

Hair Transplantation in Women: A Retrospective Study of Surgical Outcomes and Patient Satisfaction Using FUT and FUE Techniques

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Abstract

Aim: Female pattern hair loss (FPHL) is the leading cause of alopecia in women, often resulting in psychological distress. In advanced stages, hair transplantation is the only effective restorative option. This study evaluated outcomes of follicular unit transplantation (FUT) and follicular unit extraction (FUE) in women.

Materials and Methods: FPHL is the leading cause of alopecia in women, often resulting in psychological distress. In advanced stages, hair transplantation is the only effective restorative option. This study evaluated outcomes of FUT and FUE in women.

Results: The mean age was 37 years. Indications included FPHL (46.8%) and hairline restoration (32.3%). FUT was performed in 28 patients (45.2%) and FUE in 34 (54.8%). The median graft count was 1,700. Three-hair grafts were more frequent in younger patients with good donor quality and in FUE cases. No major complications occurred. Median closure rate was 99%. Overall, 67.7% reported high satisfaction. Higher satisfaction correlated with better donor density and quality, thicker/wavier hair, and greater graft numbers. Logistic regression showed hairline indication [odds ratio (OR) 4.94, $P = 0.029$] and curly/wavy hair (OR 5.82, $P = 0.015$) as independent predictors.

Conclusion: Both FUT and FUE are safe and effective in women. FUE offers broader indications and higher satisfaction. Careful patient selection, donor evaluation, and realistic expectations remain essential for optimal outcomes.

Keywords: Alopecia, female, hair transplantation, hair surgery, women

INTRODUCTION

Hair plays a central role in women's beauty, sexuality, and, above all, femininity. Many women report that having healthy, attractive hair is essential for their overall well-being. Conversely, when their hair does not look good, women may experience anxiety, feel less attractive, and develop low self-esteem. The importance of hair is underscored by findings, showing that 40% of women report difficulties in maintaining their marriages, and 63% report that their careers

are negatively affected by hair loss.¹ These observations highlight the necessity of developing, testing, and evaluating all available options for the treatment of alopecia in women.

Epidemiological studies have shown that approximately 12% of women in their 30s and nearly 40% of women in their seventh decade experience hair loss.² Causes of alopecia in women include scarring alopecias (primary and secondary) and non-scarring forms such as female pattern hair loss (FPHL), telogen effluvium, anagen effluvium, and alopecia

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areata.³ Among these, FPHL is the most common cause and is characterized by progressive thinning and decreased density from the hairline toward the vertex.¹⁻³

The diagnostic work-up of female hair loss is rigorous and includes a thorough medical and family history, hair pull test, trichogram, trichoscopy, laboratory investigations, and, in cases where scarring alopecia is suspected, scalp biopsy.⁴ No single classification system is sufficient for categorizing FPHL in women. In clinical practice, the Ludwig, Hamilton, and Olsen classifications are commonly employed.⁵

Treatment options for female hair loss (particularly FPHL) include topical and systemic medications, interventional approaches, and hair transplantation.^{2,4,5} While medical therapies may help normalize hair distribution in the early stages of FPHL, outcomes in advanced disease remain unsatisfactory, even when progression is halted. In late-stage cases, particularly Ludwig stage II and III, hair transplantation becomes the only effective means of restoring lost hair and improving aesthetic appearance.^{4,5}

The body of literature evaluating the efficacy of follicular unit transplantation (FUT) and follicular unit extraction (FUE) in women is steadily growing.⁵⁻⁷ In this manuscript, we aimed to investigate the efficacy, safety, and patient satisfaction associated with FUT and FUE in female hair transplantation through a retrospective analysis. To aid in the practical understanding of these techniques, we provide a concise comparison in Table 1, highlighting their respective advantages and limitations. This summary is intended to guide dermatologists and clinicians who may be less familiar with surgical hair restoration in women.

MATERIALS AND METHODS

Study Design and Setting

The study protocol was approved by the Bahçeşehir University Ethics Committee (approval number: 2024-04/10, date: 13.05.2025).

The study was conducted in accordance with the latest version of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to surgery, and additional verbal consent was obtained when patients were contacted by phone for the satisfaction survey.

