

Facial Hair Transplantation for Transgender Patients: A Literature Review and Guidelines for Practice

Aesthetic Surgery Journal
2021, Vol 41(3) NP42–NP51
© 2021 The Aesthetic Society.
Reprints and permission:
journals.permissions@oup.com
DOI: 10.1093/asj/sjaa430
www.aestheticsurgeryjournal.com

OXFORD
UNIVERSITY PRESS

Viren Patel, BS^{*}; Ian T Nolan, BM; Elizabeth Card, BS;
Shane D Morrison, MD, MS; and Anthony Bared, MD

Abstract

Background: Facial hair transplantation has become an increasingly popular modality to create a more masculine appearance for transmasculine patients.

Objectives: This aim of this study was to review the current literature regarding facial hair transplantation and provide recommendations and best practices for transgender patients.

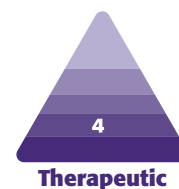
Methods: A comprehensive literature search of the PubMed, MEDLINE, and Embase databases was conducted for studies published through April 2020 for publications discussing facial hair transplant in transmasculine patients, in addition to the nontransgender population. Data extracted include patient demographics, techniques, outcomes, complications, and patient satisfaction.

Results: We identified 2 articles discussing facial hair transplantation in transmasculine patients. Due to the paucity of publications describing facial hair transplantation in transmasculine patients, data regarding facial hair transplant from the cisgender population were utilized to augment our review and recommendations.

Conclusions: Facial hair transplant is a safe and effective means of promoting a masculine appearance for transgender patients. Nevertheless, facial hair transplantation should be deferred until at least 1 year after the initiation of testosterone therapy to allow surgeons to more accurately identify regions that would benefit the most from transplantation. Additionally, providers should engage patients in discussions about any plans to undergo facial masculinization surgery because this can alter the position of transplanted hairs. Currently, follicular unit extraction from the occipital scalp is the preferred technique, with use of the temporal scalp if additional grafts are needed. Patients should be advised that a secondary grafting procedure may be needed a year after initial transplant to achieve desired density.

Level of Evidence: 4

Editorial Decision date: November 9, 2020.



Mr Patel and Ms Card are medical students, Division of Plastic Surgery, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, USA. Mr Nolan is a medical student, Hansjörg Wyss Department of Plastic Surgery, New York University Grossman School of Medicine, New York, NY, USA. Dr Morrison is a Resident, Division of Plastic Surgery, Department of Surgery, University of Washington School of Medicine, Seattle, WA,

USA. Dr Bared is an attending surgeon in private practice, Miami, FL, USA.

Corresponding Author:

Dr Shane D. Morrison MD, MS, Division of Plastic and Reconstructive Surgery, Department of Surgery, Harborview Medical Center, 325 9th Avenue, Mailstop #359796, Seattle, WA 98104, USA.
E-mail: shanedm@uw.edu; Twitter: @ShaneMorrisonMD

With the transgender population gaining more visibility, clinicians have been increasingly tasked with serving the needs of this patient population.^{1,2} In addition to the genitalia and torso, the face has become an area of interest for providers caring for transgender patients because masculine and feminine facial features are highly salient cues for signaling gender identity.³ Transgender individuals can experience significant facial gender dysphoria from facial features that do not match their identified gender. Incongruous facial features may also result in misgendering or being “outed” as transgender, which may result in discrimination from others.^{2,4-7}

Gender-affirming therapies, including both surgical and medical modalities, have been shown to be efficacious in treating the burden associated with facial gender dysphoria.^{8,9} Facial feminization surgery (FFS), which encompasses a wide array of procedures, has become an increasingly popular option for transfeminine individuals, with the goals of flattening the forehead, reducing the width of the nose, and creating a short and more pointed chin.¹⁰⁻¹⁵ On the other hand, facial masculinization surgery (FMS) aims to increase forehead width and supraorbital bossing, and to create an angled, rectangular chin and a proportionately wide nose, which are generally accepted as masculine traits.^{3,13,16-18}

Although not studied nearly as extensively as FFS, FMS has begun to appear in the surgical literature, mainly with case reports showing improvements in patient satisfaction, but lacking the sample size to be able to generalize the findings.¹⁶⁻¹⁸ Although it is clear that more research about FMS is necessary, providers have found alternative ways to “masculinize” patients’ faces, including fillers and fat grafting.^{19,20} One modality that could serve to augment FMS or as a standalone intervention is hair transplant to the face (mustache, beard, goatee) because the presence and density of facial hair contribute to a perception of masculinity.^{10,21} In early studies that determined which facial features were masculine and which were feminine, all evidence of facial hair was removed because this would be a give-away of a male face.^{10,22,23} Furthermore, recent studies have shown that increased facial hair is associated with increased perception of masculinity.²⁴

Acknowledging the importance of facial hair in creating a masculine appearance, providers have begun transplanting hair to the face of transmasculine patients, with the hopes of providing a facial aesthetic that is more in accordance with their gender identity. Despite this, there is no study describing the timing, technique, and utility of these procedures for transmasculine patients. The purpose of this study is to review the existing literature regarding facial hair transplantation and develop guidelines for practitioners caring for transmasculine patients.

