienced discrimination or been affected by legislation that has decreased their access to care [2]. Decreased physical access to care is common for patients having gender-affirming surgery. In fact, a study using a national database found 36% of patients having gender-affirming surgery were required to travel out of state and the median distance traveled by patients was 191 miles [3]. Anesthesiologists must be mindful of patient concerns about discrimination in pre-operative discussions. An additional challenge is the short amount of time anesthesiologists have to gain the trust of patients.

The anesthesiologist should employ a gender-affirming approach when greeting the patient presenting for FFS and throughout the patient's care. A gender-affirming approach is one where the patient receives support for their chosen gender identity and expression [1]. Several practices can be used for effective pre-operative communication (Fig. 14.1). First, standard questions should be asked at the beginning of care to establish the patient's gender identity. Patients should be asked how they

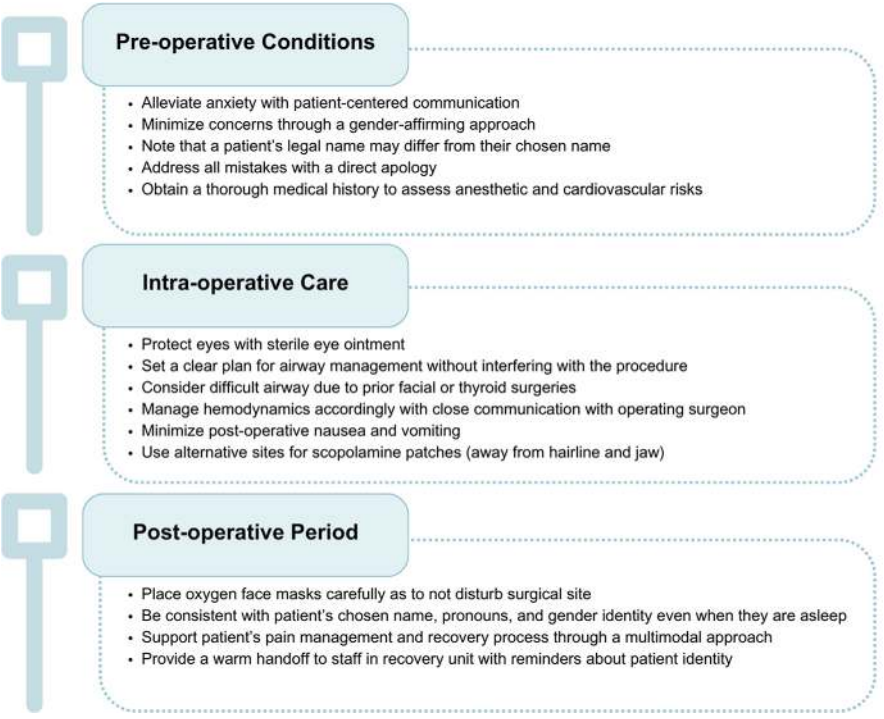

Fig. 14.1 Effective pre-operative communication practices for FFS

would like to be addressed, and what are their preferred pronouns [4]. These pronouns should be used throughout the entirety of the perioperative period, including when the patient is anesthetized and when emerging from anesthesia. During handoffs of care, perioperative staff should be informed of the patient's preferred name and pronouns. Mistakes such as incorrect pronoun use or misgendering should be immediately addressed in a direct manner with an apology [4]. It is important to note that the patient's legal name may differ from the patient's preferred name [4]. Challenges in providing gender-affirming care include the lack of formal education that anesthesiologists receive in gender-affirming healthcare [2]. Furthermore, gender diverse anesthesiologists are underrepresented, though the number of gender diverse medical students is increasing [2].

In addition to using a gender-affirming approach in caring for patients undergoing FFS, there are other steps anesthesiologists can take to help establish rapport with patients. Furthermore, anesthesiologists should be patient-centered in their communication. They should ask what the patient's concerns are regarding their anesthetic care and address each concern. Anesthesiologists should choose words thoughtfully and deliberately. Honesty, empathy, and authenticity during communication can facilitate establishment of patient confidence in their anesthesiologist [5]. Anesthesiologists must take utmost care in maintaining patient privacy [4]. This can be done by both maintaining confidentiality as well as taking steps to maintain physical privacy (e.g. closing the curtain when speaking to the patient).

In addition to unique socio-emotional concerns, anesthesiologists must be attuned toward medical comorbidities and impact of hormonal therapies on surgery. Furthermore, patients may be prescribed hormone therapy that affects their physiology and propensity for hypercoagulability. The risks and benefits of continuing estrogen therapy should be discussed between the patient, their surgeon, and endocrinologist. Estrogen may affect pre-operative laboratory values in affecting lipid values, decreasing hemoglobin, hematocrit, creatinine, and transaminases [4]. Historically, estrogen therapy was associated with an increased risk of venous thromboembolism (VTE) [1, 4]. The risk of VTE increases with smoking and use of oral estrogens [4]. The rate of VTE in transgender women is 0–6% in the literature [4]. One single center study found no thromboembolic complications in 296 FFS procedures, though the majority of patients had held estrogen therapy for several weeks prior to surgery [6]. Other side effects of exogenous estrogens include nausea, vomiting, and headache [1, 4]. On the other hand, cessation of feminizing hormones may lead to emotional and physical side effects. This includes mood swings, hot flashes, and for longer cessation periods, potential reversal of feminizing effects. The World Professional Association for Transgender Health (WPATH) advises to continue estrogen in transgender women who lack specific risk factors for VTE [7].

The effects of feminizing hormone therapy on pre-operative cardiovascular risk is unknown. Cardiovascular risk tools that are commonly used in pre-operative assessment, such as the Revised Cardiac Risk Index (RCRI) and the American College of Surgeons National Surgery Quality Improvement Project (ACS-NSQIP), do not consider hormone therapy as a risk factor [2, 8]. The literature is limited on the risk of feminizing hormone use on perioperative cardiovascular risk. In a large cross-sectional

study, multivariable analysis showed transgender women had a twofold increase in odds of having reported myocardial infarction compared with cisgender women though there was no statistically significant difference with cisgender men [9].

Intra-operative Care

Intraoperative goals for patients undergoing FFS include providing safe care for a patient undergoing complex craniofacial surgery. The anesthesiologist must consider physiologic effects from hormone therapy and plan for managing an airway with possible previous surgical instrumentation.

Medication Interactions

Estrogen has the potential for drug interaction with commonly used perioperative medications, though the clinical significance of these interactions is unknown [4]. First, estrogen may decrease pseudocholinesterase activity, which could prolong neuromuscular blockage from succinylcholine [8]. Estrogen in high doses can decrease circulating albumin and alpha1-acid glycoprotein, which may increase the free fraction of highly protein-bound drugs like bupivacaine [8]. Spironolactone is another feminizing medication, prescribed as an androgen blocker, that may increase potassium and creatinine levels [1]. These laboratory values should be monitored.

Sugammadex is a steroid binder that reverses neuromuscular blockers, such as rocuronium and vecuronium. Sugammadex binds steroids such as estrogen and progestin; there is a theoretic risk of decreasing hormone efficacy post-operatively if a patient is on feminizing hormones [8]. However, there is no clinical evidence of a drug interaction between sugammadex and feminizing steroid hormones [5]. At our institution, we routinely use sugammadex for patients undergoing FFS due to the efficacy of sugammadex for reversing deep neuromuscular blockade.

Total body fat increases in patients taking feminizing hormones. This may increase the volume of distribution of fat-soluble drugs, though drug modeling data is lacking [8]. In summary, there are no documented reports or clinical evidence of drug-drug interactions between estrogen and androgen blockers with anesthesia medications. Administration of anesthesia medications can proceed according to standard practice [1, 4].

Airway Management

Several airway concerns may arise in patients presenting for FFS due to previous feminizing surgeries (Fig. 14.2). Thus, a thorough surgical and anesthetic history should be obtained. Laryngoplasty may be associated with scarring, changes to

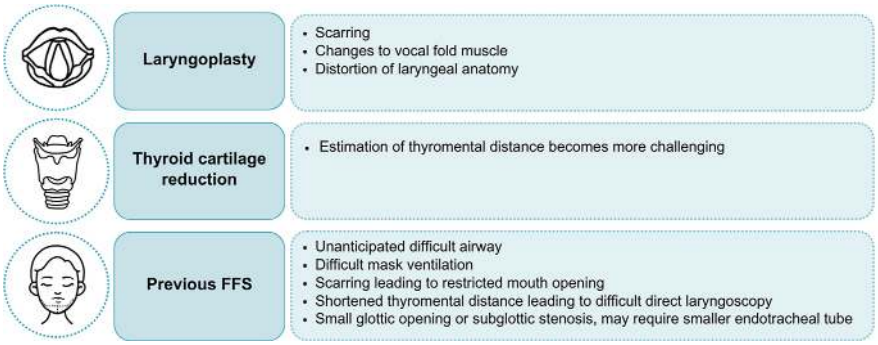

Fig. 14.2 Airway effects of feminizing surgeries

vocal fold muscles and laryngeal anatomy distortion [5]. Of particular importance for surgical outcomes, the guidance for intubation after laryngoplasty is that it should not happen within the first 3 months after laryngoplasty to avoid dehiscence (personal communication to JCL from Abie Mendelsohn). History of a thyroid cartilage shave can make estimating the thyromental distance more challenging [1]. Unanticipated difficult airway management has been reported in patients with previous FFS; potential concerns include difficult mask ventilation, restricted mouth opening due to sutured incisions, and shortened thyromental distance leading to limited visualization with direct laryngoscopy [10]. Previous FFS and other surgeries can decrease the size of the glottic opening and/or cause subglottic stenosis, requiring a smaller diameter endotracheal tube [5, 11]. Additionally, if a patient is pursuing additional surgery after FFS where a rhinoplasty has been performed, the typical practices are to either hold on elective surgery for 3 months or more to prevent accidental manipulation of the nasal bones during mask ventilation. Alternatively, if surgery must proceed, anesthesiologists should attempt to limit pressure on the nasal bones if possible.

At our institution, we use a standardized anesthetic protocol for airway management (Fig. 14.3). A reinforced endotracheal tube is used for intubation to minimize the risk of kinking, with smaller diameter endotracheal tubes available. A video of laryngoscope and other advanced airway equipment is available. After the anesthesiologist confirms the airway, the surgeon sutures the endotracheal tube to the periosteum of the maxillary crest. Dexamethasone 10 mg is given every 6 h intravenously for facial swelling with the benefit of mitigating airway swelling. The table is turned 180°, limiting the anesthesiologist's free access to the airway. After straight connector placement to place the endotracheal tube out of the field, the circuit and lines are arranged to the patient's left side. All connections are firmly secured by the surgical team and the circuit is placed in a transparent plastic sleeve to maintain sterility but easily visualize circuit disconnections. The anesthesiologist must be vigilant as to the integrity of the airway, circuit disconnections, and migration of the airway including inadvertent extubation and right mainstem intubation. Direct and clear communication with verification of understanding (closed loop communication) should be used if any airway concerns arise.

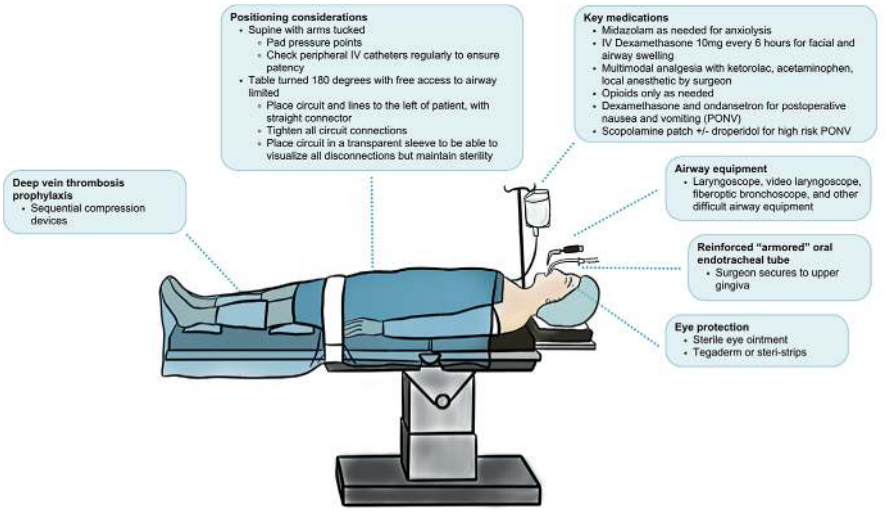

Fig. 14.3 Anesthetic protocol for FFS. (Copyrights retained by JCL)

Hemodynamic Management

Anesthetic technique can promote a quiet, still, and clear surgical field during FFS. Given the increased vascularity of the scalp, our standard surgical protocol is to prevent elevation of mean arterial pressures (no greater than 80 mm Hg) at the time of the incision scalp incision in order to decrease bleeding within the surgical field and allow for adequate exposure. Various pharmacologic approaches may achieve a moderately decreased mean arterial pressure, but agents should be short-acting and titratable. The patient should be evaluated for conditions that increase the risk of adverse events secondary to hypotension, including a history of chronic poorly controlled hypertension, ischemic heart disease, and chronic kidney disease. Normotension should be maintained for patients with elevated risk of major adverse cardiac events and acute kidney injury.

Other Intraoperative Considerations

Pain management for FFS should be multimodal. Our typical protocol includes the standard intraoperative narcotic usage supplemented with intravenous ketorolac and acetaminophen [11]. Postoperatively, we developed an Enhanced Recovery After Surgery (ERAS) protocol including scheduled ketorolac, scheduled acetaminophen, and a low dose, low efficacy narcotic for breakthrough pain (tramadol 50 mg). Compared to management in the pre-ERAS era where pain control was managed

predominantly with oral narcotics, patients had lower pain scores, less opioid usage, and a shorter hospital length of stay [11].

Prevention of post-operative nausea and vomiting (PONV) is an important goal for FFS procedures. There is no conclusive data on whether hormone use for gender affirmation affects the risk of PONV [5]. Risk factors for PONV include younger age, history of PONV, and being a non-smoker [8]. Standard PONV prophylaxis includes use of at least two antiemetic agents and three or more agents if the patient has risk factors for PONV. If used, a scopolamine patch should be placed at a site other than behind the pinna, due to the site of surgery.

Oftentimes, FFS is a lengthy operation [12] This warrants extreme care with regard to positioning. This includes: (1) maintaining vigilance with checking pressure points, (2) regularly confirming peripheral intravenous catheter patency if arms are tucked, (3) ensuring that there are no kinks in the airway circuit, and (4) checking that sequential compression devices (SCDs) are working throughout the operation. Due to the length of FFS, a urinary catheter is placed. If the patient has undergone gender-affirming surgery affecting the urethra, such as vaginoplasty, this may necessitate a smaller catheter or even consultation with a urologist.

Intraoperative Complications

Literature on intraoperative complications is directed at surgical complications. Little is known about anesthetic complications for FFS. A systematic review noted few surgical complications of FFS, with temporary facial numbness or paralysis mentioned in 6 out of 21 studies [13]. A single center series reported 68% of cases were complication-free. The most common complication was infection [14]. Increased surgical length and having multiple procedures were risk factors for infectious complications in another single center observational study. Meticulous infection control is mandatory including administration of perioperative antibiotic prophylaxis, maintenance of the sterile field, and fastidious care with intravenous access.

Emergence from Anesthesia and the Post-operative Period

Challenges in the post-operative period include treatment of pain and anxiety, superimposed on the patient's pre-existing concerns of discriminatory health treatment [4]. Emergence from anesthesia should be non-stimulating while the patient regains protective airway reflexes and consciousness. Oxygen face masks should be placed carefully during emergence and post-operatively. One approach to provide supplemental oxygen while avoiding pressure on the nose is to place a pre-cut oxygen mask with the top portion removed. The head of bed may be elevated to facilitate venous drainage and to reduce swelling. Avoidance of hypertension can aid in

preventing hematoma formation and may require treatment with antihypertensive agents.

A detailed report and handoff to the recovery room team are necessary when the patient is unable to confirm their medical history and gender identity, secondary to emerging from anesthesia. It is helpful for the anesthesiologist to educate recovery room staff and advocate for the patient in promoting use of the patient's preferred name and pronouns. Pharmacologic and nonpharmacologic interventions can be used to support the patient's mental health in the early postoperative period, with a multidisciplinary approach including social work, mental health, and spiritual care.

While there are multiple psychologic and physiologic considerations for patients undergoing FFS, an organized and comprehensive anesthetic plan that anticipates these concerns can lead to excellent clinical outcomes and high patient satisfaction.

Conclusion

The administration of anesthesia for FFS requires careful attention during the pre-, peri-, and post-operative periods. Furthermore, in the pre-operative area, one must be cognizant of patients' prior experiences within healthcare, and how these may affect experiences of anxiety and outlook toward their operation. During surgery, the anesthesia team has multiple responsibilities including airway, hemodynamics, considerations of medication interactions, pain management, and management of complications. Ultimately, a thorough understanding of such principles and this unique patient population is fundamental in formulating an optimal anesthetic plan.

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Chapter 15
The Operating Room

Shahrzad Moghadam, Leila Musavi, Erin M. Wolfe, and Justine C. Lee

Introduction

In order to ensure both safety and efficiency during FFS, surgeons must not only execute appropriate techniques, but also must create an optimized surgical setting with qualified staff and proper instrumentation. Furthermore, the challenge of FFS is compounded by the fact that multiple procedures are often performed—amplifying the need to streamline transitions, designate responsibilities among surgical team members, and allow for intra-operative assessment of aesthetic results. This chapter delves into the structure and makeup of the senior author's operating room; we discuss the layout of the operating room, the general operative workflow, staging, and finally, instrumentation for FFS.

Operating Room

Layout

The duration of FFS can vary depending on the number of feminizing procedures performed, as well as the complexity. Aside from an increase in operative time, a greater number of surgical instruments, equipment, and support staff is required to

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accommodate the multiple procedures often entailed during FFS. Thus, larger operating rooms are ideal for FFS as they provide greater ease in access to and movement of the patient.

Surgical Staff Positioning

While the number of surgical staff may vary by available resources, the ideal scenario is to have the lead surgeon assisted by two other people, of which at least one assistant is capable of performing less critical maneuvers such as skin closure and fat harvest for grafting. After intubation, our typical practice is to rotate the operating room table 180°. The lead surgeon is positioned at the head of the table. One surgical assistant is also positioned at the head of the table, just opposite to the lead surgeon's dominant hand. The second assistant should be positioned at the abdomen to allow for simultaneous opening of the scalp and fat harvest. Anesthesia colleagues are positioned at the foot of the operating room table.

Equipment Positioning

The sterile back table is typically located to the left of the patient. The mayo stand is placed near the lower half of the patient, over the operating room table. Suction and irrigation system, as well as power boxes for drills and electrocautery, are positioned to the right of the patient.

Patient

Positioning

Upon intubation, the endotracheal tube (ETT) is secured to the periosteum of the midline maxilla with a 2-0 silk suture prior to rotating the table. The operating room table is typically positioned in slight reverse Trendelenburg to reduce edema. Shoulders are resting on the edge of the bed and the head is placed in a Mayfield adult horseshoe operating table attachment. While the Mayfield horseshoe is not absolutely necessary, we have found that this allows maximal access of all surgical personnel to the patient and allows for ease of hair washing with a craniotomy drape. As with any surgical procedure, it is important to apply protective foam padding (shoulder roll, ulnar nerve protectors, and pad foam sheets for the body, and

extremities). Sequential compression devices are placed on the bilateral lower extremities. A warming device (Bair Hugger) and blanket is laid on the lower body to help maintain body temperature during the procedure. Bilateral arm boards are at the sides of the patient, with the arms tucked. A pillow is inserted underneath the patient's knees. The patient is strapped into the operating table at their torso and lower extremities.

