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REVIEW FACIAL SURGERY

# A Systematic Review of Outcomes and Patient Satisfaction Following Surgical and Non-surgical Treatments for Hair Loss

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**Abstract**

*Introduction* This systematic review aims to examine surgical and non-surgical treatments and identify those procedures that are most effective in terms of patient satisfaction.

*Materials and Methods* A systematic review protocol was developed a priori in accordance with the Preferred Reporting for Items for Systematic Reviews and Meta-Analyses-Protocols (PRISMA-P) guidelines. The search was conducted in accordance with the PRISMA guidelines, the Cochrane handbook. A multistep search of the PubMed, MEDLINE, Embase, PreMEDLINE, Ebase, CINAHL, PsycINFO, and Cochrane databases was performed to identify studies on hair loss causes and hair loss treatment with different surgical and non-surgical techniques

*Results* Our search generated a total of 781 articles; 646 studies were excluded based on the content of the abstracts, and an additional 105 studies were excluded based on the content of the complete article. We performed a review of the 30 remaining studies, which had sufficient data for inclusion, and met all the aforementioned inclusion criteria. Of the 30 studies, four were about minoxidil, four about finasteride, two about dutasteride, three about phototherapy, six about platelet-rich plasma injection, four about follicular unit transplantation technique, six about follicular unit extraction technique, and one about patient satisfaction following surgical treatment without a specified surgical technique. Only three studies used a patient-reported outcome measurement.

*Conclusions* Our study is the first comprehensive systematic review of hair loss, looking at the problem from different points of view, and focusing on finding the best solution for the patient. In the literature, there is currently no algorithm for the management of patients who go to a plastic surgeon for a solution to the problem of hair loss.

*Level of Evidence III* This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

**Keywords** Hair loss · Hair transplantation · FACE-Q · Body image · Plastic surgery · Quality of life · Bioethics

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## Introduction

There are numerous different causes for hair loss, but the vast majority of men with hair loss have androgenetic alopecia, which in men is more commonly known as "male pattern baldness" [1]. Increasingly, women are also affected by this condition; currently, 30% of women may experience thinning of hair, with obvious psychological and social repercussions. Other causes of hair loss include

thyroid disorders, iron deficiency, a high fever, drastic diets, and some medications. There are also some dermatological scalp disorders that can lead to temporary or permanent hair loss, such as lupus, lichen planopilaris, and alopecia areata. There are, however, many popular misconceptions about hair loss that should be debunked; hair loss is not, for example, caused by such things as slowed blood circulation, blocked follicles, frequent shampoos, or the use of hats or helmets. It is also important to remember that most adults lose approximately 75–100 hairs a day due to a natural process of turnover in which some hairs are shed to be replaced by others; while this turnover remains balanced, the number of hairs present on the scalp remains constant. Another cause of hair loss is stress, which can accelerate genetically programmed hair loss [2]. An individual's propensity to hair loss is inherited from family members on both sides and begins to develop after puberty [3]. Hair shafts predisposed to androgenetic alopecia on the anterior and top of the scalp begin to decrease in diameter and their life cycle shortens until their eventual disappearance, whereas the hair present on the posterior and lateral regions of the scalp is genetically "permanent" and destined to remain stable for the whole life of the individual.

The authors undertook this systematic review of the literature for studies on the clinical management of hair loss to determine answers to the following: can drug treatments be a permanent solution to hair loss, or are they useful only for slowing the progress of hair loss prior to a hair transplant? Are non-surgical treatments such as platelet-rich plasma (PRP) therapy or phototherapy effective or should ancillary procedures for hair transplantation be considered? Which surgical technique is most effective? This systematic review aims to examine surgical and non-surgical treatments and identify those procedures that are most effective in terms of patient satisfaction.