METHODS

Search Strategy

This study was conducted in adherence with guidelines set forth by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA).²⁵ One of the authors (V.P) undertook a systematic literature search of the National Library of Medicine (PubMed), MEDLINE, and Embase databases for studies published through April 2020 that discussed facial hair transplant for transgender or gender nonbinary individuals. Due to the heterogeneity of terminology used to describe both the transgender population and facial hair transplantation, an inclusive search query was developed to capture articles of interest, including original articles describing facial hair transplantation in the transmasculine population, in addition to case reports, systematic reviews, book chapters, and editorials (Table 1). Due to a lack of primary literature specific to transmasculine patients, publications describing facial hair transplantation in cisgender patients were also included. No limits on dates or article type were set on the search.

The resulting publication titles and abstracts were reviewed independently by 2 of the authors (V.P and E.C.) to determine relevance to this study’s objective, and all disagreements between reviewers were resolved with discussion and consensus. If consensus was not possible

Table 1. Search Terms Used to Query Databases

| Domain | Search Terms | Boolean Operator |
|------------------------|--|------------------|
| Population of interest | “Transgender persons,” ^a “gender identity,” ^a “transgender,” “gender nonconforming,” “gender non-conforming,” “gender variant,” “gender dysphoria,” “gender identity,” “gender diverse,” “transmen,” “trans men,” “trans women,” “transwoman,” “transmasculine,” “transpersons,” “trans persons,” “gender-affirming,” “gender reassignment,” “gender-confirmation,” “gender-confirming,” “gender minority,” “gender minorities,” “health services for transgender person,” ^a “non-binary,” “nonbinary,” “nonconforming,” “non-conforming” | OR |
| Intervention | “Facial hair,” “beard,” “moustache,” “mustache,” “goatee,” “chin strap,” “hair regrowth,” “hair regrowths,” “alopecia,” “hair transplant,” “follicular unit transplant,” “follicular unit extraction,” “hair restoration,” “beard restoration” | OR |

^aMeSH major topic; only for PubMed.

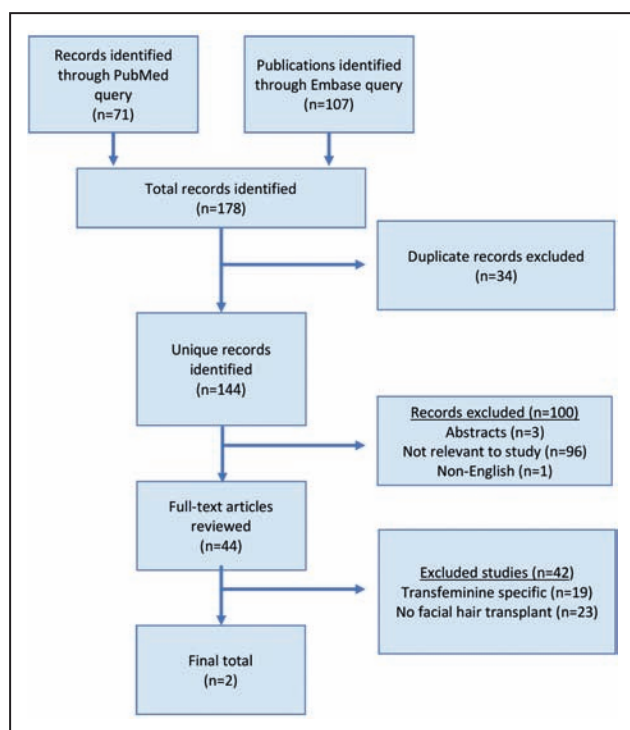


Figure 1. Literature search results.

between the reviewers, one of the senior authors (S.D.M.) made a final decision. Duplicate studies and abstracts were excluded, as was any article not written in English. The full text of eligible studies was reviewed to extract all relevant data, including patient demographics, techniques, outcomes, complications, and patient satisfaction.

RESULTS

A total of 178 publications resulted from the database query, of which 34 were removed for being duplicates. Of the remaining 144 publications, 100 were abstracts, written in a non-English language, or determined to be not relevant to the study objectives, based on review of titles and abstracts. The full text of the resulting 44 publications was reviewed in detail, with only 2 publications discussing facial hair transplant for transmasculine patients and 8 publications in the cisgender population (Figure 1). Secondary to a paucity of publications describing facial hair in the transgender population, studies on facial hair transplantation in the nontransgender population were used to augment our findings and offer recommendations.

DISCUSSION

Facial hair transplantation has become an increasingly popular procedure in the last decade.²⁶ Mustache and

beard transplantation have been described for a variety of indications, including cosmesis, congenital abnormalities, posttraumatic injury, oncologic reconstruction, and now for masculinization of the face²⁷⁻³⁶ (Table 2). Nevertheless, there is a lack of data, even in the nontransgender population, regarding important outcomes, such as graft survival rates, patient satisfaction, and complication rates.

A review of the techniques used in facial hair transplantation indicates that there has been a paradigm shift in recent years, with more providers opting to perform follicular unit extraction (FUE) as opposed to follicular unit transplant (FUT). Briefly, FUT was historically performed for hair transplantation and required excisions of strips of hair bearing occipital skin, leaving linear scars at the donor site.^{37,38} FUE, in which individual follicular grafts are harvested with punches, does not create linear scars.^{27,34,35,37}

Barrera,³⁴ who exclusively used the FUT technique for beard transplantation, estimated graft survival rates of 85% to 95% in his patients. However, there are currently no data available regarding graft survival rates in facial hair transplantation by FUE. It is postulated that FUE leads to lower graft survival than FUT, due to the higher risk of transection during extraction of the graft.³⁹ However, studies comparing the 2 techniques in the treatment of androgenic alopecia have demonstrated mixed results, with some showing FUE resulting in inferior graft survival and others showing equivalent survival rates.^{40,41} Many authors have suggested that careful handling of grafts when performing the FUE technique can reduce the risk of transection, and subsequently improve graft survival rates.^{29,37,42}