Female patients who underwent hair transplantation at a private clinic in Ankara, Türkiye, between 2005 and 2023, were included in the study through a retrospective chart review. Demographic and clinical characteristics, surgical method, donor area and graft details, presence of complications, follow-up duration, and closure rates were extracted from patient records.

Subsequently, patients were contacted by telephone and their satisfaction with the procedure was assessed using a 5-point Likert scale (1 = not satisfied at all, 2 = not satisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied). For analysis, patient satisfaction was categorized into two groups: low satisfaction (Likert 1-3) and high satisfaction (Likert 4-5).

Surgical Procedures

Patient Selection

The study included female patients diagnosed with FPHL/AGA who sought to improve the appearance of their hairline, undergo eyebrow transplantation, or correct visible secondary alopecic scars. Eligible patients were those with realistic expectations, adequate donor capacity to meet the anticipated outcomes, and no medical contraindications for surgery.

Diagnosis was established through clinical examination, family history, dermoscopy, and laboratory investigations. Prior to surgery, details of the FUT and FUE techniques were explained to all patients, potential complications were discussed, and written informed consent was obtained.

Donor Evaluation

Follicular unit and hair density were measured using a hair densitometer. Additional donor characteristics-including hair

Table 1. Comparison of FUT and FUE techniques in female hair transplantation

Feature	FUT	FUE
Donor harvesting	Linear strip excision	Individual FU excision
Scar	Linear scar	Multiple dot-like scars
Need for shaving	No	Yes (regional/complete)
Recovery	Suture removal, longer healing	Faster healing, no sutures
Main advantage	Large graft numbers in one session	No linear scar, versatile indications
Main limitation	Linear scar	Need for shaving, risk of donor thinning

FUT: Follicular unit transplantation, FUE: Follicular unit extraction

shaft thickness, hair color, skin color, and hair texture (straight or wavy)-were also assessed. These donor parameters were evaluated in conjunction with the size of the alopecic area and the patient's expectations to determine surgical eligibility and planning.

Preoperative Considerations

In all patients, the hairline zone and the front half of the mid scalp were planned as a priority. The decision for the haircut was made together with the patient, considering the availability of donor hair and grafts needed.

Surgical Technique

At the Private clinic all female patients underwent FUT between 1999 and 2009. From 2009 to 2014, FUE was performed in patients who declined FUT. Since 2014, patients have been allowed to choose their preferred method following a detailed discussion of both techniques. The final decision regarding the transplantation method was primarily based on patient preference. To illustrate this decision-making process, Table 2 summarizes the key patient-related factors influencing the choice between FUT and FUE.

For the FUE technique, classic, serrated, and trumpet punches (1 mm in diameter, 4 mm in depth) were used. All punches were operated with a micromotor-assisted rotary handpiece. During the first 100 graft extractions, punch angulation relative to the skin, motor rotation speed, applied pressure, and depth of insertion were carefully optimized.

Postoperative Care

All patients received first-generation cephalosporins for one week postoperatively, along with topical antibiotic ointment applied to the donor site. Patients were also advised to use 2% minoxidil spray twice daily for at least six months following surgery. In women with FPHL, continued medical therapy was recommended to slow or halt progression of existing hair loss, often for an indefinite period.⁸

Follow-Up

At follow-up visits, the presence of complications, donor area closure rate, and patient satisfaction with the procedure were systematically evaluated.

Survey Outcomes

The primary outcomes of this study were the evaluation of the efficacy, safety, and patient satisfaction associated with FUT and FUE in female hair transplantation. The secondary outcome was to identify factors influencing patient satisfaction with both procedures.

Statistical Analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS for Windows, Version 22.0; SPSS, Inc., Chicago, USA). Descriptive statistics were presented as number (n) and percentage (%) for categorical variables, mean (standard deviation) for normally distributed continuous variables, and median (interquartile range) for non-normally distributed continuous variables. Categorical variables were compared using Pearson's chi-square test or Fisher's exact test, whereas continuous variables were compared using Student's t-test or the Mann-Whitney U test, as appropriate.

A significance level of $P < 0.05$ was considered statistically significant for all comparisons. Patient characteristics were compared according to satisfaction status. Variables with P -values < 0.15 in univariate analyses were included in a multivariate logistic regression model to identify independent predictors of satisfaction. Model adequacy was evaluated using the Hosmer-Lemeshow goodness-of-fit test.

