Optimizing aesthetics in gender-affirming vaginoplasty and vulvoplasty: a narrative review and discussion based on over 600 cases of transfeminine vulvar construction

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Background and Objective: The vulva is the external portion of a gender-affirming vaginoplasty or vulvoplasty procedure—the "visible" result of surgery. The vulvar appearance can play a major role in how individuals feel about their surgical results and new genital anatomy. Therefore, optimizing the aesthetics of the vulva is an important component of surgical care. Although there is no one "ideal" vulvar appearance, aesthetics are optimal when each major sub-unit of the vulva is reconstructed to create a proportional and cohesive vulvar unit. In this article we perform a narrative review of the literature and discuss clinical approaches to improve aesthetic satisfaction such as patient education, re-defining the "ideal" vulva, aesthetic surgery tenets and technical strategies based on our collective experience of over 630 gender-affirming vulvar constructions.

Methods: A narrative review of the literature was completed accessing PubMed, EMBASE, Google Scholar using search terms "Vaginoplasty OR Vulvoplasty". Articles were removed if not pertaining to gender affirmation surgery, were not in English language, were not accessible or did not discuss aesthetics in the body of the text.

Key Content and Findings: A total of 1,042 articles were identified from initial search criteria. Of those, 905 were excluded as they did not involve gender affirmation as an indication. An additional 112 papers were excluded as they were not accessible, not in English, focused on non-vulvar outcomes or did not comment on vulvar aesthetics. Ultimately 25 articles were included for narrative review; 21 of these included technical descriptions of vulva and 13 had direct aesthetic discussion. The anatomy and aesthetics of the transfeminine vulva are reviewed according to the previously described principle of anatomic vulvar sub-units: the labia majora, labia minora, clitoris, urethra and the introitus.

Conclusions: Ultimately, creating the optimal vulva for each individual patient will demand flexible surgical decisions based on individual anatomy and available tissues. This narrative review provides an overview of current approaches to aesthetics in gender-affirming vulvar construction and technical insights based on our institutional experience of performing over 630 gender-affirming vaginoplasty and vulvoplasty procedures.

Keywords: Aesthetics; transgender; vaginoplasty; vulva; transfeminine

Introduction

Vulvoplasty is a surgical procedure performed in transgender and gender-diverse individuals with assigned male at birth (AMAB) genital anatomy. Vulvoplasty can be performed as a stand-alone procedure for individuals who do not desire or are not a candidate for the creation of a neovaginal canal, or more commonly vulvoplasty is performed as part of a gender-affirming vaginoplasty (1,2).

As the visible portion of a gender-affirming vaginoplasty, the vulvar appearance plays a major role in how patients feel about their surgical results and new genital anatomy. Satisfaction with post-operative vulvar aesthetics has been shown to correlate with overall satisfaction rates following gender-affirming vaginoplasty and aesthetic dissatisfaction can drive ongoing dysphoria (3,4,5). Most of the literature discussing vulvar aesthetics focuses on the challenges of achieving a pleasing aesthetic result, most often referencing the difficulty in creating the appearance of the clitoral complex and labia minora (6,7). The purpose of this paper is to (1) review the anatomy and aesthetics of the transfeminine vulva, and (2) discuss surgical strategies and clinical approaches to optimize the vulvar aesthetics. We present a narrative review of current literature on surgical vulvar aesthetics and discuss these findings based on the authors summative experience in 630 gender-affirming vulvoplasties. We present this article in accordance with the Narrative Review reporting checklist (available at https://tau.amegroups.com/article/view/10.21037/tau-22-681/rc).

Methods

A narrative review of the literature was completed accessing PubMed, EMBASE, Google Scholar using search terms "Vaginoplasty OR Vulvoplasty". Articles were removed if not pertaining to gender affirmation surgery, were not in English language, were not accessible or did not discuss aesthetics components in the body of the text. See *Table 1* for a summary of the search strategy. Institutional review board approval was not required for this study as it is a narrative review. Patient consent was provided for potentially identifiable images. All additional images are unidentifiable with no patient details included in the text.

Results

A total of 1,042 articles were identified from our initial search criteria. Of those, 905 were excluded as they did not involve gender affirmation as an indication. An additional 112 papers were excluded as they were not accessible, not in English, focused on non-vulvar outcomes or did not comment on vulvar aesthetics. Ultimately 25 articles were included for narrative review; 21 of these included technical descriptions of vulva and 13 had direct aesthetic discussion (*Figure 1*). Findings from the literature review are discussed below along with our institutions preferred techniques according to each individual anatomic vulvar sub-unit, an approach previously described by Dy *et al.* (8).

The "Ideal" vulva

Individual patient education is perhaps the most important pre-operative step to aid in post-operative vulvar aesthetic satisfaction. It is critical to specifically address the concept of an "ideal" vulvar appearance. Given the large degree of

Table 1 The search strategy summary

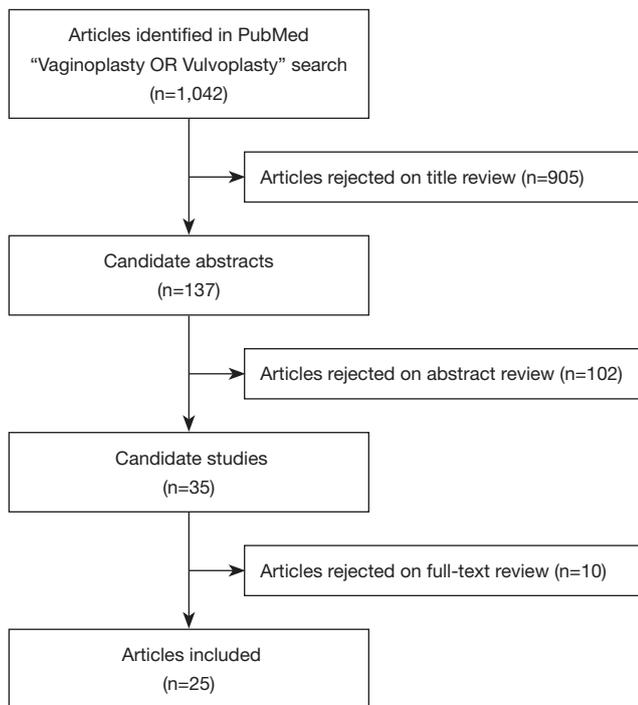| Items	Specification
Date of search	09/26/2022
Databases and other sources searched	PubMed, EMBASE, Google Scholar
Search terms used	Vaginoplasty or Vulvoplasty
Timeframe	Up to September 2022
Inclusion criteria	Articles were included if they pertained to gender affirmation surgery, were published in English, were accessible and discussed aesthetic outcomes
Selection process	Literature review with identification of abstracts done by author H.R. Papers rejected on abstract if not discussing vaginoplasty or vulvoplasty in the transgender population. Full text review carried out by authors B.R.P. and H.R.

Articles identified in PubMed
"Vaginoplasty OR Vulvoplasty" search
(n=1,042)

→ Articles rejected on title review (n=905)

Candidate abstracts
(n=137)

→ Articles rejected on abstract review (n=102)

Candidate studies
(n=35)

→ Articles rejected on full-text review (n=10)

Articles included
(n=25)

Figure 1 Summary of literature review of vulvar aesthetics in transfeminine vulvoplasty and vaginoplasty.

variation in the appearance of natal vulva, it is crucial to educate patients that there is not one "ideal" appearance of a post-operative vulva either. In fact, much of the beauty of the vulva comes from these subtle and nuanced differences. Variation in individual opinion may impact perceptions and definitions of a "natural" appearance. Furthermore, every surgical result will vary according to age, body habitus, tissue volume, tissue characteristics and unique aspects of individual healing.

Providing an array of images of natal vulva can be helpful to illustrate this concept of vulvar diversity. In our practice, The *Great Wall of Vagina* by Jaime McCartney and *Womanhood*: *The Bare Reality* by Laura Dodsworth are utilized for this purpose (9,10). It is just as important to also provide an array of patient images to illustrate post-operative vulvar diversity (i.e., creation of an institution's own "*Great wall of vulva*").