Data on patient satisfaction after facial hair transplantation also remain sparse. Civas et al,²⁹ in a series of 10 patients undergoing beard transplantation, reported that 8 patients (80%) were “satisfied” or “very satisfied” with their results, whereas 2 patients (20%) were “indecisive” or “nonsatisfied.” Various authors report high rates of satisfaction after 1 or 2 transplant procedures, but do not provide data from patient satisfaction surveys to corroborate this claim.^{30,32,34}

Timing of Facial Hair Transplant for Transmasculine Patients

There are no studies describing preoperative evaluation of transmasculine patients requesting facial hair transplantation or the appropriate timing for the procedure. An important consideration for hair transplant surgeons would be whether or not the patient is planning on pursuing FMS. Although still not nearly as popular as FFS, it is expected that the number of patients pursuing FMS will only rise in the coming years.^{2,7} Because FMS alters the position of the

Table 2. Summary of Studies Included in the Literature Review

| Reference | Study type | No. of cases | Indication | Technique | Donor site | Outcomes reported | Follow-up |
|-------------------------------------|-------------------|--|----------------------------------|--|------------------------------|--|-----------|
| Bared ^{27,42,a} | Author experience | NA | Facial masculinization | FUE to beard and mustache | Occipital and temporal scalp | NA | NA |
| Marks and Senna ^{28,a} | Systematic review | NA | Dermatologic surgery | NA | NA | NA | NA |
| Civas et al ²⁹ | Case series | 10 | Cosmetic | FUE to beard and mustache | NA | Number of grafts, patient satisfaction, closure rate | 39 months |
| Epstein ³⁰ | Author experience | 700 (facial hair and eyelashes) | NA | FUE/FUT to beard and mustache | Occipital scalp | NA | NA |
| Levesque et al ³¹ | Case report | 1 | SCC | FUT to free flap to form beard | NA | NA | NA |
| Reed and Grayson ³² | Case report | 1 | Cleft lip mustache alopecia | FUT to mustache | Submental beard | Patient satisfaction | 1 year |
| Straub ³³ | Author experience | NA | Cosmetic | FUT to beard and mustache | NA | NA | NA |
| Barrera ³⁴ | Author experience | 750 total (not specific to beard and mustache) | Cosmetic, congenital, and trauma | FUT to beard and mustache | NA | Graft survival | NA |
| Gandelman and Epstein ³⁵ | Author experience | NA | Cosmetic, iatrogenic, and trauma | FUT to beard and mustache | Occipital and temporal scalp | NA | NA |
| Vallis ³⁶ | Case report | 1 | Trauma | Strip technique, secondary punch graft | Parietal scalp | NA | NA |

FUE, follicular unit extraction; FUT, follicular unit transplant; NA, not applicable. ^aArticles that mention facial hair transplant for transmasculine patients.

midface and mandible, deferring facial hair transplantation until after FMS could avoid the transplanted hairs growing in abnormal regions or directions. In some instances, facial hair transplantation could be coordinated with FMS, but it is likely that there may be higher revision rates. However, due to the stark appearance facial hair can make to the face, some patients may request this prior to pursuing any FMS. Thus, shared decision-making with the patient and surgeon should be completed to decide the appropriate timing for the optimal outcome and minimization of dysphoria.

Hair transplant surgeons should perform a thorough history regarding their patient's hormone therapy and the effects it has had on facial hair growth. Testosterone therapy remains a mainstay for many transmasculine patients because of its many masculinizing effects, which include increased lean body mass, cessation of menstruation, and reduced glandular and adipose tissue in the chest. However, one of the most desirable effects of testosterone therapy is the development of both facial and body hair. In a prospective study measuring the effects of gender-affirming testosterone therapy on body and facial hair

growth, researchers found a significant increase in both body and facial hair density, according to the Ferriman-Gallwey hirsutism score.⁴³ After scoring a 2 at baseline, subjects' Ferriman-Gallwey scores increased to a median of 11 at 4 months and eventually 16 at 12 months (a score of 7 indicates hirsutism for cisgender females). Although subjects had significant increases in facial and body hair at 4 months, the investigators noted that facial hair diameter and density continued to increase over the 12-month study period. However, facial hair density was still significantly lower when compared with that of nontransgender male controls and some transmasculine subjects failed to grow any facial hair even after 1 year of hormone therapy.⁴⁴ These findings were corroborated by another study that prospectively looked at 20 transmasculine patients initiating testosterone therapy and retrospectively at 50 transmasculine patients who had been on testosterone therapy for an average of 9.9 years (range 3.2-27.5 years).⁴⁵ Similarly, researchers found that the most significant facial hair growth occurred within the first year of initiation of testosterone therapy, but facial hair growth was more sparse when compared with growth of body hair.⁴⁵

The findings from these studies underscore the potential of facial hair transplant as an adjunctive modality to masculinize the face. Although testosterone therapy is effective in increasing facial hair density, it is clear that transmasculine patients have variable responses, with some having little to no facial hair growth at all, possibly due to genetic variability.^{44,46,47} Nevertheless, hair transplantation should be deferred at least for 1 year after initiation of hormone therapy, to avoid unnecessary surgery and to determine which areas of the face require hair transplantation to fully meet the patient's goals. Additionally, any patient pursuing FMS should be advised to wait until after FMS, so that transplanted hairs do not end up mispositioned, unless otherwise discussed by the patient and their surgeon.