RESULTS

General Characteristics of the Patients

A total of 62 women were included in the study, with a mean age of 37 years (Table 3). The most common indications for hair transplantation were FPHL (46.8%) and correction of the

Table 2. Patient considerations in choosing between FUT and FUE

Patient factor	FUT	FUE
Desire to avoid linear scar	✗	✓
Willingness to shave donor	✓ (not required)	✗ (shaving required)
Need for maximum grafts in one session	✓	✗ (limited by density)
Preference for faster recovery	✗ (suture removal, longer healing)	✓ (no sutures, quicker healing)
Suitable for eyebrow or scar transplantation	Less common	✓

FUT: Follicular unit transplantation, FUE: Follicular unit extraction

hairline (32.3%) (Table 4). General patient characteristics are summarized in Tables 3 and 4.

Most patients had straight, medium-thickness, black hair. The median Ludwig stage was II, and donor quality and density were classified as medium in the majority of cases. Regional shaving was the preferred method in most women (91.9%). In all patients, the donor area was the parietal-occipital region.

The median total number of transplanted grafts was 1,700, with the majority of grafts containing three hair shafts (median 900 grafts of type III). Grafts containing three hairs were more

frequently obtained in younger patients with medium or high donor quality ($P = 0.003$) and donor density ($P = 0.016$).

No complications were observed. The median follow-up period was 20 months. The median donor area closure rate was 99%, with closure of 100% achieved in 50% of patients, 99-90% in 24.2%, 89-50% in 21%, and < 50% in 4.8%. The median satisfaction score was 4 on the Likert scale (satisfied). Overall, 21% of patients reported being very satisfied, 46.8% satisfied, 27.4% undecided, and 4.8% dissatisfied with the procedure.

Table 3. General characteristics of patients [mean $\pm$ SD and median (min.-max.)]

	Mean $\pm$ SD	Median (min.-max.)
Age	37.11 $\pm$ 9.92	34.5 (24-67)
Weight	64.35 $\pm$ 9.87	65 (48-92)
Height	167.69 $\pm$ 5.34	168 (155-185)
Body mass index	22.88 $\pm$ 3.33	22.4 (17.24-35.94)
Ludwig hair loss degree	1.72 $\pm$ 0.65	2 (1-3)
Total number of grafts	1651.03 $\pm$ 720.45	1700 (200-3200)
I	327.62 $\pm$ 130	300 (35-700)
II	602.38 $\pm$ 314.49	600 (100-1500)
III	895.48 $\pm$ 363.84	900 (345-1700)
Total hair shafts	3739.37 $\pm$ 1888.11	3700 (300-7300)
Control period (months)	19.39 $\pm$ 9.42	20 (4-40)
Closure % rate	86.9 $\pm$ 19.72	99 (25-100)
Satisfaction	3.84 $\pm$ 0.81	4 (2-5)

SD: Standard deviation, Min.: Minimum, Max.: Maximum

Table 4. General characteristics of patients (n, %)

Category	Variable	n	%
Indication	Hairline	20	32.3
	Ludwig	29	46.8
	Eyebrow	9	14.5
	Scar	4	6.5
Fitzpatrick skin type	2	9	14.5
	3	25	40.3
	4	25	40.3
	5	1	1.6
	6	2	3.2
Natural hair color	Blonde	1	1.6
	Red	1	1.6
	Auburn	10	16.1
	Gray	1	1.6
	Brown	19	30.6
	Black	30	48.4
Hair thickness	Thin	22	35.5
	Medium	39	62.9
	Thick	1	1.6
Hairstyle	Straight	40	64.5

Table 4. Continued

Category	Variable	n	%
	Wavy	17	27.4
	Curly	5	8.1
Donor area	Parietal-occipital	62	100.0
Hair shaving method	Intermittent	1	1.6
	Regional	57	91.9
	Complete	4	6.5
Donor FU density	Sparse	12	19.4
	Medium	39	62.9
	Intense	11	17.7
Donor quality	Poor	12	19.4
	Medium	34	54.8
	Good	16	25.8
Method	FUT	28	45.2
	FUE	34	54.8
Complication	None	62	100.0

FUT: Follicular unit transplantation, FUE: Follicular unit extraction

Surgical Methods Used

Among the 62 patients, 28 (45.2%) underwent FUT between 2005 and 2016, and 34 (54.8%) underwent FUE between 2011 and 2023. Patient characteristics according to surgical technique are summarized in Table 5.

