



# Perception of femininity and attractiveness in Facial Feminization Surgery

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**Background:** Facial Feminization Surgery (FFS) alters bone and soft tissue to feminize facial features of transgender females. This study aims to evaluate perceptions of femininity, attractiveness, and ideal surgical outcomes in transgender females, non-transgender females and plastic surgeons.

**Methods:** The data was extracted from a survey of transgender females (n=104), non-transgender females (n=192) (completion rate of 48.4%) and plastic surgeons who performed FFS (n=23) (survey response rate of 31.5%). Five virtually-modified forms of three facial features, the nasal tip width, supratip break, mandibular gonial angles, and the composite images of the above features of an individual, assigned male at birth, were used. Respondents were requested to select and rank images based on personal perceptions of femininity and attractiveness.

**Results:** Transgender females chose a narrower nasal tip width as more attractive ( $P \leq 0.001$ ), and evaluated a more acute supratip angle, and more obtuse mandibular gonial angle as both more feminine and attractive (all  $P \leq 0.023$ ) compared to non-transgender females. Plastic surgeons chose a more obtuse mandibular gonial angle as more feminine ( $P = 0.007$ ) and a more ideal surgical outcome ( $P = 0.046$ ), compared to transgender female respondents. In the assessment of composite images, non-transgender female ranked the options with more obtuse mandibular gonial angle as more feminine (all  $P \leq 0.036$ ) than transgender females.

**Conclusions:** Acknowledging the difference in transgender females' perceptions of facial femininity and attractiveness from non-transgender females and plastic surgeons could assist plastic surgeons in managing expectations of surgical outcomes.

**Keywords:** Facial feminization; attractiveness; femininity; gender-affirming surgery (GAS)

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## Introduction

Gender-affirming surgeries (GAS) are a set of genital and non-genital surgeries that are essential in the multidisciplinary healthcare provision for the transgender community (1). The World Professional Association

for Transgender Health (WPATH) has defined gender-affirming interventions, treatments, and surgical procedures as beneficial and effective in the treatment of gender dysphoria and distress caused by the discrepancy between a transgender person's gender identity and sex assigned at

birth (2). WPATH acknowledges that non-genital GAS, including Facial Feminization Surgery (FFS), are often of greater practical significance in the patient's daily life than reconstruction of the genitals (3).

FFS is a collection of procedures that alters bone and soft tissue, to feminize facial features to aid social identification of transgender females (individuals assigned male at birth) who self-identify with the female gender. The historical basis of FFS is sexual dimorphism, in which the sexes have different biological phenotypes, including facial features (4). FFS alters a transgender female's, typically "male" facial features, to fit a more female phenotype. Through understanding the anatomic differences between the male and female face one may develop impressions of masculinity and femininity. Some FFS surgeons strive to achieve the "metrics of normal skeletal form" of a female face, based on quantitative measurements and statistical analysis of sexual differences of the skull (4). However, other surgeons achieve femininity through physical attractiveness, rather than an average of the quantitative norm (5).

This study aims to better understand the goals of transgender female individuals, who present for FFS, their personal perceptions of femininity, attractiveness and their preferences for ideal surgical outcomes. This study was carried out through a survey in which respondents evaluate standardized, virtual-modified images of three facial features, the nasal tip width, supratip angle break, and the mandibular gonial angle. Additionally, a composite of the above facial features, was assessed in an individual who was assigned as male at birth. These anatomic features were chosen because they are often asked to be modified in our clinic during consultation for FFS. However, what contributes to attractiveness and what is consistently needed for femininity is unclear in the presently available literature. Hence, features such as dorsal nasal hump, frontal bone ridge, and thyroid cartilage prominence with consistent trends of ideal surgical outcome were not chosen (6,7).

In addition, we compared the responses of transgender females, to non-transgender females, and plastic surgeons who perform FFS. With challenges in communication between transgender individuals and healthcare professionals (8), this study aims to facilitate the communication between transgender female patients and plastic surgeons. By understanding possible differences in perceptions, one may improve management of expectations.

## Methods

This study was granted exemption by the Yale University Institutional Human Investigation Committee (HIC: 2000024657) and was conducted in accordance with the Declaration of Helsinki (as revised in 2013). We present the following article in accordance with the SURGE reporting checklist (available at <http://dx.doi.org/10.21037/atm-20-3376>). Informed consent was taken from all individual participants. We presented progressive degrees of change of the nasal tip width, nasal supratip angle, and gonial angle of the mandible to respondents. The facial features were studied first in isolation, in which respondents were asked to choose the most "feminine" and most "attractive" option out of 5 variations. In addition, transgender female and plastic surgeon respondents were asked to choose their ideal surgical outcome, for themselves and for their patients respectively. Subsequently, the facial features were studied in combination in which respondents ranked the 9 composites images, from the least to most feminine, in order to explore the relative importance of nose and mandible in determining femininity.