Initial Consultation

The most important step in planning for facial hair transplantation is understanding patient goals. Transmasculine patients consulting for facial hair transplantation are likely very motivated and have a specific understanding of how they want their beard and mustache to look.^{30,42} Patients should be instructed to allow their beard and mustache to grow for at least 1 week prior to initial consultation. This will allow the transplant surgeon and patient to more clearly identify where transplantation is necessary. Moreover, this will allow the surgeon to gain an appreciation of the patient's natural hair growth patterns, which will be of vital importance when placing grafts.³³ Regardless, patients should be educated about graft regrowth rates and warned that a secondary transplant procedure may be needed to achieve satisfactory results.^{30,42,48} Facial hair growth patterns for a masculine appearing beard and mustache are shown in Figure 2.

Transplantation to the Beard

When considering donor sites for beard transplant, attempts should be made to find hairs that closely match the recipient site. Just as with hair transplant for androgenic alopecia, the occipital scalp is the preferred donor site, although use of grafts from the temporal area has been described as well.^{27,35} Patients should be counseled that once these hairs are used, they will not be available for grafting to address androgenic alopecia if it were to develop in the future; however, this may not be an issue because some transmasculine patients believe androgenic alopecia further promotes a masculine appearance.^{28,49,50}

The donor retrieval process is identical to what has been extensively described in hair transplantation for androgenic alopecia, and therefore will not be discussed in detail in this review.^{37,51} Briefly, after shaving and administration of local anesthetic, a mechanical punch device with

the smallest drill size is used to extract follicular units. To achieve full beard density, numerous follicular units are required, with some estimates suggesting extracting at least 250 grafts per sideburn and 500 per cheek.^{27,29,30,42} After donor follicle extraction, the recipient site is prepped and anesthetized. In the beard and sideburns, the angle of the slit incisions must be very acute, bordering on parallel to the skin, oriented inferiorly to ensure hair does not grow outwards from the face and create an unnatural look (Figure 3). Similarly, to prevent the follicle from shifting during the healing process, the smallest possible incisions should be made without disrupting the subdermal plexus.^{27,29,30,35} Various authors suggest making the incision with the smallest blade that will allow placement of a follicle (0.5-0.8 mm), with traction applied by the nondominant hand to ensure an acute angle.^{27,30,33,35,42,48}

In transplanting follicles in the beard, the angle of native hairs must be closely followed. In the sideburn, single hair grafts should be used along the anterior edge and the posterior edge, where hairs generally demonstrate more posterior growth.³⁵ In the central areas of the sideburn, 2 to 3 hair grafts are used to create increased hair density, usually in a caudal orientation.^{27,29,34,42} In the cheek, 3-hair grafts can be used depending on the thickness of donor hair, generally oriented inferiorly (Figure 4). Close attention must be paid when transplanting hairs near the oral area as the hairs take on a more anterior growth pattern. In the infraoral region, hair growth starts oriented inferiorly, but takes a more horizontal direction along the mental crease, before returning to a more vertical orientation.³⁵

Transplantation to the Mustache

Similar to beard transplantation, patient goals must be explored during initial consultation to guide operative planning. Numerous grafts will be needed to achieve appropriate density in the mustache, with estimates suggesting up to 800 grafts may be necessary, but at most 300 grafts should be placed in a single procedure.^{27,42} If a patient requests simultaneous beard and mustache transplant, it may be necessary to use temporal scalp for donor grafts to supplement grafts extracted from the occiput.

After extraction of a sufficient number of grafts, the oral area must be anesthetized with mental and infraorbital nerve blocks, along with direct infiltration of local anesthetic to the tissue above the upper lip. Akin to beard transplantation, the smallest possible incision should be made to prevent changes in angulation during the healing process. One or 2 hair grafts can be used in the center of the mustache to achieve appropriate density, although this may be difficult in the central moustache due to the angulation of the skin near the