Patients may request different aesthetic "ideals" or outcomes based on their personal interpretation and preferences for certain variations in vulvar anatomy. Exposure to only particular aesthetic variations in the media and on the internet can create an artificial image or unrealistic standards with regards to the "ideal" vulvar

form (11,12). Clarifying patient preferences during the pre-operative consultation can help guide surgical decision making and education. For a successful outcome, the surgeon must ensure that expectations can be met. In some circumstances, significant pre-operative education must be done to adjust unrealistic expectations, with a mutual goal of post-operative satisfaction. In practice we re-define the "ideal" vulva as the vulva that best relieves individual dysphoria based on individual anatomy and the tissue available for vulvar reconstruction.

Aesthetic differences from natal vulva

We advise against over-comparison to the natal vulvar anatomy. For patients very focused on these potential differences, providing additional pre-operative education about these subtleties can assist in alleviating concerns and setting expectations prior to and following surgery. As discussed, the key to aesthetic satisfaction is for an individuals' pre-operative goals and expectations to align with their surgical result. For some individuals, understanding how their vulva may differ from a natal vulva is a necessary step in this process.

Common differences of a post-operative vulva as compared to a natal vulva include: (I) a slightly larger clitoris, (II) a longer distance between the clitoris and the urethral meatus, (III) labia minora that may not completely frame the introitus, (IV) potential lack of a defined posterior fourchette, (V) lack of a defined anterior labial commissure (*Figure 2*).

Aesthetic principles

Dy *et al*. have previously presented their approach to vulvoplasty, noting the aesthetic goals of the procedure: (I) labia minora that are well-defined and three-dimensional; (II) labia minora that frame the introitus; (III) sufficient clitoral hooding; (IV) a patent introitus that appears closed at rest; and (V) prominent labia majora (8). Creating an aesthetic vulva employs many of the guiding principles upon which plastic surgery was founded—namely the judicious use of available tissues and replacing "like with like" (8,13). In this study, the authors note that each penile structure has an embryological homologue in the natal vulva. Understanding this embryology informs the tissues used to construct each vulvar sub-unit. This allows for the additive effect of each reconstructed subunit and its expected
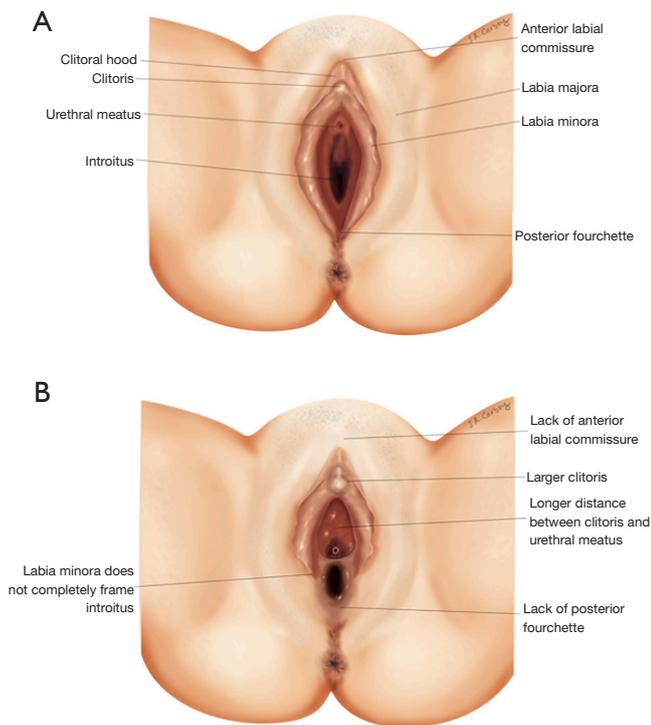
Figure 2 Anatomy of a natal vulva. (A) Anatomy of a post-surgical vulva. There are several subtle differences in anatomy highlighted here. (B) These can include a larger clitoris, less distinct anterior commissure, a longer distance between the clitoris and urethra, labia minora that do not completely frame the introitus and lack of a posterior fourchette.

structure to create a synergistic and overall "aesthetic" and "expected" vulvar appearance (8).

Although it is helpful to discuss each sub-unit of the vulva separately, it is important to never lose sight of the "overall picture". An optimal aesthetic result is accomplished by achieving the discernible presence of all important sub-units of the vulva and appropriate anatomic proportions. As there is a finite amount of tissue available in each case, each step and decision will affect the next. Trade-offs regarding use of tissue will often need to be made to best optimize the overall look and function of the vulva, as opposed to optimizing one sub-unit at the expense of the others. Below we discuss these goals according to this sub-unit approach and the principle of embryologic homologues. The authors acknowledge that many differences in opinion and techniques exist between surgeons and centers. The techniques discussed below reflect best practices at our institution and a synthesis of prior studies which have

informed our current approach.

Anatomic vulvar sub-units

The labia majora

The embryologic homologue of the labia majora is the scrotum (8). Concordantly, it is standard to construct the labia majora utilizing scrotal skin (14,15). The labia majora represent the dominant feature of the vulva, responsible for a large part of the visible portion of the external genitalia. The key factors that will contribute to aesthetic labia majora are maximal preservation of fat and labial volume and the avoidance of excess skin and labial ptosis.

The first step to creating the desired appearance of the labia majora is thoughtful marking of the incisions and excess scrotal skin to be removed. There is significant variation in skin incision patterns in the field of vaginoplasty and vulvoplasty surgery, with some authors describing a midline scrotal incision followed by delayed skin excision and others preferring immediate skin excision (14,16,17). It is our preference to perform immediate skin excision whenever possible so the skin graft can be prepared while the perineal dissection proceeds. Practices vary between institutions regarding timing of skin excision. Late skin excision has the potential to prolong surgical time since graft processing is delayed; however, it allows the surgeon to use as much vascularized skin in constructing the vulva as possible to minimize need to skin graft the vulvar surface (14). The following description represents the marking process at our institution.

The lateral incisions set the lateral borders of the labia majora. We mark this incision approximately one finger-breadth medial to the groin crease to avoid the border of the labia majora being placed excessively lateral, which may result in an overly wide appearance of the vulva. Conversely, placing these incisions any more medial will result in increased visibility of the labial scars. If possible, these lateral incisions should not extend superiorly beyond the level of the adductor longus tendon in order to avoid excessive visibility of the upper portion of the scars, however in some cases extension superiorly may be necessary in order to avoid a dog ear. In our practice, the inferior marking of skin resection is set by palpating the level of the perineal body. This anatomic level, in all described vaginoplasty techniques will be the location of the neovaginal introitus. In our hands the superior borders of skin excision are set by holding tension on the scrotal skin in the midline and
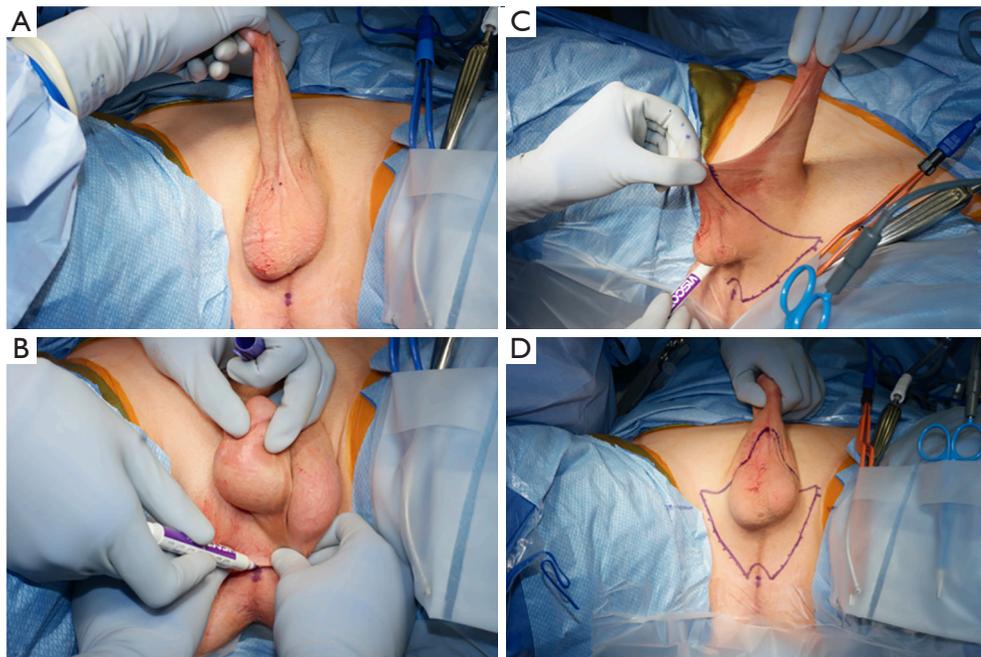
Figure 3 Markings for skin excision. (A) A mark is placed at the perineal body which is the level of the neovaginal introitus; (B) the skin is grasped in the midline and pulled down to the level of the perineal body until the desired smooth contour is achieved without excessive tension; (C) lateral incisions are marked from the level of the perineal body to the adductor longus tendon, one finger-breadth medial to the groin crease; (D) final markings including the perineal flap.

pulling this down to the level of the perineal body marking until the remaining tissue creates a smooth contour (14). This midline mark is made and the lateral and medial marks are connected accordingly. See *Figure 3* for examples of the markings for immediate scrotal skin excision; noting that these markings will set the anatomic boundaries of the labia majora sub-unit.