### *Creation of photographs*

The photographs of this study were created using VECTRA 3D software. The modifications were made to the facial features on a 3D photograph of a male Caucasian individual, aged 28 years, without any hormone therapy or craniofacial surgery. The photographs were reviewed by senior plastic surgeons (AJF, MA, and JP). Written consent to alter and distribute photos for the purposes of this study was provided. The digital changes made to the photographs, representing variations of possible surgical outcomes, were guided by objective measures consistent with published literature and historical quantitative measurements on sexual dimorphism (6,7,9-12).

The three altered features are the nasal width, angle of the supratip break, and gonial angle (*Figures 1-3*). Five variations for each feature were labelled 1 to 5 and presented on a spectrum: 1 being the option expected to be most feminine, and 5 being the altered option expected to be least feminine in accordance to published literature on typical measures of feminine and masculine facial features. The literature suggests a more accented and smaller nasal tip, a more acute supratip angle, and a softer, more obtuse gonial angle, are considered more feminine. The interval



**Figure 1** Image options of variations of nasal tip width provided to respondents. The options of 1 to 5 are with increasing widths of nasal tip with 2 mm intervals.



**Figure 2** Image options of variations of supratip break provided to respondents. The options of 1 to 5 are with increasing supratip break angle with 5° intervals.

in measurements used between options are equal, and are changed progressively per option; for the nasal tip width: 2 mm, supratip break: 5°, and mandibular gonial angle: 6°.

In the second part of this study, options 1, 3, 5 for each of the three facial features were combined, to create 9 composite images (*Figure 4*). Options A to C, D to F, G to I have the gonial angle of the mandible in options 1, 3, 5 respectively. Options A, D, G, options B, E, H, options C, F, I have the supratip break and width of nasal tip of options 1, 3, 5 respectively.

### *Survey questions*

The survey was hosted on Qualtrics, a secure survey hosting website. It collected basic demographic information,

including age, ethnicity, country of residence, education level, household income, employment, and gender(s) to which respondents experience romantic or sexual attraction. Transgender female respondents were asked the age at which they began hormone therapy, transition history (social, legal, medical, and/or surgical). They were also asked what gender-affirming procedures (facial bony surgical, face and neck soft tissue surgical, facial non-surgical, body surgery, top surgery and bottom surgery) they have accessed, are interested in accessing in the future, or have health insurance coverage. Non-transgender female respondents were asked for their gender identities, and whether they had rhinoplasty or orthognathic surgery performed for either reconstructive or cosmetic purposes. Plastic surgeons were asked how many FFS that have



**Figure 3** Image options of variations of mandibular gonial angle provided to respondents. The options of 1 to 5 are with decreasing gonial angle with  $6^\circ$  intervals.

involved rhinoplasty or orthognathic surgery they have performed in the past 10 years.

#### *Distribution of survey*

The survey was distributed to individuals who self-identify as transgender females through regional and national organizations, medical schools, engagement with social media platforms, including Facebook groups with members interested in FFS. Respondents were encouraged to share

the study with other potentially interested individuals. The study was shared on Reddit (13), a social news aggregation website, with community specific discussion boards, by a member of the public. The response rate is incalculable because there is no sampling frame.

The distribution to non-transgender female respondents was initiated through Facebook advertisements, and Qualtrics panel, to target respondents, with similar demographics distribution after responses from at least 100 transgender female individuals were received.



**Figure 4** Image options of the combinations of nasal width, supratip break and mandibular gonial angle provided to respondents. Options 1, 3 and 5 of each of the three facial features were combined, to create 9 varying composites images. (A,B,C,D,E,F,G,H,I) refers to images in *Figure 4*. Options A to C, D to F, and G to I, have the same mandibular gonial angle as in options 1, 3 and 5, respectively. Options A,D,G, options B,E,H, and options C,F,I, have the same supratip break and width of nasal tip as in the options of 1, 3 and 5, respectively.

Plastic surgeons involved academically or clinically in FFS were first contacted by email in May, and a subsequent follow-up email was sent in June 2019.

### *Statistical analysis*

Test of normality was produced using Shapiro-Wilk test (SPSS, v.24.0, IBM Corp., Armonk, NY). Independent T tests were used when there were 2 categorical variables, and ANOVA test if there were more than 2 categorical variables. Pearson correlation was used to calculate correlation between 2 values with a normal distribution. The  $r$  value of more than 0.6 considered as strong correlation. The P value of less than 0.05 was considered statistically significant.

### **Results**

There were 319 respondents in total and there are three

main groups in this study for comparison. One hundred and four transgender female respondents, 192 non-transgender female respondents which include cisgender female ( $n=93$ ), cisgender male ( $n=88$ ), transgender male ( $n=4$ ), and non-binary ( $n=4$ ) individual respondents, and plastic surgeons who perform FFS ( $n=23$ , survey response rate: 35.1%). Transgender female and non-transgender female groups collectively have a survey completion rate is 48.4%. The demographics are presented in *Tables 1-3*.