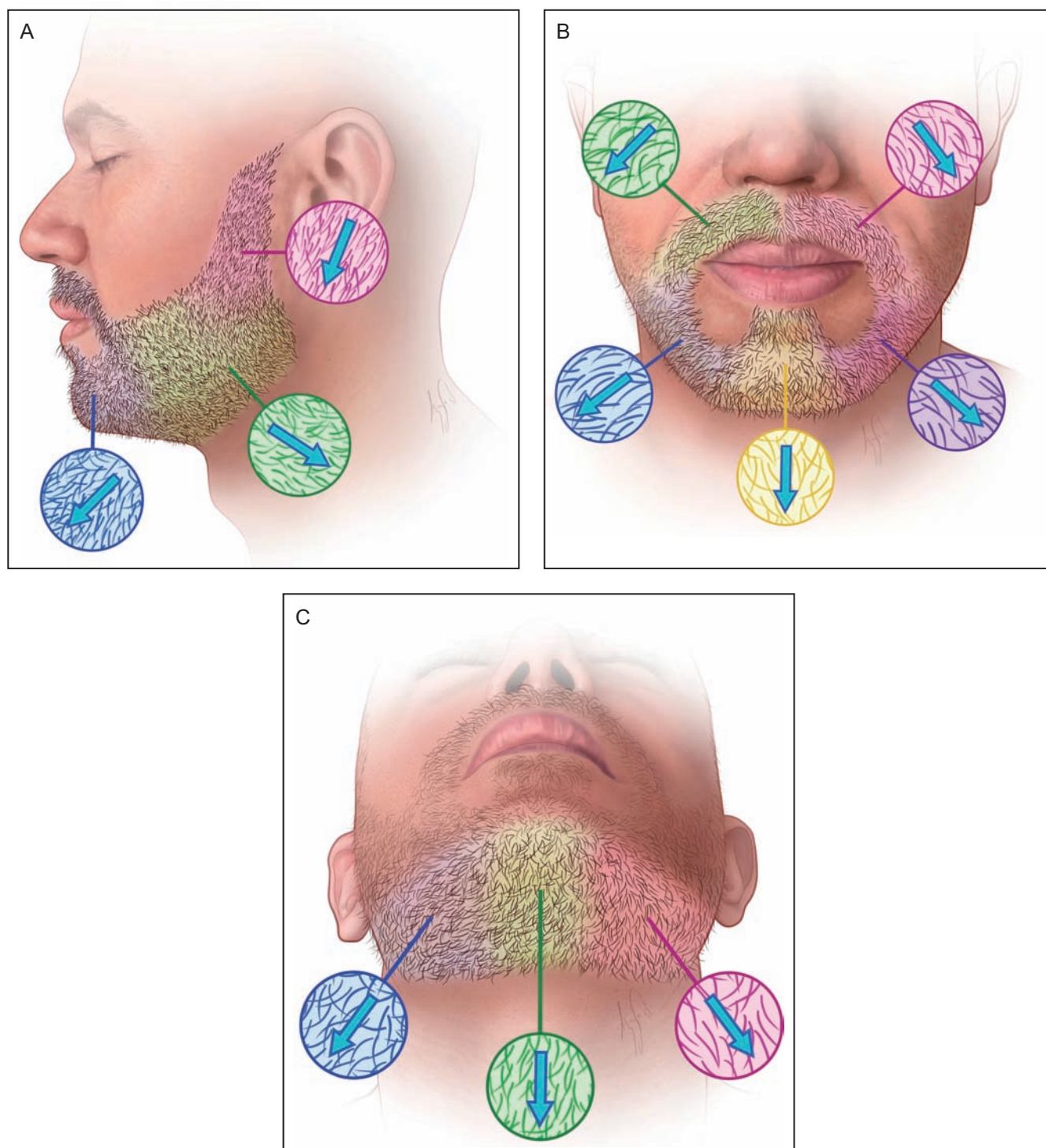


Figure 2. (A) Lateral view, (B) anterior view, and (C) inferior view of normal direction of hair growth of male facial hair.

Cupid's bow.^{32,42,52} On the superior and inferior border of the mustache, single hair grafts can be used, generally oriented inferiorly.³³ The growth of the mustache is largely vertical, but becomes more horizontal on the lateral border, until transitioning to the goatee where hairs return to a vertical orientation.^{27,30,35,42}

Postoperative Care

The postoperative care is similar for beard and mustache transplantation. Patients are advised to keep the recipient site as dry as possible for 5 days to avoid changing the angulation of the transplanted hairs.^{27,30,42}



Figure 3. Acute angle of incision needed to ensure downward growth of grafted hairs.

Similarly, patients should limit their diet to semisolids for the first 5 days to prevent excessive facial muscular activity, which could also displace grafted hairs.²⁹ After 5 days, the patients are allowed to wash their face to remove any crusting or blood, and shaving is permitted after 10 days. Transplanted hair growth generally starts after 4 months, but can continue to increase in density up to 1 year after the procedure.^{27,30,42} Typical results from facial hair transplantation in transmasculine patients are shown in Figure 5.

Complications

Poor Regrowth

Hair regrowth rates after transplantation vary from individual to individual. Despite this, both surgeon and assistant experience has been repeatedly mentioned as critical to achieving high regrowth rates.^{27,30,37,42} Patients should wait at least 1 year after initial transplant before pursuing additional hair transplantation.

Some hair transplant surgeons have begun exploring the use of platelet-rich plasma (PRP) as an adjunct to hair transplantation or as a standalone therapy.⁵³⁻⁵⁵ In brief, PRP is a concentrate extracted from the peripheral blood of patients that contains growth factors such as vascular endothelial growth factor, epidermal growth factor, and insulin-like growth factor 1, among others.⁵⁶ The factors in PRP have been found to affect hair growth by stimulating differentiation and promoting follicle growth.⁵⁷⁻⁵⁹ Although most studies have attempted to use PRP as a standalone therapy, some have showed improved outcomes when PRP is used as an adjunct to hair transplantation. Uebel et al⁶⁰ developed a technique whereby extracted grafts