## Materials and Methods

A systematic review protocol was developed a priori in accordance with the Preferred Reporting for Items for Systematic Reviews and Meta-Analyses-Protocols (PRISMA-P) guidelines [4, 5]. The search was conducted in accordance with the PRISMA guidelines [6], the Cochrane handbook [7], and criteria from Terwee et al. [8] A multistep search of the PubMed, MEDLINE, Embase, PreMEDLINE, Ebase, CINAHL, PsycINFO, and Cochrane databases was performed to identify studies on hair loss causes and hair loss treatment with different surgical and non-surgical techniques (Table 1). Key words or MeSH terms were used where available (Table 2). The search strategy was trialed and modified in collaboration with an experienced librarian. Both abstracts and complete articles were reviewed. References cited by the studies were also searched to identify any previously missed studies. Each potential study was examined by two independent reviewers for adherence to inclusion/exclusion criteria. Exclusion criteria included (1) all reports not written in English, (2) reports on non-human subjects, (3) reports that did not assess surgical hair transplantation or non-surgical hair loss treatment, (4) reports that did not analyse outcomes following surgery, and (5) expert opinions, reviews, letters to editors, comments, and conference reports. Discrepancies were discussed between two reviewers. The search was repeated prior to actual manuscript submission in June 2019 to identify any new articles. Data required for the following analyses were extracted from each paper and collated in MS Word and Excel for Mac (V14.5.7).

## Results

Our search generated a total of 781 articles. Of these, 698 were identified using the search terms shown in Table 2. Further 83 articles were identified by reviewing the references of the first 698 articles. Results are presented as tables and a narrative synthesis.

Figure 1 summarizes our search results. In all, 646 studies were excluded based on the content of the abstracts, and an additional 105 studies were excluded based on the content of the complete article. We performed a review of the 30 remaining studies, which had sufficient data for inclusion and met all the aforementioned inclusion criteria. All studies identified from the literature review were assessed to determine the outcome of hair loss treatment, i.e. pharmacological treatment (Table 3), non-surgical treatment (Table 4), or surgical treatment (Table 5), and utilization of validated patient satisfaction questionnaires. Of the 30 studies which met the inclusion criteria, four were about minoxidil [9–12], four about finasteride [13–16], two about dutasteride [17, 18], three about phototherapy [19–21], six about platelet-rich plasma (PRP) injection [22–27], four about follicular unit transplantation (FUT) technique [28–31], six about follicular unit extraction (FUE) technique [32–37], and one about patient satisfaction following surgical treatment without a specified surgical technique [38]. Only three studies used a patient-reported outcome measurement: one used a hair growth questionnaire for use in the evaluation of therapeutic effects of treatment in men [39], another used the FACE-Q [40], and another used the Rosenberg self-esteem scale [41]. The questionnaires were analysed by reviewers to assess adherence to the rules of the US Food and Drug Administration [42], and the Scientific Advisory Committee of the Medical Outcomes Trust [43], for development

**Table 1** PICOS criteria

| Parameters | Inclusion criteria | Exclusion criteria |
|---|---|---|
| Patient, population, or problem | (1) Patient candidate to hair transplantation<br>(2) Hair loss causes<br>(3) Hair loss treatment<br>(4) Databases research (PubMed, MEDLINE, Embase, PreMEDLINE, Ebase, CINAHL, PsycINFO and Cochrane databases) | Patient with psychiatric disorder, with abuse of alcohol or drug, with progeria syndrome, alopecia in scar tissue, post-chemotherapy alopecia |
| Intervention, prognostic factor, or exposure | Analysis of different techniques of hair transplantation with long-term outcomes<br>Analysis of different non-surgical treatments for hair loss | |
| Comparison or intervention (if appropriate) | The use of PROMs in patient's evaluation, prospective studies, management algorithm | |
| Outcome you would like to measure or achieve | (1) Variation of quality of life and outcomes following hair transplantation<br>(2) Evaluation of the different techniques for hair transplantation and patient's satisfaction | |
| Study design | (1) Articles published up to may 2019<br>(2) Studies in the English language<br>(3) All articles focused on the patient's<br>Satisfaction, hair transplantation, alopecia surgical treatment, FUE, FUT, CFU, alopecia non-surgical treatment | (1) All reports not written in English<br>(2) Reports on non-human subjects<br>(3) Reports that did not assess surgical hair transplantation or hair loss non-surgical treatment<br>(4) Reports that did not analyse outcomes following surgery<br>(5) Expert opinions, reviews, letters to editor, comments, conference reports |