### *Perception of “femininity”, “attractiveness”, and “ideal surgical outcome”*

There are statistically significant differences of means in options chosen as the most feminine and most attractive between transgender female, non-transgender female and plastic surgeon respondents, depending on the facial feature (*Table 4*). Transgender female respondents considered a more

**Table 1** Demographics of transgender female, and non-transgender female respondents

Respondents	Transgender female, n (%)	Non-transgender female, n (%)
Number	104	192
Age (years)		
<20	7 (6.7)	13 (6.8)
21–25	14 (13.5)	34 (17.8)
26–30	17 (16.3)	33 (17.3)
31–40	28 (26.9)	51 (26.7)
41–50	17 (16.3)	27 (14.1)
>50	21 (20.2)	33 (17.3)
Gender identity <sup>1</sup>		
Cisgender male	–	88 (45.8)
Cisgender female	–	93 (48.4)
Transgender male	–	4 (2.1)
Non-binary	–	4 (2.1)
Decline to state	–	3 (1.6)
Ethnicity		
White/Caucasian	80 (76.9)	143 (74.5)
Multi-Ethnic	14 (13.5)	16 (8.3)
Latin	4 (3.8)	5 (2.6)
East Asian	2 (1.9)	11 (5.7)
South Asian	1 (1.0)	5 (2.6)
African American	1 (1.0)	9 (4.7)
Not listed	2 (1.9)	3 (1.5)
Country		
Non-US	27 (26.0)	21 (10.9)
US	77 (74.0)	171 (89.1)
Northeast	33 (42.3)	47 (27.5)
Midwest	13 (16.7)	30 (17.0)
South	15 (19.2)	59 (34.5)
West	16 (21.8)	35 (19.9)
Education level		
Some or completed high school	9 (9.3)	16 (8.5)
Some or completed college	60 (61.9)	122 (64.6)
Graduate school	28 (28.9)	51 (27.0)

Table 1 (continued)

**Table 1** (continued)

Respondents	Transgender female, n (%)	Non-transgender female, n (%)
Household income/USD		
<25,000	20 (21.1)	38 (20.2)
25–49,999	16 (16.8)	38 (20.2)
50–100,000	29 (30.5)	57 (30.3)
100–249,999	23 (24.2)	47 (25.0)
>250,000	7 (7.4)	8 (4.3)
Sexual/romantic attraction to		
Transgender male	34 (24.3)	29 (14.9)
Cisgender male	56 (40.0)	104 (54.2)
Transgender female	61 (43.6)	22 (11.3)
Cisgender female	81 (57.9)	85 (44.3)
Non-binary	41 (29.3)	24 (12.3)
All options	20 (14.3)	11 (5.6)
None of the above	2 (1.4)	18 (9.2)

<sup>1</sup>Cisgender refers to individuals who identify as the gender they were assigned to at birth. Non-binary individuals are those who experience gender that are not exclusively masculine or feminine.

**Table 2** Profile of transgender female respondents

Characteristic	Transgender female, n (%)
Age of hormone therapy <sup>1</sup> begun	
<16	1 (1.0)
16–18	3 (2.9)
18–25	21 (20.2)
25–35	25 (24.0)
35–45	22 (21.2)
>45	17 (16.3)
Never received hormone therapy	15 (14.4)
Transitions <sup>2</sup>	
Social or legal	6 (6.5)
None	1 (1.1)
Social or legal and medical	39 (42.4)
Social legal and medical-surgical	27 (29.3)
Medical only	17 (18.5)
Medical-surgical only	2 (2.2)

Table 2 (continued)

Table 2 (continued)

Characteristic	Transgender female, n (%)
Gender-affirming procedures accessed <sup>3</sup>	
Facial bony surgical	21 (20.2)
Face and neck soft tissue surgical	29 (27.9)
Face non-surgical	29 (27.9)
Top surgery/breast augmentation	15 (14.4)
Bottom surgery/genital reconstruction	25 (24.0)
None	36 (34.6)
Gender-affirming procedures interested in or planned <sup>3</sup>	
Facial bony surgical	72 (69.2)
Face and neck soft tissue surgical	82 (78.8)
Face non-surgical	47 (45.2)
Top surgery/breast augmentation	43 (41.3)
Bottom surgery/genital reconstruction	58 (55.8)
None	6 (5.8)
Insurance access to <sup>3</sup>	
Facial bony surgical	8 (7.7)
Face and neck soft tissue surgical	12 (11.5)
Face non-surgical	23 (22.1)
Top surgery/breast augmentation	15 (14.4)
Bottom surgery/genital reconstruction	37 (35.6)
Fertility preservation	4 (3.8)
Don't know	10 (9.6)
Insurance does not cover any procedures	25 (24.0)

<sup>1</sup>Hormone therapy includes both hormone suppression and hormone replacement therapy; <sup>2</sup>Social transition potentially includes name and pronoun changes, gender expression; Legal transition potentially includes official document/gender marker changes; Medical intervention may include puberty blockers/androgen blockers, with or without estrogen/cross hormone replacement therapy; <sup>3</sup>Definitions of procedures: Facial bony surgical, Jaw reduction, Facial bone reconstruction (forehead, cheeks, jaw, chin includes osteoplasty, genioplasty; face and neck soft tissue surgical, brow lift, blepharoplasty, malar implants, chin implants, forehead lift; facial non-surgical, collagen, hair removal, hair transplantation, lip reduction/enhancement, neck tightening, rhinoplasty, nose implants, otoplasty, rhytidectomy, thyroid cartilage reduction; body surgery, abdominoplasty, gluteal and hip augmentation (implants, lipofilling); top surgery, breast augmentation, nipple reconstruction; bottom surgery, vaginoplasty, orchiectomy.