Prepping and Draping

To prepare for surgery, the patient's hair is first shampooed, sectioned, and secured for visibility of the pre-trichial or coronal incision. No shaving of the hair is performed and, thus, management of the hair is important for operative efficiency. Ocular lubricant is placed into the eyes bilaterally. A Foley catheter is placed. Tumescent solution is injected into the planned donor sites, typically abdomen and flanks, for harvesting of fat, if applicable. Betadine 5% is then used to prep the face, scalp, neck, and upper chest and alcohol-based chlorhexidine prep is used for the fat graft donor site.

A head drape including a half sheet with two towels is first placed under the patient's head. The towels are then stapled 1 cm beyond the posterior aspect of the hairline or coronal incision. Towels are then used to drape the chest and to square off the abdomen. A half sheet is used over the lower extremities. A clear sterile probe cover is then used to prep the endotracheal tube into the operative field. We have found that this step has improved our operative efficiency as the endotracheal tube connections are visible and easily adjusted during the case. Given that the surgery includes significant movement of the head, it is common to have to adjust the tube for disconnections at least once during each case. A craniotomy drape with a drainage bag attached to suction is then placed under the patient's head, again taking care to leave the endotracheal tube and associated tubing for the airway above the drapes.

Operative Workflow

Order of Procedures for a Full, Single-Stage FFS

Our sequence for a full single-stage FFS begins with the forehead reconstruction by the lead surgeon including the pre-trichial or coronal incision, fronto-orbital reconstruction, harvesting of split cranial bone graft, and soft tissue maneuvers such as the brow lift, canthopexies, and hairline advancement when applicable. Simultaneously, one surgical assistant will harvest fat from the abdomen and prepare the fat for facial grafting. Once fat is prepared, the surgical assist will return to

the head of the bed and help with the remaining portion of forehead feminization. Simultaneously with scalp closure by the first surgical assistant, fat grafting of the face occurs followed by opening the chin and gonial angles. If chondrolaryngoplasty is required, our collaborating laryngologist (Abie Mendelsohn, MD) typically will then perform the procedure after the chin is open but prior to the genioplasty maneuvers. In our collaborative practice, we have not performed open chondrolaryngoplasties since 2019 due to the superiority of the endoscopic technique to the open technique in scarring and visualization. After completion of the chondrolaryngoplasty, completion of the genioplasty and gonial angles reduction is performed.

After completion of the osseous maneuvers of the lower face, the nose and the lip are addressed. If a feminizing rhinoplasty and an upper lip lift are planned simultaneously, our typical practice is to unite the approaches through the same incision. If the feminizing rhinoplasty is performed in isolation, either an open or closed approach through standard incisions is performed. For patients who undergo lip augmentation, a combination of fat grafting from the abdominal harvest and dermal fat grafting from excised, de-epithelialized scalp tissue is typically used for the lips. Our general workflow is detailed (Fig. 15.1).

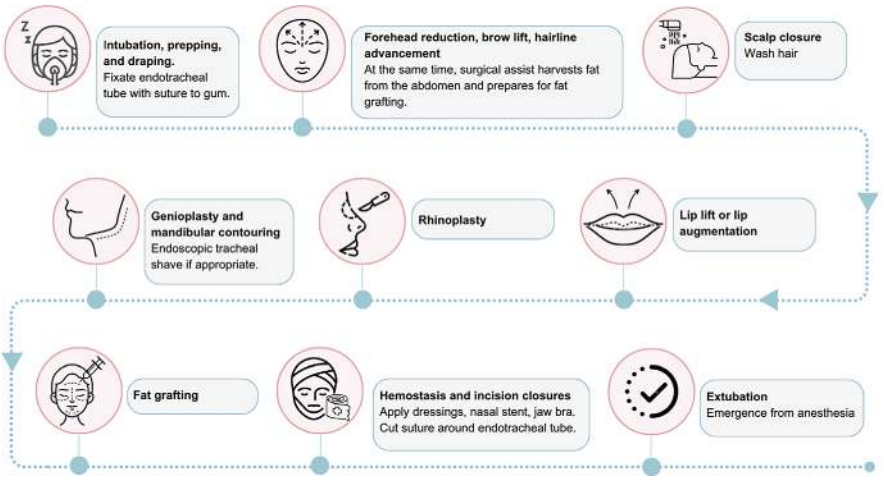

Fig. 15.1 Sequence of facial feminization surgical procedures

FFS Staging

In some instances, patients or surgeons may either undergo or perform FFS in a multi-stage approach. In our practice, the rationale for such instances is usually either due to medical co-morbidities and/or age in order to allow for a shorter surgery and easier recovery or the identification of other anatomic areas of dysphoria after addressing the initial areas of interest. In other surgical practices, surgeon fatigue, the availability and capabilities of assistants, as well as operating room availability are all potential reasons for staging. Should staged FFS procedures be planned, our typical separation of surgeries are the following: Stage I: Feminizing forehead reconstruction with fat grafting; Stage II: Feminizing rhinoplasty, genioplasty, gonial angles reduction, lip lift and/or augmentation, and fat grafting.

In rare circumstances when dentoskeletal discrepancies are present and the patient is agreeable to correction of such discrepancies, our typical practice is to prepare the patient for orthognathic surgery including pre-surgical orthodontics prior to other feminizing procedures. In such cases, we perform orthognathic surgery approximately 6 months or more prior to all other feminizing procedures to allow for sufficient time for osseous healing as well as reduction of postoperative edema.

Instruments and Equipment

A table listing the instrumentation needed for FFS is provided (Table 15.1). Our typical practice includes virtual modeling, planning, and three-dimensionally printed, patient-specific guides that we developed and previously described [1]. There are additional items within each tray that are specified (Tables 15.2, 15.3, 15.4, and 15.5). Thus, we have always included guides in all of our feminization procedures involving osseous maneuvers.

Table 15.1 Equipment and Instruments utilized in facial feminization surgery

Item	Count	Purpose
Equipment and trays		
Silastic cutting board	1	For carving during rhinoplasty
Caliper 2.0 mm	1	For measuring small and consistent distances; Lip lift;
Spinal needle 18GA	2	Rhinoplasty
5 mm light cord	1	To instill tumescent
In-light camera handle	1	Endoscopic tracheal shave
Irrigation cysto/bladder	1	Endoscopic tracheal shave
Coagulator suction 10F	1	Endoscopic tracheal shave
Precision match pro bend instrument	1	Endoscopic tracheal shave
Tracheal shave tray	1	Endoscopic tracheal shave
Mesh tray stryker	1	Endoscopic tracheal shave
Sinus 30-degree 4 mm × 18 cm STORZ	1	
Bur 4 mm EGG	1	Endoscopic tracheal shave
Rasp 11 × 5 mm	8	Osseous reconstruction
Saw blade 27 mm	12	Osseous reconstruction
10 mL syringe	10	Osseous reconstruction
1 mL syringe	10	Fat grafting
Doyle splint	2	Fat grafting
Thermasplint	1	Rhinoplasty
Nasogastric sump tube 18 F	1	Rhinoplasty
FFS Tray	1	Gastric decompression Tray includes instruments for sinus set-back, forehead reduction, mandibular exposure, and septo-rhinoplasty.
FFS plating tray	1	Plating system consisting of 1.2 mm (frontal sinus setback) and 2.0 mm screws (genioplasty), 3 mm and 4 mm in length. Includes fine mesh, chin plates, and 1.2 mm plates.
RemB drill stryker	1	Rasping for chin and gonial angles, forehead burring, drilling for screws, or cutting for genioplasty
Byron-tulip fat graft tray	1	Fat grafting
Stryker FFS drill	1	
Vital Vue irrigation system	1	
Stryker TPS console with foot pedal Irrigation Pouch 3 M	1	Osseous reconstruction, craniotomy
Bair Hugger Warmer	1	
Pulsatile stockings/SCDs	1	
		To catch water from hair prep
Heel and ulnar nerve protectors Mayfield Headholder Horseshoe	1 1	Maintain patient body temperature

(continued)

Table 15.1 (continued)

Item	Count	Purpose
Head drape Towels	1	Venous thromboembolism prophylaxis
Large sheet	1	Pressure wound prevention
Craniotomy drape	1	To hold/position patient head
Urinary Foley Catheter	1	
Tubular net bandage	1	
Fat grafting pack	1	
Craniofacial plastic surgery pack Facial feminization pack Gruber rhinoplasty retractor Blunt fishhooks 12 mm	1 1 1 4	Includes packing and dressings Includes packing and dressings Includes packing and dressings
Sutures		
Prolene 2-0 CT-1	4	Scalp whip stitch
Prolene 5-0 P3	3	Scalp advancement
Prolene 6-0 P3	1	Scalp progressive tension
Vicryl 2-0 SH	3	sutures
Vicryl 3-0 SH	2	Scalp closure
Vicryl 4-0 RB-1		Brow lift
		Turkish Delight Nasal
PDS 4-0 P-3	3	Reconstruction
PDS 5-0 P-3	2	Nose and weir incisions
Monocryl 4-0 PS4C	1	Nose
Monocryl 5-0 PS4C	1	Lip lift; Cinch to nose
Chromic 4-0 PS4C	1	Lip lift
Chromic 5-0 P3	2	Mouth incisions
Gut Plain 4-0 SC1	1	Lip incisions
Gut Plain 4-0 FS2	2	Septum
Gut Plain 5-0 PC1	1	Scalp Fat graft site closure
Medications		
Bonneys Blue Dye 0.25 mL	1	Frontal sinus marking
Bupivacaine 0.25%-Epinephrine Injection 1:200,000 (30 mL)	1	
Lidocaine 1% (25 mL), Epinephrine 1:1000 (1 mL), 0.9% NS (1000 mL)	1	
Tumescent Solution (250 mL)	2	
Mupirocin ointment 2% (22 g)		
Betadine 5%		
Chloroprep	2	
Floseal 10 mL		

Table 15.2 Instruments in FFS tray

3/24/2025 3:05 PM **MOR FFS Tray - 000** Page 2 of 5

Prepared by: jojom Set ID: MORFFST - 000 Set Cat: MORPLA Barcode: 120638 - 000 Date prepared: 3/24/2025

Date used: _____ Tech/RN: _____ Set was: [ ] Satisfactory [ ] Unsatisfactory Ster method: Steam Printed by: kaless

If not satisfactory, please explain: _____

List instruments needing repair/replacement: _____

Pre Cnt	Qty Rqd	Qty Mi	SPD Cnt	Description	CLS Inst	Manuf	Prod #	Comment
21	**0**	**0**		**In sterilization bag**				
4	0	0		Knife Handle # 3		Jarit	110-165	
4	0	0		Adson Forcep with teeth 5"		V Mueller	NL1400	
2	0	0		Brown Forcep w/Teeth 6 1/4"		V Mueller	SU2500	
6	0	0		Adson Brown Forcep 4 3/4"		V Mueller	SU-2504	
1	0	0		Forcep, Cushing, Dressing, Bayonet		Codman	30-1191	
2	0	0		Forcep, McIndoe Dressing 6" Serrated Jaws		Jarit	130-284	
2	0	0		Gerald Forcep with teeth 7"		Jarit	285-125	
11	**0**	**0**		**In sterilization bag** Add tip protectors				
2	0	0		Castroviejo Forceps w/Teeth 0.5mm 4 1/4"		SSI	60-1635	
2	0	0		Iris Scissors Cvd. BLACK HANDLE		ASSI-S&T	ASIM-12-0003	
2	0	0		Iris Scissors Angled		SSI	60-1850	
2	0	0		Jamison Tenotomy Scissors Curved (Black Handle) 5 3/4"		Jarit	102-300	
1	0	0		Dorsal Cottle Scissors, Angled		V Mueller	RH1699	
1	0	0		Castroviejo Caliper		V Mueller	OP2710	
1	0	0		Forcep, Takahashi		Ruggles	R-1875	
7	**0**	**0**		**Scissors** On Striger				
1	0	0		Metzenbaum Scissors Straight 5 3/4"		Codman	36-5010	
1	0	0		Metzenbaum Scissors Curved 7"		Jarit	101-258	
2	0	0		Mixter Scissors Straight 6"		Codman	54-1010C	
1	0	0		Mayo Scissors Straight 6 3/4"		Jarit	099-210	
1	0	0		Scissors, Lister, Bandage, 7 1/4"		Jarit	100-526	
1	0	0		Operation Scissors Sharp Curved Gold 5 1/2 "		Symmetry	32-630	
19	**0**	**0**		**Needleholders**				
2	0	0		Needleholder, Webster, Smooth Jaw		Jarit	120-118	
6	0	0		Baumgartner Needleholder 5"		Codman	36-2010	
4	0	0		Needleholder, Crile Wood, 6"		KLS Martin	20-638-15	
2	0	0		Mayo Hegar Needleholder 6"		Jarit	121-135	
3	0	0		Needleholder, Olsen-Hegar, 5 1/4"		Jarit	121-150	
2	0	0		Sarot Needleholder 7"		Codman	36-3020	
32	**0**	**0**		**Clamp**				
8	0	0		Clamp, Halstead, Mosquito, Curved, Mirror, 5"		Jarit	105-102	
4	0	0		Crile Clamp Curved 5 3/4"		Jarit	106-121	

(continued)

Table 15.2 (continued)

3/24/2025 3:05 PM **MOR FFS Tray - 000** Page 3 of 5

Prepared by: jojom Set ID: MORFFST - 000 Set Cat: MORPLA Barcode: 120638 - 000 Date prepared: 3/24/2025

Date used: _____ Tech/RN: _____ Set was: [ ] Satisfactory [ ] Unsatisfactory Ster method: Steam Printed by: kaless

If not satisfactory, please explain: _____

List instruments needing repair/replacement: _____

Pre Cnt	Qty Rqd	Qty Mi	SPD Cnt	Description	CLS Inst	Manuf	Prod #	Comment
2	0	0		Crile Straight Clamp 5 1/2"		Jarit	106-120	
2	0	0		Jacobson Clamp Delicate Slightly Curved 7 1/2"		V Mueller	CH8620	
2	0	0		Clamp, Rochester -Oschner (Kocker) 6 1/4"		Jarit	107-100	
2	0	0		Kocher Clamp Straight 8"		Codman	34-4130	
4	0	0		Tonsil Clamp Curved 7 1/4"		Codman	30-4291	
4	0	0		Towel Clamp Small		Jarit	109-100	
2	0	0		Clamp Towel, Large		Jarit	109-102	
2	0	0		Edna Clamp 5 1/2"		Codman	32-5015	
9	**0**	**0**		**In sterilization bag**				
2	0	0		Retractor, Ragnell		Jarit	410-220	
2	0	0		Guthrie Eye Fixation Hook 5/18 2mm		Symmetry	38-6530	
2	0	0		Hook, Skin Single Prong		Jarit	410-150	
3	0	0		Skin Hook 2 Prong 10mm		Symmetry	38-6648	
6	**0**	**0**		**Septum Knife**				
2	0	0		Knife, Cronin Septum (D Knife)		Padgett	P-605	Add tip protectors
1	0	0		Knife, Ballenger, Swivel		V Mueller	RH761	
1	0	0		Elevator, Cottle (Septrum), Joseph		Karl Storz	N4660	
2	0	0		Elevator, Freer (Septum) 7 1/2"		Codman	65-6620	
2	**0**	**0**		**Bottom Tray**				
1	0	0		Stripper, Pterygoidmasseteric, Sling, Right		Lorenz	01-0140	
1	0	0		Stripper, Pterygoidmasseteric, Sling, Left		Lorenz	01-0142	
4	**0**	**0**		**Osteotome**				
1	0	0		Lambotte Mini Osteotome, 2mm		Jarit	250-391	
1	0	0		Lambotte Mini Osteotome 4		Jarit	250-392	
1	0	0		Lambotte Mini Osteotome, 6mm		Jarit	250-393	
1	0	0		Osteotome, Graft Spliting (Stubby)		KLS Martin	48-276-15	
9	**0**	**0**		**Elevators**				
				In sterilization bag				
1	0	0		Obwegeser Elevator Curved 6mm 7"		KLS Martin	48-132-06	
1	0	0		Elevator, Obwegeser, Flat, 7mm, 7"		KLS Martin	48-132-07	
2	0	0		Elevator, Obwegeser, Flat, 9mm, 7"		KLS Martin	48-132-09	
1	0	0		Elevator, Nasal, Fracture, Boies		Jarit	400-279	
2	0	0		Elevator, Joseph, Curved		KLS Martin	37-585-16	

(continued)

Table 15.2 (continued)

3/24/2025 3:05 PM **MOR FFS Tray - 000** Page 4 of 5

Prepared by: jojom Set ID: MORFFST - 000 Set Cat: MORPLA Barcode: 120638 - 000 Date prepared: 3/24/2025

Date used: _____ Tech/RN: _____ Set was: [ ] Satisfactory [ ] Unsatisfactory Ster method: Steam Printed by: kaless

If not satisfactory, please explain: _____

List instruments needing repair/replacement: _____

Pre Cnt	Qty Rqd	Qty Mi	SPD Cnt	Description	CLS Inst	Manuf	Prod #	Comment
2	0	0		Molt Elevator #9		Biomet	09-0394	
4	**0**	**0**		**Rasp**				
1	0	0		Rasp, Fomon 1/2"		KLS Martin	37-682-01	
1	0	0		Rasp, Fomon 3/4"		KLS Martin	37-682-02	
1	0	0		Rasp, Fomon 5/6"		KLS Martin	37-682-03	
1	0	0		Rasp, Fomon 7/8"		KLS Martin	37-682-04	
17	**0**	**0**		**Retractors**				
2	0	0		Army/Navy Retractor		Jarit	199-105	
1	0	0		Wieder Metal Retractor X-Large 43mm Blade		KLS Martin	38-297-02	
1	0	0		Retractor, Aufricht, 6 1/4"		Miltex	21-188	
1	0	0		8in Martin Malleable 25mm		KLS Martin	15-975-25	
2	0	0		Spatula, Habeer, Abdominal, Flexible, Double Ended, 17mm x 25mm, 8"		KLS Martin	15-971-00	
1	0	0		Retractor, Ribbon, 5/8" x 8"(olive-corona)		KLS Martin	48-330-02	or 01-106-02
1	0	0		Retractor, Ribbon, 1/2" x 8"(olive-corona)		KLS Martin	48-330-01	or 01-106-01
2	0	0		Retractor, Hargis, Cheek (Short Blades)		KLS Martin	38-829-01	
1	0	0		Retractor, Black 20X12mm Tessier Soft Tissue		KLS Martin	48-331-02	
1	0	0		Retractor, Black 30X12mm Tessier Soft Tissue		KLS Martin	48-331-03	
1	0	0		Retractor, Black (04) Tessier Soft Tissue		KLS Martin	48-331-04	
1	0	0		Retractor, Hargis, Mandibular, Body		Lorenz	01-0149	
1	0	0		Retractor, Obwegeser 2 1/2" Blade		Lorenz	01-0103	
1	0	0		Retractor, Obwegeser 3 1/4" Blade		Lorenz	01-0104	
3	**0**	**0**		**Speculum/Rongeur**				
1	0	0		Speculum, Nasal, Short 50mm		KLS Martin	36-856-02	
1	0	0		Speculum, Nasal, Long 70mm		KLS Martin	36-856-03	
1	0	0		Rongeur, Ruskin 4mm		Codman	53-1311	
3	**0**	**0**		**Miss**				
2	0	0		Frazier Suction 12fr.		V Mueller	NL1903	
1	0	0		Mallet, 1lb		Jarit	250-403	

Table 15.3 Instruments in FFS Stryker tray

3/30/2022 1:46 PM **MOR CON FFS Plating Tray STRYKER - 000** Page 1 of 3

Prepared by: Set ID: MORFFS - 000 Set Cat: MORPLA Barcode: 119387 - 000 Date prepared: 3/30/2022