A smooth, voluminous contour of the labia majora is typically desirable (18,19). Individual tissue volume should be assessed, however maximal preservation of fat and Dartos tissue is often necessary to preserve adequate fullness to the labia majora. There are inherent limitations to the scrotal tissue. The scrotum is tasked with thermoregulation for the testicles and the Dartos layer is temperature responsive. What may appear as "trim" labia in cool temperatures may look loose and saggy when warm (*Figure 4*). The scrotum does not naturally contain subcutaneous fat and there is often a clear transition of the fullness of the lower abdominal and mons fat and the loss of adipose tissue as one enters the relatively fat-devoid scrotum (20) (*Figure 5*). The majority of the fat available then for labial fullness comes from skeletonizing the spermatic cord during orchiectomy. If all available fat and connective tissue is not preserved, the labia majora will often look deflated.

The labia majora also tend to lose volume with resolution of post-operative swelling and additional fat atrophy (20). In patients who have a very prominent adipose transition between the scrotum and adjacent tissue, there is a greater risk for developing a "hollowed" appearance. In our experience both the superior and the inferior half of the labia majora are at risk for "hollowing out". We mitigate these risks through careful attention to intra-operative fat preservation and re-distribution. The superolateral labia can appear flat if excessive subcutaneous tissue is removed with skin graft harvest. In some cases, the fat spared from the spermatic cord can retract superiorly and predispose to inferior hollowing. During closure, suturing the column of fat down to the inferior margin of the labia majora can aid in maintaining the desired fat distribution evenly throughout the labia (*Figure 6*). Some authors have reported preservation and use of the spermatic cord for additional labial volume augmentation; however, we have not found this to be necessary in addition to the risk of cord palpability and persistent dysphoria from this practice (20). Other reported strategies have included preservation of all scrotal skin with de-epithelialization and burial for additional labial
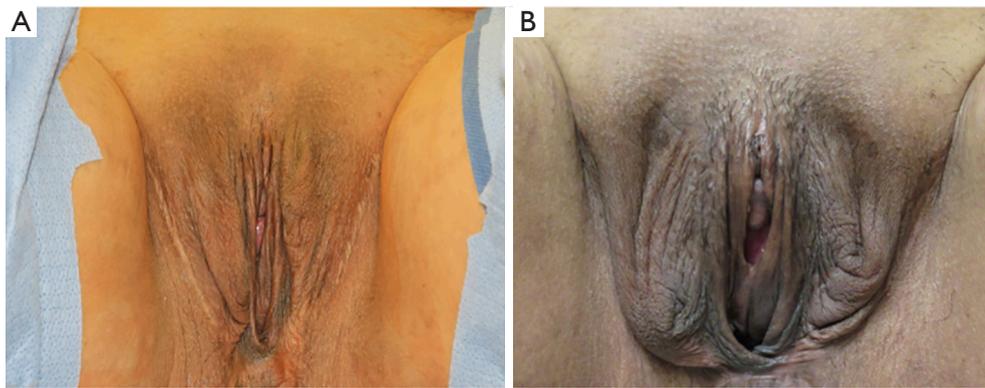

Figure 4 There are limitations inherent to the tissues available in vulvoplasty. The Dartos layer in the scrotum is thermoresponsive. This can greatly affect aesthetic appearance. Note the vulvar appearance in same patient in cool temperature (A) and in a warmer environment (B).
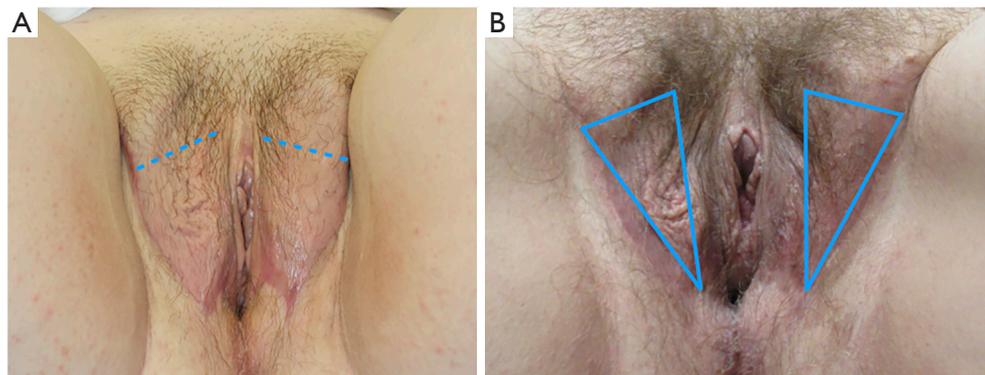

Figure 5 Hollowing of the labia majora. (A) There is often a clear transition visible between the fat of the mons and the loss of adipose tissue as you enter the fat-devoid scrotum (blue dashed line) as can be seen in this patient at 3 months post-operatively. (B) The more pronounced this is intra-operatively, the greater tendency for a "hollowed" out appearance to occur post-operatively, as is seen here at 12 months. The blue triangles outline this area of labial hollowing.

volume (21). If additional labia majora volume is requested in the post-operative period our preferred approach is a combination of de-epithelialization and internalization of any redundant labia majora skin in combination with fat grafting. Although some controversy exists regarding degree of fat graft take, one study reports patient satisfaction after a single round of fat grafting to the labia majora during aesthetic revision (22).

The aesthetics of the labia majora subunit will not become apparent until closure at the end of the case, which can be challenging due to herniation of fat through the incisions. However, once the inferior points of the labia majora flaps are brought down for closure, careful attention must be paid to excise excess scrotal skin. Excess skin will appear ruggated and ptotic which can result in a dysesthetic

"scrotal" appearance, especially on standing (*Figure* 7). However, skin excision should not be so aggressive that a tension-free closure is compromised, potentially leading to more severe wound breakdown and increasing risk of introital stenosis. Even with immediate skin excision, there will often be a dog ear of skin excess that needs to be excised at closure. This is best done medially in order to hide the incision along the natural junction of the labia majora and labia minora subunit (8,23) (*Figure 8*). In our experience, lateral excision of the dog ear will result in a scar landing in the midline of the labia majora which will be very visible (24).

It is challenging at the time of the primary vulvoplasty to create the appearance of an anterior labial commissure. The pedicle of the penile skin tube as it is pulled down
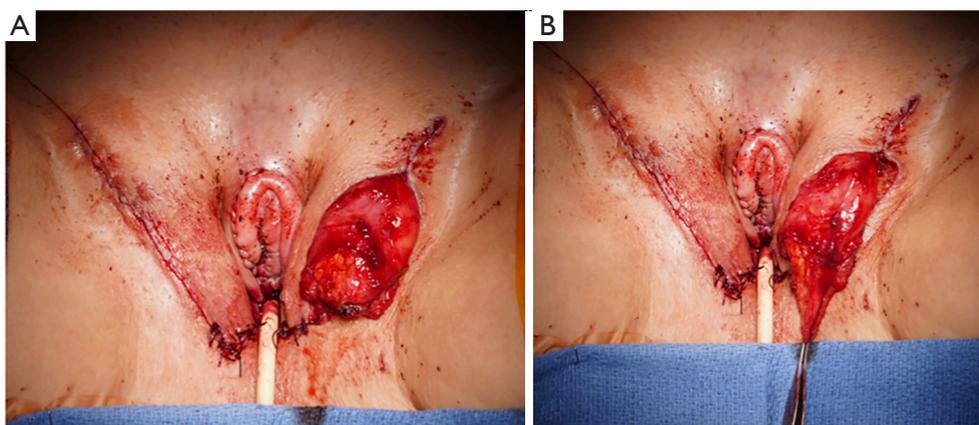
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Figure 6 Much of the fat available for labial volume comes from skeletonizing of the spermatic cord. This column of fat has a tendency to retract superiorly. Securing this fat down to the inferior margin of the labia major can aid in maintenance of the desired volume distribution evenly throughout the labia.