FUT, as the earlier adopted transplantation method, was performed mainly for FPHL and hairline restoration, whereas FUE was additionally applied for eyebrow and scar transplantation ($P = 0.004$). Donor quality and density were significantly higher in the FUE group ($P < 0.05$). Grafts containing three hairs were more frequently obtained in patients treated with FUE ($P < 0.001$). The follow-up period was significantly longer in FUT patients ($P = 0.001$).

Overall, patients who underwent FUE reported significantly higher satisfaction compared with those who underwent FUT ($P = 0.028$).

Factors Affecting Patient Satisfaction

As described in the methods section, patients were classified into two groups according to satisfaction with hair transplantation: low satisfaction ($n = 20$, 32.3%) and high satisfaction ($n = 42$, 67.7%). Factors associated with patient satisfaction are summarized in Table 6.

Higher satisfaction was observed in patients with greater donor density ($P = 0.042$, $r = 0.26$), better donor quality ($P = 0.038$, $r = 0.26$), and higher graft numbers ($P = 0.037$, $r = 0.27$). These findings were consistent with both retrospective data and our clinical experience. A negative correlation was identified between follow-up duration and satisfaction, with

higher satisfaction reported by patients assessed at an earlier follow-up ($P = 0.013$, $r = -0.31$). Satisfaction tended to be higher in patients who underwent FUE compared with FUT, although this difference did not reach statistical significance (Table 6).

According to multivariate logistic regression analysis (Table 7), patients who underwent hair transplantation for hairline restoration were 4.94 times more likely to belong to the high-satisfaction group compared to those treated for other indications [$P = 0.029$, 95% confidence interval (CI): 1.17-20.79]. Similarly, individuals with curly or wavy hair had a 5.82-fold higher likelihood of being in the high-satisfaction group compared with those with straight hair ($P = 0.015$, 95% CI: 1.41-24.15).

DISCUSSION

We report on 62 women who underwent FUT or FUE hair transplantation at our private clinic between 2005 and 2023. In the earlier years, FUT was primarily performed for FPHL and hairline restoration, whereas in later years, FUE was also utilized for eyebrow and scar transplantation. Grafts containing three hairs were more frequently obtained in younger patients with medium-to-good donor quality and density, as well as in those treated with FUE. Donor quality and density were significantly higher among patients who underwent FUE, and consequently, these patients reported greater satisfaction with their procedures.

Satisfaction was also higher among patients treated for hairline restoration and in those with thicker, wavier hair, higher donor density, better donor quality, and a greater number of grafts transplanted.

Tablet 5. Characteristics of patients who underwent FUT and FUE

Characteristics	FUT	FUE	P
Age, mean (SD)	36.14 (8.3)	37.9 (11.2)	0.48
Weight, mean (SD)	66.8 (10.2)	62.3 (9.3)	0.074
Height, mean (SD)	166.9 (4.7)	168.3 (5.8)	0.31
BMI, mean (SD)	24.03 (3.9)	21.9 (2.9)	0.012
Indication, n (%)			
Hairline	8 (28.6)	12 (35.3)	0.004
Ludwig	19 (67.9)	10 (29.4)	
Eyebrow	0	9 (26.5)	
Scar	1 (3.6)	3 (8.8)	
Ludwig hair loss degree, n (%)			
1	8 (42.1)	3 (30)	0.24
2	8 (42.1)	7 (70)	
3	3 (15.8)	0	
Fitzpatrick skin type			
2	3 (10.7)	6 (17.6)	0.38
3	11 (39.3)	14 (41.2)	
4	14 (50)	11 (32.4)	
5	0	1 (2.9)	
6	0	2 (5.9)	
Hair color, n (%)			
Blonde	0	1 (2.9)	0.015
Red	0	1 (2.9)	
Auburn	4 (14.3)	6 (17.6)	
Gray	0	1 (2.9)	
Brown	15 (53.6)	4 (11.8)	
Black	9 (32.1)	21 (61.8)	
Hair thickness, n (%)			
Thin	14 (50)	8 (23.5)	0.074
Medium	14 (50)	25 (73.5)	
Thick	0	1 (1.6)	
Hair style, n (%)			
Straight	19 (67.9)	21 (61.8)	0.099
Wavy	9 (32.1)	8 (23.5)	
Curly	0	5 (14.7)	
Hair shaving method, n (%)			
Intermittent	0	1	0.11
Regional	28 (100)	29	
Complete	0	4	
Donor FU density, n (%)			
Sparse	9 (32.1)	3 (8.8)	0.023
Medium	17 (60.7)	22 (64.7)	
Intense	2 (7.1)	9 (26.5)	
Donor quality, n (%)			
Bad	9 (32.1)	3 (8.8)	0.012
Medium	16 (57.1)	18 (52.9)	
Good	3 (10.7)	13 (38.2)	
Total graft count, median (IQR)	1575 (1385-2075)	1800 (500-2400)	0.74
1	300 (250-387.5)	300 (200-437.5)	0.86
2	600 (500-800)	550 (150-800)	0.094
3	700 (500-900)	1200 (700-1400)	< 0.001
Total hair shaft count	3615 (3062-4950)	4555 (650-5600)	0.82
Follow-up period, month, median (IQR)	24 (18.5-28.5)	12 (8.75-24)	0.001
Patient satisfaction, n (%)			
Very satisfied	3 (10.7)	10 (29.4)	0.028
Satisfied	13 (46.4)	16 (47.1)	
Undecided	9 (32.1)	8 (23.5)	
Not satisfied	3 (10.7)	0	