Table 3 Demographics of plastic surgeon respondents

Characteristic	Plastic surgeon, n (%)
Number	23
Age	
31–40	7 (30.4)
41–50	7 (30.4)
>50	9 (39.1)
Number of FFS that included rhinoplasty and mandible contouring in past 10 years	
0–5	3 (13.0)
5–10	5 (21.7)
10–20	2 (8.7)
20–30	3 (13.0)
30–40	2 (8.7)
40–50	3 (13.0)
>100	5 (21.7)
Gender identity	
Cisgender male	16 (69.5)
Cisgender female	3 (13.0)
Decline to state	4 (17.4)
Ethnicity	
White/Caucasian	17 (73.9)
East Asian	1 (4.3)
South Asian	2 (8.7)
Not Listed	2 (8.7)
Middle Eastern/Turkish	1 (4.3)
Geographical location	
Non-US	9 (25.7)
US	14
Northeast	4 (17.4)
South	2 (8.7)
West	8 (34.8)

acute supratip break [ $2.6 \pm 1.0$  vs.  $3.0 \pm 1.1$ ,  $P=0.003$ , (mean  $\pm$  SD)], ( $3.0 \pm 0.7$  vs.  $3.4 \pm 0.8$ ,  $P=0.003$ ) and a more obtuse gonial angle ( $2.0 \pm 1.1$  vs.  $2.2 \pm 1.4$ ,  $P=0.023$ ) ( $2.1 \pm 1.1$  vs.  $2.5 \pm 1.2$ ,  $P=0.020$ ) to be both more feminine and attractive than non-transgender female respondents. Transgender females considered a narrower nasal tip ( $2.2 \pm 0.9$  vs.  $2.7 \pm 1.1$ ,

**Table 4** Mean value of options being chosen as the most feminine, the most attractive and the ideal surgical outcome, of nasal tip width, supratip break, and mandibular gonial angle, in transgender female, non-transgender female, and plastic surgeons

Anatomic feature	Transgender female	Non-transgender female		Plastic surgeon	
		Mean (SD)	P value	Mean (SD)	P value
<b>Nasal tip width</b>					
Most feminine	2.0 (0.9)	2.0 (1.1)	0.667	1.8 (0.7)	0.379
Most attractive	2.2 (0.9)	2.7 (1.1)	<0.001**	2.2 (0.8)	0.880
Ideal surgical outcome	2.1 (0.9)	–	–	2.1 (0.6)	0.983
<b>Supratip break</b>					
Most feminine	2.6 (1.0)	3.0 (1.1)	0.003*	2.8 (0.7)	0.420
Most attractive	3.0 (0.7)	3.4 (0.8)	0.003*	3.0 (0.5)	0.730
Ideal surgical outcome	3.0 (0.7)	–	–	2.9 (0.5)	0.510
<b>Gonial angle</b>					
Most feminine	2.0 (1.1)	2.2 (1.4)	0.023*	1.4 (0.6)	0.007*
Most attractive	2.1 (1.1)	2.5 (1.2)	0.020*	1.9 (0.9)	0.203
Ideal surgical outcome	2.1 (1.1)	–	–	1.7 (0.8)	0.046*

\*, P<0.05; \*\*, P<0.001.

**Table 5** Relative impact of lower mean of more expectedly feminine option indicating narrower nasal tip width, more acute supratip break, more obtuse gonial angle chosen on femininity, attractiveness and ideal surgical outcome by transgender female, non-transgender female, plastic surgeon respondents

Anatomic feature	Femininity			Attractiveness			Ideal surgical outcome	
	Transgender female	Non-transgender female	Plastic surgeon	Transgender female	Non-transgender female	Plastic surgeon	Transgender female	Plastic surgeon
Narrow nasal tip width	++	++	+++	+++	++	+++	++	++
Acute supratip break	+++	+	++	+++	++	+++	++	+++
Obtuse gonial angle	++	+	+++	++	+	+++	++	+++