Figure 7 There is a fine line between too much and too little scrotal skin left over the labia. The patient in (A) had a mild excess of scrotal skin leading to a "scrotal" appearance of the labia majora on standing (B). The patient in (C) had a large degree of skin excess leading to a "scrotal" appearance in all positions.

and inverted creates a separation between the labia majora that often cannot be corrected primarily (*Figure 9*). A key maneuver to decrease separation at the anterior commissure is minimizing downward tension on the penile skin tube. One method to accomplish this is adding additional length to the penile skin tube with as much skin graft as needed to achieve minimal tension on closure. However, even cases where tension in minimal can still result in separation between the upper labia majora at the anterior commissure. This can be especially prominent in patients with a wide penile base. If this is a source of aesthetic dissatisfaction for the patient post-operatively, this can be addressed by a wedged skin excision and closure at a second stage (24,25). However, the authors have not found this to be a common request in clinical practice, potentially due to the added tissue volume from the folded neurovascular bundle and

tunica in our chosen technique discussed below.

The clitoris

The embryologic homologue of the glans clitoris is the glans of the penis (8). It is widely accepted that the coronal ridge, with its rounded edge and pattern of sensory innervation from the dorsal nerve of the penis, is best suited to shape the clitoris (26-28). There is typically an excess of glans and coronal ridge tissue, except for some cases involving pubertal suppression. A variety of techniques to create the clitoris have been described including a dorsal wedge technique and various M or W-shaped flaps (16,29). Below we discuss our technical preferences that we believe create optimal clitoral aesthetics while minimizing risk to damage of the neurovascular pedicle.
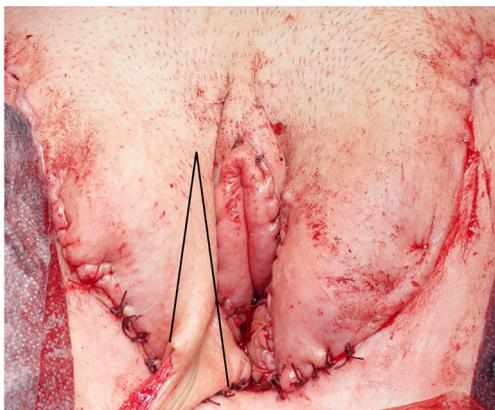
Figure 8 There is always a dog ear of excess skin to excise. This should be done medially at the junction of the labia majora and minora (as marked). Lateral excision will flatten and efface the labia minora in addition to creating a visible scar that lies in the middle of the labia majora subunit.

Figure 9 The penile-inversion technique creates a separation between the superior aspects of the labia majora where the penile skin tube is pulled down (arrows). This separation is a challenge to the creation of an anterior labial commissure. The additional volume of the folded tunica at this level can help off-set this concern.

It is our practice to mark approximately 1–1.5 cm on either side of midline on the coronal ridge. This tissue will be coned to shape the clitoris. The remaining central glans is discarded. What is done with the remaining coronal ridge tissue beyond the 1–1.5 cm marks depends on the technique utilized to create the labia minora which is determined based on the amount of available penile skin (discussed below) (30). In situations where the preputial skin or distal
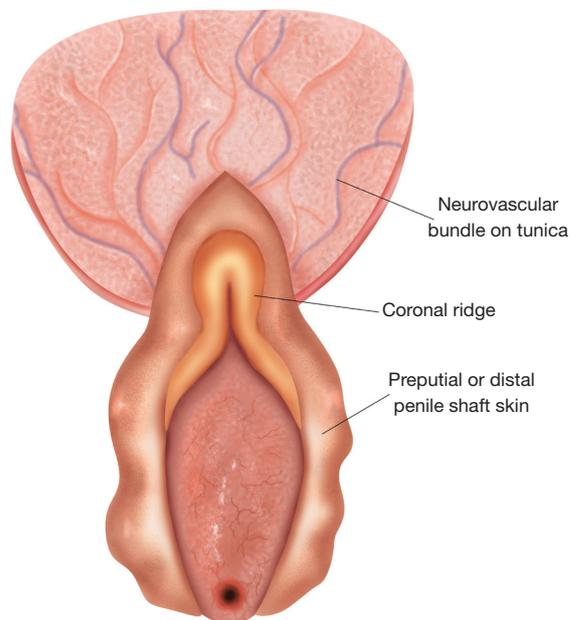

Figure 10 Labia minora and clitoral hood construction using the preputial or distal penile shaft skin. When enough skin is available, the preputial skin is the best match for the labia minora tissue. With this technique, the tissue of the coronal ridge is coned to form the clitoris as well as the clitoral frenulum, creating a smooth transition between the clitoris and labia minora sub-units.

penile shaft skin is used for the labia minora, we will keep the entire coronal ridge in continuity with this skin (8,21,23). The area marked at 1–1.5 cm will then be coned to form the clitoris, which results in an outward/ lateral curvature of the remaining tissue of the coronal ridge. This effect will closely resemble the natal clitoral frenulum resulting in a smooth transition between the clitoris and labia minora sub-unit (*Figure 10*).

We also perform an alternative technique of using a dorsal urethral flap to create the medial aspect of the labia minora (31). If this technique is used, then the remaining tissue of the coronal ridge beyond 1.5–2 cm is discarded and the glans is simply incised and coned at the markings (*Figures 11,12*). In this situation it is important to leave a small lip of skin proximal to the coronal ridge in order to allow for meticulous inset of the clitoris into the urethral flap (*Figure 13*). The urethral flap can suffer from venous congestion that can lead to delayed healing and raw flap edges. These edges can stick together leading to fusion over the clitoris. This should be monitored in the post-operative period and any adhesions should be released at the clinic visit to prevent fusion over the clitoris. Our algorithm for
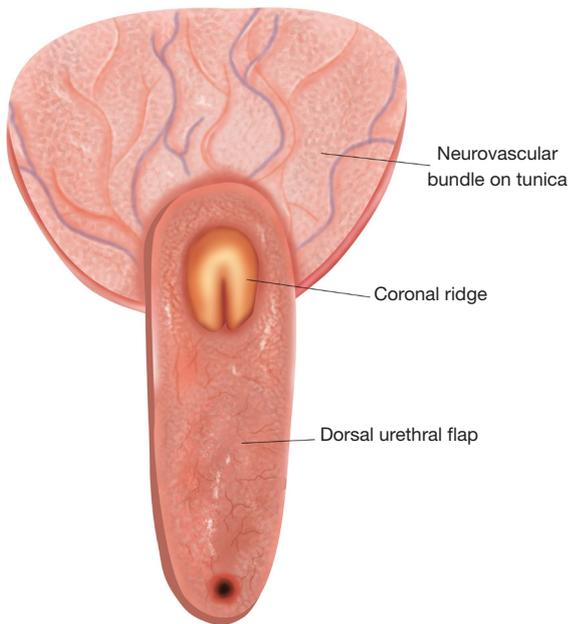
Figure 11 Labia minora and clitoral hood construction using the dorsal urethral flap. This technique is available in all patients as there is always an excess of urethral tissue. However, there is no substitute for the preputial skin when it comes to the aesthetics of the labia minora. We reserve this technique for individuals who lack sufficient penile skin.

selection of technique for clitoris, labia minora and clitoral hood construction is summarized in *Figure 14*.