FUT: Follicular unit transplantation, FUE: Follicular unit extraction, SD: Standard deviation, IQR: Interquartile range

Table 6. Factors affecting patient satisfaction

Characteristics	Low satisfaction (not satisfied and undecided)	High satisfaction (satisfied and very satisfied)	P
Age, mean (SD)	39.7 (8.9)	35.8 (10.2)	0.16
Weight, mean (SD)	66 (11.2)	63.6 (9.2)	0.37
Height, mean (SD)	167.9 (4.5)	167.6 (5.8)	0.84
BMI, mean (SD)	23.4 (4.1)	22.6 (2.9)	0.37
Indication, n (%)			
Hairline	3 (15)	17 (40.5)	0.045
Others (Ludwig, eyebrow, scar)	17 (85)	25 (59.5)	
Ludwig hair loss degree, n (%)			
1	4 (33.3)	7 (41.2)	0.83
2	7 (58.3)	8 (47.1)	
3	1 (8.3)	2 (11.8)	
Fitzpatrick skin type			
2	2 (10)	7 (16.7)	0.64
3	10 (50)	15 (35.7)	
4	8 (40)	17 (40.5)	
5	0	1 (2.4)	
6	0	2 (4.8)	
Hair color, n (%)			
Blonde	1 (5)	0	0.29
Red	0	1 (2.4)	
Auburn	2 (10)	8 (19)	
Gray	0	1 (2.4)	
Brown	9 (45)	10 (23.8)	
Black	8 (40)	22 (52.4)	
Hair thickness, n (%)			
Thin	11 (55)	11 (26.2)	0.024
Medium	9 (45)	30 (71.4)	
Thick	0	1 (2.4)	
Hair style, n (%)			
Straight	17 (85)	23 (54.8)	0.020
Wavy/curly	3 (15)	19 (44.2)	
Hair shaving method, n (%)			
Intermittent	0	1 (2.4)	0.27
Regional	20 (100)	37 (88.1)	
Complete	0	4 (9.5)	
Donor FU density, n (%)			
Sparse	6 (30)	6 (14.3)	0.038
Medium	13 (65)	26 (61.9)	
Intense	1 (5)	10 (23.8)	
Donor quality, n (%)			
Bad	7 (35)	5 (11.9)	0.011
Medium	11 (55)	23 (54.8)	
Good	2 (10)	14 (33.3)	
Method, n (%)			
FUT	12 (60)	16 (38.1)	0.11
FUE	8 (40)	26 (61.9)	

FUT: Follicular unit transplantation, FUE: Follicular unit extraction, FU: Follicular unit, SD: Standard deviation

Table 7. Multivariate logistic regression analysis evaluating patient satisfaction

	OR	95% CI	P value
Indications			
Others (Ludwig, eyebrow, scar)	1		
Hair line	4.94	1.17-20.79	0.029
Hair style			
Straight	1		
Wavy/curly	5.82	1.41-24.15	0.015
OR: Odds ratio, CI: Confidence interval			

This may be explained by the ability to achieve denser FU placement and to transplant a greater proportion of three-hair grafts when donor quality and density are favorable and using the FUE method.