**Table 2** Search terms

| Search group | Search terms |
|---|---|
| PROM | Treatment outcome, personal satisfaction, outcome assessment, quality of life, quality-of-life, questionnaire, outcome, satisfaction, instrument, survey-, assessment-, body image, hair loss outcome, scalp |
| Surgical procedures | Combined Follicular Unit, Follicolar Unit Transplantation, Follicolar Unit extraction, alopecia treatment, hair transplant, hair transplantation, male pattern alopecia, female pattern alopecia, male pattern hair loss, female pattern hair loss, FUT, FUE, CFU |
| Elective procedures | Aesthetic, cosmetic, elective, plastic surgery, dermatology, trichology |

*PROM* patient-reported outcome measure

and validation criteria (Table 6) and content analysis (Table 7).

## Discussion

Hair loss can be caused by several conditions. Physiologically, a hair cycle is composed of three phases: "anagen", an active growing phase, involving about 90% of hairs on the scalp at any given time; "catagen", a degeneration phase, involving $< 10\%$ of scalp hair; and "telogen", a resting phase during which hair is shed, involving about 5% of hairs. Hair loss causes can be divided into focal and diffuse etiologies. Alopecia areata, trichotillomania, and tinea capitis can cause a focal hair loss, while telogen or anagen effluvium usually causes a diffuse hair loss. Trichorrhexis nodosa, or the weakening and breaking of hairs, can occur following a chemical or physical trauma to the hairs. Androgenetic alopecia is a common form of hair loss in both men and women and may take a diffuse or focal form [44]; in men, this condition is also known as male pattern baldness. Androgenetic alopecia is a polygenetic condition and is the most common type of progressive hair loss. Severity, age of onset and scalp location of hair loss in