Date used: _____ Tech/RN: _____ Set was: [ ] Satisfactory [ ] Unsatisfactory Ster method: Steam Printed by: kaless

If not satisfactory, please explain: _____

List instruments needing repair/replacement: _____

Pre Cnt	Qty Rqd	Qty Mi	SPD Cnt	Description	Manuf	Prod #	Comment
	1	**0**	**0**	**Container**			
	1	0	0	Half-size Solid Bottom 8"	Aesculap	JK344	With Gold Lid
	202	**0**	**0**	**2.0 MP Plates/Screws**			
	1	0	0	Module w/Lid 2.0 MP Plt/Scr	Stryker	29-20903	
	10	0	0	Screw, MP Bone, 2.0 x 4MM, Bone Cross	Stryker	50-20704	
	20	0	0	Screw, MP Bone, 2.0 x 5MM, Bone Cross	Stryker	50-20705	
	20	0	0	Screw, MP Bone, 2.0 x 6MM, Bone Cross	Stryker	50-20706	
	10	0	0	Screw, 2.0X8MM MP CROSS-PIN SELF TAPPING SCREW	Stryker	5020708	
	10	0	0	Screw, 2.0X10MM MP CROSS-PIN SELF TAPPING	Stryker	5020710	
	10	0	0	Screw, 2.0X12MM MP CROSS-PIN SELF TAPPING	Stryker	5020712	
	10	0	0	Screw, 2.0X14MM MP CROSS-PIN SELF TAPPING	Stryker	5020714	
	10	0	0	Screw, 2.0X16MM MP CROSS-PIN SELF TAPPING	Stryker	5020716	
	20	0	0	Screw, 2.0X4MM MP CROSS-PIN SELF DRILLING	Stryker	5020904	
	20	0	0	Screw, 2.0X5MM MP CROSS-PIN SELF DRILLING	Stryker	5020905	
	10	0	0	Screw, 2.0X6MM MP CROSS-PIN SELF DRILLING	Stryker	5020906	
	5	0	0	Screw, 2.3X6MM Emergency MP Cross	Stryker	5023706	
	5	0	0	Screw, 2.3X10MM Emergency MP Cross	Stryker	5023710	
	5	0	0	Screw, 2.3X12MM Emergency MP Cross	Stryker	5023712	
	4	0	0	Plate, 90 Degree T-Bone No Bar	Stryker	55-08240	
	2	0	0	MP 6 HOLE DOUBLE Y PLATE	Stryker	5508260	
	2	0	0	MP 6 HOLE DOUBLE Y PLATE WITH BAR	Stryker	5508262	
	1	0	0	PLT/4 HOLE MP CHIN, 2MM	Stryker	9209102	
	1	0	0	Plate, 4 Hole, MP Chin, 3MM	Stryker	9209103	
	1	0	0	PLT/4 HOLE MP CHIN, 4MM	Stryker	9209104	
	1	0	0	PLT/4 Hole MP Chin, 5MM	Stryker	9209105	
	1	0	0	PLT/4 HOLE MP CHIN, 6MM	Stryker	9209106	
	2	0	0	MP 2X3 HOLE 3-D PLATE .6MM PROFILE, SQUARE	Stryker	5506320	
	2	0	0	PLT/4 Hole BP Medium Bar	Stryker	55-08203	
	2	0	0	MP 4 HOLE PLATE	Stryker	5508204	
	2	0	0	PLT/4 Hole MP w/ Bar	Stryker	55-08205	
	2	0	0	MP 6 HOLE PLATE	Stryker	5508206	
	2	0	0	MP 16 HOLE PLATE	Stryker	5508216	
	2	0	0	PLT/Trapeze, 2x2 Hole, MP	Stryker	92-55563	
	2	0	0	1.5X50MM DRILL, 8MM STOP STRYK END	Stryker	6015008	
	2	0	0	1.5X58MM DRILL, 20MM STOP STRYK END	Stryker	6015020	
	2	0	0	1.5X50MM DRILL, 5MM STOP, STRYK END	Stryker	6015105	
	2	0	0	1.5X107.5MM DRILL, 20MM STOP, STRYK END	Stryker	6015920	
	1	0	0	Twist Drill, 7mm Stop, Stryker, 1.6mm	Stryker	60-16007	
	12	**0**	**0**	**2.0 MP Instruments**			

(continued)

Table 15.3 (continued)

3/30/2022 1:46 PM **MOR CON FFS Plating Tray STRYKER - 000** Page 2 of 3

Prepared by: Set ID: MORFFS - 000 Set Cat: MORPLA Barcode: 119387 - 000 Date prepared: 3/30/2022

Date used: _____ Tech/RN: _____ Set was: [ ] Satisfactory [ ] Unsatisfactory Ster method: Steam Printed by: kaless

If not satisfactory, please explain: _____

List instruments needing repair/replacement: _____

Pre Cnt	Qty Rqd	Qty Mi	SPD Cnt	Description	Manuf	Prod #	Comment
	1	0	0	Tray for MP Instruments	Stryker	29-13903	
	2	0	0	Bender, Plate Implant	Leibinge	36-00726	
	2	0	0	Screw Blade, Modified	Stryker	6020140	
	2	0	0	Screwdriver, Revolving Handle/Rigid	Leibinge	62-20295	
	1	0	0	Pliers, Plate Bending, 2.0mm	Leibinge	01-08070	
	1	0	0	Plate/Screw Forceps	Leibinge	62-18110	
	1	0	0	Cutter/Plate	Stryker	6218335	
	1	0	0	2.0MP PLT INLAY, SM	Stryker	2920904	
	1	0	0	2 Level Rack, Half-Size	Stryker	29-13900	
	189	**0**	**0**	**1.2 Upperface Plates / Screws**			
	1	0	0	1.2 UF PLT/SCR Module w/ Lid	Stryker	29-12900	
	25	0	0	Bonescrew, AXS, ST, 1.2 x 3MM, 5P	Stryker	56-12003	
	35	0	0	Bonescrew, AXS, ST, 1.2 x 4MM, 5P	Stryker	56-12004	
	15	0	0	Bonescrew, AXS, ST, 1.2 x 5MM, 5P	Stryker	56-12005	
	5	0	0	Bonescrew, AXS, ST, 1.2 x 6MM, 5P	Stryker	56-12006	
	30	0	0	Bonescrew, AXS, SD, 1.2 x 3mm, 5P	Stryker	56-12903	
	30	0	0	Bonescrew, AXS, SD, 1.2 x 4mm, 5P	Stryker	56-12904	
	10	0	0	Bonescrew, ER, AXS, ST, 1.4 x 3mm, 5P	Stryker	56-14003	
	10	0	0	Bonescrew, ER, AXS, ST, 1.4 x 5mm, 5P	Stryker	56-14005	
	2	0	0	Twist Drill, 0.9mm, 4mm Working Length, Stryker End	Leibinge	60-09504	
	2	0	0	Twist Drill, 1.0mm, 6mm Working Length, Stryker End	Leibinge	60-10506	
	4	0	0	Plate, Straight, Upperface, Malleable, 18 Hole Implant	Leibinge	55-04218	
	4	0	0	Plate, Upperface, Malleable, 3-D, 2x2 Hole Implant	Leibinge	55-04231	
	4	0	0	Plate, Upperface, Malleable, 3-D, 2x6 Hole Implant	Leibinge	55-04233	
	4	0	0	Plate, Upperface, Malleable, Double Y, 7 Hole Implant	Leibinge	55-04240	
	4	0	0	Plate, Upperface, Malleable, Curved, 10 Hole Implant	Leibinge	55-04250	
	4	0	0	Plate, Upperface, Malleable, Straight, Condensed, 24 Hole Implant	Leibinge	55-04424	
	12	**0**	**0**	**1.2/1.7 Upper/Midface Instruments**			
	1	0	0	Upper/Midface Inst Tray	Stryker	29-13901	
	1	0	0	Bender, 3-Prong	Leibinge	62-12173	
	2	0	0	AXS Blade, STD, 1.2/1.7MM	Stryker	62-12173	
	1	0	0	Plate/Screw Forceps	Leibinge	62-18110	
	1	0	0	Plate Cutter, In-Situ Implant	Leibinge	62-18330	
	2	0	0	Twist Drill, Sagital Split, Stryker End, 1.9 x 20 mm	Leibinge	60-19820	
	2	0	0	Handle, Screwdriver, Universal, Metal	Leibinge	62-20285	
	2	0	0	Drill Guide, VSP 2.3/2.7	Stryker	VSP-DWG-001	

Container* Filter Check Initials _____*

QA/Peer Review Initials:_____

3/30/2022 1:46 PM **MOR CON FFS Plating Tray STRYKER - 000** Page 3 of 3

Prepared by: Set ID: MORFFS - 000 Set Cat: MORPLA Barcode: 119387 - 000 Date prepared: 3/30/2022

Date used: _____ Tech/RN: _____ Set was: [ ] Satisfactory [ ] Unsatisfactory Ster method: Steam Printed by: kaless

If not satisfactory, please explain: _____

List instruments needing repair/replacement: _____

Pre Cnt	Qty Rqd	Qty Mi	SPD Cnt	Description	Manuf	Prod #	Comment

Total Rqd: 416 Total Miss: 0 Total In: 0 Last Modified: 3/30/2022 # of changes:

Table 15.4 Instruments in tracheal shave tray

3/24/2025 3:10 PM **MOR Tracheal Shave Tray - 000** Page 2 of 2

Prepared by: Set ID: MOREndBr - 000 Set Cat: MORH&N Barcode: 120601 - 000 Date prepared: 3/24/2025

Date used: _____ Tech/RN: _____ Set was: [ ] Satisfactory [ ] Unsatisfactory Ster method: Steam Printed by: kaless

If not satisfactory, please explain: _____

List instruments needing repair/replacement: _____

Pre Cnt	Qty Rqd	Qty Mi	SPD Cnt	Description	CLS Inst	Manuf	Prod #	Comment
	1	**0**	**0**					
	1	0	0	Cannula, Single Port Dissector		Karl Storz	50200ES	Port must be open for sterilization
	5	**0**	**0**					
	1	0	0	Coag suction, L-shaped hook, crvd right with Trumpet connector		Storz	50203DR	
	2	0	0	5MM, MONOPOLAR SPATULA ELECTRODE		Elmed	SM37520-83-M	
	1	0	0	Clickline disecctor/grasper, heavy horiz, curved		Storz	50236GW	
	1	0	0	Insert Tube, outer w/Scissors,		Storz	50235GW	
	7	**0**	**0**					
	1	0	0	Cord Monopolar High Frequency		Karl Storz	26006M	
	2	0	0	Clickline Plastic Handle Rotating Insulated W/O Ratchet		Karl Storz	33151P	
	1	0	0	HANDLE, PISTOL GRIP SUCTION/IRRIGATION		Elmed	52500-28-00	
	1	0	0	Adapter, For Electrode Handle		Elmed	52500-28-01L	
	1	0	0	Rongeur, Ferris Smith, Pituitary, Straight, 4mm x 10mm		Codman	53-1165	
	1	0	0	Rongeur, Ferris Smith Pituitary Straight 3mmx10mm		Codman	53-1162	

Container* Filter Check Initials _____*

QA/Peer Review Initials:_____

Total Rqd: 13 Total Miss: 0 Total In: 0 Last Modified: 3/24/2025 # of changes:

Table 15.5 Instruments within FFS Stryker Drill tray

4/3/2024 2:37 PM **MOR Stryker FFS Drill - 000** Page 2 of 2

Prepared by: Set ID: SabrDrill - 000 Set Cat: MORPLA Barcode: 122119 - 000 Date prepared: 4/3/2024

Date used: _____ Tech/RN: _____ Set was: [ ] Satisfactory [ ] Unsatisfactory Ster method: Steam Printed by: kaless

If not satisfactory, please explain: _____

List instruments needing repair/replacement: _____

Pre Cnt	Qty Rqd	Qty Mi	SPD Cnt	Description	CLS Inst	Manuf	Prod #	Comment
	10	**0**	**0**					
	2	0	0	Stryker Sumex hand Switch		Stryker	5400-121-000	
	1	0	0	Attachment, 8cm Non-Footed		Stryker	5407-NFA-8CM	
	2	0	0	Drill Pi Plus		Stryker	5407-300-000	
	2	0	0	Attachment, 7cm Short Straight		Stryker	5407-120-450	
	1	0	0	Attachment, MIS Hub Base		Stryker	5407-120-900	
	1	0	0	Attachment, Curved MIS Drill Carrier		Stryker	5407-120-950C	
	1	0	0	Attachment, Hub		Stryker	5407-120-300	

Wrap Tray QA/Peer Review Initials:_____

Total Rqd: 10 Total Miss: 0 Total In: 0 Last Modified: 4/3/2024 # of changes:

Concluding Remarks

Successful execution of FFS requires not only surgical technique, but also an optimized surgical setting and staff that prioritize both safety and efficiency. This chapter details the personnel, physical layout of the operating room, our operational workflow, and surgical instrumentation. In providing this information, we hope to provide surgeons and trainees with helpful advice for successful planning for the day of surgery.

Reference

1. Hoang H, Bertrand AA, Hu AC, Lee JC. Simplifying facial feminization surgery using virtual modeling on the female skull. Plast Reconstr Surg Glob Open. 2020;8(3):e2618.

Chapter 16
Hospital Course and the Post-Operative Period

Kaavian Shariati, Meiwand Bedar, Renee Gewarges, Jake A. Alford, and Justine C. Lee

Introduction

After FFS there are a number of considerations that one must have in caring for patients during their immediate hospital course and the post-operative period. Approximately 95% of our procedures are one-stage FFS and require approximately 7 hours of operative time to complete. Hence, our typical practice is to admit patients for overnight observation. During their overnight stay, patients are subject to an established enhanced recovery after surgery (ERAS) protocol—entailing a standardized set of antibiotics, corticosteroids, pain medications, and wound care considerations. After meeting standard discharge milestones, patients are discharged on post-operative day one with clinic follow-up in 1–2 weeks. Follow-up appointments entail evaluation of incisions, considerations of wound care, post-operative swelling, and aesthetic results. Complications and criteria for revision operations are additionally discussed. The purpose of this chapter is multi-fold: [1] to provide an

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overview of the immediate hospital course and post-operative period for patients undergoing FFS; [2] to discuss the senior author's ERAS protocol for FFS; [3] to touch upon potential complications for the various procedures entailed in FFS; [4] to highlight the indications and criteria implemented for pursuing revision surgeries in patients.

Post-anesthesia Care and Hospital Course

Following emergence from anesthesia, the patient is transferred from the operating room (OR) to the post-anesthesia care unit (PACU) for close monitoring and supportive care. The patient is typically transported with a suctioned airway, face mask oxygen, spontaneous or assisted ventilation, and the use of a transport monitor. During the transfer to PACU, it is necessary to communicate pertinent details such as the particular surgical procedures performed, pertinent medical history, anesthetic management and issues or concerns, and expectations and plans for the early post-operative period.

Pain management has been ERAS-protocolized since 2019 to emphasize a minimal narcotic regimen. Patients are placed on scheduled intravenous ketorolac 15 mg every 6 hours started at the end of the surgery until discharge. We have not found any issues with excessive bleeding in our experience as we have had zero returns to the operating room within the first 90 days of surgery or bedside draining of hematomas. Note that we will forego ketorolac in rare circumstances where non-steroidal anti-inflammatory drugs (NSAIDS) are contraindicated, such as patients with inflammatory bowel disease. In addition to NSAIDS, patients received intravenous acetaminophen intraoperatively and remain on scheduled acetaminophen 500–650 mg per oral every 6 hours after surgery. We typically use an alternating schedule so that every 3 hours the patient will have either a dosage of ketorolac or acetaminophen. For breakthrough pain, a light narcotic (tramadol 50 mg per oral) is part of the postoperative orders every 6 hours. For severe pain which is exceedingly rare, we have occasionally ordered a stronger oral or intravenous narcotic only after discussion with nursing and evaluation by on-call staff. Stronger narcotics are never part of hospital orders pro re nata to minimize usage. Upon discharge, patients are prescribed scheduled ibuprofen 400 mg per oral every 6 hours and remain on scheduled acetaminophen 500–650 mg per oral every 6 hours on the same alternating schedule as the perioperative period. Tramadol also remains for breakthrough pain, however, patients are given a maximum of a 5 day supply of tramadol (Table 16.1).

A multimodal analgesic strategy – using a diversified regimen of pain medications – has been shown to improve perioperative pain control, reduce hospital length of stay, and decrease reliance on outpatient opioids [5–9]. Post-operative opioid misuse has been identified among patients who have undergone operations pertaining to cosmetic or plastic surgery [9–13]. The concern regarding post-operative opioid misuse is particularly heightened for FFS patients, as members of the TGD community are already at increased risk; indeed, prescription drug misuse is

Table 16.1 Post-operative medications for discharge

Medication	Primary Indication	Class/description
Tramadol 50 mg (Ultram) pro re nata every 6 hours	Breakthrough pain only	Opioid analgesic
Ibuprofen 400 mg (Advil, Motrin) scheduled every 6 hours	Pain	Non-opioid analgesic
Acetaminophen 500–650 mg (Tylenol) scheduled every 6 hours	Pain	Non-opioid analgesic
Ondansetron (Zofran)	Nausea, vomiting	Antiemetic
Chlorhexidine 0.12% solution (Peridex) oral rinse twice daily or as needed	Intraoral incision care	Oral antiseptic wash
Mupirocin 2% ointment twice daily to incisions and as needed	Skin incision care	Topical antiseptic
Cephalexin (Keflex) for 7 days after surgery	Prophylactic antibiotic	Oral (systemic) antibiotic
Docusate (Colace)	Constipation	Stool softener

suggested to be three-fold greater among TGD individuals relative to the general US population [14–18]. The likely reasons for the elevated risk are multi-fold. First, mental health diagnoses, particularly anxiety and depression, are known risk factors for persistent opioid usage for all individuals [19]. In the TGD population, both anxiety and depression are substantially elevated compared to the non-TGD population. Across our own cohort as well as larger population-based studies, anxiety and depression is estimated to be present in 75–80% of TGD population. Additionally, surgery itself carries a risk for persistent opioid use [12]. Thus, these known variables that contribute to opioid risk are pre-existing and unavoidable in the FFS patient population.