These findings, while consistent with our clinical experience, should be interpreted with caution. The associations identified have not yet been validated in larger comparative studies, and further prospective research is needed to confirm these observations and establish causality.

As follow-up duration increased, patient satisfaction tended to decrease, which may be because earlier patients had undergone FUT. Approximately 15% of all hair transplant surgery patients are female.⁹ Satisfactory results can be achieved in appropriately selected cases, and hair transplantation continues to be the only effective method to restore lost hair for significant female alopecia.

Diagnosis of female hair loss is more complex than the diagnosis of hair loss in men. Distinguishing FPHL from telogen effluvium and alopecia areata incognita is often challenging. Fortunately, trichoscopy has made this differentiation more straightforward in recent years. Surgeons performing hair transplantation in women-especially those who are not dermatologists-should be trained and experienced in trichoscopy. Patients presenting with a receding hairline, a wide forehead, or concerns about a masculinized appearance are generally straightforward candidates for transplantation.

Selecting the right patient is a crucial step in hair transplantation. Realistic expectations are an essential prerequisite; if anticipated surgical outcomes do not align with patient expectations, it may be more appropriate not to proceed with the procedure. Even technically successful results may be perceived as unsatisfactory if expectations are unrealistic.

According to our clinical experience, the following female patients were considered suitable candidates for hair transplantation:

1. Those willing to accept an average cosmetic outcome that can realistically be achieved given the donor-recipient area balance, and who maintain realistic expectations.

2. Patients with Ludwig stage II-III FPHL and high donor density.
3. Patients with a high hairline and average-to-high donor density.
4. Patients with visible secondary scarring alopecia.
5. Patients with primary scarring alopecia in a stable phase.
6. Patients with traction alopecia and sufficient donor supply.

Conversely, the following groups were considered unsuitable candidates for hair transplantation:

1. Patients with diffuse unpatterned alopecia or diffuse alopecia.
2. Patients with insufficient donor supply.
3. Patients with telogen effluvium.
4. Patients with active primary scarring alopecia.
5. Patients with unrealistic expectations.

The suitability of female patients for hair transplantation primarily depends on donor characteristics, which represent the most critical stage of the procedure. In our clinical practice, we have observed considerable variation in donor hair quality among female patients. Based on these observations, we have proposed a donor classification system, which is presented in the Supplementary Appendix. As this classification is derived from clinical experience and has not yet been formally validated, future multicenter and methodology-focused studies are needed to assess its reproducibility and clinical utility.

Patients with moderate to high donor density are suitable candidates for both FPHL and hairline correction. In contrast, patients with low donor density may be suitable only for limited procedures, such as correction of frontal or frontotemporal recession, modest hairline lowering, or localized scarring alopecia.

One of the main limitations of the FUE technique in female patients is the need to shave the donor area to a length of approximately 1 mm. This conclusion is primarily based on

our practical surgical experience, as supporting evidence in the literature remains scarce. Although long-hair punches have been introduced in recent years, they are not yet adequate to yield a sufficient number of grafts for large sessions and are more appropriate for covering small areas.

The decision regarding haircut length should be made in collaboration with the patient, taking into account lifestyle, occupation, and timing of return to work. From the surgeon's perspective, the simplest approach to facilitate graft harvesting and implantation is complete scalp shaving, as in male patients. When this option was explained, a small number of patients preferred full shaving. For women who routinely cover their hair with a hijab or bonnet, shaving was not a major concern. Importantly, patients should be informed that complete shaving can increase the number of harvestable grafts.

In patients with sparse parietal hair or those wishing to avoid social detection of hair transplantation, shaving was limited to the occipital region if sufficient grafts could be harvested. The least noticeable haircut was achieved by leaving hair between shaved strips, provided that the patient's safe donor width was adequate. Avoiding partial shaving in the parietal regions, unlike in men, may lead to excessive thinning of a narrow area in order to obtain the desired graft numbers. Patients should be informed that hair shaft diameter in the donor region may subsequently decrease. Additionally, there is a risk of scar coalescence and postoperative telogen effluvium.