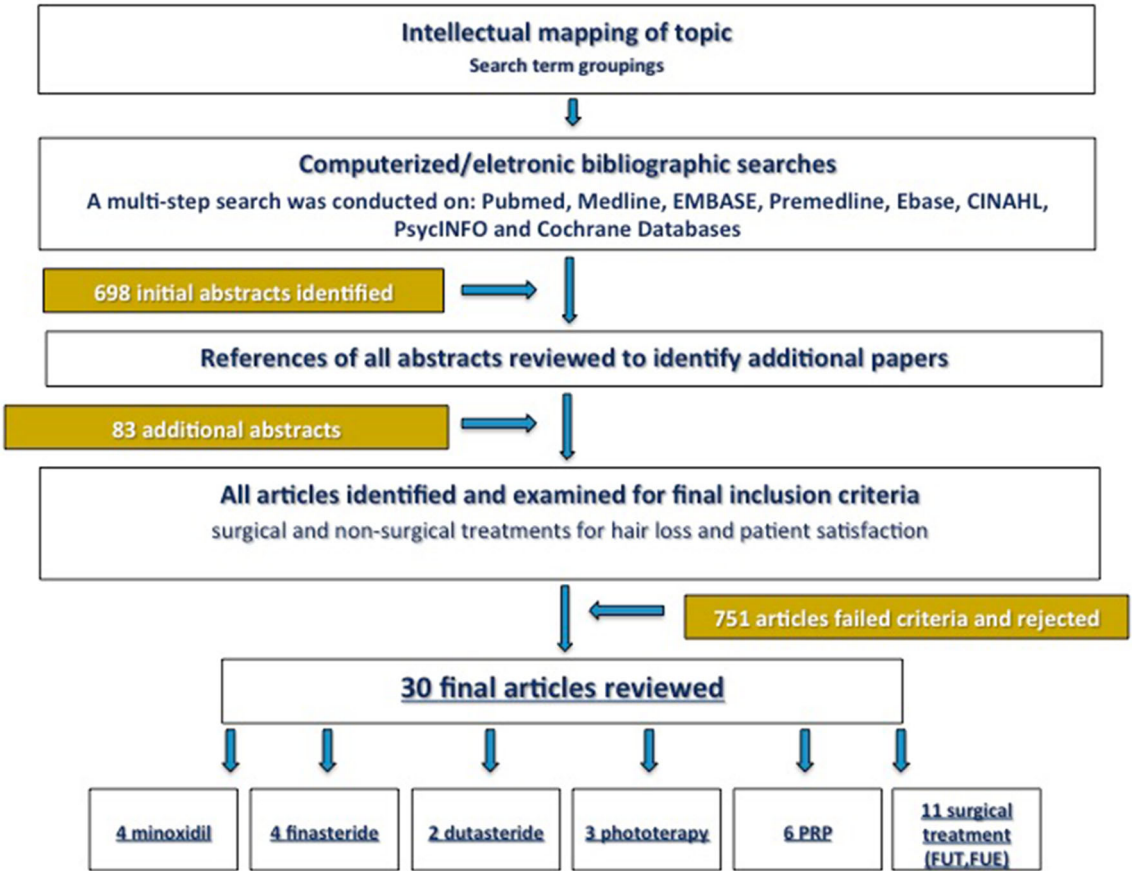


**Fig. 1** Flow diagram search strategy

this condition may vary among individuals, but the temporal and vertex regions are the most commonly affected areas, with the occipital region being typically spared. The condition is characterized by a progressive miniaturization of the hair follicle and reduction in the diameter, length, and pigmentation of the hair, causing transformation of terminal hair into vellus hair [45, 46]. Without treatment, patients with androgenetic alopecia undergo progressive hair loss as a consequence of an altered hair cycle [47]. More specifically, the anagen phase duration (which is responsible for hair length) gradually decreases, while the duration of the telogen phase increases [48, 49]. Current evidence suggests that androgenetic alopecia is a multifactorial disorder, determined by the effects of several different genes as well as environmental factors [50]. Androgenetic alopecia is closely related to the body's androgen levels, since androgens control hair growth, together with thyroid hormones and glucocorticoids [51, 52]. Androgens have different functions, depending on the body site. In androgen-dependent areas, they can enlarge the hair follicle, while in other areas in susceptible men they can inhibit hair growth, promoting the miniaturization of the hair follicles and shortening the anagen phase [53]. Thus, there are different factors at play in the causation of androgenetic alopecia. A primary role is played by the dermal papilla cells, which maintain the epithelial cell growth by releasing growth factors, which have an autocrine action on the dermal papilla and a paracrine action on the other follicle cells [54–57]. These hair growth stimulating factors include insulin-like growth factor 1 (IGF-1), basic fibroblast growth factor (bFGF), and vascular endothelial growth factor (VEGF). Other factors such as interleukin 1 alpha (IL-1α) and tumour necrosis factor alpha (TNFα) have an inhibitory and pro-apoptotic effect. TGF-β1 is a catagen inducer in the hair cycle, likely playing an important role in the early catagen induction of androgenetic alopecia [58]. Local androgen bioavailability is a determining factor on its effect on hair follicles. Generally, men affected by androgenetic alopecia have normal serum androgen levels, but testosterone and dihydrotestosterone (DHT) production are increased locally [59]. Indeed, through the action of specific enzymes, the skin is able to synthesize androgens with autocrine or paracrine actions [60]. Testosterone reaches the skin via capillary blood flow and is converted to the more powerful DHT by 5α-reductase. Even dehydroepiandrosterone