To reduce the possibility of misuse in this at-risk patient population, steps can be taken during both the planning and preparatory stages prior to the operation (Figs. 16.1 and 16.2). The most important factor that we have found is counseling and education prior to surgery. Starting with the initial consultation, patients are given a summary of postoperative events and pain control by our surgical coordinator. At the time of the preoperative consultation, these events are reiterated. We discuss the opioid epidemic in nearly every discussion that we have with patients on pain control to emphasize the necessity to use narcotics as sparingly as possible. Because of these concerns, we also counsel the patients that we absolutely do not refill tramadol prescriptions after the 5 day pro re nata course given on discharge. These types of conversations have been essential in helping patients understand the rationale for the medication regimen as well as earn their trust and buy-in to be a partner in their care. Additionally, within our patient population, the implementation of improved, patient-centered information to maximize patient engagement combined with a structured regimen for prehabilitation unexpectedly reduced perceived pain in patients during the hospital stay as well as the first week after surgery. While the

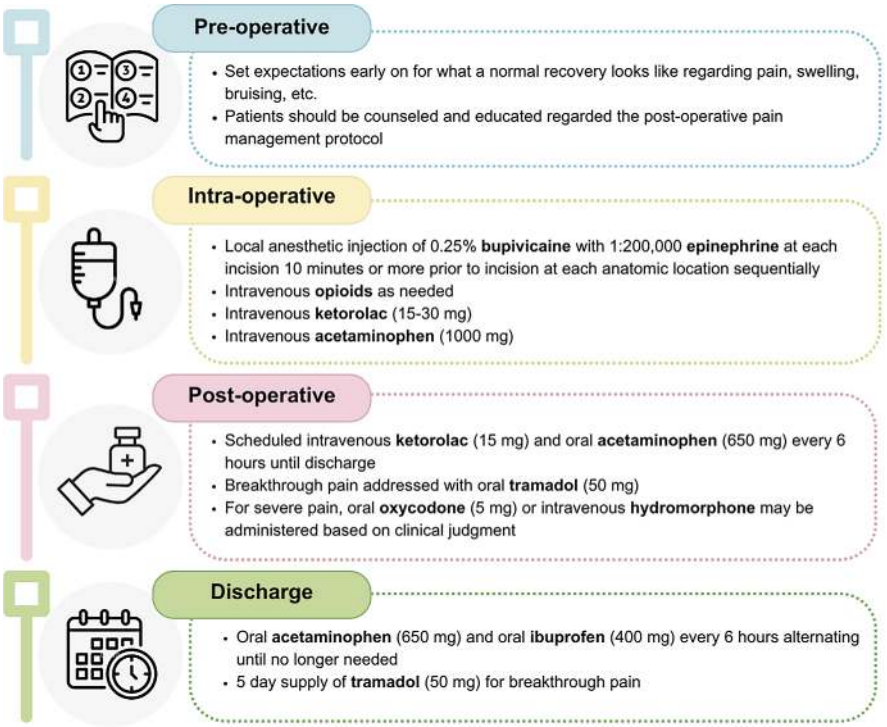

Fig. 16.1 Management of pain medication regimen

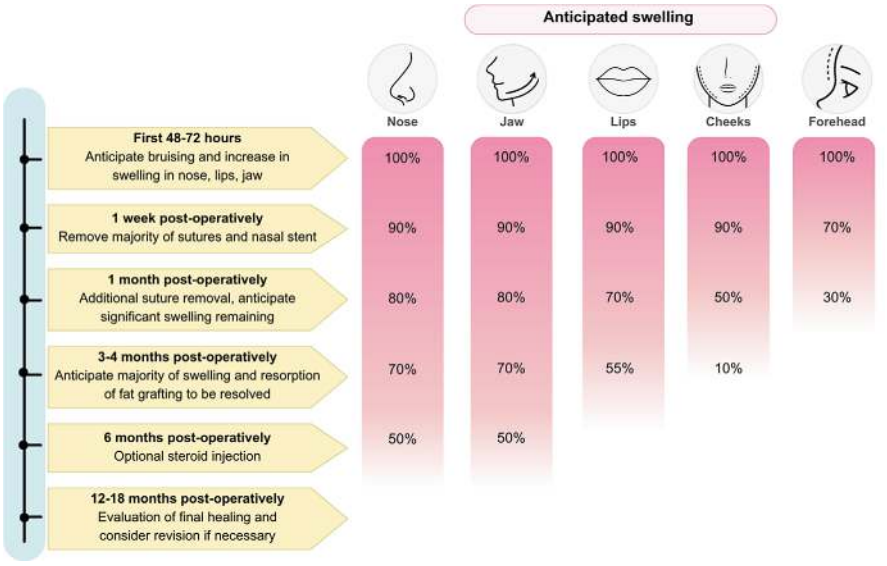

Fig. 16.2 Anticipated swelling along post-operative timepoint

goal of the counseling and documents were not specifically to reduce opioid usage or pain, the setting of expectations and increased knowledge on the events after surgery was likely contributory. These findings are in line with those reported in the greater surgical literature on non-pharmacologic methods for improving post-surgical pain control.

We have been asked why our ERAS protocol does not contain gabapentin [2]. While it is not commonly a topic of discussion, misuse of gabapentinoids has been reported [20–22]. Further, those with a history of substance use or ongoing opioid use are at heightened risk, and gabapentin misuse is most frequently accompanied by the misuse of other substances such as opioids, alcohol, and benzodiazepines [23]. The demonstrated role of gabapentin in potentiating fatal opioid consumption indicates that its use in this context warrants caution [20, 24].

Antiemetics

In order to treat nausea or vomiting during the post-operative period—often exacerbated with opioid analgesics—patients are also typically prescribed antiemetics such as ondansetron, promethazine, or metoclopramide. In addition to these medications, patients should be instructed to maintain good hydration and nutrition during this period to further alleviate the nausea.

Antibiotics

Most operations indicate the use of an antibiotic regimen in the following days. Patients are typically provided a seven-day course of oral antibiotics such as cephalexin (Keflex) or amoxicillin-clavulanate (Augmentin); [25–27]. In addition to oral antibiotics, patients are prescribed topical antibiotics such as mupirocin ointment to apply to incision sites during the initial healing period. For patients who have undergone mandibular manipulation or operation to the lower face or jaw, an antiseptic oral rinse such as chlorhexidine (Peridex) is often necessary [25]. These medications and others described above are summarized (Table 16.1).

Wound Care

Patients should be provided with guidance on the proper care and maintenance of wounds during this period. This should include instructions on cleaning and dressing changes, and the importance of proper hygiene in promoting healing and preventing infection. Head wraps are kept in place until 48 hours following surgery. At this time, the patient should be instructed to remove them, shower for a maximum

of 5–10 minutes, and apply prescribed antibiotic ointment to the incision sites twice daily. If desired, patients may choose to cover their scalps with a clean, loose stockinet cap. Chin straps should be worn for the first week, but can be removed temporarily in order to shower or perform skin or incision checks.

Regarding any nasal splints, stents, or dressings, patients should be instructed to leave these in place until the first post-operative appointment. Patients may be able to gently clean the outer nostrils with a clean cotton tip and water, and may place dressing under the nose—for example, a pad of gauzes secured with tape—in order to address any nasal drainage. Over-the-counter saline nasal sprays can be used to help break up clotted blood and mucus within the nasal passages. Patients must be instructed to refrain from blowing their noses or picking at the contents within their noses. If patients need to sneeze, they should do so with an open mouth for the first 6–8 weeks post-operatively.

When showering, patients should avoid directing the water stream to or near the surgical area. Additionally, patients should be advised to avoid consuming nicotine, exposing surgical incision sites to sunlight, and applying lotion, cologne, or deodorant to or near the incision sites.

After the skin incision is fully sealed (approximately 3–4 weeks), patients can be instructed to take steps that may assist in the prevention of scars. For example, they should be advised to apply sunscreen regularly so as to prevent the hyperpigmentation of scars, and may implement supplemental care through the use of over-the-counter silicone strips or vitamin E ointment.

Post-operative Edema

The face becomes edematous in the post-operative period, with severity varying among patients. The swelling is often most noticeable in the regions surrounding the nose, eyelid, and lower jaw. While the head wrapping placed initially will help to prevent swelling, additional measures can be taken. Providing immediate cooling therapy after the surgery over the first 24–48 h may be helpful. Additionally, compression therapy of the jaw over the initial post-operative weeks can alleviate edema while also assisting in tissue repositioning. Since 2024, we have recommended several techniques for massaging the face to assist in draining the edema, similar to the idea of lymphatic drainage. To reduce swelling at home, patients can be instructed to apply cloth dipped in iced water to the face for up to 20 min at a time, four times daily for the first week after surgery. Patients should be advised to avoid direct application of ice or cold packs that might damage the skin. Patients can expect the swelling and bruising to gradually decrease over several weeks to months after the surgery, though some features such as the nose may remain swollen for up to 12–18 months after the operation.

Diet and Activity

Patients should be advised regarding diet and physical activity during this period. There are no restrictions for patients without oral incisions. However, in the setting of oral incisions, patients are instructed to refrain from foods that will potentially affect the healing of the mucosa (e.g. nuts, seeds, crunchy foods) for approximately 10–14 days. Patients are instructed to increase their intake of protein in order to promote wound healing. Normal dietary habits can be gradually resumed after the first 2 weeks have passed.

We typically recommend patients to return to activities of daily living as soon as possible to maximize the speed of healing, drainage of edema, and to prevent blood clots. In the first week, we expect that patients should be able to walk in their homes without assist and potentially walk a block outside of the home. While patients are not ambulating, we recommend that patients keep their face and head elevated to decrease postoperative swelling. When sleeping, we recommend that patients stay on their backs and elevate with several pillows. Patients are cautioned to avoid direct pressure on the face (e.g. sleeping prone) for the first 6 weeks and to avoid contact sports for 3 months for bone healing to be completed. By the second week after surgery, we expect that patients should be capable of venturing outside of the home for basic activities such as coffee, dinner, etc as well as start to drive locally with supervision provided that they are no longer taking any narcotic pain medication. Most patients who can work remotely (e.g. tech, research, administrative) will start to work after 2 weeks, while patients with person-facing occupations (e.g. entertainment or sales industries) will wait for 4 weeks before returning to work.

Follow-Up

Our standard followup schedule is described (Table 16.2).

Table 16.2 Post-operative timepoints with associated goals of care

Post-operative timepoint	Goals
1 week	Removal of sutures, bandages, nasal splints Evaluation of incision sites Assessment of pain and healing Assessment of medication needs
4–6 weeks	Assessment of edema and need for reduction
4 month	Evaluation of patient satisfaction Assessment of swelling, symmetry, sensation of upper and lower face, psychosocial outcomes
1 year	Evaluation of patient satisfaction Assessment of need for revision, numbness, scarring, contour abnormalities, psychosocial outcomes

While the follow-up appointments may be used to address non-urgent medical concerns, patients should also be advised to seek immediate medical care if they begin to develop more urgent features such as body temperatures greater than 38 °C (100.4 °F), shortness of breath, chest pain, calf or leg pain, unusual drainage or loss of fluid from incision sites, persistent headaches or visual disturbances, persistent nausea or vomiting, or severe uncontrolled pain. Additionally, any unilateral facial swelling that continues to worsen over the course of several hours should be treated with antibiotic empirically as it is most likely a brewing infection. Albeit rare, when this occurs, it typically occurs around 2–3 weeks after surgery and after the immediate postoperative course has been completed. We have never had to take a patient back to the operating room in the first 90 days yet. Thus, infections that require more than local wound care or a course of per oral antibiotics are unusual.

Psychological Support

Psychological support in the perioperative period has been an understudied adjunct to standard postoperative care. We have had several instances when discussions with the treating therapist, psychologist, or psychiatrist prior to surgery has been important in preparing the care team for the needs of the patient before and after surgery. There has been one instance of a patient in substance abuse recovery who then relapsed after surgery. Thus, all surgeons should consider counseling patients preoperatively that surgery is a stressor. Like all stressors, patients should prepare to take on the stressor and have coping mechanisms in place as needed. As of this writing, we are in the process of developing prehabilitation programs (please see Chap. 4) that include components addressing mental health preparation for surgery.

Complications and Revisions

While we have not had any operative complications after FFS requiring surgery within the first 90 days after surgery, 16% of our cohort have undergone revision surgeries at 90 days after surgery or beyond. Note that we have not had any re-hospitalizations for FFS within 90 days after surgery, although patients have been hospitalized for several unrelated diagnoses (e.g. spontaneous pneumothorax from a pleural bleb). The most common revision surgeries that have been requested by patients have been scar widening in the lateral forehead or scalp, followed by contour abnormalities of the nose. Revisions for contour abnormalities of the mandible and forehead are rare. We have yet to have to revise an under-corrected forehead, although we have had 4 instances of revision of the mandible for additional reduction. This is likely due to our practice of a more aggressive forehead reduction and a more conservative mandibular reduction in an effort to avoid jowling as much as

possible. On long-term revisions which have been rarely encountered in our practice, the most common reason has been hardware removal due to visualization or irritation. There have also been two instances of mucoceles which have necessitated reoperation by re-advancement of the frontal bone by approximately 2 mm. Note that this was never due to any obstruction of the nasofrontal duct. Rather, the primary reason was the narrowing of the superior aspect of the frontal sinus from the setback. Since we have experienced the mucoceles, we have changed the way that we plan the setback such that the sagittal distance between the anterior and posterior tables is never narrowed to less than 4 mm. The rationale for this general rule of thumb is the fact that the endoscopic drill is 4 mm, thus any reduction beyond 4 mm precludes the potential of an endoscopic approach for treatment of the mucocele.

Beyond revisions for scarring, contour, or functional issues after the index surgery, patients may desire additional procedures after the initial FFS procedure that are meant to address facial features not initially targeted. Such additional procedures represents true staging. While our general approach is to perform the entirety of FFS for each patient in one instance, it is important to note that the anatomical areas that trigger dysphoria are not always easy for every patient to definitively identify. When the patient is uncertain about any anatomic area, our practice is always to encourage the patient to forego that area and re-assess after addressing the areas for which the patient is absolutely certain. Thus, there are some instances where the patient has addressed the forehead and only later realized that the chin and jaw were of importance to them. Alternatively, there have also been patients who have requested a highly minimal rhinoplasty to then later realize that they actually envisioned a more dramatic feminization and have then requested a revision rhinoplasty.

Conclusion

The postoperative period after FFS includes immediate PACU and inpatient care, the healing and recovery process after discharge, scheduled follow-up visits with the surgical team, ongoing monitoring for complications and potential revision needs, and assessment of patient satisfaction. To prepare for this phase, the care team should develop a comprehensive recovery and pain-management plan that is tailored to each patient's individual needs while also addressing the shared risks faced by patients undergoing FFS. During the post-operative period, the pain experienced by FFS patients can be managed by a holistic, multimodal approach that is informed by the risks faced by this population. Following the immediate perioperative period, the attention then shifts to supporting patients through the recovery process which is largely dominated by slow resolution of edema. While complications are rare, this period requires substantial patience. Additional surgeries after the acute healing period has subsided may be warranted for both revision and true staging. While there are many ways one can design postoperative protocols for FFS

patients, our hope is that our protocols may assist in generating a roadmap that can be helpful for others to adapt.

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Chapter 17
Discussing Outcomes and Evidence-Based Research in Facial Feminization Surgery

Sarah K. Fadich, Kelly X. Huang, Nghiem H. Nguyen, Brendan J. Cronin, and Justine C. Lee

Introduction

Although GAS has been deemed as medically necessary by the World Professional Association for Transgender Health (WPATH) for the treatment of gender dysphoria for TGD individuals, FFS continues to be one of the most challenging procedures to access under health insurance compared to other GAS [1–3]. One of the major reasons for such barriers to care has been the lack of high-level evidence on the efficacy or necessity of FFS. Thus, despite the significant impacts on patient mental health and social inclusion, FFS has often been considered cosmetic. The existing literature to date is largely limited to small sample size, qualitative, cross-sectional, and uncontrolled research studies. There is also a paucity of standardized surgical approaches for FFS that can reliably deliver safe and improved outcomes for patients. Therefore, it is crucial for providers of FFS to amass high-quality evidence on quality-of-life and clinical outcomes in order to establish robust guidelines and standardized surgical approaches. In this chapter, we review the existing

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literature on psychosocial and clinical outcomes following FFS and provide guidance to assist in reporting future FFS surgical outcomes research.

The Evolution of the FFS Outcomes Research

In the mid-1980s, FFS emerged as a novel surgical technique for TGD patients to provide a more feminine facial appearance. This approach was pioneered by Dr. Douglas Ousterhout and was informed by his earlier work, where he characterized the sexual dimorphisms between male and female skulls – specifically the brow bone, chin, and jaw. He then adapted existing craniofacial surgical techniques to align these features within the range of the patient's identified gender. Following Ousterhout's contributions, there were only a few case series demonstrating various surgical techniques to feminize the forehead contour, mandible, nose, zygoma, and soft tissues. These reports generally reported surgical techniques, craniometric outcomes, and clinician reported feminization and, in one case series, a very cursory report of patient satisfaction [4–6].

In 2010, Ainsworth and Spiegel published the first ever study employing a validated generic instrument (SF-36v2) to evaluate quality of life in trans women who had received FFS compared to those who had not [7]. Moreover, they developed the Facial Feminization Surgery Outcomes Evaluation (condition specific, non-validated) which was modeled after a set of validated outcome measures for rhinoplasty, facelift, blepharoplasty, and skin resurfacing. They found that at baseline, transgender women had a lower mental health-related quality of life when compared to the general cis-female population and that both genital and facial gender-affirming surgery were associated with an improved mental-health-related quality of life. Unfortunately, despite the best of intentions, this study has been consistently cited in utilization management documents by insurance companies as literature that has insufficiently supported facial gender-affirming surgery as medically necessary. This downstream consequence illustrates how important it is and will be for every manuscript on gender-affirming surgery to pass extreme scientific rigor due to the politically charged nature and uncertain landscape for insurance coverage.

The field of TGD healthcare experienced four major advancements in the early 2010s. The first of these was the passage of the Affordable Care Act in 2010 which prohibited denial of insurance coverage on the basis of gender or sex. Then, in 2013, WPATH published the updated Standards of Care, Version 7, which called for more research to guide future practice while easing barriers to accessing more individualized gender-affirming care. That same year, the American Psychiatric Association's publication of the Diagnostic and Statistical Manual Version 5 (DSM 5) further reduced barriers by aligning diagnostic criteria more closely with the lived experience of many TGD people. The DSM 5 also changed the term "gender identity disorder" to "gender dysphoria" and updated its diagnostic criteria with an expanded focus emphasizing psychosocial impairment and distress that results from the incongruence between biological sex and psychological gender.

In 2015, the US Trans Survey published the results of a survey of 75,000 transgender Americans who shared their lived experiences. The survey revealed significant challenges faced by TGD individuals, including high rates of discrimination, economic instability, and violence. It also highlighted critical issues such as widespread harassment in schools, high levels of unemployment and poverty, and significant barriers to accessing healthcare. These results laid bare the reality that much of the psychosocial impairment and distress experienced by TGD people stems not only from gender/sex incongruence, but also from external factors that could be ameliorated with adequate support and facilitating gender transition [1, 8–11].

While these developments established a clear impetus for the provision of gender-affirming treatments, the majority of FFS studies have continued to focus on clinical outcomes as opposed to patient reported outcome measures (PROMs). In a systematic review of FFS outcomes research in 2022, approximately half of the analyzed articles utilized validated PROMs; only 38% of those articles utilized a PROM that had been validated in the TGD population [12]. Studies consistently report high satisfaction rates among patients who have undergone FFS [13, 14].

In 2022, the senior author's group published the first prospective FFS outcomes study. We evaluated quality of life outcomes using 11 validated, quantitative patient-reported psychosocial instruments from the Patient-Reported Outcomes Measurement Information System (PROMIS) [15]. Briefly, PROMIS is the culmination of a collaborative effort by the National Institutes of Health to generate validated, quantitative, freely available PROMs to quantify health-related QoL in a manner that could be compared across populations and diagnoses [16, 17]. We found that, compared to 107 patients who were awaiting FFS, the 62 patients who completed FFS reported better scores in anger, anxiety, depression, positive affect, social isolation, global mental health, and meaning and purpose. Even after accounting for previous gender-affirming surgeries, hormone therapy duration, mental health diagnoses, socioeconomic characteristics, and patient-reported social relationships, FFS independently predicted improved outcomes in all seven psychosocial measures. Our subsequent study published in 2024 following a single cohort of 127 patients undergoing FFS further demonstrated preoperative depression as a major predictor of multiple postoperative psychosocial domains [18].