Punches with a standard diameter of 1.0 mm were used with a micromotor. For eyebrow and sideburn transplantation in women, punches smaller than 1.0 mm are preferable. As hair follicle depth in women is shorter than in men, an incision depth of 2-3 mm is generally sufficient to facilitate graft extraction with forceps. For this reason, 4 mm punches were routinely used in our patients, as longer punches may be more difficult to control.

In Ludwig stage II-III patients, dense placement of grafts along the hairline and midscalp provides sufficient coverage, allowing residual sparseness to be concealed by longer hairstyles. Extending transplantation to the vertex in women does not typically provide additional cosmetic benefit. This recommendation is derived from our clinical experience and may not be universally applicable. Closing the transition zone with one- and two-hair FUs, reinforcing the frontal tuft with two- to three-hair FUs, and then advancing grafts posteriorly into the midscalp (and further if indicated by baldness pattern) indirectly creates the appearance of greater density.¹⁰

Among the specific complications of FUE in women are postoperative donor telogen effluvium, typically resolving within 3-4 months, and cicatricial alopecic patches resulting

from coalescence of punch scars when excessive extractions are performed. Limiting excision to approximately 20-25% of the donor area in the first session can minimize these risks.

For women with Ludwig stage II FPHL or hairline correction, approximately 2,000 FUs are required for satisfactory results, which can be achieved in patients with medium to high donor density. Greater numbers of study participants are necessary for Ludwig stage III patients. However, partial haircutting with the FUE method imposes limitations, and when combined with excision restrictions of 1 cm² in the donor area, alternative approaches are required. In suitable candidates with medium-to-good donor characteristics, hybrid surgery can be considered. These sessions may be performed on the same day or sequentially; in the latter case, FUT may be performed first, followed by FUE six months later.¹¹

Study Limitations

This study has several limitations. First, its retrospective and single-center design restricts the generalizability of the findings. Second, the relatively small sample size (n = 62) may not fully reflect the heterogeneity of female hair loss presentations and surgical outcomes. Third, subjective measures such as patient satisfaction may be influenced by recall bias, given the variability in follow-up durations. Finally, the absence of a control or comparison group limits the ability to directly assess the superiority of one technique over another. Future prospective, multicenter studies with larger sample sizes and standardized follow-up protocols are warranted to validate the proposed donor classification and strengthen the surgical recommendations presented.

CONCLUSION

Hair transplantation represents a valuable treatment option for carefully selected female patients with alopecia, particularly those with FPHL, high hairlines, or scarring alopecia. In this retrospective study of 62 women, both FUT and FUE proved to be effective and safe techniques. Higher satisfaction was observed among patients with favorable donor quality and density, thicker and wavier hair, and larger numbers of transplanted grafts.

FUE offered greater versatility in indications-such as eyebrow and scar transplantation-and was associated with higher satisfaction rates compared with FUT. Ultimately, careful patient selection, thorough donor evaluation, and the establishment of realistic expectations remain essential determinants of optimal outcomes in female hair transplantation.

Ethics

Ethics Committee Approval: The study protocol was approved by the Bahçeşehir University Ethics Committee (approval number: 2024-04/10, date: 13.05.2025).

Informed Consent: Written informed consent was obtained from all participants prior to surgery, and additional verbal consent was obtained when patients were contacted by phone for the satisfaction survey.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.C., Ü.A., Concept: E.C., Ü.A., Y.H., B.A., Design: E.C., Ü.A., Y.H., B.A., Data Collection or Processing: E.C., Ü.A., Y.H., B.A., N.M.F.İ., H.M.A., Analysis or Interpretation: E.C., Ü.A., Y.H., B.A., N.M.F.İ., H.M.A., Literature Search: Y.H., B.A., N.M.F.İ., Writing: E.C., Ü.A., Y.H., B.A., H.M.A.

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SUPPLEMENTARY 1. Donor classification in females

Good donor	Moderate donor	Bad donor
• > 60 FU in 1 mm² • FUs mostly having 2-3 hairs	• 40-50 FU in 1 mm² • FUs mostly having 2-3 hairs	• < 40 FU in 1 mm² • FUs mostly having 1-2 hairs
FU: Follicular unit		