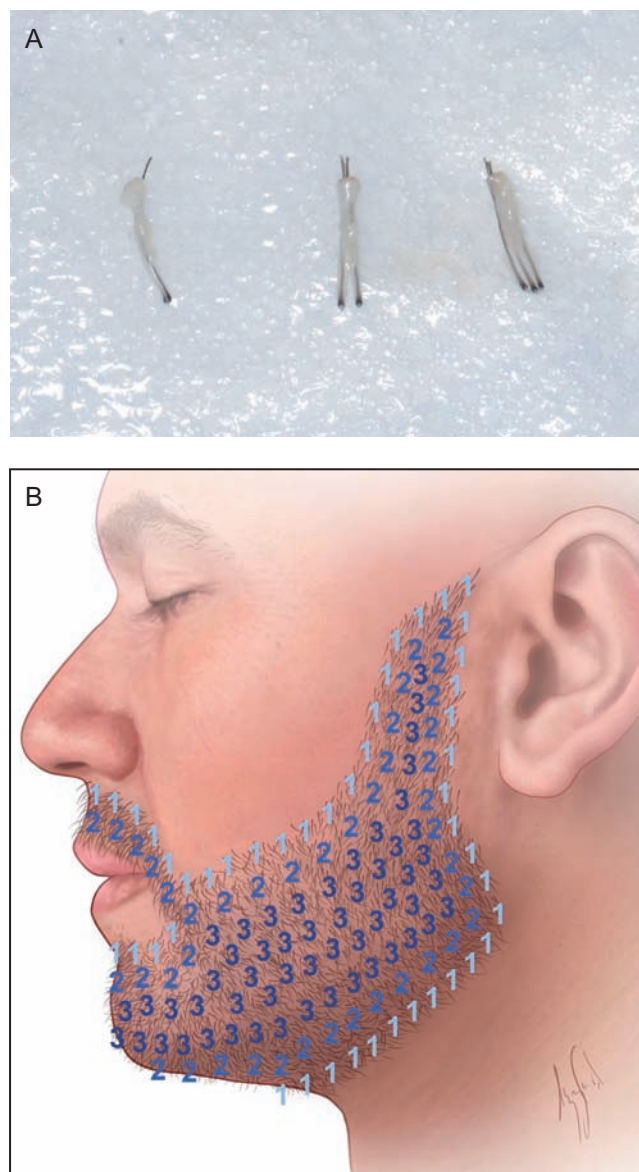


Figure 4. (A) Extracted graft from area with a hair density of 1 to 3. (B) Distribution of grafts on beard.

were soaked in patients' PRP for 15 minutes before transplantation in the recipient side, and found a 15% increase in hair density. Garg⁶¹ administered PRP to the recipient site at the time of grafting following FUE, and found that PRP resulted in significantly quicker growth and increased graft density. Although these results are promising, more research needs to be done before PRP becomes standard of care for patients undergoing facial hair transplant. Hair transplant surgeons can discuss the option of PRP injections—which have only very mild side effects—with transgender patients with poor facial hair regrowth after transplant.⁵³



Figure 5. (A) Preoperative and (B) 6 months postoperative view of facial hair transplantation for a 26-year-old transmasculine patient.

Angulation

Poor angulation remains a complication of facial hair transplant, which is not as common in transplant for androgenic alopecia. Transplanted hairs in the beard, and more commonly in the mustache, tend to shift during healing and grow perpendicularly, creating an unnatural appearance.^{34,42} As mentioned, improper angulation can be limited by ensuring that all incisions in the recipient site are as small as possible to prevent graft shifting during healing. Additionally, the angle of the incision must be acute as possible to ensure downward growth. Bared^{27,42} suggests performing the incisions with a longer blade so that the handle can lie flat against the patient and create an ultra-acute angle. If incorrectly angled hairs are detected after transplant, they can be removed by FUE.

Donor Site

Because FUE is used to extract grafts from the occipital scalp, there are no unique donor-site complications specific to facial hair transplantation when compared to transplantation to the scalp. In general, donor-site complications are rare and relatively mild. If too many grafts are extracted, or if there is asymmetric extraction, a moth-eaten or depleted look can result on the donor site.⁶²⁻⁶⁴ Hypopigmented scarring can also form if punches are taken too close together on the donor site. This is usually not a problem for most patients, as hair growth in the area will cover the pinpoint macules, but patients should be informed about this possibility.^{62,64} Cyst formation, folliculitis, and donor-site necrosis are also reported donor-site complications, but occur very rarely, especially with more experienced transplant surgeons.^{37,38,62,63}

Limitations

This review is largely limited by a lack of primary evidence discussing facial hair transplant for transmasculine patients.

We postulate that principles of facial hair transplantation from the nontransgender population apply to transgender patients, but further studies are needed to develop evidence-based guidelines. Interestingly, even the studies that discuss facial hair transplant for nontransgender patients are either case reports or single author's experiences, without any quantification of outcomes or patient satisfaction.^{30,34,35,42,52} It is clear that further studies are required in all populations to further characterize this procedure, especially with facial hair transplant gaining popularity.²⁶ Future directions include quantifying regrowth rates in facial hair transplantation after FUE, studying the effects of PRP on hair growth after transplantation, and patient satisfaction studies for transmasculine patients who undergo facial hair transplantation.⁶⁵

CONCLUSIONS

Facial hair transplantation has become a promising option for transmasculine patients wishing to enhance their masculine appearance. Currently, we recommend waiting at least 1 year after initiation of testosterone therapy before pursuing facial hair transplantation. Furthermore, transplant surgeons should engage in open discussions about patient plans to pursue facial masculinization surgery because such surgery would inform the appropriate timing for transplantation. In the last decade, FUE has emerged as the preferred technique, due to the absence of linear scars, although transplant surgeons should use whichever technique best suits patient goals and surgeon experience. Complications such as poor angulation and low regrowth rates are common, but can be addressed after the initial procedure and limited with proper technique.

Acknowledgments

Shane D. Morrison and Anthony Bared contributed equally to this work as senior authors.

Disclosures

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Funding

The authors received no financial support for the research, authorship, and publication of this article.