**Table 3** Studies about pharmacological therapy for hair loss treatment

| Title | Authors | Year | Study type | Number of patients | Mean follow-up period | Average age | Complications | Outcome measurement | Treatments |
|---|---|---|---|---|---|---|---|---|---|
| A randomized clinical trial of 5% topical minoxidil versus 2% topical minoxidil and placebo in the treatment of androgenetic alopecia in men | Olsen EA et al | 2002 | Randomized clinical trial | 393 men | 48 weeks | 36.5 | Hair loss persistence | General questionnaire | minoxidil |
| A multicenter, randomized, placebo-controlled, double-blind clinical trial of a novel formulation of 5% minoxidil topical foam versus placebo in the treatment of androgenetic alopecia in men | Olsen EA et al | 2007 | Randomized study | 352 men | 16 weeks | 39.2 | Hair loss recurrence, Scalp irritation | Not used | minoxidil |
| A randomized, placebo-controlled trial of 5% and 2% topical minoxidil solutions in the treatment of female pattern hair loss | Lucky AW et al | 2004 | Randomized clinical trial | 381 women | 48 weeks | 37 | Occurrence of pruritus, local irritation, and hypertrichosis | General questionnaire | minoxidil |
| Use of topical minoxidil therapy for androgenetic alopecia in women | Jacobs JP et al | 1993 | Randomized clinical trial | 346 men | 32 weeks | 33.6 | Hair loss persistance | Not reported | Minoxidil |
| Finasteride in the treatment of men with androgenetic alopecia. Finasteride Male Pattern Hair Loss Study Group | Kaufman KD et al | 1998 | Randomized study | 1553 men | 12 months | 33 | Libido decreased, Erectile dysfunction, Decreased ejaculate volume, Body hair growth increased, Urinary frequency | Hair growth questionnaire | Finasteride |
| Finasteride in the treatment of men with frontal male pattern hair loss | Leyden J et al | 1999 | Randomized clinical trial | 326 men | 12 months | 33 | Not reported | General questionnaire | Finasteride |
| Dutasteride improves male pattern hair loss in a randomized study in identical twins | Stough DB et al | 2007 | Randomized study | 32 men | 12 months | 34 | Not reported | Not reported | Dutasteride |

**Table 3** continued

| Title | Authors | Year | Study type | Number of patients | Mean follow-up period | Average age | Complications | Outcome measurement | Treatments |
|---|---|---|---|---|---|---|---|---|---|
| A randomized, active- and placebo-controlled study of the efficacy and safety of different doses of dutasteride versus placebo and finasteride in the treatment of male subjects with androgenetic alopecia | Gubelin Harcha W et al | 2014 | Randomized study | 917 men | 24 weeks | 38 | Altered libido, Impotence, Ejaculation disorders, Breast enlargement, Breast tenderness | Not reported | Finasteride, dutasteride |
| Clinical dose ranging studies with finasteride, a type 2 5alpha-reductase inhibitor, in men with male pattern hair loss | Roberts JL et al | 1999 | Randomized clinical trial | 227 men | 12 months | 30 | Not reported | Hair growth questionnaire | Finasteride |
| Finasteride treatment of female pattern hair loss | Iorizzo M et al | 2006 | Cases series | 37 women | 12 weeks | 34 | Not reported | General questionnaire | Finasteride |

(DHEA) and dehydroepiandrosterone sulphate (DHEA-S) are converted to testosterone and DHT in sebocytes, sweat glands, and dermal papilla cells [61]. Androgen degradation is performed by the actions of keratinocytes. Testosterone conversion to DHT is performed by the actions of two different isoenzymes: 5α-reductase type I and type II. 5α-reductase type II expression seems to be higher in the dermal papilla cells of subjects affected by androgenetic alopecia [62]. Changes in 5α-reductase expression can increase testosterone conversion to DHT. Thus, local androgen bioavailability depends on the expression of several androgen- and oestrogen-synthesizing enzymes. Even androgen receptors play an important role in androgenetic alopecia. These 110-kDa ligand-inducible nuclear receptors regulate the expression of target genes. In the skin, androgen receptors are present in epidermal and follicular keratinocytes, sebocytes, sweat gland cells, dermal papilla cells, dermal fibroblasts, endothelial cells, and genital melanocytes [63, 64]. The role played by androgen receptors in androgenetic alopecia is significant in two ways. Firstly, there are more androgen receptors in dermal papilla cells from balding scalp hair follicles, than from non-balding scalp follicles, and secondly, in individuals affected by androgenetic alopecia, DNA methylation of the androgen receptor promoter is increased in follicles from the occipital scalp compared with those from the vertex of the scalp [65]. Indeed, an increased degree of androgen receptor methylation, which results in a reduced androgen receptor expression, seems to protect an individual from miniaturization and hair loss. Even androgen receptor co-activators (i.e. Hic-5/ARA55) are differently expressed in dermal papilla cells from different sites, and they seem to correlate with the presence of androgenetic alopecia [66, 67].