It is our preference to leave the neurovascular bundle of the penis *in situ* on the dorsum of the tunica albuginea. The alternative approach is to dissect the neurovascular bundle off of the tunica (15,16). In addition to a simpler dissection that does not risk damage to the neurovascular pedicle, we find that the volume added by the folded tunica over the pubic bone helps fill in any depression or concavity resulting from inferior traction and inversion of the penile skin tube. Without this added bulk, any lack of an anterior labial commissure can be more pronounced. Other authors have described fat transposition and anchoring procedures to modify mons aesthetics and correct this deformity (15,16,32,33). Although the bulk of the neurovascular pedicle and tunica at this level has previously been described as aesthetically unfavorable, we have found this to be an overall advantage in all but the most slender patients and have not found it necessary to perform additional aesthetic modifications to the mons. For even the extremely slender patient with a girthy penis, this bulk may appear excessive initially but gradually diminishes over the first year after surgery. Notably Chen *et al.* have described narrowing this dorsal strip of tunica in order to
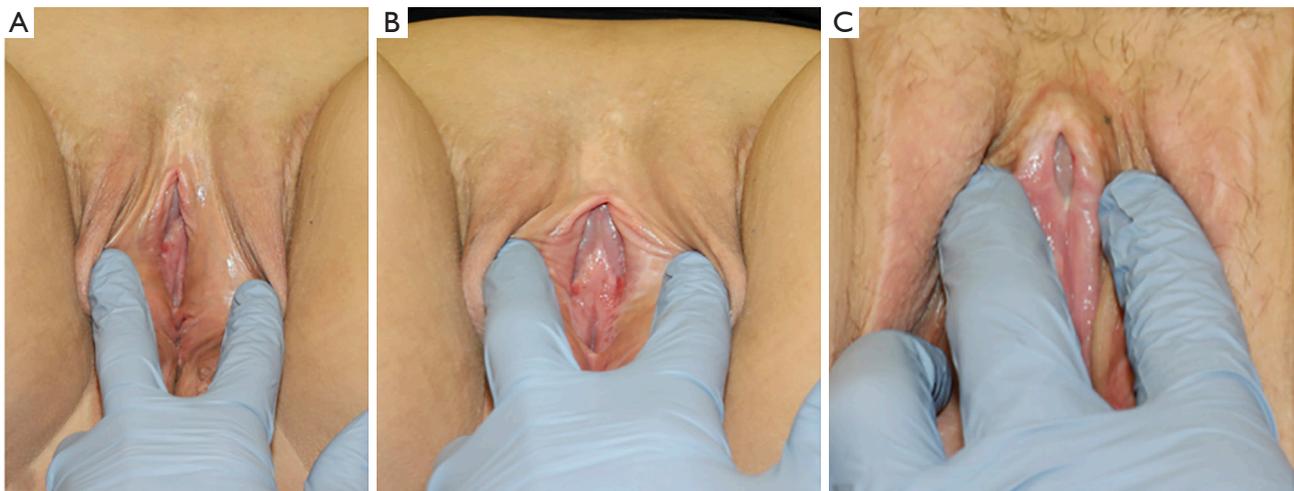

Figure 12 Clitoral hood and labia minora aesthetics. (A,B) A typical result of labia minora and clitoral hood construction using preputial skin; (B) note the smooth transition between the clitoris, clitoral frenulum and labia minora. (C) A typical result of labia minora and clitoral hood construction using a dorsal urethral flap.
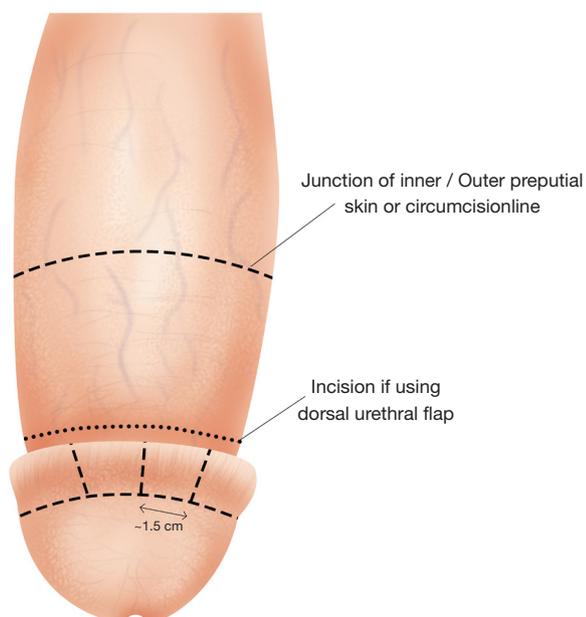
Figure 13 Penile skin incision markings used for the preputial/distal penile shaft skin and dorsal urethral flap techniques.

avoid risk of excessive bulk (34).

Once the clitoris is formed, careful attention must be paid to clitoral positioning. One pitfall is an overly large or overly projected clitoris, which can result in a phallic appearance. The clitoris should be positioned exactly midline and aligned with the inferior edge of the adductor longus tendon (8,23,35). An alternative approach describes positioning at the prior penile base (16). Ultimately, the most "anatomic" position for the clitoris is at the point where the two corpora join, however positioning at this point will often lead the clitoris to be placed too low due to the thicker pubic symphysis of the testosterone exposed pelvis. Positioning too inferiorly can result in difficulty with stimulation and lack of visibility due to excessive coverage and hooding. Positioning too far superior can create an excessively long distance between the clitoris and urethra in addition to creating an overly prominent and visible clitoris with diminished clitoral hooding. Therefore, we use the adductor longus tendon as a more consistent anatomic landmark for clitoral placement (8,23). In larger patients
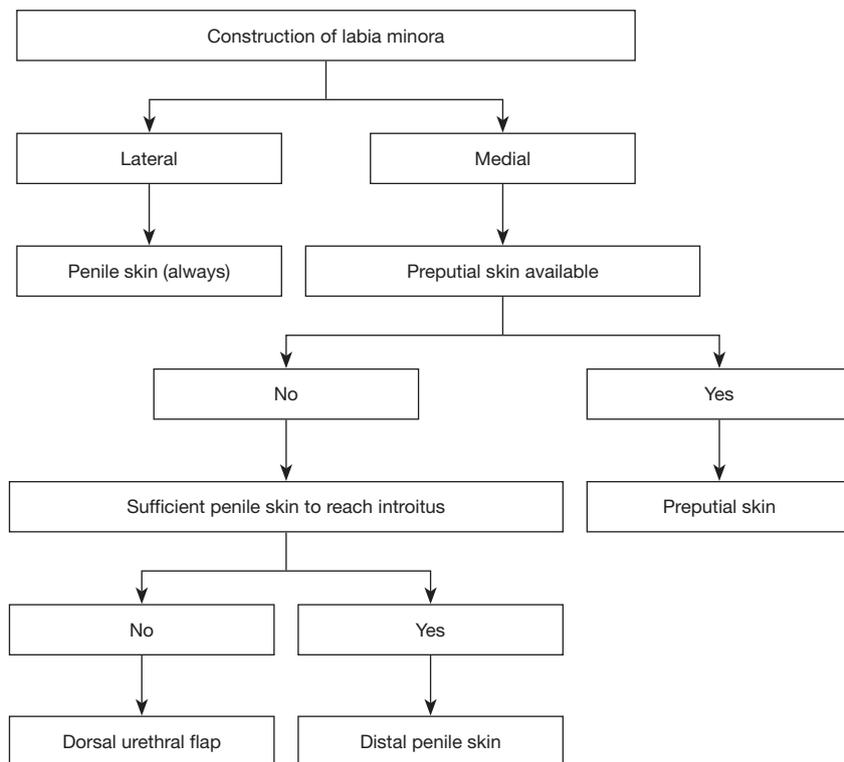

Figure 14 Algorithm for technique selection for creation of the labia minora and clitoral hood.