In the next phase of this project, we aim to publish our longitudinal data which assesses patient-reported psychosocial outcomes at three time points: preoperatively, short-term (3–6 months), and long-term (12–18 months) postoperatively. Our longitudinal results will provide further data of the effects of FFS on patient mental health and quality of life. Corroborating such assessments at other institutions with varying state health policies will also contribute essential evidence on the efficacy of FFS to guide national insurance coverage and healthcare access. Additionally, our group has focused on distinguishing the outcomes between binary transgender individuals and gender-diverse individuals, recognizing that gender-diverse individuals may have different gender affirmation preferences. As such, our preliminary data has shown that there is a positive association between gender-diverse identity

and likelihood of undergoing revision surgery. We suspect that gender identity and expression are fluid in nature, which may lead to gradual revisions as patients find concordance with their gender expression.

Types of Outcomes

FFS outcomes studies can be categorized into three different types of outcomes:

1. Clinical surgical outcomes
2. Clinician-reported outcomes
3. Patient-reported outcomes

Clinical Surgical Outcomes

Clinical surgical outcomes are purely based on postoperative events and complications. These data are often recorded in the patient chart through hospital events, follow-up clinic visits, and objective measurements. The rate of complications can be categorized as major or minor complications. Standard definitions often delegate permanent damage to vital structures or anything that requires invasive intervention as a major complication. For example, emergent operative intervention, emergent hospital readmission, infections requiring intravenous antibiotics, abscesses requiring incision and drainage, hematomas requiring surgical intervention, and permanent nerve palsies. Minor complications include events such as temporary nerve palsies or numbness, postoperative alopecia, wound dehiscence, infections treated with oral antibiotics, and asymmetry or scarring.

Other surgical outcomes of interest may include operative time, estimated blood loss, revision rates, days of hospital admission, administration of opioid pain medications, which help provide further information about efficacy of surgical techniques and enhanced recovery protocols.

Clinician-Reported Outcomes (CROs)

Clinician-reported outcomes (CROs) play a crucial role in evaluating the success of FFS in achieving the desired goals. Aesthetic outcomes are a primary focus of FFS, as they directly relate to the procedure's goal of enhancing facial femininity. Standardized photographic assessments provide an objective means of documenting and analyzing changes in facial appearance following FFS. Other imaging options also include panorex X-rays and facial CT scans, which allow for detailed evaluation and comparison of bony contours. Anthropometric measurements offer

quantifiable data on the physical changes achieved through FFS, allowing for precise evaluation of surgical outcomes.

Despite their clinical relevance, CROs have inherent limitations that must be considered when evaluating the overall success of FFS procedures. These limitations may include observer bias, variability in measurement techniques, and the potential disconnect between clinician assessments and patient-perceived outcomes. Therefore, while CROs provide valuable objective data, they should be considered alongside PROMs for a comprehensive evaluation of FFS success.

Patient-Reported Outcome Measures (PROMs)

It is crucial that researchers use validated patient-reported outcome measures (PROMs) that are well suited to evaluate the research question at hand. These are often helpful for measuring outcomes specific to the TGD community, such as gender dysphoria or gender congruence. However, researchers should keep in mind that PROMs specific to the TGD population no longer allow for comparison to the cisgender population. When selecting PROMs for FFS research, careful consideration must be given to the distinct advantages and limitations of each type of measure. In addition, there are key terms to understand when analyzing PROMs (Table 17.1). Furthermore, a combination of generic and condition-specific validated measures

Table 17.1 Validation of patient-reported outcome measures: key terminology

Validation of patient reported outcome measures: key terminology
Reliability refers to the consistency of a measure. This can be assessed through test-retest reliability (consistency over time), inter-rater reliability (consistency between different raters), or internal consistency (how well different items within the measure correlate with each other). Reliability is typically measured using statistical methods such as Cronbach's alpha or intraclass correlation coefficients.
Construct validity assesses whether the measure actually captures the theoretical construct it claims to measure. This is often evaluated by examining how well the measure correlates with other established measures of similar constructs (convergent validity) and how it differs from measures of unrelated constructs (discriminant validity).
Face validity is a subjective assessment of whether the measure appears, on the surface, to measure what it intends to measure. While it's the least rigorous form of validity, it's important for ensuring that respondents understand and engage with the measure appropriately.
Content validity evaluates whether the measure comprehensively covers all aspects of the construct being measured. This often requires input from both experts in the field and members of the target population, making it particularly important in community-engaged research. Importantly, measures are always validated within specific populations, and their applicability to other groups requires careful expert judgment. This means that a measure validated in one population (e.g., cisgender women) may not be automatically valid for use in another population (e.g., transgender women), particularly if the measure includes items related to specific anatomical features or experiences. Researchers must critically evaluate whether the validation process and the content of the measure are appropriate for their specific research population.

should be used to provide a comprehensive assessment of FFS outcomes. This approach allows for both broad comparisons across populations and detailed evaluation of FFS-specific concerns, ultimately contributing to a more robust evidence base in the field of FFS.

Generic measures, such as the SF-36 and PROMIS, offer broad insights into overall health and well-being. PROMIS, developed by the National Institutes of Health, is particularly valuable due to its rigorous validation and ability to compare outcomes across different populations and conditions. It includes measures for physical, mental, and social health, allowing for a multi-dimensional assessment of FFS outcomes. The use of PROMIS instruments in FFS research facilitates comparisons with general population norms and other clinical populations, enhancing the interpretability and generalizability of findings.

Condition-specific measures provide targeted assessments of gender-related experiences and outcomes. The Gender-Q, specifically developed for gender-affirming procedures, is a comprehensive, validated instrument that addresses the unique concerns of transgender and gender-diverse individuals [19]. It includes modules relevant to FFS, such as facial appearance satisfaction and psychosocial impact of facial features. Face-Q has also emerged as a promising tool for evaluation of outcomes following FFS [20, 21]. The Utrecht Gender Dysphoria Scale (UGDS) is another valuable tool, focusing on the assessment of gender dysphoria – a primary indication for FFS. Validated PROM scales are summarized (Table 17.2).

While ad hoc measures can be tailored to address specific research questions or clinical concerns in FFS, they should be used judiciously (Table 17.3). These non-validated, custom-designed questionnaires produce a low level of evidence and, while highly customizable, should only be employed when existing validated measures do not adequately address the research question at hand. The use of ad hoc measures limits comparability across studies and can introduce bias, potentially undermining the strength of research findings.

Table 17.2 Validated PROMs

Measure	Description	Scale	Source
PROMIS	11 validated, quantitative instruments in assessing anxiety, anger, depression, global mental health, global physical health, satisfaction with sex life, positive affect, emotional support, social isolation, companionship, and meaning and purpose	0–100	[15]
Glasgow Benefit Inventory (GBI)	18-item questionnaire assessing changes in quality of life	Five-point Likert (−100 to +100)	[22]
Satisfaction With Life Scale (SWLS)	Five-item scale measuring overall life satisfaction	Not specified	[23, 24]
Subjective Happiness Scale (SHS)	Four-item scale measuring experienced happiness	Not specified	[23, 24]
Cantril Ladder (CL)	Single-item scale rating overall well-being	0 (extremely bad) to 10 (extremely good)	[23]
Transgender Congruence Scale (TCS)	30-item scale rating body satisfaction, including facial appearance	1–5	[25]
Body Image Scale (BIS)	30-item scale measuring body dissatisfaction	Not specified	[25]
Hospital Anxiety and Depression Scale (HAD)	14-item scale measuring anxiety and depression	Two separate domains	[25]
EuroQol-5-Dimensions (EQ-5D) visual analog scale	Single-item scale rating health state	0–100	[25]

Table 17.3 Non-validated PROMs

Measure	Description	Scale	Source
Facial feminization outcome score	Nine-question instrument	5-point Likert (0–4)	[26]
Patient satisfaction with FFS	Single question	5-point Likert (0–4)	[26]
Self-perceived facial femininity and masculinity	Free-response questions	N/A	[26]
Satisfaction with chondrolaryngoplasty	Seven-question instrument	Higher scores = better outcomes	[27]
Satisfaction with surgical outcome	Subjective questionnaires and photos	N/A	[28]
Satisfaction with surgery outcome	Postoperative evaluation	N/A	[29]
Satisfaction with GAS procedures	Single question	5-point Likert	[23]
Regret about specific procedures	Single question per procedure	Yes/No	[23]
Satisfaction with outcomes	Patient feedback	N/A	[30]

Guideline for Selecting PROMs

Standardization of outcomes reporting is not just beneficial, but imperative. In their comprehensive meta-analysis of GAS, Oles et al. highlighted a stark reality: the lack of consistent use of outcome measures and the absence of validated FFS-specific instruments represent the two primary barriers to high-quality research in this domain [31]. This heterogeneity in reporting methods and outcomes has hindered the ability to draw meaningful comparisons across studies, impeding the advancement of evidence-based practice and potentially limiting access to care for patients.

The development and adherence to a facial Gender-Affirming Surgery Core Outcome Set (fGAS-COS) emerges as a crucial next step. This author is currently working with an international workgroup of researchers and plastic surgeons to develop field-wide consensus around what that core outcome set should include. The objective is to provide a standardized minimum set of outcomes that should be measured and reported in all clinical trials of FFS, thereby facilitating data synthesis, meta-analyses, and ultimately, the generation of high-level evidence. This standardization is not merely an academic exercise; it has profound implications for patient care, surgical innovation, and health policy decisions, including insurance coverage. Moving forward, it is imperative that researchers, clinicians, and stakeholders in the field of FFS recognize the collective responsibility to contribute to and adhere to these standards to elevate the quality and impact of FFS research.

Measuring Outcomes in Clinical Practice, Quality Improvement, and Research

The integration of outcomes measurement into routine clinical care represents a powerful opportunity for surgeons performing FFS to enhance patient care, refine surgical techniques, and contribute to the advancement of the field. This section outlines a progressive approach to outcomes measurement that surgeons can implement, starting with basic clinical applications and building toward more complex research endeavors. We propose a four-tiered model of increasing complexity and impact:

1. Clinical Application: Incorporating patient-reported outcome measures (PROMs) into routine clinical care to inform individual patient management and improve communication.
2. Quality Improvement: Systematically tracking outcomes for internal quality improvement purposes, ideally through a patient registry.
3. Retrospective Research: Utilizing quality improvement data and patient registries to conduct and publish retrospective studies.
4. Prospective Research: Designing and implementing prospective cohort studies to generate high-quality evidence.

By adopting this stepwise approach, surgeons can gradually build a robust outcomes measurement program that serves multiple purposes—from enhancing day-to-day clinical care to contributing valuable data to the broader scientific community. This model allows surgeons to start with manageable changes to their practice and progressively expand their impact on the field of FFS (Table 17.4).

Table 17.4 Steps toward designing outcomes studies in FFS

Step	Description
1. Define objectives	Clearly articulate the goals of the registry (e.g., quality improvement, research)
2. Determine data scope	Identify key variables to collect (demographics, procedures, outcomes)
3. Select software	Choose a secure, HIPAA-compliant platform compatible with existing systems
4. Develop protocols	Create standardized procedures for data collection and entry
5. Address ethics/legal	Ensure proper patient consent and data protection measures
6. Train staff	Educate team members on registry protocols and software use
7. Implement quality control	Establish measures to ensure data accuracy and completeness
8. Set up follow-up system	Create processes for long-term patient outcome tracking
9. Plan data analysis	Determine how registry data will be analyzed and reported
10. Launch and monitor	Begin data collection and regularly review registry performance

In the following subsections, we will explore each tier in detail, providing practical guidance on implementation and highlighting the benefits at each level. Our goal is to demonstrate that meaningful outcomes measurement is not only achievable within the constraints of busy surgical practices but is also an essential component of advancing patient care and the field of FFS as a whole.

Clinical Practice

Tools such as the Gender-Q and Face-Q have immediate utility in the clinical care of patients. For example, the Gender-Q has modules that assess various aspects of gender-affirming care ranging from anatomy-specific questionnaires, and psychosocial measures to the experience of accessing healthcare from the clinical team. The modules for facial appearance include a 15-question survey to assess each facial region. Furthermore, the granularity of treatment efficacy data play an important role in counseling patients on the specifics of their surgical plan. This is particularly useful in the case of FFS given the numerous aggregate procedures in a single anesthetic event.

For the clinician who does not have the intent or bandwidth to publish, there remains a strong impetus to incorporate measurement of clinical outcomes into everyday practice. To effectively integrate data collection into existing workflows, surgeons should adopt a strategic approach that aligns research objectives with routine clinical care processes. These outcomes should be seamlessly incorporated into standard patient assessment protocols, utilizing electronic health records (EHRs) to capture data efficiently. Standardized clinical assessment forms, designed to capture key surgical outcomes and complications, can be integrated into routine follow-up visit templates. Furthermore, employing data visualization tools that present real-time aggregated outcomes can provide immediate clinical value, incentivizing consistent data collection.

The Gender-Q facial appearance models can help in preoperative assessment, planning, and expectation setting. Oftentimes, patients seeking FFS fixate on one or two anatomical features that cause them the most distress to the distraction of how other features may contribute. By analyzing each facial feature in a systematic fashion (e.g. hairline, forehead, nose, cheeks, chin, and jawline) via a facial module survey before a preoperative consultation, both the patient and provider can systematically plan for surgical procedures, while simultaneously generating a quantitative and robust database for research purposes. For many patients who undergo FFS, a prolonged period of recovery can be complicated by anxiety about their ultimate outcome or even temporary regret. Tools such as pre- and postoperative photography and trending survey results can help temporalize postoperative concerns and assess for efficacy of various procedure modalities.

Quality Improvement

Implementing a robust quality improvement (QI) program is essential for enhancing patient outcomes, optimizing surgical techniques, and continuously refining care processes. When setting up a QI program, surgeons should focus on several key areas. First and foremost, establishing a systematic method for tracking both short-term and long-term outcomes is crucial. This includes monitoring surgical complications, patient satisfaction, and quality of life measures, ideally utilizing a patient registry to streamline data collection and analysis.

Developing standardized protocols for preoperative assessment, surgical techniques, and postoperative care helps reduce variability and ensures consistent, high-quality care. Regular case reviews or morbidity and mortality conferences provide valuable opportunities to discuss challenging cases, complications, and potential areas for improvement.

Integrating patient feedback through standardized questionnaires or PROMs administered at regular intervals post-surgery is equally important. Surgeons should also prioritize continuous education by staying updated on the latest FFS techniques and research through conferences, workshops, and peer-to-peer learning. Fostering a culture of open communication and collaboration within the surgical team can help identify process improvements and enhance overall care delivery. Using the collected data to inform decision-making is critical, whether it involves adjusting surgical techniques, modifying patient selection criteria, or refining postoperative care protocols. When possible, benchmarking outcomes against those of other FFS surgeons or centers can help identify areas of excellence and those needing improvement. Leveraging technology, such as 3D imaging or virtual surgical planning can enhance surgical precision and outcomes. Finally, involving patients in the QI process by seeking their input on care experiences and perceived areas for improvement ensures a patient-centered approach. By implementing these QI strategies, surgeons can create a systematic approach to continuously improving their FFS practice, leading to better patient outcomes, increased satisfaction, and advancement of the field as a whole.

Creating a Patient Registry

Launching a patient registry can be a daunting endeavor; however, once established, the payoff is profound. A well-designed registry has the potential to streamline patient facing PROM collection while providing real-time review of responses and trends during clinic visits while capturing clinical and PROM data that can provide important insights for both quality improvement and research.

1. Serves as a platform for collecting PROM data before clinic visits and displaying longitudinal survey data to be used during follow-up visits.

2. Allows for input of CRO data such as operative time, estimated blood loss, and complications.
3. Serves as a repository for photo metrics.
4. Allows for streamlined custom reports to be generated and pasted into clinic notes in order to eliminate redundancy in workflow.

Community Engagement

Given the historical vulnerability of the TGD population in society, researchers should find meaningful ways to engage such communities in design, implementation, and distribution research impacting their medical and surgical care. In the National Institute of Health Strategic Plan to Advance Research on the Health and Well-being of Sexual and Gender Minorities, the authors discussed the importance of elevating community engagement [32]. Engaging in community discourse is an important way to ensure that research interests align with the needs and priorities of community members. Additionally, the report urges researchers to foster a diverse research workforce by recruiting and retaining sex and gender minority community members on research teams whenever possible (Goal 3, Objective 4). This not only provides important representation in the work itself, but it also provides crucial opportunities for career advancement members of the community seeking career in academia, research, and medicine.

Community-engaged clinical research offers significant benefits that enhance the quality, relevance, and impact of medical studies. By actively involving community members throughout the research process, from study design to dissemination of results, this approach ensures that research questions address pressing community health concerns and that study protocols are culturally appropriate. This collaboration leads to improved recruitment and retention rates, increased trust in the research process, and more effective implementation of findings. Moreover, community engagement facilitates knowledge translation, builds research capacity within communities, and promotes ethical conduct of studies.

The benefits of community-engaged research extend beyond individual studies to impact broader public health outcomes. By addressing community-identified health priorities and implementing culturally appropriate interventions, this approach has the potential to lead to better health outcomes and reduce health disparities. It also increases the likelihood that successful interventions will be sustained beyond the duration of the study and can influence policy decisions due to its demonstrated community relevance. Ultimately, community-engaged clinical research fosters partnerships between researchers and communities that produce more meaningful, applicable, and impactful results, contributing significantly to public health improvement.

The Publishing Pathway—Start with the End in Mind

The place to start with any research endeavor is formulating a research question. It is helpful to take a further step back and consider how published findings could be used more broadly. Common lines of inquiry include clinical quality assurance, efficacy, complications, patient satisfaction, and so on. Researchers should also consider how published findings can be used as part of the greater body of evidence—both immediately and for comparative studies and future meta-analyses. From this perspective, reverse engineering what those studies might need clarifies how clinical workflows can be designed to maximize enrollment and streamline data collection. Ultimately, early methodological and study design choices determine the quality and impact of the evidence produced.

In summary, we suggest the following guidelines when conducting FFS research:

1. Incorporate standardized surveys and modules into each preoperative and postoperative clinical visit to improve surgical planning and outcomes tracking.
2. Standardize and use validated PROMs when possible.
3. Utilize a mix of generic and condition-specific PROMs when possible.
4. Design prospective studies when possible to generate higher-quality evidence.
5. Gather community engagement and feedback when possible to align goals and avoid potential negative consequences of research.

How Outcomes Data Are Used by Clinicians, Researchers, Insurance Companies, and Health Policy Makers

We contend that perhaps the most important step in designing a research study is carefully considering the myriad of ways that our outcomes can and will be utilized beyond strictly clinical or research contexts. Researchers must ask themselves, "How can these findings be misconstrued? How can this study potentially harm this community? How can it potentially help?"

Policies defining insurance coverage and the determinations of medical necessity for individual claims are two distinct aspects of the healthcare insurance system. They both draw on the medical literature and standards of care to determine which services and procedures are covered for a patient. Health policies governing the inclusion of FFS are widely variable in the US, ranging from explicit exclusions to mandated inclusion, with about half of US states mandating some level of coverage [33]. This patchwork of health policy is largely due to the relatively low volume of high-quality research and corresponding standards of care in combination with arguments that FFS is cosmetic and thus evades mandated coverage.

As surgical techniques improve and FFS is more readily offered at large regionalized centers, standardization of outcomes research will increase the usefulness of our data. Higher-quality research may lead to better evidence-based guidelines,

which allows increased access for insurance coverage, as well as broader advances and protections for gender-affirming healthcare in both national- and state-level health policy.

The Future of FFS Research

As the field of FFS expands to meet demand, there is an equally pressing need for standardization in research. Thus, we advocate the development of a consensus-driven adoption of a core set of outcome measures to be utilized in future studies in this space. This will facilitate comparability research and allow for insights that will drive innovation, improve quality of care, and facilitate evidence-based clinical decision making. Furthermore, such data will provide a clear basis of high-quality evidence upon which insurance companies and health policy makers will determine coverage.