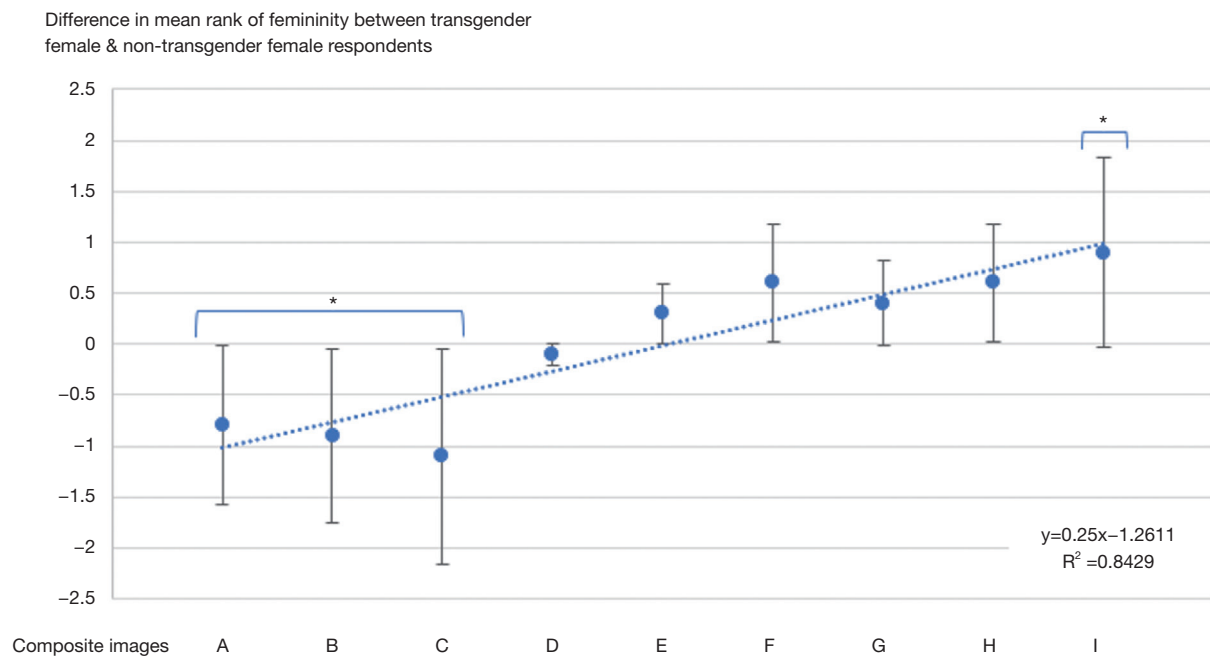
+, low; ++, moderate; +++, high.

P≤0.001) as more attractive than non-transgender female respondents. Differences in mean of the supratip break and nasal tip (0.4 to 0.5) between the two respondents groups in perceptions of femininity and attractiveness are larger than the corresponding differences in means of the gonial angle (0.2 to 0.4) between transgender females and non-transgender female respondents. The perceptions between plastic surgeons and transgender female respondents were mostly similar (Table 5) except plastic surgeons considered a more obtuse gonial angle as more feminine and a more ideal surgical outcome than transgender female respondents (2.0±1.1 vs. 1.4±0.6, P=0.007; 2.1±1.1 vs. 1.7±0.8, P=0.046).

### *Ranking of composite photographs in determining femininity*

Non-transgender females consistently ranked composite images that have more obtuse gonial angles as more feminine. The mean rank of options chosen by non-transgender female respondents decreased from 5.7 (±3.0, SD) for option A to 3.8 (±3.2) for option I, option A to I of increasingly obtuse mandibular gonial angles. The relationship between increasingly obtuse gonial angles and increasing femininity is linear (Figure 5). In contrast, the mean rank of options chosen by transgender female respondents ranged narrowly from 4.7 (±2.5) to 5.3 (±1.8)





**Figure 5** Graphically depicted difference in mean ranks of femininity of composite images between transgender and non-transgender respondents. The options A-I refer to images in *Figure 4*. As the scale of 1 to 9, 1 is the least feminine, and 9 is the most. \*,  $P < 0.05$ .

with no clear trend. The differences in mean rank for options between transgender and non-transgender female respondents were only statistically significant for the most obtuse gonial angle, i.e., options A, B and C ( $P = 0.036$ ,  $P = 0.013$ , and  $P = 0.001$ , respectively), and the most acute gonial angle, i.e., options I ( $P = 0.022$ ) (*Table 6*).

However, in options with the most acute gonial angle (options G, H and I) both transgender and non-transgender females evaluated the options with a more acute supratip break and narrower nasal tip width only, as more feminine ( $5.1 \pm 2.2$ ,  $4.9 \pm 2.9$ ,  $4.7 \pm 3.5$  in transgender group; and  $4.6 \pm 2.4$ ,  $4.3 \pm 2.6$ ,  $3.8 \pm 3.2$  in non-transgender females, respectively).

#### ***Effect of demographics, sexual attraction, transition on transgender females' perception of femininity of the mandible***

Given the difference in perception of femininity of mandible between transgender and non-transgender individuals and plastic surgeon respondents, we analyzed possible factors that influence perception of femininity in transgender respondents, including demographic features, romantic/sexual attraction to various gender identities, and insurance status.