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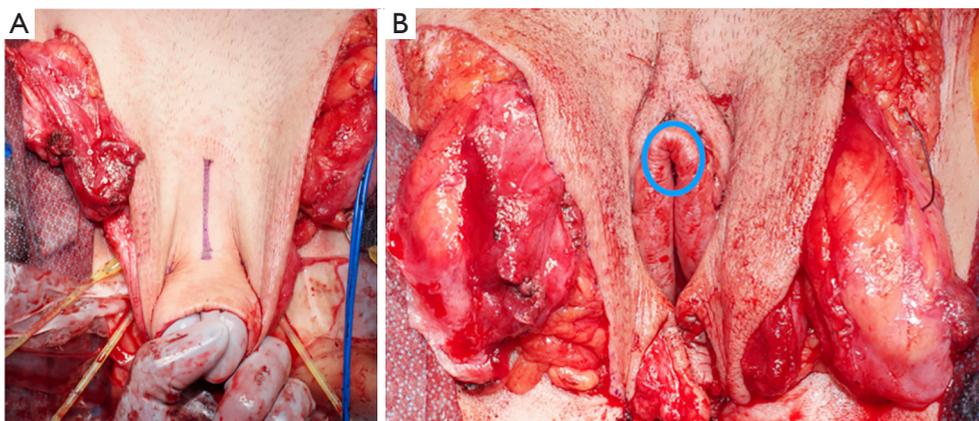
Figure 15 Clitoral positioning and hooding. (A) The amount of clitoral hooding is largely determined by the degree of midline splitting of the penile skin tube in order to deliver the clitoral-urethral complex; (B) ideally the clitoris should be visible at its inferior half. Intra-operatively the clitoris will typically not be readily visible even with sufficient skin splitting due to swelling, as is the case here. Clitoris position outlined here by the blue circle.

it is often necessary to place the clitoris at the level of the superior aspect of the adductor longus tendon in order to compensate for the increased coverage from the excess lower abdominal and mons tissue.

Clitoral hooding is desired as an overly exposed clitoris can look somewhat phallic in addition to causing hypersensitivity. The clitoral hood is best constructed using preputial skin and should be in-continuity with the reconstructed labia minora (36,37). Some authors describe folding over and suturing the preputial skin in order to increase hooding (33,34). In our experience this has not been necessary and the ultimate amount of clitoral hooding is more largely determined by the degree of midline splitting of the penile skin tube as the clitoral-urethral complex is delivered (*Figure 15*). If the midline incision is carried too far superiorly or there is too much tension on the penile skin flap then the clitoris will be overly exposed and insufficiently hooded as post-operative healing occurs. Ideally the clitoris should be visible at approximately its inferior half.

The labia minora

The labia minora are among the most variable of genital anatomy, from diminutive to robust. Their construction poses the greatest aesthetic challenge in vulvoplasty. While there are widely variable natal labia minora, in vulvoplasty they tend to be on the more "trim" side of the spectrum. As described by Dy *et al.* penile skin is typically used to create

the lateral surface of the labia minora (8). Variation exists in the literature regarding the choice of tissue used to create the medial surface. Whenever available, it is our preference to use the preputial skin for this purpose. Aesthetically speaking, there is no substitute. In uncircumcised patients, this inner preputial skin tends to be thin, pink in color and mucosal in appearance giving the best texture and color match to construct the medial aspect of the labia minora. This distal penile shaft skin in circumcised patients is thicker and darker with an epithelialized surface which may result in a less ideal appearance of the medial aspect of the minora compared to uncircumcised patients. In the United States where there is a high circumcision rate, the natal preputial skin is not often available (38). In these circumstances the next best option is to create the medial aspect of the labia minora using the distal penile shaft skin. As demonstrated in perfusion studies and in the authors experience, it is reliable to take skin proximal to the circumcision scar and we will include up to 1 cm of additional skin proximal to the circumcision scar if needed for labia minora volume. This skin has previously been shown to reliably be perfused by the glans tissue and neurovascular bundle (39). Depending on preference for labia minora size, this requires using the distal 1.5 to 3 cm of penile skin (8,30). Prior to using the distal penile skin for construction of the labia minora, we ensure there will be enough additional penile skin to reach and form the new vaginal introitus. If insufficient penile skin is available for this purpose, then the introitus will have to be constructed with skin graft—an unfavorable clinical
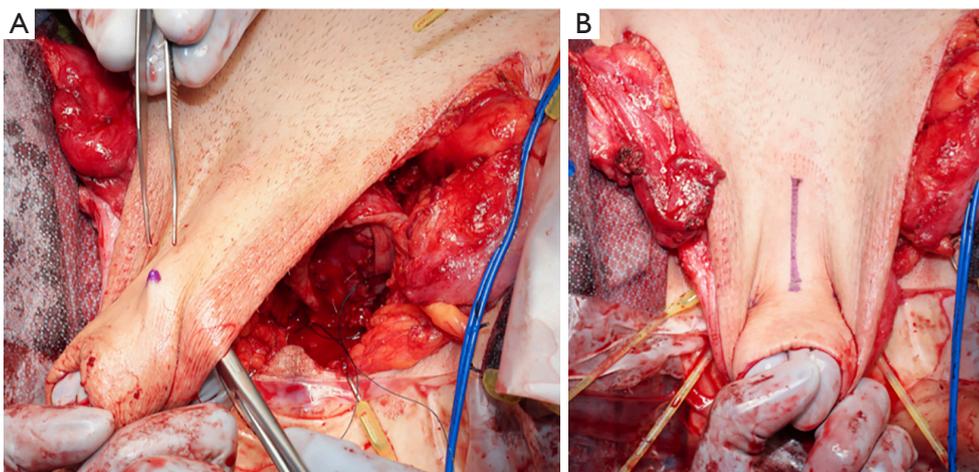
Figure 16 Labial projection sutures. Aesthetics and projection of the labia minora benefit from deep sutures placed through the penile skin tube (A) and anchored down to the level of the corporal bodies. These are placed at the lateral edge of the desired point of definition of the labia minora. (B) The purple dots reflect the site of anchoring of the penile skin to the corpora.

scenario. In cases where there is no preputial skin available and insufficient penile shaft skin to reach the introitus, then we will construct the medial labia minora utilizing a dorsal urethral flap as urethral tissue is always available in excess (20,31). In all three strategies (preputial skin, distal shaft skin, urethral flap) the inner minora is formed by these respective tissues and the outer labia minora is formed by the split penile skin tube (*Figure 14*).

One additional challenge to reconstruction of the labia minora is maintaining long-term definition. This is sometimes easier in vulvoplasty, where there is no internal tension on the penile skin that, if excessive, can lead to effacement of the labia minora. The key to maintenance of three-dimensional definition is sufficiently loose skin and accentuation of the crease defining the junction of the labia majora and the labia minora sub-units. In our experience sutures that anchor the penile skin tube down to the corpora at the lateral edge of the desired point of definition of the labia minora will greatly improve overall aesthetics and aid in maintenance of long-term definition (*Figure 16*). There is a balance to this step, and tension should be in a medial to lateral direction, being careful to not over advance the penile skin inferiorly. Too much inferior tension on the penile skin tube will efface the minora and make the clitoris appear more prominent and exaggerate the separation of the labia majora at the level of the anterior commissure. Quilting sutures have been described by various authors and are sometimes used as an adjunct to create increased definition of the superior aspect of the labia minora as

well as the clitoral hood (8,23,40). *Figure 17* illustrates an optimal example of intra-operative labia minora aesthetics using these techniques. The main difference in our approach to labia minora construction in vulvoplasty as compared to vaginoplasty is that we often split the penile skin tube in cases of vulvoplasty. Doing so allows for maximal use of penile skin for the creation of labia minora and an easier closure at the inset of the perineal flap into the base of the urethra. In cases of vulvoplasty we will use skin for medial labia minora construction in all cases, as no skin is needed for neovaginal and introital lining.

Urethra

The area between the clitoris and urethral meatus in a natal vulva is referred to as the urethral plate. This is best constructed with tissue that bears a mucosal surface. In all cases we accomplish this by using a dorsal urethral flap (*Figure 18*). Alternative techniques in gender affirming vaginoplasty and vulvoplasty have sought to avoid use of a urethral flap due to concerns of bleeding and potential discomfort with intercourse and have instead brought the clitoris and the urethra out through separate incisions in the penile skin tube. However, this results in the dysesthetic appearance of a large skin bridge between the clitoris and urethra which in our opinion is best avoided.