Other factors play a role in androgenetic alopecia pathogenesis, including oxidative stress and prostaglandin D2, which has been found to be an inhibitor of hair growth in androgenetic alopecia [68, 69]. Hair follicle sensitivity to androgens is a consequence of a multifaceted system of pre-receptor 5α-reductase, androgen receptors, and post-receptor co-activators [70, 71].

After discussing the causes of hair loss, we now move on to the central topic of this review: to analyse patient outcomes and satisfaction following surgical and non-surgical procedures for hair loss treatment. Table 3 lists all the studies on the pharmacological treatment of hair loss that met the inclusion criteria of our review. Based on our findings, we conclude that the most used drugs for hair loss are minoxidil, finasteride, and dutasteride. In the majority of these studies, the follow-up period was 12 months [13–15, 17]. Only one study involved the use of a specific hair loss questionnaire [13]. Some, but not all, studies reported on the possible complications of these drug treatments; those reported the following complications: decreased libido, erectile dysfunction, decreased ejaculate volume, increased body hair growth, urinary frequency,

**Table 4** Studies about non-surgical treatment for hair loss

| Title | Authors | Year | Study type | Number of patients | Mean follow-up period | Average age | Complications | Outcome measurement | Procedures |
|---|---|---|---|---|---|---|---|---|---|
| Hair growth induced by diode laser treatment | Bernstein EF | 2005 | Case report | 1 man | Not reported | 24 | Not reported | Not reported | 810-nm diode laser treatment |
| HairMax LaserComb laser phototherapy device in the treatment of male androgenetic alopecia: A randomized, double-blind, sham device-controlled, multicentre trial | Leavitt M et al | 2009 | Randomized clinical trial | 123 men | 26 weeks | 48 | Not reported | Not reported | HairMax LaserComb laser phototherapy |
| Efficacy and safety of a low-level laser device in the treatment of male and female pattern hair loss: a multicenter, randomized, sham device-controlled, double-blind study | Jimenez JJ et al | 2014 | Randomized clinical trial | 146 men 188 women | 26 weeks | 49 | Not reported | Not reported | HairMax LaserComb laser phototherapy |
| Platelet-Rich Plasma and Micrografts Enriched with Autologous Human Follicle Mesenchymal Stem Cells Improve Hair Re-Growth in Androgenetic Alopecia. Biomolecular Pathway Analysis and Clinical Evaluation | Gentile P. et al | 2019 | Cases series | 57 men | 12 weeks | Not reported | Not reported | Not reported | PRP |
| The Effect of Platelet-Rich Plasma in Hair Regrowth: A Randomized Placebo-Controlled Trial | Gentile P. et al | 2015 | Randomized study | 23 men | 24 months | 35 | Not reported | Not reported | PRP |
| The effect of autologous activated platelet rich plasma (AA-PRP) injection on pattern hair loss: clinical and histomorphometric evaluation | Cervelli V. et al | 2014 | Randomized study | 10 men | 12 months | 40 | Not reported | Not reported | PRP |
| Therapeutic efficacy of autologous platelet-rich plasma and polydeoxyribonucleotide on female pattern hair loss | Lee SH et al | 2015 | Randomized study | 40 women | 7 weeks | 34 | Not reported | Not reported | PRP, polydeoxyribonucleotide |
| The effect of autologous activated platelet-rich plasma injection on female pattern hair loss: A randomized placebo-controlled study | Tawfik AA et al | 2018 | Randomized study | 30 women | 6 months | 30 | Not reported | Not reported | PRP |
| Treatment of male pattern alopecia with platelet-rich plasma: A double-blind controlled study with analysis of platelet number and growth factor levels | Rodrigues BL et al | 2019 | Randomized study | 36 men | 3 months | 32 | Not reported | Not reported | PRP |