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Chapter 18
Access to Care in Facial Feminization

Madeline Chin, Jonnby LaGuardia, Allison C. Hu, and Justine C. Lee

Introduction

Access to FFS is determined by a multitude of structural and individual factors. Furthermore, TGD patients have faced challenges in obtaining gender-affirming care due to both extrinsic and intrinsic reasons. Extrinsic factors include those impacted by socioeconomic, political, community, and safety conditions, while intrinsic factors are individualized to the patient experience (i.e., fear, psychological stressors, mental health, lack of social support). While FFS has gained tremendous popularity in recent years, health laws and policies have been highly variable and constantly changing; this has ultimately complicated the process of patients in navigating and obtaining FGAS. This chapter aims to [1] highlight national trends with respect to prevalence to FFS and associated barriers to care, [2] discuss the current state of insurance coverage (i.e., private, Medicaid) of FFS and specifically,

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delineate the extent of insurance coverage by state, and [3] deliver insight from perspectives of patients navigating the process of obtaining FFS. We would like to note that as of this edit (February 2026), the insurance landscape is continuing to shift due to the current federal administration. We urge readers to use this only as a historical guide and consult individual state policies as well as federal guidance for the most current information.

Prevalence of FFS, Trends, and Barriers to Care

While FFS has been described in the literature as early as the 1980s by Ousterhout, access to FFS has historically been limited [1, 2]. As the prevalence of GAS has risen, there have been a greater number of studies characterizing the temporal trends of GAS in the United States [3–7]. Gender-affirming surgeries have increased significantly, nearly tripling from 2016 to 2019 [5]. While these recent studies have documented an increase in GAS overall (i.e., top and genital gender-affirming surgeries) and an increase in these procedures covered by insurance, there is limited data specifically tracking the prevalence of FFS [4, 8, 9].

In fact, Hauc et al. incorporated FFS data among the National Inpatient Sample (NIS) from 2015 to 2017, and found that FFS was found to be more limited than other GAS with over 80% of procedures occurring in the West and Northeast [10]. More recent NIS data from 2016 to 2020 has confirmed that the rate of FGAS procedures has increased consistently, from 513 individual procedures (i.e., rhinoplasty, liposuction, genioplasty) in 2016 to 2262 in 2020 [7]. However, future studies are needed to better track and quantify the prevalence of FFS based on geographic region and population.

Given the geographic variability and institutional-dependent nature of FFS, this presents additional challenges for TGD patients. Moreover, in a 2020 review by Cohen et al., there were 282 surgeons who provided FFS in the United States, albeit there is a lack of clarity in whether all surgeons identified had the appropriate training or skillsets necessary to FFS procedures [11]. The states with the highest number of surgeons providing FFS were California ($n = 68$, 18.3%), New York ($n = 43$, 11.6%), and Texas ($n = 31$, 8.3%) [11]. Thus, about half of the surgeons providing FFS were located in three states alone. Given such discrepancies to access, many patients have resorted to alternative means of obtaining FFS, namely changing their residence or relocating. Outside of plastic and reconstructive surgery training programs located in states with protective laws for gender-affirming care, limited exposure to gender-affirming surgery (GAS) continues to constrain the pipeline of future surgeons. In response, new educational opportunities have emerged, including workshops, conferences, and dedicated fellowships focused on training in FFS [12, 13].

Furthermore, even if patients live in regions with a high density of FFS-providing surgeons, this does not guarantee access to such procedures. According to the 2015 United States Transgender Survey, nearly one-quarter (23%) of respondents

reported that they avoided seeking healthcare in the past year due to fear of being mistreated as a transgender person [14]. Delays in seeking care due to fears of mistreatment are not unfounded. Furthermore, one-third of respondents who had seen a provider in the past year reported having at least one negative experience with a doctor or other healthcare provider related to being transgender [14]. These data highlight how a lack of gender-affirming healthcare resources can impact patients seeking care. The World Professional Association for Transgender Health (WPATH) recommends a multidisciplinary approach for patients seeking GAS and that surgeons participate in continuing education activities in the field of GAS to maintain current knowledge [15].

In addition to experiences within healthcare settings, TGD patients face disadvantages with respect to income level, unemployment, housing insecurity, violence, and psychological stressors compared to their cis-gender counterparts. The 2015 United States Transgender Survey cites that the unemployment rate among transgender people of color (20%) was four times higher than the U.S. unemployment rate (5%). Nearly one-third (29%) of respondents were living in poverty, compared to 12% in the U.S. population. Finally, 39% of respondents experienced serious psychological distress, compared with only 5% of the U.S. population.

In summary, access to FFS is expanding but prone to limitations given extrinsic factors, namely, the availability of qualified surgeons and geography, as well as intrinsic factors, including prior healthcare experiences and socioeconomic status (Fig. 18.1). In the subsequent section, we plan to discuss the current state of insurance coverage within FFS, the implications of policies, and future outlook for TGD patients accessing FFS.

Fig. 18.1 Extrinsic and intrinsic barriers to FFS

Coverage by Insurance

Cost has consistently been cited as one of the major barriers to accessing gender-affirming care [14, 16]. Prior to the changes in legislation, TGD patients have historically paid out of pocket as FFS was not covered under health insurance plans [17, 18]. Thus, FFS—often consisting of multiple surgical procedures—has been regarded as financially prohibitive for many patients. In the early to mid-2010s, FFS ranged from $40,000 upward for full-face, one-stage operation [6]. At the time of this writing, the cost has substantially increased to $70,000 or more in the private sector. In tertiary and quaternary care centers such as UCLA, for patients seeking surgery without or outside of insurance coverage, out-of-pocket costs are even higher partially due to the higher cost of the facilities, healthcare personnel, and the reconstructive procedure codes that are set by the individual institutions. This is in contrast to other GAS, such as transmasculine and transfeminine chest surgery, which have comparably greater levels of insurance coverage [4]. A 2019 review of policies from large private insurers demonstrated that 96% covered transmasculine chest surgery, while 68% covered transfeminine chest surgery [19]. Thus, both public and private insurance coverage for FFS have notably trailed behind other GAS.

Given the prohibitive cost of FFS without health insurance, insurance coverage is the singular most important factor determining access to care [19]. Patients often have to navigate a complex process prior to receiving approval for FFS (Fig. 18.2). To complicate matters further, there are nuances in insurance coverage that are not well understood by many patients and surgeons. To clarify the primary issues, we will summarize the major considerations.

Private Insurance

The primary driver for private insurance coverage of FFS is the employer providing health benefits. Unlike state-based plans (i.e., Medicaid and all plans supported by the Affordable Care Act), employer-based plans are not governed by state law, albeit state laws do have some impact in influencing coverage (Fig. 18.3). Rather, employer-based health benefit plans are subject to the federal Employee Retirement Income Security Act of 1974 (ERISA) [20–22]. ERISA provides employers with broad discretion in deciding which health insurance benefits to offer and does not mandate that employers provide specific benefits. ERISA governs most private-sector employer-sponsored health plans, including retirement and health insurance plans, and sets minimum standards for these voluntarily established plans. However, once an employer decides to offer a health plan, ERISA imposes rules regarding fiduciary responsibilities, transparency, and participant rights, such as the right to sue for benefits or breaches of fiduciary duties. ERISA also includes a preemption clause under Section 514(a) such that it supersedes any state laws that "relate to"

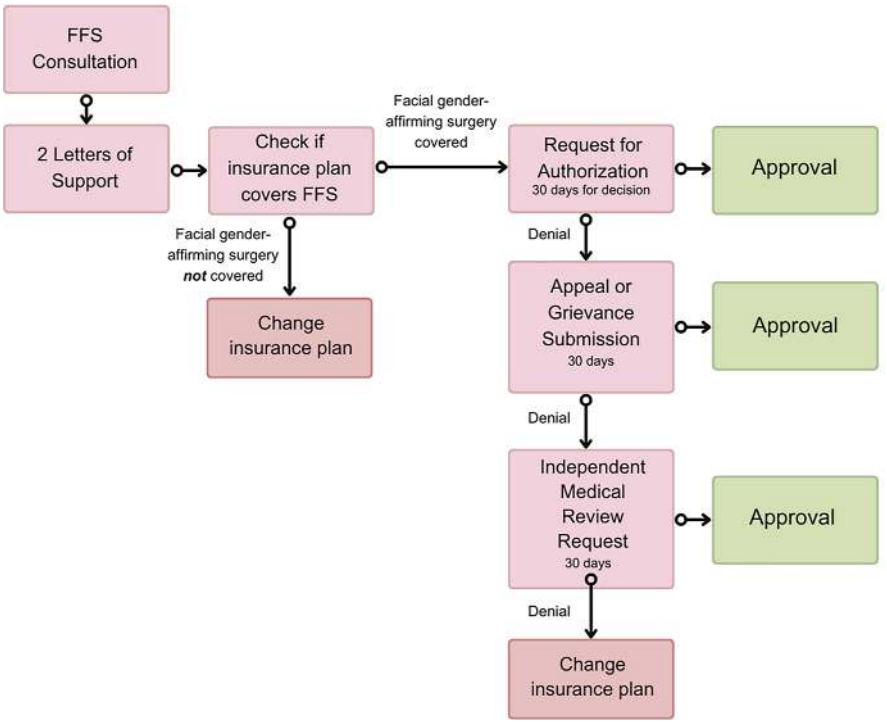

Fig. 18.2 Process of obtaining insurance approval for FFS. (Copyrights retained by JCL)

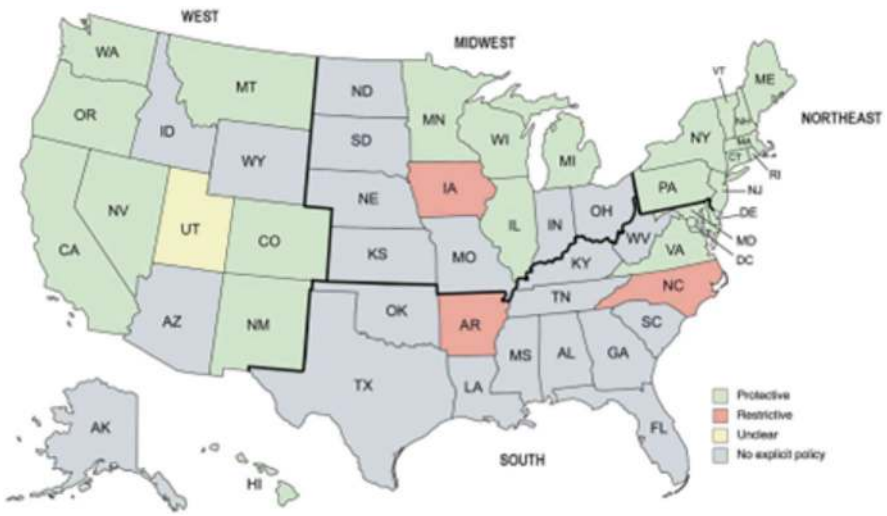

Fig. 18.3 Categorization of individual state policies on gender-affirming care for private Insurers. (Copyrights retained by JCL)

employee benefit plans. This preemption allows self-funded (or self-insured) plans to bypass state insurance regulations, giving employers the freedom to decide which benefits to include without being bound by state mandates on coverage (such as those for gender-affirming surgeries). As a result, even in states with protective policies such as California, some employer-based plans may exclude coverage for gender-affirming surgery, while employers in more restrictive states may choose to include such coverage. The latter situation illustrates one of the reasons for patients with private health insurance coverage traveling for surgery.

Beyond legislation, ambiguity in gender-affirming procedures is frequently found in private insurance policies. Many private insurers do not explicitly list FFS as a covered service, leaving patients and providers uncertain about whether the procedure will be approved. Even when FFS is covered, policies differ widely with respect to the type of procedures covered without regard to the individual nature of FFS for each patient.

Public Insurance

The major driver in public insurance coverage is state legislation (Fig. 18.4). Until the Vermont bill in 2008, there were no states that offered gender-affirming care under state law [23]. The second state, California, passed its protections for gender-affirming care in 2013 [3, 24]. Over the years, the number of states offering Medicaid policies that cover gender-affirming care has increased, reflecting broader recognition of the medical necessity of these procedures. A turning point came in 2016,

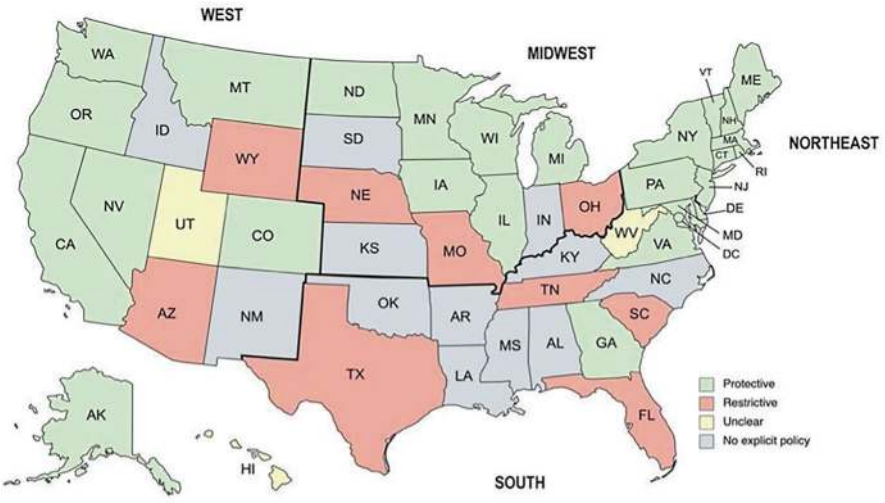

Fig. 18.4 Categorization of individual state policies on gender-affirming care for Medicaid. (Copyrights retained by JCL)

when the U.S. Department of Health and Human Services issued a ruling under Section 1557 of the Affordable Care Act, prohibiting discrimination based on gender identity for healthcare providers and insurers receiving federal funds, including Medicaid as well as all plans offered on the health insurance exchange [25]. However, despite federal guidance, Medicaid coverage for FFS varies widely from state to state. While some states, like California and Vermont, have been pioneers in offering Medicaid coverage for gender-affirming care, others have lagged behind or outright refused to provide such coverage. In 2022, only 26 states and the District of Columbia have protective policies for gender-affirming care overall despite federal law [3, 4].

Among the states protecting gender-affirming care, only eight states had Medicaid policies that explicitly covered FFS, while 17 states explicitly covered other gender-affirming surgeries like chest or genital surgery (Figs. 18.5 and 18.6) [4]. As of 2022, 17 states were noted to explicitly provide Medicaid coverage for either gender-affirming chest or genital surgery; yet, only 8 states provided explicit coverage for FFS. This disparity highlights the challenges TGD patients face in accessing comprehensive care in that clarity is not present. Of note, the lack of explicit language does not always equate to lack of coverage. For example, California has chosen to not include specific language on facial surgeries in its Medi-Cal guidance documents but broadly covers gender-affirming facial procedures. However, in states with less clear policies, the lack of explicit coverage represents an unknown for patients on how much coverage could be expected. In states with protective gender-affirming care policies, the absence of specific language was likely intentional, allowing flexibility in patient access within a rapidly evolving surgical landscape without restricting particular procedures.

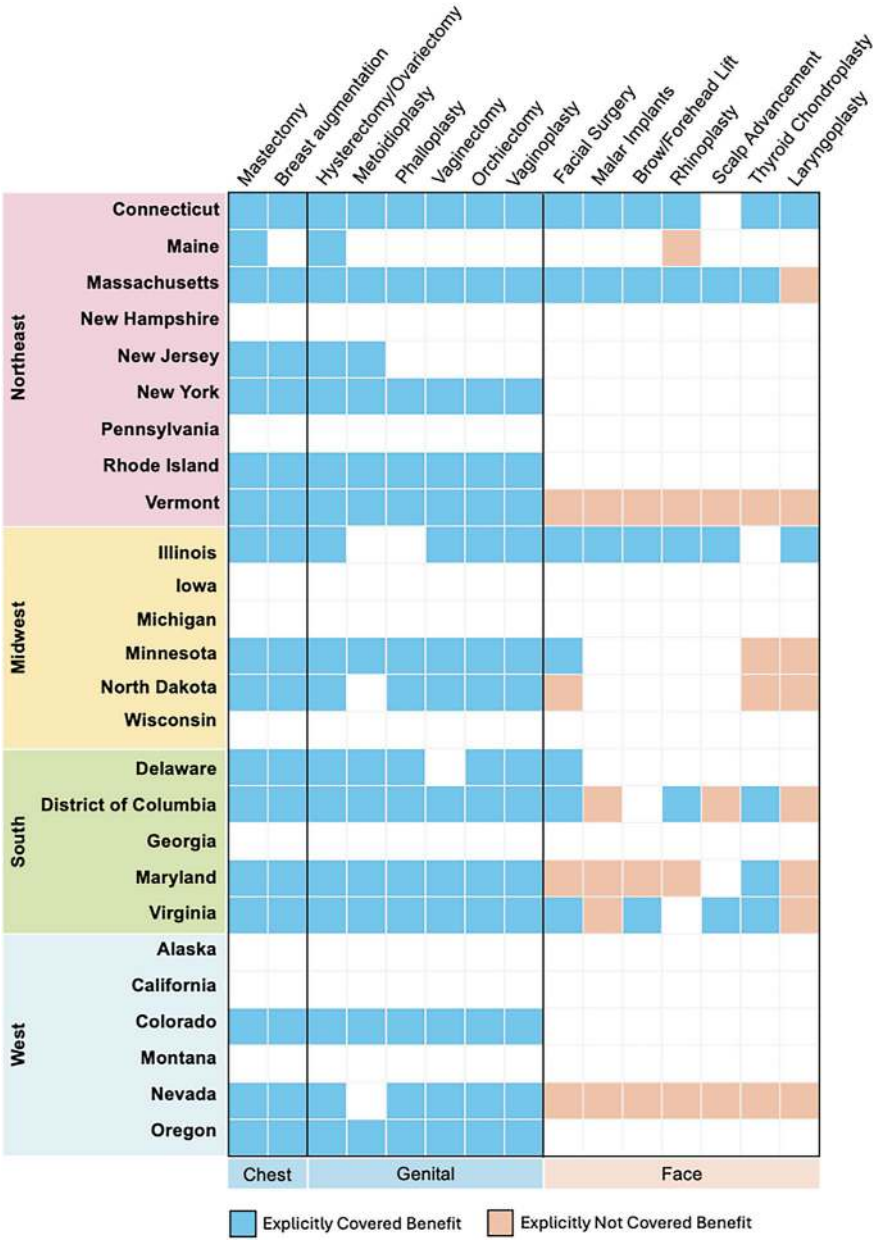

Fig. 18.5 Medicaid coverage for gender-affirming craniofacial and neck procedures. (Copyrights retained by JCL)

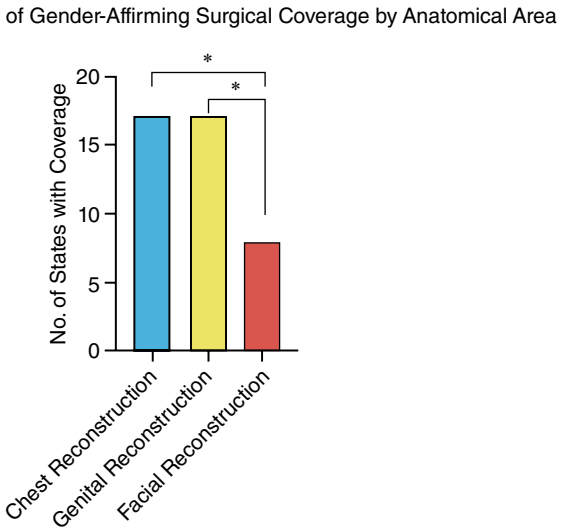

Fig. 18.6 Comparison of number of states that reported explicit coverage for gender-affirming surgeries by anatomical area. (Copyrights retained by JCL)

Coverage at the Patient Level: Experiences and Challenges

For patients and providers, navigation of the insurance process for FFS can often be challenging and time-consuming. For physicians and practice administrators, these challenges range from disparities in coverage for private versus public insurance carriers, in network versus out of network benefits, preauthorization disputes, and the lack of standard coverage policies [22]. Even in states in which insurance coverage for FFS is legally protected, multi-level insurance appeals may be required. The required documentation for insurance approval can vary by plan. For example, while the most recent edition of the World Professional Association for Transgender Health (WPATH) Standards of Care recommends only one letter of support for patients planning to undergo gender-affirming surgery, this recommendation does not always align with some insurance plans which may require further documentation of support [15].