Transgender female respondents who started hormone therapy at an older age or have never been treated with

hormone therapy chose a mandible with a more acute gonial angle as more feminine ( $P = 0.033$ ). Respondents who have undergone social-legal and medical-surgical transitions, chose a mandible with a more obtuse gonial angle as more feminine, compared to individuals who have either made social-legal changes or undergone medical gender-affirming interventions alone ( $P = 0.022$ ) (*Table S1*).

Transgender female respondents who are romantically/sexually attracted to cisgender men and other transgender female individuals prefer a more obtuse gonial angle, as more feminine, and an ideal surgical outcome as compared to the transgender females who did not share those romantic/sexual attractions ( $1.80 \pm 0.90$  vs.  $2.27 \pm 1.30$ ,  $P = 0.034$ ;  $1.84 \pm 0.90$  vs.  $2.28 \pm 1.35$ ,  $P = 0.047$ ) (*Figure S1*). Having accessed, planned or insurance coverage for various gender-affirming procedures had no statistical significance on perception of femininity of the mandible (*Table S2*).

#### ***Correlations between femininity, attractiveness and ideal surgical outcome***

The correlation between femininity and attractiveness is stronger among transgender female respondents ( $r = 0.5-0.8$ , all  $P < 0.001$ ), compared to non-transgender respondents ( $r = 0.3-0.5$ , all  $P < 0.001$ ). In plastic surgeons, the correlation

**Table 6** Mean ranking of composite images by respondent groups, difference in mean rank and P value of difference in mean rank between transgender and non-transgender female respondents

Composite images	A	B	C	D	E	F	G	H	I
Mean rank <sup>1</sup> (mean, SD)									
Transgender female	4.9 (3.0)	4.9 (3.0)	4.7 (2.5)	5.2 (2.0)	5.3 (1.7)	5.3 (1.8)	5.1 (2.2)	4.9 (2.9)	4.7 (3.5)
Non-transgender female	5.7 (3.0)	5.8 (2.7)	5.8 (2.5)	5.3 (1.9)	5.0 (2.0)	4.7 (2.0)	4.6 (2.4)	4.3 (2.6)	3.8 (3.2)
Difference in mean rank (difference, 95% CI)	-0.8 (-1.5, -0.1)	-0.9 (-1.5, -0.2)	-1.1 (-2.0, -0.5)	-0.1 (-0.6, 0.4)	0.3 (-0.1, 0.7)	0.6 (0.1, 1.0)	0.4 (-0.1, -1.0)	0.6 (-0.1, 1.2)	0.9 (0.1, 1.7)
P value of difference in mean rank	0.036*	0.013*	<0.001**	0.670	0.180	0.013*	0.139	0.083	0.022*

The options A-I refer to images in Figure 4. <sup>1</sup> On the scale of 1 to 9, 1 is the least feminine and 9 is the most. \*, P<0.05; \*\*, P<0.001.

between femininity and ideal surgical outcome ( $r=0.7, 0.8$ , all  $P<0.001$ ) is stronger than the correlation between attractiveness and ideal surgical outcome ( $r=0.8, 0.9$ , all  $P<0.001$ ) (Table 7).

## Discussion

The WPATH Standards of Care (SOC) recommends criteria for initiation of chest and all genital gender-affirming surgical treatments for gender dysphoria. However, clear surgical guidelines for FFS have not been delineated (2). The WPATH SOC acknowledges that while most professionals agree that genital surgery and mastectomy cannot be considered purely cosmetic, opinions diverge as to what degree other surgical procedures, including FFS, can be considered purely reconstructive. The surgical interventions, like FFS, can have a “radical and permanent” influence on the quality of life and therefore it is medically necessary for individuals with gender dysphoria (3). Studies in neural networks highlight the gender-affirming power of being *socially identified* in congruence with the gender with which one self-identifies (14). In fact, some social scientists view FFS as enacting a far more “profound change” than genital reconstruction surgery. FFS has been reported to be either attained or desired in 45% of transgender females (15), and shown to be highly effectively in alleviating related gender dysphoria and improving quality of life (16). Yet, only an estimated 3–8% of transgender individuals have access to FFS (17).

This study demonstrates the difference in perceptions of femininity and attractiveness, between transgender females and non-transgender females. Transgender female respondents perceive a smaller nasal tip width, more acute supratip angle, and more obtuse gonial angles are more “feminine” and “attractive” compared to non-transgender female respondents. Plastic surgeon are more likely to choose a relatively more obtuse gonial angle as more feminine and as ideal surgical outcome compared to transgender females. This suggests the mandible is a more effective indicator of femininity in non-transgender female compared to transgender female respondents. However, in options with the most acute gonial angle, options with a more a narrower nasal tip, and a more acute supratip break seems to assume importance in indicating femininity.