The greater length of an androgenized pelvis and a desired anchoring point of the clitoris at the level of the adductor longus tendon results in an increased distance
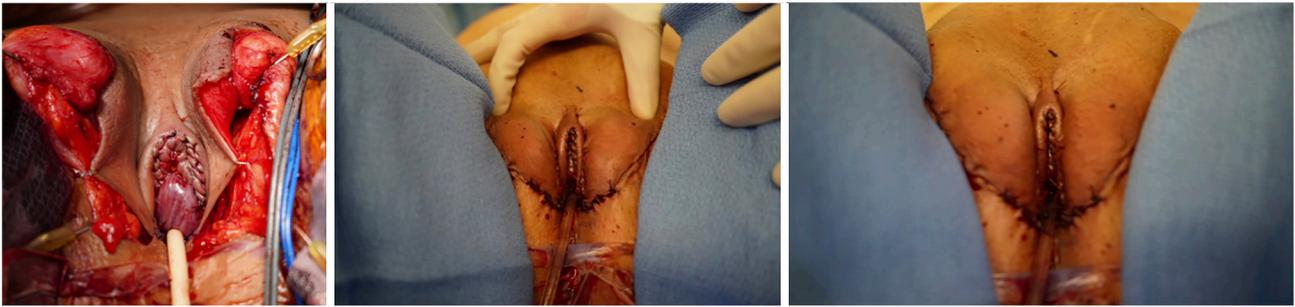
Figure 17 The "ideal" appearance of the labia minora intra-operatively. Note the well-defined junction between the labia minora and labia majora in addition to the projection and definition of the superior labia minora and clitoral hood. This is achieved with a combination of anchoring and quilting sutures.
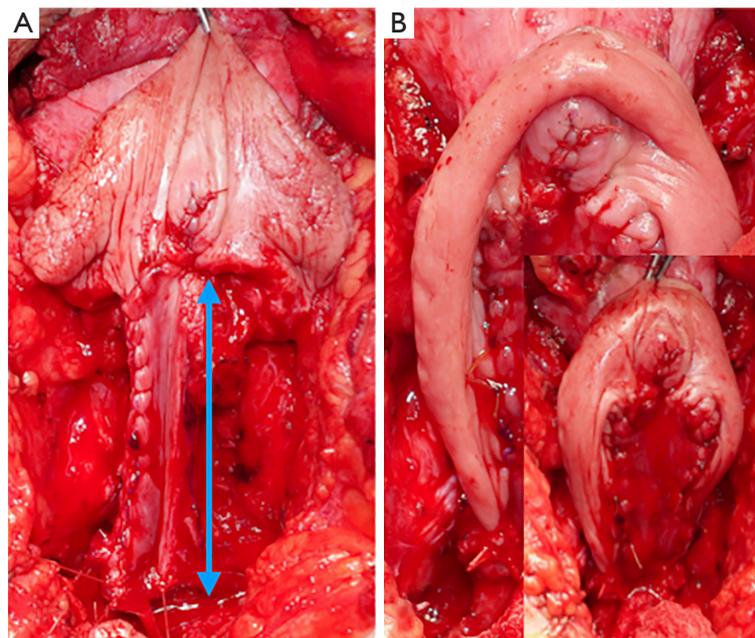

Figure 18 Construction of the vestibule and urethral plate. (A) The area between the clitoris and urethral meatus is known as the urethral plate. This is constructed using a dorsal urethral flap (blue arrows). (B) The aesthetics of the clitoral-urethral complex with the clitoris, clitoral hood, labia minora and urethral plate.

between the clitoris and urethral meatus compared to a natal vulva (*Figure 2*). This is a choice of function. In order to avoid an anteriorly directed urinary stream, the bulbar urethra must be spatulated inferiorly down to a level that results in a straight course directly back to the urethral sphincter. Shortening the distance between the urethra and clitoris would then require placing the clitoris lower which has greater aesthetic consequences than an increased distance between the clitoris and urethral meatus. When reconstructing the urethral plate with a dorsal urethral flap, it is important that the urethral

flap is not excessively long. When the flap is brought up to meet the clitoris any excess urethral tissue can buckle as the medial labia minora are pulled down and anchored inferiorly. This can ultimately result in excessive outward projection and herniation of the midline urethral tissue, creating a dysesthetic midline bulge that can mask the desired projection of the labia minora. We routinely narrow and trim the superior and lateral edges of the urethral flap in order to avoid excessive swelling and bulk of the urethral flap underneath the clitoris and between the labia minora.
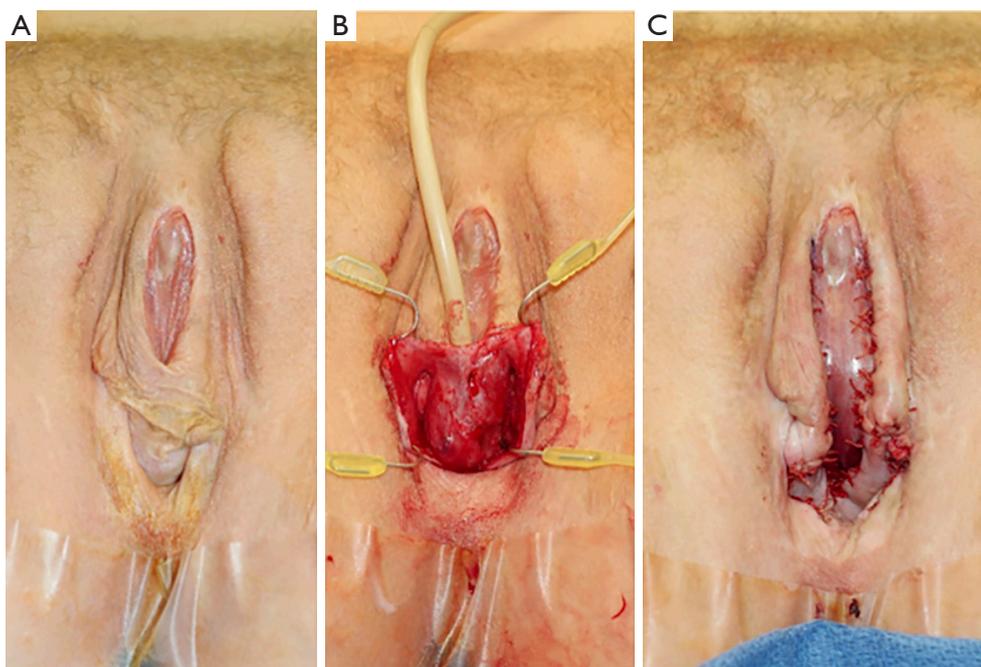
Figure 19 Inadequate urethral spatulation and debulking of corpus spongiosum. (A,B) Patient with excess corpus spongiosum and inadequate spatulation of the urethra leading to anteriorly directed urinary stream and introital bulge interfering with penetration; (C) revision surgery to correct the anterior urinary stream and remove the excess spongiosum tissue.

The corpus spongiosum beneath the urethral meatus requires dedicated attention in vaginoplasty. The base of the intact bulb will often cover the neovaginal introitus. Since this is an erectile organ, leaving excess spongiosum tissue at this level can result in engorgement with sexual arousal and difficulty with intromission (41). Inadequate debulking of the spongiosum beneath the neomeatus can also result in a visible bulge at the introitus at rest that is aesthetically undesirable. This becomes increasingly pronounced with arousal and can be a driver of persistent dysphoria (*Figure 19*).

The introitus

The introitus, when possible, is best constructed utilizing vascularized skin. In many cases there will be a sufficient length of penile skin available to reach underneath the bulbar urethra and ultimately form the vaginal introitus. However, in cases with very limited tissue where no penile skin can reach underneath the bulb of the urethra, the introitus will need to be constructed with skin graft—this is becoming more common due to the increasing frequency of cases presenting with penoscrotal hypoplasia in the presence or absence of pubertal suppression (42,43).