Earlier in our experience, we reviewed the process in terms of timing and costs of navigating FGAS patients through the insurance process at UCLA [22]. Even at a major academic institution within a state with protective policies, only 65% of our patients received insurance authorization without the need for initiating an appeal or grievance process. In other words, only 65% of patients received a comparable experience to authorization requests for other reconstructive procedures. Notably, most patients in this subset had Medi-Cal. The total time from initial consultation to definitive authorization for this group was 1.1 ± 0.2 months [22].

Within the same cohort, 25% of patients required an extended approval process, most commonly requiring the initiation of a grievance process followed by an independent medical review. Ultimately, patients in this group did receive approval; however, this process required 7.0 ± 1.1 months, a sixfold longer process compared with the group with standard approval ($p < 0.001$). Of note, at the time, the majority of the plans that had their initial denials overturned were those insured by the state of California and not self-insured policies. Hence, independent review by the California Department of Managed Healthcare was the ultimate factor in the approval. Additionally, these appeals required significant administrative time and effort to successfully obtain approval. For this subset, it was estimated that the time and cost estimate of the insurance appeal process was 10.8 ± 1.0 h and $855.00 ± 91.53 per patient.

For 10% of our patients, despite multi-level appeals and independent medical review requests, surgery was ultimately denied. All patients in this group had employer-based, self-insured private insurance governed by ERISA. In this group, it is worth noting that a lengthy and costly multi-level process was undertaken to no avail. While time and costs can be quantified, the negative effect of the denial process on the individual patient and their mental well-being can only be imagined.

At the time of this writing, the process in California has substantially improved. The number of approvals is likely to be much higher at this point likely due to the increased knowledge of the surgeons and surgical offices. However, due to federal policy changes, 2025 has been notable for an increase in denials by private insurances returning our practice to more grievance processes compared to the recent. Moving forward, it remains unclear whether this increased scrutiny will stabilize as utilization patterns normalize or continue to evolve alongside the expanding field of FFS.

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Chapter 19
Patient Perspectives

Katarina B. J. Morgan and Sarah K. Fadich

The Decision to Pursue FFS

Framing the Conversation

For many TGD patients, the decision to pursue FFS is not actually a *decision* as much as it is a *necessity*. Furthermore, the face is an individual's connection with society. When a patient experiences dysphoria associated with their facial appearance, this adversely impacts their ability to engage with others in the world. Misalignment between identity and anatomy may become an all-consuming distraction, limiting a person's capacity to form interpersonal relationships, perform activities of daily living, and pursue professional opportunities. The resulting mental health consequences may be severe and debilitating.

Surgeons must understand that when they perform FFS, they are not simply addressing a patient's internal dysphoria; rather, they are fundamentally and irreversibly modifying that patient's relationship with society. Given the unparalleled importance of the face as a gender cue, many patients may regard FFS as their most important surgery of their entire transition. While non-surgical interventions like padding, tucking, and shapewear may conceal dysphoric triggers below the neck, patients often resort to hormonal therapy and facial hair removal to achieve a more

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cis-feminine facial appearance. However, these measures may not be sufficient in addressing underlying masculine facial anatomy; thus, patients may pursue surgical intervention.

As FFS continues to gain recognition, access remains limited for the majority of TGD patients. This vast unmet need results in widespread emotional distress at a population level, with a significant mental toll on individuals who identify a treatment for gender dysphoria yet are unable to obtain it. No matter what surgical innovations may follow, FFS cannot be truly revolutionary for TGD communities without equitable access.

Barriers to Care

Many patients will go to extreme lengths to access the surgery, including uprooting the lives of themselves and their families for an opportunity to receive FFS. Patients may abandon a career they love to work for a company that offers an FFS benefit. They may cross state lines in search of a government that is more sympathetic to trans issues. Some may engage in sex work to save for surgery, while others may already rely on it for survival. This political and social reality can lead to heightened emotions and expectations for patients who are considering FFS. Furthermore, surgeons play an important role in helping manage expectations, ensuring that adequate behavioral and social supports are in place alongside surgery, and providing emotional encouragement for patients in the preoperative period.

Cost is often the most significant barrier to a patient undergoing FFS. Without payment support from a third-party source, the cost of surgery may present as an insurmountable barrier for some TGD patients [1]. Surgeons should recognize that the patients at initial consultation represent a small fraction of the broader transfeminine population who desire FFS but for whom it is unattainable. Moreover, those who ultimately reach the consultation stage are a reflection of the socioeconomic and cultural disparities inherent in accessing gender-affirming care.

Sequencing of the Surgeries

Many patients seek FFS alongside chest, genital, and other gender-affirming surgeries. Patients may choose to sequence these surgeries based on the level of dysphoria they experience with each body part, how society perceives their respective appearances, or the extent of insurance coverage for a given procedure. Additionally, addressing gender dysphoria in one body region can have a significant impact on the way an individual's gender and gender identity is perceived by society. As a result,

undergoing one gender-affirming surgery can heighten any remaining dysphoric triggers for patients. It can be uncomfortable and often unsafe for TGD patients to possess some body parts that are perceived as cis-feminine by society while others are viewed as cis-masculine. Surgeons should be mindful of this potential struggle during their conversations with patients regarding FFS in the broader context of their medical transition.

Selecting a Surgeon

Introduction

For many patients, selecting the "right" surgeon is the most deliberative aspect of the facial feminization journey. As this text has established, no two experiences with gender dysphoria are the same. Thus, patients will have varying objectives and priorities regarding surgery. Surgeons should recognize that each patient's decision is highly personal and is often contingent on the establishment of trust between surgeon, staff, and patient (Fig. 19.1).

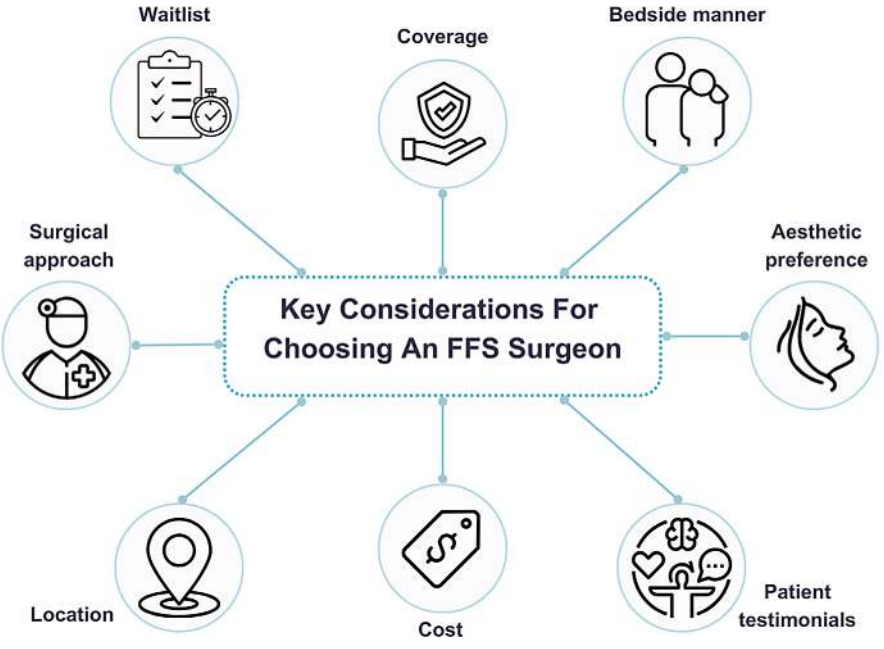

Fig. 19.1 Key considerations for choosing a FFS surgeon

General Approach

When searching for their facial feminization surgeon, patients often follow one or a combination of two general approaches, which the authors will describe as "coverage-driven" and "community-driven."

Coverage-driven individuals understand that their employer or insurer provides a facial gender-affirming surgery benefit, and will work within the bounds of their plan to select (or be assigned) a surgeon. This process mirrors the way patients in the broader medical system often receive their specialty care. Patients may receive a referral from their primary care provider for a particular surgeon or clinic, or they may speak with their employer's human resources department or a third-party insurance representative to understand their options. Patients in this category may have prior experience with the medical system or have undergone previous gender-affirming procedures, making them more familiar with the complexities of the medical insurance process. As coverage for gender-affirming care becomes more commonplace, insurers for these patients may vary widely, ranging from generous, self-insured corporate plans to public payers (i.e., Medicaid plans). Surgeons should be aware the substantial variation in benefits, network limitations, and cost sharing among payers.

Community-driven individuals take a distinct approach to selecting their surgeon. Rather than being guided by their insurance benefits these patients explore surgeons based on feedback and experiences from friends or others in the community. Many of these patients may have a facial gender-affirming surgical benefit but may not fully understand the network limitations of their coverage, leading them to consult with surgeons who are not contracted within their insurance network. Therefore, it is important for staff to be knowledgeable about contracted networks (both surgeon and surgical facility) and be capable of explaining the insurance process to patients in a manner that does not falsely imply coverage. The remainder of patients in the community-driven cohort may not have a facial gender-affirming surgical benefit and are often interested in understanding out-of-pocket costs and available financing options for cash-paying patients.

Research and Resources

Patients are likely to conduct their own research into the surgeons they are considering. This research may consist of peer-to-peer modes of communication as well as forums (i.e., Facebook, Reddit). These online spaces serve as trusted venues for patients to share their experiences with a particular surgeon, solicit recommendations on what procedures to consider, share before-and-after photographs, discuss complications or revisions, and seek support from a community of individuals with similar life experiences. In several forums, patient testimonials and photographs are organized into wiki-style directories that prospective patients can utilize to assess

all aspects of a surgeon's practice, from front office operations to bedside manner, surgical technique, and post-operative protocols. The result is a living, community-oriented resource bank with high utility and sophistication.

Patient testimonials may have a profound impact on a given surgeon's practice. The novelty of facial gender-affirming surgery affords surgeons the opportunity to build an international reputation in a relatively short period of time (for better or worse). Without exaggeration, a single outstanding online review, accompanied by clear before-and-after photographs and a detailed narrative, can generate hundreds of consultation inquiries for an otherwise unknown surgeon. Some patients may reference a surgeon's prior cases by name, often in surprising detail and sometimes with accompanying photographs, during consultation. However, just as a single outstanding review can rapidly elevate a practice, another describing serious adverse events or alleging medical negligence or malpractice can quickly undermine it.

Key Considerations

Each patient develops their own list of factors when selecting a surgeon, weighing each element differently in the decision to pursue a particular provider. These considerations include:

Coverage For patients with an FFS insurance benefit, coverage strongly influences surgeon selection. Many of the most recognized surgeons decline to contract with major insurance carriers, which may limit patients to providers at academic medical centers depending on their geographic region. Patients may also have to travel considerable distances depending on the adequacy of their insurance network in a given region [2].

Cost For uninsured patients, the cost of FFS may be prohibitive. For those with insurance, coverage may be subject to variable reimbursement rates depending on the specific procedures performed as well as the treatment location.

Aesthetic Preferences Gender markers and beauty standards vary significantly across cultures. Each patient will have unique aesthetic preferences for individual facial features and their collective impact on the face. There is also a distinction between pure feminization of anatomical structures versus so-called beautification; much of this distinction lies in the soft tissue work that constitutes FFS. Human perception of gender is often complex, and feminization and beautification are not two strictly distinct processes. Nevertheless, patients may have a preference for surgeons who deliver aesthetic results that are more glamorized versus those that are more natural. While surgeons may be known for delivering a particular aesthetic, they should still individually discuss aesthetic preferences in a patient-centered approach to surgery. In addition, ethnic considerations cannot be understated when performing FFS, with particular attention to which features patients may wish to preserve or alter in relation to ethnicity.

Surgical Approach Patients may have their own preferences regarding surgical approach and may be seeking a surgeon with particular training or experience. For example, patients may conclude from their medical imaging that a type III forehead reconstruction is indicated and thus may avoid surgeons who only perform burring of the anterior table of the frontal sinus. Patients may similarly prefer surgeons who perform pre-operative imaging utilize virtual surgical planning (VSP)—while others may not. In addition, patients may consider non-surgical interventions for feminization, and thus, may prefer providers who often perform both non-surgical and surgical interventions for facial feminization.

Bedside Manner The establishment of trust between patient and provider is critical for a surgery as complex and intimate as FFS. Candid discussion of experiences with gender dysphoria requires considerable vulnerability on the part of patients and may trigger negative or overwhelming emotions in clinical settings. Patients seek providers who create a safe and welcoming environment in which they can discuss surgical goals, ask questions, and share concerns without intimidation or fear. Rushing through a consultation, speaking more than listening, and being overly prescriptive with treatment recommendations are common ways for a surgeon to inadvertently turn away patients.

Patient Testimonials Social media forums often reinforce narratives that sensationalize specific providers based on polarizing reviews—which can lead to a concerning "cult of personality" for a given surgeon. This dynamic may result in the unintended consequence of patients feeling they are receiving suboptimal care from providers who lack a strong online presence or a history of outstanding online reviews. Surgeons should remain aware of this trend and may encourage former patients to share their experiences online if they are interested in expanding their practice.

Geography While geographic constraints are decreasing as more FFS providers enter the field, the search for the "right" surgeon remains challenging for many patients. Some patients prefer surgeons within their geographic region, while others may travel long distances and even internationally for their preferred surgeon. To minimize this burden, surgeons may consider offering virtual consultations as a means to expand access to FFS.

Waitlist A long waitlist can easily deter patients who may otherwise be interested in a particular surgeon. Patients frequently document wait times of two years or longer for some of the most well-known providers. Extended waitlists on a national scale indicate substantial unmet need within the community. Surgeons should strive to maintain their waitlists at a reasonable length and help refer patients to trusted colleagues when wait times are unacceptable. Staff should also maintain cancellation lists and make efforts to move up patient consultations and surgeries whenever possible.

One Author's Approach

Ultimately, patients will select the surgeon that satisfies the most prerequisites at a cost that is attainable for them. It is common for patients to schedule consultations with several providers before selecting one to perform the surgery. In selecting her own surgeon, this author began by researching available providers online and combing through reviews (see: **Patient Testimonials**) on forums such as those discussed earlier in this chapter. She also posted her own pictures on one forum and solicited feedback and recommendations from peers. This helped her to compile both a list of procedures she was interested in as well as a list of surgeons whose results aligned with her aesthetic preferences (see: **Aesthetics**). From there, she chose to schedule initial consultations with five surgeons; three were virtual and two were in-person consultations (see: **Geography**). She used those consultations to answer her questions about surgical approach, procedure recommendations, cost, and other considerations.

By the final consultation, she had narrowed her list significantly. One surgeon was overly prescriptive and condescending (see: **Bedside Manner**); another was trained using outdated surgical techniques (see: **Surgical Approach**); a third required his patients to finance the entire surgery upfront and seek reimbursement from their insurance (see: **Cost** and **Coverage**). This left two surgeons to choose from. Next, the author projected financial costs for each surgeon based on the terms provided to her by her insurance company in her plan's summary of benefits and coverage. Importantly, one surgeon was a preferred in-network surgeon with her plan, while the other was out-of-network and could trigger balance billing. The difference in out-of-pocket costs between the two surgeons was projected to exceed $10,000. Following a blended community- and coverage-driven approach, the author ultimately selected the in-network surgeon who also had an amazing bedside manner, was trained in the newest surgical techniques, engaged in research and advocacy to benefit the community, and had established a patient-provider relationship built on mutual trust and respect.

In summary, every patient will conduct their own process in selecting the surgeon to perform their FFS, and this author's example is meant to highlight one of those unique approaches. The diversity of the community suggests each patient will have their own preferences and priorities, and surgeons should avoid a one-size-fits-all approach to care. Surgeons seeking predictable success should strive to recognize patients' individualized experiences with dysphoria, listen reflectively, allow patients to take an active role in their surgical planning, set reasonable expectations, and support patients' physical and mental health throughout the process. The next section will describe the pre-operative consultation process in further detail from the patient perspective.

Pre-operative Consultation

The initial consultation serves as an opportunity for patients to meet their provider and assess whether they share the same values and goals for surgery. Positive chemistry is essential to building trust and mutual respect. Surgeons who dominate the conversation, offer unsolicited opinions, speak over patients, or adopt an argumentative tone may discourage patients from pursuing further care.

Patient-Centered Approach

Surgeons should be prepared to engage patients with a wide range of medical literacy related to facial feminization surgery. Some patients may arrive with minimal understanding of available procedures or anatomy, while others may present highly detailed treatment plans informed by extensive independent research. A successful consultation allows the patient's dysphoria to guide the discussion. Surgeons should begin by eliciting the patient's experiences with facial dysphoria and clarifying surgical objectives.

Because dysphoric triggers and aesthetic priorities vary widely, each consultation is inherently unique. Patients' perceptions of gender are shaped by culture, evolving social norms, and personal experience, and many maintain emotional attachments to specific facial features. As a result, some patients may wish to preserve or only partially modify features that are traditionally considered masculine. Surgeons should remain mindful of their own biases and avoid reinforcing cisnormative, white, or Eurocentric beauty standards that may conflict with a patient's goals.

It is important to recognize that each patient's experience of gender and their relationship to society is highly individualized. Social cues related to gender perception vary across cultures, and norms and ideals surrounding gender identity continue to evolve.

Surgeons who are overly prescriptive with their recommendations during the consultation risk overtreatment or failing to address the patient's individualized concerns. Offering unsolicited surgical recommendations may also introduce new dysphoric triggers for patients about anatomy that had not previously caused distress. Patients commonly ask surgeons for their treatment recommendations, and the point of a consultation is for surgeons to share their professional medical advice with the patient. However, surgeons should strive to offer any recommendations in the broader context of the patient's surgical objectives. Active listening is crucial to developing a collaborative, patient-centered treatment plan that addresses the patient's chief concerns in seeking surgery.

Discussion of specialized training and experience in FFS is also essential to building trust. Visual aids should be incorporated into the discussion to demonstrate a range of surgical outcomes including common complications like scarring or

shock hair loss. Surgeons should prepare a series of case images that best illustrate their surgical technique and results. Quality before-and-after photographs are one of the most convincing methods for recruiting new patients, and they also function to set realistic expectations for patients regarding surgical outcomes and aesthetics. Providing former patients a copy of their own before-and-after images and encouraging them to share with their networks doubles as free and highly effective marketing for a surgeon's practice. Patients will also discount providers who decline to provide B&As; claiming HIPAA or hospital policy precludes providers from sharing photographs will not satisfy patients who have successfully seen photos at other consultations they have attended.

Setting Realistic Expectations

Expectation-setting is critical to the pre-operative surgical planning process. Patients must understand the full range of risks, benefits, costs, and alternatives for each individual procedure prior to proceeding with surgery. Managing these expectations early on in the process will help mitigate serious mental health consequences during the post-operative period. Patients may not recognize the potential for complications of FFS; if these complications do occur, they may lack adequate support structures to manage the resulting physical or emotional challenges.

Miscellaneous Considerations

Pre-consultation Imaging

For surgical planning, patients may undergo medical imaging such as head and neck computed tomography (CT) scan to assess anatomic structures. These images may serve as visual aids during the consultation to assist in explaining the surgical procedures and approach to patients. These scans may also be leveraged to create virtual surgical plans with surgical guides and models—particular for bony contouring the forehead and jaw.