This study also demonstrates that both transgender females and plastic surgeons chose features which are expected to be more feminine as the ideal surgical outcome than non-transgender female respondents. Some surgeons have argued

**Table 7** Pearson correlation and 95% confidence interval of the most feminine, the most attractive, the most feminine facial features, and ideal surgical outcome, in transgender female, non-transgender female and plastic surgeon respondents

Anatomic feature	Transgender female		Non-transgender female		Plastic surgeon	
	Correlation (95% CI)	P value	Correlation (95% CI)	P value	Correlation (95% CI)	P value
<b>Nasal tip width</b>						
Most feminine & most attractive	0.5 (0.3, 0.7)	<0.001**	0.3 (0.2, 0.5)	<0.001**	0.5 (0.0, 0.9)	0.007*
Most feminine & ideal surgical outcome	0.8 (0.6, 0.9)	<0.001**	–	–	0.7 (0.3, 0.8)	0.001*
Most attractive & ideal surgical outcome	0.7 (0.5, 0.8)	<0.001**	–	–	0.8 (0.5, 1.0)	<0.001**
<b>Supratip break</b>						
Most feminine & most attractive	0.6 (0.4, 0.8)	<0.001**	0.5 (0.3, 0.6)	<0.001**	0.8 (0.5, 1.0)	<0.001**
Most feminine & ideal surgical outcome	0.6 (0.5, 0.8)	<0.001**	–	–	0.8 (0.4, 1.0)	<0.001**
Most attractive & ideal surgical outcome	0.8 (0.7, 0.9)	<0.001**	–	–	0.8 (0.1, 1.0)	<0.001**
<b>Gonial angle</b>						
Most feminine & most Attractive	0.8 (0.7, 0.9)	<0.001**	0.4 (0.3, 0.5)	<0.001**	0.5 (0.1, 0.8)	0.018*
Most feminine & ideal surgical outcome	0.9 (0.9, 1.0)	<0.001**	–	–	0.7 (0.3, 0.9)	<0.001**
Most attractive & ideal surgical outcome	0.8 (0.7, 0.9)	<0.001**	–	–	0.9 (0.8, 1.0)	<0.001**

\*, P<0.05; \*\*, P<0.001.

that it is beneficial to achieve extremes of femininity through FFS to decrease a transfeminine individual's chances of being identified by the public as a gender with which they do not identify (9). This choice by transgender females could reflect societal pressures transgender female individuals face to be hyperfeminine (18), and detract the consideration of FFS as a highly individualized set of procedures, serving individual patients with an individualized goal based on what is realistic.

The choice to attractiveness and femininity reflects critiques by social scientists who argue FFS is a tool for cope with stigma, rather than redirecting efforts to the social discrimination (19). Bioethicists suggest that stating FFS as medically necessary, in achieving binary expectations of gender identification could limit the access of individuals who are deemed to be “feminine enough” to FFS (20). Additionally, the principal goal of FFS is to attain a specific type or amount of femininity could unintentionally socially delegitimize non-binary individuals or transfeminine individuals, who are most comfortable with a gender expression that is not necessarily consistent with historical measures of femininity (21). Due to the potential of FFS in restricting expression of transgender-females, social scientists have suggested for FFS to be considered as medically useful, rather than medically necessary (18,22).

The results of this study show that FFS could allow

transgender female individuals to simultaneously achieve both femininity and attractiveness. The correlation between femininity and attractiveness is stronger in transgender female and plastic surgeon than in non-transgender female respondents.

However, managing the expectations of patients presenting for FFS is challenging for plastic surgeons (8). Plastic surgeons and transgender female respondents have different perceptions of “femininity”, “attractiveness” and ideal surgical outcome of the mandible, although their opinion on the nose shape are similar. This is helpful for plastic surgeons in interpreting the actual preferences and expectations of transgender female individuals presenting for surgery. Some strategies suggested in the existing literature include using photographs of female family members as a discussion point and asking individuals presenting for surgery to point out their favorite features of the face, so as to start the discussion between surgeons and transgender females on a positive note (11).

Transgender female individuals seeking FFS do not have homogenous perception of femininity (11). Age at which medical hormonal therapy was initiated, transition history, and romantic/sexual attractions are all influencing factors that impact the perceptions of “femininity”. Medical hormonal therapy affects facial structures and could explain

different goals among transgender females, depending on whether or not, and for how long they have been treated with hormone therapy, and when the hormone therapy was initiated. Standardized anti-androgen and estradiol therapy has been shown to induce the increased volume of soft tissue in cheek and decrease soft tissue around jaw (23). Hence, earlier and increasing access to medical intervention with puberty blockers and age-appropriate feminizing hormone replacement therapy, could impact future goals of FFS in gender-affirming care.

Respondents who have undergone more extensive gender-affirming interventions, were more likely to choose options with more obtuse gonial angle as the most feminine than those who had limited or partial transition. However, previous gender-affirming procedures, interests in future GAS, and insurance access, do not affect the perceptions of femininity, attractiveness or ideal surgical outcome in facial structures.

There are several limitations to this study. The individual depicted in our study was Caucasian, and 80.6% of transgender female respondents identified as white. Although the analysis of demographics show no difference in perception of femininity, attractiveness, and ideal surgical outcome between ethnicities, the inclusion of faces from different ethnicities may alter the results in future studies (24-26). The sample size of plastic surgeons is small, despite our outreach efforts. Commonly, more than one FFS procedure is performed in the same operative setting (27). However, the upper third of the face was not included in this study, hence we were unable to evaluate its effect on facial harmony. Finally, although this study shows correlation between various groups and desired outcomes, it does not fully explain the intentions and motivations of those seeking changes.