REFERENCES

- Steinmetz K. The transgender tipping point. *Time Magazine*. May 2014.
- Winter S, Diamond M, Green J, et al. Transgender people: health at the margins of society. *Lancet*. 2016;23(388):390-400.
- Brown E, Perrett DI. What gives a face its gender? *Perception*. 1993;22(7):829-840.
- Barret J. Disorders of gender identity. *Br J Psychiatry*. 2014;204:96-97.
- James S, Herman J, Rankin S, Keisling M, Mottet L. *The Report of the 2015 US Transgender Survey*. Published online 2016. National Center for Transgender Equality. <https://www.transequality.org/sites/default/files/docs/USTS-Full-Report-FINAL.PDF>. Accessed January 22, 2021.
- Haas AR, Herman J. *Suicide Attempts Among Transgender Non-conforming Adults: Finding of the National Transgender Discrimination Survey*. Published online 2014. National Center for Transgender Equality. https://www.transequality.org/sites/default/files/docs/resources/NTDS_Report.pdf. Accessed January 22, 2021.
- Morrison SD, Chen ML, Crane CN. An overview of female-to-male gender-confirming surgery. *Nat Rev Urol*. 2017;14(8):486-500.
- WPATH. World Professional Association for Transgender Health Position Statement on Medical Necessity of Treatment, Sex Assignment, and Insurance Coverage in the USA 2016. http://www.wpath.org/site_page.cfm?pk_association_webpage_menu=1352&pk_association_webpage=3947. Accessed January 22, 2021.
- Winter S, Settle E, Wylie K, et al. Synergies in health and human rights: a call to action to improve transgender health. *Lancet*. 2016;388(10042):318-321.
- Spiegel J. Facial determinants of female gender and feminizing forehead cranioplasty. *Laryngoscope*. 2011;121(2):250-261.
- Ousterhout DK. *Facial Feminization Surgery: A Guide for the Transgendered Woman*. Omaha, NE: Addicus Books; 2009.
- Deschamps-Braly JC. Facial gender confirmation surgery: facial feminization surgery and facial masculinization surgery. *Clin Plast Surg*. 2018;45(3):323-331.
- Ascha M, Swanson MA, Massie JP, et al. Nonsurgical management of facial masculinization and feminization. *Aesthet Surg J*. 2018;39(5):123-137.
- Morrison SD, Vyas KS, Motakef S, et al. Facial feminization: systematic review of the literature. *Plast Reconstr Surg*. 2016;137(6):1759-1770.
- Raffaini M, Magri AS, Agostini T. Full facial feminization surgery: patient satisfaction assessment based on 180 procedures involving 33 consecutive patients. *Plast Reconstr Surg*. 2016;137(2):438-448.
- Deschamps-Braly JC. First female-to-male facial confirmation surgery with description of a new procedure for the masculinization of the thyroid cartilage. *Clin Plast Surg*. 2018;45:323-331.
- Sayegh F, Ludwig DC, Ascha M, et al. Facial masculinization surgery and its role in the treatment of gender dysphoria. *J Craniofac Surg*. 2019;30(5):1339-1346.
- Ousterhout DK. Dr Paul Tessier and facial skeletal masculinization. *Ann Plast Surg*. 2011;67(6):S10-S15.
- Wang Q, Guo X, Wang J. Autogenous fat grafting for chin augmentation: a preliminarily clinical study of cosmetic outcome. *J Craniofac Surg*. 2015;26(7):e625-e627.
- Binder WJ, Dhir K, Joseph J. The role of fillers in facial implant surgery. *Facial Plast Surg Clin North Am*. 2013;21(2):201-211.
- Sykes JM, Dilger AE, Sinclair A. Surgical facial esthetics for gender affirmation. *Dermatol Clin*. 2020;38(2):261-268.
- Roberts T, Bruce V. Feature saliency in judging the sex and familiarity of faces. *Perception*. 1988;17(4):475-481.
- Bruce V, Burton AM, Hanna E, et al. Sex discrimination: how do we tell the difference between male and female faces? *Perception*. 1993;22(2):131-152.
- Dixon BJ, Brooks RC. The role of facial hair in women's perceptions of men's attractiveness, health, masculinity and parenting abilities. *Evol Hum Behav*. 2013;34(3):236-241.
- Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):e1000097.
- International Society of Hair Restoration Surgery. *2017 Practice Census Results*. Published online August 2017. International Society of Hair Restoration Surgery. <https://ishrs.org/2018/08/08/ishrs-2017-practice-census-infographic/>. Accessed January 22, 2021.
- Bared A, Epstein JS. Hair transplantation techniques for the transgender patient. *Facial Plast Surg Clin North Am*. 2019;27(2):227-232.
- Marks DH, Senna MM. Androgenetic alopecia in gender minority patients. *Dermatol Clin*. 2020;38(2):239-247.
- Civas E, Aksoy B, Aksoy HM, Calikoglu E. Follicular unit extraction as a valuable method for the restoration of beard: retrospective case series study. *J Cosmet Dermatol*. 2020;19(8):2049-2056.
- Epstein JS. Facial hair restoration. *Facial Plast Surg Clin North Am*. 2013;21(3):457-467.
- Levesque AY, Schalet BJ, Dolph JL. Beard reconstruction using hair grafts in a free flap. *Can J Plast Surg*. 2011;19(4):151-152.