Virtual Consultations

Surgeons may consider offering both in-person and virtual consultations as appropriate. Surgeons—especially those interested in developing a national profile—should expect consultations with patients traveling from various parts of the country or even the world. Travel for in-person consultations can impose a significant

financial burden, particularly for patients completing multiple consultations across jurisdictions. While insurance may cover the consultation or surgical procedure itself, it rarely covers associated travel, lodging, or meal expenses, making in-person consultations cost-prohibitive for many patients. Offering virtual consultations can improve access and equity for these populations while expanding the geographic scope of the practice.

Other Pre-operative Considerations

Expectation Management and Worsened Post-operative Dysphoria

While physical pain and discomfort from FFS tend to improve with time, the emotional recovery can be far less linear. While the medical care team thoroughly mitigates physical risk of harm prior to surgery, the psychosocial challenges of the surgical journey are less consistently addressed. Recovery from FFS can be particularly difficult in the immediate postoperative period. It may also be challenging during a frequently overlooked extended recovery phase, when swelling can temporarily exacerbate gender dysphoria. While surgeons routinely counsel that it will take 12–18 months to see the final result, the phenomenon and timeline of dependent edema settling into the chin and jaw should be discussed explicitly.

A key component of recovery is setting clear expectations that dysphoria may worsen temporarily before improving. Given the possibility of transient worsening gender dysphoria, patients would benefit from additional screening and support.

Social Considerations

One cannot understate the impact that FFS has on how individuals interact with others and are perceived in social settings. Gender dysphoria often improves following FFS, and experiences of misgendering tend to decrease, further reducing dysphoria and enhancing social functioning. These changes may lead to increased confidence and reduced social anxiety, with downstream effects across social, romantic, and personal domains of life. Navigating social situations after FFS can be both empowering and challenging. Less expected, however, is the need for trans women to prepare for the loss of perceived “male privilege” and the new experience of sexism.

"Passing" and "Going Stealth"

The ability to be generally perceived socially as one's identified gender will sometimes be referred to as "passing." A related term, "stealth" is when a TGD person "passes" and, in some contexts, chooses not to disclose their gender identity. While many patients use these terms to describe their goals for FFS and transition, clinicians should adopt this language only when it reflects how patients have articulated their own objectives. As a general principle it is safest to follow a patient's lead with regard to language describing the many sensitive aspects of transition. While many patients use these two terms, for others they can be problematic because they place the power of validation and affirmation on society and not the individual. They can further invalidate individuals who do not desire to blend into the gender binary.

Careful assessment of goals and expectations is crucial not only for surgical planning, but also communicating their feasibility. While people have varying goals and desires as it pertains to "passing" or living "stealth," it remains that most just want to live at peace with their face and body and to feel safe and affirmed by society and in their relationships.

Post-Transition Paradox

The process of transition can be all-consuming. In an ideal world, there is a seamless pivot to thriving as one's genuine self. In reality, however, the transition process often demands substantial time, resources, and emotional energy. When one reaches a post-transition life, many milestones in life may have been delayed. Patients may lose friends, family, faith community, or social support. For these reasons, post-transition can come with an unexpected kind of loneliness.

Historical Marginalization

Surgeons caring for the TGD populations should be aware of the marginalization and financial plight they experience. Such factors exacerbate the barriers to accessing surgeries. These barriers can be broken down into intrinsic factors related to gender dysphoria and its complications (e.g., social isolation, anxiety, depression, poor self-image) or extrinsic factors such as employment discrimination, social stigma around gender nonconformity, wage disparities, housing insecurity, lack of family or social support, hostile work environments, and legal or financial barriers to aligning one's legal name and gender marker. The cumulative impact of these factors is reflected in the disproportionately high rates of housing insecurity, unemployment and underemployment, survival or sex work, exploitation, physical and

sexual violence, adverse childhood experiences, and incarceration among TGD individuals, with the highest burden borne by trans women of color.

Treating gender dysphoria has proven to have a cascading positive impact on global mental health and social function. These outcomes alone provide strong justification for the value and importance of FFS.

Legal Considerations

Patients who are unable to update their legal documentation prior to surgery may benefit from completing an advance healthcare directive that reflects their identified gender, preferred name, next of kin, and any specific medical wishes. This is particularly important when a patient's default next of kin may not be supportive or affirming of their gender identity. Surgeons should provide the necessary documentation to allow for changes in legal documentation per patient's preference for gender identity.

Impact on Relationships

For many, the most impactful change they will encounter is a change in social perception of their gender and reduction in misgendering. There is a compounding positive impact when the reduced frequency of encountering transphobic violence or harassment is combined with the increased frequency of effortless and affirming encounters. Being gendered correctly by a stranger is a sort of unprompted affirmation that can spark a sense of gender euphoria. As these encounters become the norm, they will contribute to healing the wounds of years of discrimination, harassment, or misgendering.

Most patients who undergo FFS report that social and interpersonal interactions feel easier and require less emotional vigilance, leading to greater confidence and comfort. Many will report that the mental and emotional bandwidth that is liberated allows them to be more present and authentic in their relationships. While this shift may appear to others as a change in personality, for the individual it often reflects increased emotional safety and the ability to more fully flourish.

Romantic/Intimate Partners

The impact that FFS might have on a person's romantic relationships is highly variable and patient-dependent. Some TGD people delay many aspects of their life during transition including finding a partner. For unpartnered people, the reduction in gender dysphoria and improved confidence can dramatically improve the ability to

foster new romantic relationships. For those who are partnered, the experience is more varied. Partners often report that witnessing their loved one flourish after FFS strengthens the relationship. Conversely, some TGD individuals describe that reduced dysphoria and improved self-image allow them to leave relationships that were previously unhealthy. More than half of relationships that predate transition end at some point in the process. In relationships destined for demise, surgery can function as an accelerator.

The Concept of Grieving

Family members and partners may struggle with a loved one's transition, often early in the process and again with the rapid change in appearance following FFS. A common refrain expressed by family members is that transition brings about a strong sense of grieving or loss. For the transitioner, this reaction can feel deeply hurtful and invalidating, as it centers perceived loss rather than relief from long-standing distress. Because FFS can dramatically accelerate change in appearance, it is important for the surgeon to be aware of this common phenomenon. Encouraging loved ones to find their own support groups or resources (e.g., PFLAG, TransFamilies, GLAAD) to help unpack some of these feelings can be helpful.

Children and Family

TGD adults who already have children with children often have questions about how their children will perceive facial feminization surgery and how best to prepare and support them. While this is more the domain of family counseling—which should be highly encouraged—the surgeon should be prepared to address some basic questions, set expectations, and provide resources.

Children are generally adaptable and accepting. Young children are particularly adaptable as it pertains to a parent's transition. Often the hardest adjustment is during the immediate post-op period which stems from the child's concern about the bruising, wounds, or period of convalescence.

Adolescents may have a harder time adapting. Developmentally, they are in the process of finding their own identity. This is a time where they are highly attuned to social expectation and peer validation. Parents who began social transition during their child's adolescent years are also more likely to encounter difficulty helping their child adapt.

Families living in rural or socially conservative communities are likely to encounter more stigma which will be particularly difficult for an adolescent. Above all, the most important risk factor for a difficult transition is the degree of support and affirmation in the home(s) of the child. Patients with a non-supportive co-parent should be particularly prepared for a potentially difficult adjustment period.

Non-supportive/Toxic Co-parent

This represents a small but critically important subgroup of patients that should be identified during the preoperative period. While many co-parents will struggle through this process, a couple of key characteristics that might portend a particularly difficult adjustment period, (1) Are they passively unsupportive or actively toxic and condemning? (2) Are they willing to work together to help the children adapt in an affirming way or are they bent on condemning the transition? Children's attitudes and response to transition are a direct reflection of their environment. When one parent is actively hostile toward the parent in transition, the children will almost certainly struggle.

In cases with fraught custody arrangements, there is a corresponding possibility that the hostile parent could use FFS as an opportunity to further alienate the children. Patients in such a predicament should be counseled on this possibility and encouraged to seek multimodal support (therapy, support groups, parental coaching, etc.). The emotional pain of having one's children alienated is a profound emotional trauma that elevates the risk of anxiety, depression, and suicidality; in this population, timely treatment of gender dysphoria may be particularly life-saving. Unfortunately, this scenario is not uncommon, especially among patients from socially conservative backgrounds. In many cases, even when a co-parent remains adversarial, relationships with children can be restored over time, although this process may take years.

Framing "The Surgery" Conversation with Friends and Family

Patients present with varying levels community and family support. Even among those with a highly supportive social group, patients are often asked to defend their decision to pursue FFS. Encouraging patients to frame surgery as a deeply personal and private decision can be helpful, including preemptive statements such as: "*I'm sharing this because you're important to me and I value your support. I'm not seeking commentary on my appearance or my need for surgery*." In such cases, it would be highly advisable to have a few short-form resources that patients can provide to friends and family.

Day of Surgery

For many patients, FFS is the most transformative aspect of their transition, as it addresses internal dysphoria while also shaping how their gender is perceived externally. On the day of surgery, the entire care team should strive to create an environment that honors this monumental occasion and appropriately supports patients through a period of peak anxiety, anticipation, and expectations.

Preparation

Fostering a successful surgery day for patients begins long before the actual date of surgery. Surgical coordinators and other support staff should engage patients during the preoperative period to set expectations and review the surgical day timeline. While intake and anesthesia teams focus on clinical preparation, thorough social preparation is equally important. A surgeon's care team should have intentional conversations with patients about coordinating day-of-surgery logistics, developing an aftercare plan, ensuring adequate behavioral and physical supports, and managing the emotional strain of surgery.

Managing Fear and Anxiety

Many TGD patients associate clinical settings with fear and anxiety based on prior negative experiences. Few actions undermine trust more quickly than misgendering or deadnaming. A single lapse by any team member—from front office staff to nursing or anesthesia personnel—can sever trust immediately, regardless of intent or role.

Surgeons should ensure that each team member who comes in contact with a patient on surgery day is aware of the patient's chosen name and pronouns or is capable of soliciting this information from the patient without incident. Prompts like "I go by [name]; what can I call you?" and "I use [pronouns]; what pronouns do you use?" are a low lift for any team member who is meeting a patient for the first time. Ideally, the electronic health record should record this information for each patient, and staff are trained to check this information before addressing them. Misgendering during early postoperative encounters—particularly in the recovery area or inpatient setting—can have a profoundly negative effect on a patient's perception of the surgical experience and its overall success.

Promoting Patient Autonomy

Patients often seek a sense of control—however small—over a process that is otherwise largely out of their hands. The care team should therefore look for opportunities to support patient autonomy on the day of surgery.

Reviewing the surgical plan presents another opportunity for patients to exert their autonomy. Patients often wish to speak directly with their surgeon to voice concerns, reiterate aesthetic preferences and priorities, clarify lingering questions, and connect with a familiar provider who knows their case well. Surgeons should avoid rushing this conversation, despite time constraints or lengthy question lists. Emphasizing shared excitement and long-term surgical goals can help balance discussions focused on immediate postoperative expectations.

Another suggestion for promoting autonomy is allowing patients to choose the music played as they go under anesthesia. This by no means will affect the results of the surgery, but it may be an additional way to deepen the bond between surgeon and patient while calming any remaining restlessness and anxiety.

Post-operative Healing/Recovery Process

Recovery and Self-Care

A healthy post-operative recovery begins with strong pre-operative education, preparation, and expectation management. Knowing the full extent of physical challenges associated with post-operative recovery can help keep fear and anxiety at bay as well as prepare to address things like pain, swelling, bruising, and wound care considerations.

Beyond the immediate post-operative period, patients often face challenges that are largely psychological. As bruising resolves and regular life resumes, there is a natural draw to immediately begin assessing the efficacy of the surgery. This is problematic when the swelling of surgery can take 18 months to resolve. This is particularly relevant with jaw contouring, as swelling may confer a more accentuated masculine appearance for several months.

A patient and community-centered recovery protocol should center on promoting patient agency and ownership in their recovery. Some patients may become highly motivated to pursue any intervention perceived to aid recovery, regardless of cost or level of evidence, while others prefer clear, streamlined guidance. There should be an emphasis on evidence-based interventions while not discounting those interventions that are less studied or evidence-based.

A comprehensive FFS recovery plan should encompass pre-operative optimization, enhanced recovery protocols in the perioperative period, and a robust toolbox of interventions to address pain, nausea, swelling, bruising, scarring, depression, and anxiety.

Pre-operative
- Nutritional prehabilitation.
- Smoking cessation.
- Reviewing post-operative plan re: travel, support system/help, etc.
- Expectation management.

Perioperative
- ERAS protocol.
- Surgical planning—navigating staging.
- Considerations in choosing in-patient and out-patient surgery.

Post-operative
- Nutrition (adequate protein and caloric intake).
- Pain management (multi-modal approach that minimizes narcotics).
- Swelling management (gua sha / ice roller lymphatic massage, inclined sleeping, compression).
- Scar mitigation (sunscreen, silicone products).
- Post-operative depression and anxiety (therapy, support groups, reviewing pre-op photos *and* post-op progress photos).

Final Considerations

Given the promise of FFS, the authors sincerely hope hope that every TGD person who struggles with facial gender dysphoria can have access to such procedures. The small but growing circle of surgeons who have trained within FFS holds the privilege of helping patients better align their physical appearance with their gender identity. However, this privilege comes with serious responsibilities—particularly with respect to quality, cost, and access.

These authors would like to thank their own FFS surgeons, Drs. Justine Lee and Tommy Liu, for not only delivering exceptional surgical results but also for empowering them to excel in so many other aspects of their lives. This chapter could not have been written without the transformations that occurred as a result of FFS.

Lasting Impact, a Note from the Authors

For SKF, FFS came nearly 6 years into her transition, delayed due to denial by insurance. Despite having a fairly "successful" transition with hormones, FFS would prove to be the single most life-changing step in her journey. It has allowed her to shed a lifetime of social angst and fear and has empowered her to realize her fullest authentic self in every domain of life. Treating the dysphoria and anxiety that once was a pervasive fog, tainting every waking moment and social interaction has provided a sort of levity and ease with which she navigates her life. Hard things are just a little easier, and joyful things just a little more joyful. In a society that stigmatizes and pathologizes trans people, being visibly trans is at worst dangerous and at best a sort of involuntary nudity revealing the most vulnerable and painful parts of her inner world. FFS changed everything. At long last, it handed over the scrolls of her trans story and empowered her to choose, on her terms and timing, when and with whom to share. Like someone seeing both themselves and the world after a lifetime of astigmatism, this new view on life feels at once sensational and peaceful. To live authentically—to see and be seen as you truly are—is a superpower, appreciated most by those who have lived without. It is this author's sincerest dream that every trans person experiences their own highest fidelity and authenticity.

For KBJM, FFS was the single most important step in her transition. It was intentionally her first gender-affirming surgery, and it was by far the most impactful in addressing her gender dysphoria and allowing her to safely move about the world. Prior to surgery, this author would spend hours every day obsessing over her masculine facial features and imagining a life where her face aligned more closely with her soul. She isolated herself from the world, constantly fearing rejection from friends, intimate partners, and even strangers. Now, years after her initial surgery, her facial gender dysphoria is virtually nonexistent. Not only that—she feels beautiful and desirable for the first time in her life. She is able to form new relationships with people without being forced to address her transgender identity in the very first conversation. While there is tremendous privilege in this new reality, it has empowered her to be vulnerable and share her story on her own terms and in situations that she deems safe. Being transsexual is a core part of KBJM's identity, but it no longer has to be the "only" label society assigns to her. In closing, surgery gave this author the freedom to excel in her professional career, to form more meaningful interpersonal relationships, and to advocate more loudly for universal access to gender-affirming care for others in her community. It allowed her to transform into someone the childhood version of herself could hardly imagine but never gave up hoping to become. And *that* is the full promise of facial feminization surgery.

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Chapter 20
Concluding Remarks

Sumun Khetpal, Aaron S. Long, and Justine C. Lee

FFS has emerged as a promising frontier within plastic and craniofacial surgery. Its origins can be traced to early twentieth-century physical anthropology and orthodontic literature examining sexual dimorphism between reference male and female skulls. Beyond cephalometric and anthropometric measurements distinguishing male from female, we discuss how achievement of the feminine aesthetic often transcends these objective measures.

Contemporary FFS requires the surgeon to consider ethnic, racial, and individualized experiences of gender dysphoria and to approach the preoperative consultation as a patient-centered opportunity for restoration and affirmation throughout the transition process. Achieving optimal outcomes demands integration of features that promote femininity and harmony while adhering to fundamental principles of facial aesthetics and craniofacial surgery. Through the preceding chapters, we aim to equip readers—whether trainees or attending surgeons—with the knowledge and perspective necessary to provide thoughtful, effective care for transgender and gender-diverse patients undergoing FFS.

Our text had several aims including the following: (1) to describe how FFS fits into the broader process of gender-affirming care and help primary care providers guide patients through the initial steps to receiving surgery; (2) to guide surgeons through the process of pre-operative consultation among transgender and gender-diverse patients; (3) to help surgeons understand anatomic differences between cis-masculine and cis-feminine faces; (4) to discuss operative techniques and procedural

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considerations across facial feminization procedures for facial feminization (i.e. forehead reduction, hairline advancement, brow lift, rhinoplasty, lip lift, genioplasty, facial fat grafting); (5) to review operating room setup, anesthesia considerations, and post-operative protocols for hospitalization among patients undergoing FFS; (6) to examine the advent and role of VSP within FFS; (7) to highlight the role of the World Professional Association of Transgender Health (WPATH) and the Standard of Care (SOC) in determining readiness for surgical referral and pre-operative consultation; and (8) to orient surgeons and staff to challenges of promoting access, lowering cost, and enhancing delivery of care. While each of these points is examined in detail throughout the book, the authors would like to highlight several key takeaways.

Chapters 1, 2, 3, and 4 review the historical foundations of FFS and outline pre-operative considerations, including surgical readiness, coordination of mental health, primary care, and endocrinology services, and navigation of the consultation process. Chapters 5, 6, 7, 8, 9, 10, and 11 discuss virtual surgical planning (VSP), and dive into the specific operative techniques used to feminize particular facial features. Chapters 12 and 13 address clinical and technical considerations unique to non-binary patients and patients of diverse ethnic backgrounds. Chapters 14, 15, and 16 focus on intraoperative care, including anesthesia considerations, operative workflow, and postoperative recovery. Chapters 17 and 18 review the current state of the evidence base for FFS, relevant healthcare policies, and extent of insurance coverage within the United States. Chapter 19 presents two patient perspectives, offering insight into their transition journeys, including surgeon selection, navigation of the gender-affirming care environment, surgical preparation, and postoperative recovery.

As demand for FFS continues to rise within the United States, the field remains ripe for continued innovation and advancement. The constant revision and re-iteration of technique to enhance aesthetic and functional outcomes; the exploration of various media (bone, skin, fascia, and cartilage) and relevance to aging, femininity, ethnicity; the role of technology and artificial intelligence in planning and executing the surgical team's vision; the compound of data and potential contributions to the evidence base for quality of life and clinical outcomes associated with FFS; the application of devices and methods from other surgeries and specialities [1–3]. The field is endless for opportunity, but its continued growth relies on several factors including insurance reimbursement, robust surgeon workforce, development of gender-affirming surgery programs, and sustained institutional support of research efforts [4–9].

Ultimately, the future of FFS lies not only in technical refinement, but also in fostering a healthcare environment that fully recognizes and supports the diverse needs of TGD individuals. By embracing this responsibility, we move closer to a world where gender-affirming care is accessible, evidence-based, and transformative for all.

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