## Conclusions

Transgender female perceptions of facial femininity and attractiveness differ from non-transgender females, but are similar to plastic surgeons, except for the mandible. Transgender female respondents chose options that are expected to be the most feminine and attractive, and as their ideal surgical outcome, compared to non-transgender respondents. In the analysis of composite images, non-transgender females considered options with more obtuse mandibular gonial angle as more feminine, while transgender females did not. Acknowledging differences of these perceptions could impact FFS planning, and result in clearer expectations and outcomes for both transgender females and plastic surgeons.

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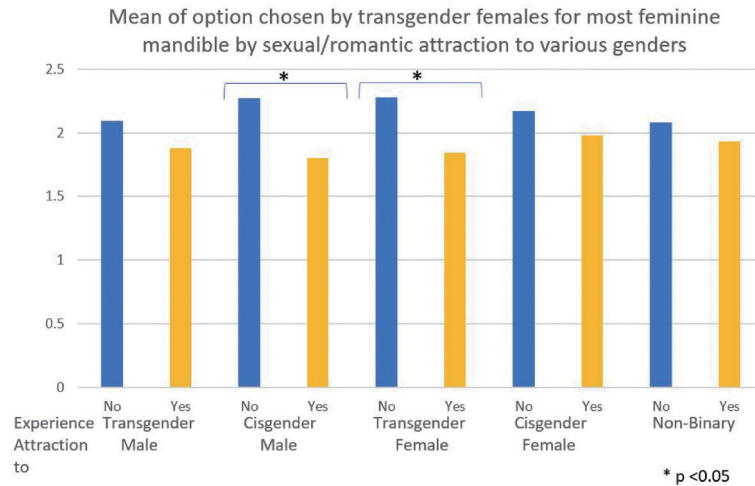
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**Table S1** Mean and P value for most feminine gonial angles comparing transgender female respondents who identified with and without sexual attraction to various sexual identities

Characteristic	Most feminine	
	Mean (SD)	P value
Age		
<20	1.43 (0.54)	0.135
21–25	1.43 (0.51)	
26–30	1.94 (0.97)	
31–40	2.29 (1.21)	
41–50	2.24 (1.25)	
>50	2.14 (1.32)	
Ethnicity		
White/Caucasian	2.05 (1.11)	0.927
Multi-Ethnic	1.93 (1.21)	
Latin	1.75 (0.50)	
East Asian	1.5 (0.71)	
South Asian	1	
African-American	5	
Not listed	1.5 (0.71)	
Country		
Non-US	2.26 (1.16)	0.214
US	1.94 (1.10)	
Education		
Some or completed high school	1.78 (0.97)	0.394
Some or completed college	1.98 (1.11)	
Graduate school	2.29 (1.27)	
Household income		
<25,000	1.65 (0.75)	0.178
25–499,999	1.88 (1.15)	
50–100,000	2.45 (1.27)	
100–249,999	2.09 (1.16)	
>250,000	2.14 (1.35)	
Age of medical hormonal therapy (HRT)		
<16	3	0.033*
16–18	1.33 (0.58)	
18–25	1.48 (0.51)	
25–35	2.16 (1.07)	
35–45	2.00 (1.23)	
>45	1.94 (0.90)	
Never received HRT	2.73 (1.58)	
Transition		
Socio or legal	2.67 (1.86)	0.022*
None	4	
Socio or legal and medical	2.21 (1.06)	
Socio legal and medico-surgical	1.52 (0.51)	
Medical only	2 (1.28)	
Medico-surgical only	2 (0)	

\*, P&lt;0.05.



**Figure S1** Mean of option chosen by transgender females for most feminine mandible by sexual/romantic attraction to various genders.

**Table S2** Mean for most feminine for gonial angle for transgender female respondents who have accessed, are interested in, or have insurance coverage for various gender affirming procedures

Most feminine	Accessed			Planned			Insurance coverage		
	Mean (SD)		P value	Mean (SD)		P value	Mean (SD)		P value
	N	Y		N	Y		N	Y	
Facial, hard tissue, surgical procedures	2.05 (1.16)	1.90 (0.99)	0.572	2.13 (1.13)	1.97 (1.13)	0.526	2.01 (1.11)	2.17 (1.47)	0.808
Any surgical and non-surgical facial procedures for both hard and soft tissue	2.21 (1.27)	1.86 (0.97)	0.111	1.93 (1.00)	2.03 (1.15)	0.724	2.04 (1.14)	1.86 (1.03)	0.540
No facial, body, bottom work	1.88 (1.00)	2.28 (1.30)	0.088	1.99 (1.12)	2.50 (1.23)	0.361	1.94 (1.01)	2.17 (1.32)	0.333