**Table 5** Studies about surgical treatment for hair loss

| Title | Authors | Year | Study type | Number of patients | Mean follow-up period | Average age | Complications | Outcome measurement | Surgical Procedures |
|---|---|---|---|---|---|---|---|---|---|
| The role of platelet plasma growth factors in male pattern baldness surgery | Uebel CO et al | 2006 | Cases series | 20 men | 7 months | 38 | Not reported | Not reported | FUT, PRP |
| Follicular unit transplantation for the treatment of secondary cicatricial alopecia | Shao H et al | 2014 | Cases series | 20 men 17 women | 12 months | 25 | Epidermoid cysts | Not reported | FUT |
| Harvested vs estimated follicular units in hair transplantation | Huang YL et al | 2019 | Retrospective study | 69 men | 4 months | 38 | Not reported | Not reported | FUT |
| Association Between Scalp Laxity, Elasticity, and Glidability and Donor Strip Scar Width in Hair Transplantation and a New Elasticity Measuring Method | Park JH et al | 2017 | Retrospective study | 54 men, 34 women | 10 months | 31 | Not reported | Not reported | FUT |
| Nonshaven Follicular Unit Extraction: Personal Experience | Park JH et al | 2019 | Retrospective study | 324 men, 234 women | 12 months | 36.5 | Not reported | Not reported | FUE |
| Effect Of Follicular Unit Extraction on The Donor Area | Humayun Mohmand M et al | 2018 | Retrospective study | 10 men | Not reported | 32 | Not reported | Not reported | FUE |
| Robotic Follicular Unit Graft Selection | Bernstein RM et al | 2016 | Randomized study | 24 men | Not reported | Not reported | Not reported | Not reported | Robotic FUE |
| Hidden Transection of Follicular Unit wxtraction in Donor Site | Kim DY et al | 2016 | Cases series | 20 men | Not reported | Not reported | Not reported | Not reported | FUE |
| Evaluating The Satisfaction Of Patients Undergoing Hair Transplantation Surgery Using The FACE-Q Scales | Liu Y et al | 2019 | Prospective study | 131 men | 6 months | 35.5 | Not reported | FACE-Q | FUE |
| follicular Unit Extraction Hair Transplantation with Micromotor: Eight Years Experience | Ors S et al | 2015 | Cases series | 968 men 32 women | 5 years | 35 | inclusion cyst in the donor area | Not reported | FUE |

**Table 5** continued

| Title | Authors | Year | Study type | Number of patients | Mean follow-up period | Average age | Complications | Outcome measurement | Surgical Procedures |
|---|---|---|---|---|---|---|---|---|---|
| The relationship between self-esteem and hair transplantation satisfaction in male androgenetic alopecia patients | Liu F et al | 2018 | Retrospective study | 1106 men | 9 months | 35.5 | Not reported | FACE-Q, Rosenberg Self-Esteem Scale | Not specified |

**Table 6** Analysis of development and validation criteria of the questionnaires

| | FACE-Q | Rosenberg self-esteem scale | Male hair growth questionnaire |
|---|---|---|---|
| *Item generation* | | | |
| Patient interviews | + | | + |
| Literature | + | + | |
| Expert opinion | + | | |
| Develop conceptual model | + | + | + |
| *Item reduction* | | | |
| Expert opinion | + | | |
| Item redundancy | + | | |
| Endorsement frequencies | + | | |
| Missing data | + | | |
| Factor analysis | + | | |
| Test of scaling assumptions | + | | |
| *Psychometric analysis* | | | |
| Acceptability | + | | |
| Internal consistency reliability | + | | + |
| Item total correlations | + | | |
| Interrater reliability | + | | + |
| Test–retest reliability | + | | + |
| *Validity* | | | |
| Within scale | + | + | |
| Comparison with other measures | + | | |
| Hypothesis testing | + | + | + |
| Responsiveness | + | + | + |