In some cases of penoscrotal hypoplasia it is possible to avoid skin graft at the introitus by judicious use of available tissue and prioritizing introitus construction using vascularized penile skin. However, in cases of penoscrotal hypoplasia with very limited skin and a short stretched penile length, we often choose to construct the medial labia minora with a dorsal urethral flap and save all available length of penile shaft skin in order to reach under the urethra to form the vaginal introitus. However, excessive tension on the penile shaft skin in order to reach the introitus must be avoided. Too much tension will lead to effacement and loss of labia minora definition in addition to increasing the risk of severe introital wound breakdown and resulting stenosis. In our experience, if there is severely limited tissue, grafting the introitus is preferable to excessive degrees of tension on the available penile skin (43). For best results, a surgeon must be willing to graft the introitus when it is needed. See *Figure 20* for an example of vulvar aesthetics in the setting of limited skin due to pubertal suppression and the need to graft the introitus. If there is insufficient scrotal skin available to construct the introitus and line the total neovaginal canal (in cases of perineal approach vaginoplasty) or reach the peritoneal flaps

Figure 20 Patient who underwent prior pubertal suppression resulting in penoscrotal hypoplasia and ultimately required skin grafting of the introitus. With judicious decision-making regarding allocation of available skin, satisfactory aesthetics can be achieved.

in robotic peritoneal flap vaginoplasty, then we will harvest full thickness skin graft from the groin crease, bilaterally if necessary (43). We mark the groin crease in the pre-op area at the natural crease along the junction of the thigh and lower abdomen as the crease can be distorted once positioned in surgery leading to scar malposition. If more skin is needed than can be provided by bilateral groins, we harvest skin from the lower abdomen in an abdominoplasty pattern. This is only necessary in cases of severe penoscrotal hypoplasia and open perineal vaginoplasty without the use of peritoneum.

The optimal aesthetics of the introitus represent a compromise between the avoidance of a "gaping" introitus and a high-riding introitus or "ski-slope" deformity (8,22). In our experience if the penile skin tube is brought down without any posterior spatulation it will tend to ride up and both visually block the introitus in addition to creating mechanical difficulty with dilation and penetration. To avoid this phenomenon, the authors prefer to use a small posteriorly based perineal flap to inset into the posterior lip of the penile skin tube (8,22,31). The flap will be made longer in patients with a larger body habitus, long perineum or deep perineal body. The skin tube is spatulated to accommodate inset of the perineal flap. It is important that the perineal flap is anchored firmly down to the fibrous tissue of the perineal body to anchor the introitus in place (*Figure 21*) (20). If the perineal flap is created too large and the penile skin tube is excessively spatulated this can create

an overly "open" appearance or gap to the introitus that should be avoided (8). At our center, patients are instructed to limit walking to <2,000 steps per day until wounds are fully healed. Heavy activity levels can lead to significant wound separation at the introitus or even dehiscence of the penile skin tube and perineal flap which can lead to difficulty with dilation and also compromise the introital and labial aesthetics.

The role of a second stage

Many individuals will achieve a great aesthetic result following a one-stage vulvoplasty or vaginoplasty procedure. The literature favors the aesthetic outcomes with a one-stage approach, however, there is a degree of unpredictability regarding individual healing (44). Additionally, there are particular aspects of vulvar aesthetics that cannot always be safely or reliably addressed during the primary surgery—such as creation of an anterior labial commissure. For individuals that are particularly concerned about vulvar aesthetics pre-operatively, it is important to provide education about the potential role of a second stage or revision procedure. There are often small modifications that can be done at a second stage to correct or improve various aspects of the overall vulvar appearance. As substantial changes occur over the first 12 months post-operatively, we typically delay any second stage revision

Figure 21 Inadequate anchoring of the introitus. (A,B) Patient without anchoring of perineal flap and inadequate spatulation of penile skin tube. This led to a high riding ring of skin at the introitus and scar spread interfering with dilation and aesthetics. (C,D) A patient with anchoring of the perineal flap down to the perineal body, with a well secured introitus leading to ideal function and appearance.

until 12 months following the initial procedure. Revision rates reported in the literature vary widely from 6% to 66% (16,17,38). In our experience, the most common requests for revision include a reduction of skin excess of the labia majora and revision labiaplasty for increased definition of the labia minora. Less frequent requests include anterior commissure reconstruction or labia majora fat grafting (5) (*Figure 22*). Any aesthetic revisions will be done in conjunction with functional revisions. The most common functional revision request is revision urethroplasty for urethral webbing which presents with persistent urinary spraying and/or engorgement of the urethral bulb with arousal (24,25). If patients pursue vaginoplasty after a prior

vulvoplasty they are offered either a perineal approach or robotic peritoneal flap vaginoplasty depending on their medical history, goals and technical preferences.

Discussion

Much of the early experience in gender-affirming vaginoplasty and vulvoplasty surgery was appropriately focused on functional outcomes such as urination and optimizing vaginal depth. As the field of genital gender-affirming surgery expands, the importance of aesthetics to overall patient satisfaction is becoming increasingly apparent. Multiple studies have demonstrated the important
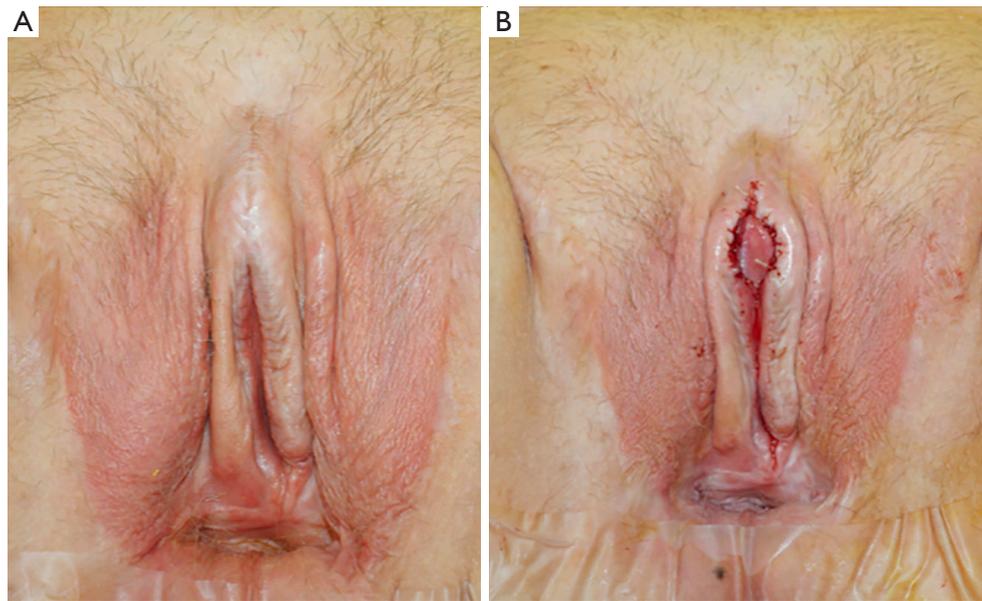
Figure 22 Patient with excess clitoral hooding due to cross fusion of the dorsal urethral flap prior to (A) and following revision (B). Poor vascularity at the end of the flap can lead to delayed healing and cross fusion of the flap resulting in this appearance.

role vulvar aesthetics play in determining patient satisfaction with surgical outcomes (4,5).

Creating a vulva is a technically demanding procedure. For optimal results both the function and the aesthetics of the vulva must be considered, which takes careful planning. Adhering to the core tenets of plastic surgery, replacing "like with like" and judiciously using the tissues available will set the stage for an aesthetic result. Although the purpose of this paper is to serve as an overview of techniques and an aesthetic guide to vulvoplasty, there is no replacement for an aesthetic eye. Each vulvar sub-unit should be optimized individually, but it is important to maintain perspective on how the sub-units will come together as a whole. Because the appearance of one sub-unit will invariably affect the appearance of another, creating the optimal vulva for each individual patient will demand flexible surgical decisions based on anatomy and the tissues available.

Conclusions

Aesthetic outcomes will influence overall satisfaction with the results of genital gender-affirming surgical procedures. Although there is no one "ideal" vulvar appearance, aesthetics are optimal when each major sub-unit of the vulva is reconstructed to create a proportional and cohesive vulvar

appearance. This article reviews important considerations and approaches to optimize the aesthetic outcomes of the vulva in genital gender affirming surgery.

Footnote

Ethical Statement: The authors are accountable for all aspects of the work in ensuring the questions related to the accuracy or integrity of any part of the work are appropriately resolved and investigated. Institutional review board approval was not required for this study as it is a narrative review. Patient consent was provided for potentially identifiable images. All additional images are unidentifiable with no patient details included in the text.

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