32. Reed ML, Grayson BH. Single-follicular-unit hair transplantation to correct cleft lip moustache alopecia. *Cleft Palate Craniofac J*. 2001;38(5):538-540.
33. Straub PM. Replacing facial hair. *Facial Plast Surg*. 2008;24(4):446-452.
34. Barrera A. Reconstructive hair transplantation of the face and scalp. *Semin Plast Surg*. 2005;19(02):105.
35. Gandelman M, Epstein JS. Hair transplantation to the eyebrow, eyelashes, and other parts of the body. *Facial Plast Surg Clin North Am*. 2004;12(2):253-261.
36. Vallis CP. Hair transplantation to the upper lip to create moustache. *Plast Reconstr Surg*. 1974;54(5):606-609.
37. Sharma R, Ranjan A. Follicular unit extraction (FUE) hair transplant: curves ahead. *J Maxillofac Oral Surg*. 2019;18(4):509-517.
38. Dua A, Dua K. Follicular unit extraction hair transplant. *J Cutan Aesthet Surg*. 2010;3(2):76-81.
39. Park JH, You SH. Various types of minor trauma to hair follicles during follicular unit extraction for hair transplantation. *Plast Reconstr Surg-Glob Open*. 2017;5(3):e1260.
40. Beehner M. *A Comparative Study of FUE and FUT Survival in Four Patients*. ISHRS; 2015.
41. Tsilosani AZ. Singular graft's survival. *Georgian Med News*. 2006;130:14-18.
42. Bared A. What's new in facial hair transplantation? *Facial Plast Surg Clin N Am*. 2019;27(3):379-384.
43. Ferriman D, Gallwey JD. Clinical assessment of body hair growth in women. *J Clin Endocrinol Metab*. 1961;21:1440-1447.
44. Giltay EJ, Gooren LJ. Effects of sex steroid deprivation/administration on hair growth and skin sebum production in transsexual males and females. *J Clin Endocrinology Metab*. 2000;85(1):2913-2921.
45. Wierckx K, Van de Peer F, Verhaeghe E, et al. Short- and long-term clinical skin effects of testosterone treatment in trans men. *J Sex Med*. 2014;11(1):222-229.
46. Meyer WJ 3rd, Webb A, Stuart CA, Finkelstein JW, Lawrence B, Walker PA. Physical and hormonal evaluation of transsexual patients: a longitudinal study. *Arch Sex Behav*. 1986;15(2):121-138.
47. Gorton RN, Erickson-Schroth L. Hormonal and surgical treatment options for transgender men (female-to-male). *Psychiatr Clin North Am*. 2017;40(1):79-97.
48. Nordström RE, Greco M, Vitagliano T. Correction of sideburn defects after facelift operations. *Aesthetic Plast Surg*. 2000;24(6):429-432.
49. Irwig MS. Testosterone therapy for transgender men. *Lancet Diabetes Endocrinol*. 2017;5(4):301-311.
50. Moreno-Arrones OM, Becerra A, Vano-Galvan S. Therapeutic experience with oral finasteride for androgenetic alopecia in female-to-male transgender patients. *Clin Exp Dermatol*. 2017;42(7):743-748.
51. Rassman WR, Bernstein RM, McClellan R, Jones R, Worton E, Uyttendaele H. Follicular unit extraction: minimally invasive surgery for hair transplantation. *Dermatol Surg*. 2002;28(8):720-728.
52. Duskova M, Sosna B, Sukop A. Moustache reconstruction in patients with cleft lip: (final aesthetic touches in clefts—part ii). *J Craniofac Surg*. 2006;17(5):833-836.
53. Badran KW, Sand JP. Platelet-rich plasma for hair loss. *Facial Plast Surg Clin N Am*. 2018;26(4):469-485.
54. Trink A, Sorbellini E, Bezzola P, et al. A randomized, double-blind, placebo- and active-controlled, half-head study to evaluate the effects of platelet-rich plasma on alopecia areata. *Br J Dermatol*. 2013;169(3):690-694.
55. Cervelli V, Garcovich S, Bielli A, et al. The effect of autologous activated platelet rich plasma (AA-PRP) injection on pattern hair loss: clinical and histomorphometric evaluation. *Biomed Res Int*. 2014;1-9.
56. Ehrenfest DD, Andia I, Zumstein M, et al. Classification of platelet concentrates (platelet-rich-plasma—PRP, platelet-rich, fibrin—PRF) for topical and infiltrative use in orthopedic and sports medicine: current consensus, clinical implications, and perspectives. *Muscles Ligaments Tendons*. 2014;4(1):3-9.
57. Cotsarelis G, Millar SE. Towards a molecular understanding of hair loss and its treatment. *Trends Mol Med*. 2001;7(7):293-301.
58. McElwee K, Hoffmann R. Growth factors in early hair follicle morphogenesis. *Eur J Dermatol*. 2000;10(5):341-350.
59. Niimori D, Kawano R, Felemban A, et al. Tsukushi controls the hair cycle by regulating TGF- β 1 signaling. *Dev Biol*. 2012;372(1):81-87.
60. Uebel CO, da Silva JB, Cantarelli D, Martins P. The role of platelet plasma growth factors in male pattern baldness surgery. *Plast Reconstr Surg*. 2006;118(6):1458-1466; discussion 1467.
61. Garg S. Outcome of intra-operative injected platelet-rich plasma therapy during follicular unit extraction hair transplant: a prospective randomised study in forty patients. *J Cutan Aesthet Surg*. 2016;9(3):157-164.
62. Kerure AS, Patwardhan N. Complications in hair transplantation. *J Cutan Aesthet Surg*. 2018;11(4):182-189.
63. Mohmand MH, Ahmad M. Effect of follicular unit extraction on the donor area. *World J Plast Surg*. 2018;5:193-197.
64. Avram MR, Rogers N, Watkins S. Side-effects from follicular unit extraction in hair transplantation. *J Cutan Aesthet Surg*. 2014;7(3):177-179.
65. Klassen AF, Kaur M, Johnson N, et al. International phase I study protocol to develop a patient-reported outcome measure for adolescents and adults receiving gender-affirming treatments (the GENDER-Q). *BMJ Open*. 2018;8(10):e025435.