breast enlargement, and/or breast tenderness. None of the studies presented drug treatment as a definitive solution to hair loss, and therefore, drug treatments cannot be considered as definitive treatments giving permanent results. In Table 4, we list those studies of non-surgical treatments for hair loss that we analysed that met the inclusion criteria. None of these studies used a questionnaire to analyse patient satisfaction. The maximum follow-up period in these studies was 24 months [23]. None of the authors reported complications after the treatment. Table 5 shows the studies of the surgical treatment of hair loss that met the inclusion criteria. Only two of these studies used questionnaires to analyse patient satisfaction. The longest follow-up was 5 years, in a randomized study on the Micromotor FUE technique [37]. None of the studies compared the techniques most commonly used, such as the FUE and the FUT techniques, to understand which technique gives superior and more permanent results, with the same clinical indications. There are at present no clear and precise indications on the preferred surgical technique to be

**Table 7** Content analysis of the questionnaires

| | FACE-Q | Rosenberg self-esteem scale | Male hair growth questionnaire |
|---|---|---|---|
| *Self-perception of body appearance* | | | |
| Satisfaction with appearance | + | | + |
| Noticeable change in appearance | + | | + |
| Noticeable improvements in "feature" | + | | + |
| Family and friends' satisfaction with appearance | + | | |
| Reliance on concealment of appearance | + | | |
| Looking to undergo additional procedures to improve appearance | + | | + |
| *Self-concept* | | | |
| Self-esteem/confidence | + | + | + |
| Feeling/looking "normal" | + | | |
| Feeling attractive | + | | |
| Ability to look at self | + | | |
| Negative feelings about self | + | | |
| Concern regarding others' negative perception of self | + | + | |
| Shame/stigma/embarrassment | + | | |
| *Psychological functions* | | | |
| Optimism | + | | |
| Social/professional interactions | + | | |
| Concern/excessive worry | + | | |
| Social network appearance | | | |
| Avoidance of uncomfortable situations | + | | |
| Dysphoric emotions | | | |
| Sexual comfortable | | | |
| acceptability as a sexual partner | | | |
| Ability to enjoy life | + | + | |
| Appearance in photos | | | |

used based on the defect to be corrected, and none of the authors reported on it in any of the analysed studies. The FACE-Q questionnaire [40] achieved the highest score in the analysis of development and contents and therefore should be the first choice to assess levels of patient satisfaction. Specifically, the FACE-Q module that should be used for patients undergoing treatments for hair loss is the FACE-Q adverse effects: forehead, eyebrows, and scalp. According to the scientific literature and revisions already carried out [72, 73], the most frequently used classification to define the degree of alopecia is the Norwood–Hamilton scale [74, 75].

However, what is currently lacking in the literature is a correlation between the various degrees of alopecia and the procedure that can give optimal results.

Otherwise, patients will not be sufficiently informed to be able to give true consent to treatment procedures. Better transparency will engender patient trust in aesthetics medicine and improve its methodology.

## Conclusions

It is absolutely necessary to provide patients with improved transparency and certainty in relation to treatments used for hair loss, so as to offer the patient an effective solution to their problem. In the literature, there is currently no algorithm for the management of patients who go to a plastic surgeon for a solution to the problem of hair loss. It is therefore necessary to undertake prospective, evidence-based studies to fully address the problem of hair loss, so as to be able to offer the patient an optimal and long-lasting solution. It is also necessary to undertake follow-up and analysis of the possible confounders in the diagnosis of hair loss. Ethically it is therefore necessary to undertake prospective studies based on evidence-based medicine to properly address the problem of hair loss, so as to be able to offer the patient an optimal and long-lasting solution. Our study is the first comprehensive systematic review of hair loss, looking at the problem from different points of view, and focusing on finding the best solution for the patient.

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**Compliance with Ethical Standards**

**Conflict of interest** Authors declare that they have no conflict of interest to disclose.

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**Informed Consent** For this type of study, informed consent is not required.

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