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A Systematic Review of the Outcome of Hair Transplantation in Primary Scarring Alopecia

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Keywords

Scarring alopecia · Cicatricial alopecia · Hair loss · Hair transplant

Abstract

Importance: Hair loss, or alopecia, is one of the most commonly presented problems in dermatology. Scarring alopecias are considered particularly damaging due to limited success in slowing permanent disease progression, and current treatment methods, such as intralesional and topical steroids and topical minoxidil, are largely ineffective. **Objective:** Hair transplantation is a debated treatment option for advanced cases of primary scarring alopecia. This study reviews the efficacy of hair transplantation as a treatment option for primary scarring alopecia. **Evidence Review:** A primary literature search was conducted using PubMed to identify articles in scarring alopecia and hair transplants published from 1960 to the present time. **Findings:** Fifteen reports with 34 patients were included in this review. Twenty six patients experienced moderate to positive results, while 8 patients experienced negative results or recurrence of disease. Positive hair transplantation results have been reported in patients with central centrifugal cicatricial alopecia, en coup de sabre, discoid lupus erythematosus, pseudopelade de brocq, and folliculitis decalvans. Positive and

negative results were observed in patients with lichen planopilaris and frontal fibrosing alopecia. **Conclusion and Relevance:** Findings show that hair transplant surgery can be considered as a treatment option for certain primary scarring alopecias. However, data must be interpreted with caution due to concern for positive-result publication bias.

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Introduction

Scarring alopecia, otherwise known as cicatricial alopecia, refers to irreversible inflammatory follicular damage associated with scarring and hair loss. Primary scarring alopecias are generally subdivided into three categories: lymphocytic (lichen planopilaris [LPP], frontal fibrosing alopecia [FFA], central centrifugal cicatricial alopecia [CCCA], and pseudopelade of brocq), neutrophilic (folliculitis decalvans, tufted folliculitis, and dissecting cellulitis), and mixed lymphocytic/neutrophilic (folliculitis keloidalis, folliculitis necrotica, and erosive pustular dermatosis) [1]. Primary scarring alopecia are more common in women, who present typically in ages between 30 and 50 years [2]. Though the exact pathogenesis of primary scarring alopecia differ among particular diagnoses, the predominant similarity is that immune cells permanently

damage the follicular stem cell reservoir of the outer root sheath, or bulge region, of hair follicles [3].

Current therapeutic regimens aim to slow or inhibit the progression of the disease with local or systemic immunomodulation. First-line treatments are topical steroids, such as fluocinonide, and clobetasol lotion or cream, and intralesional triamcinolone acetonide [4]. Antibiotics, retinoids, hydroxychloroquine, and mycophenolate are commonly used to adjunct corticosteroids and decrease inflammation in rapidly progressive disease [5].

Hair transplants are used by many patients as a treatment option; however, there are no clear guidelines regarding its implementation. The philosophy of this surgical technique relies on balding-resistant, hair-abundant tissue surviving after it is transplanted to the balding skin. Hair restoration procedures have dramatically evolved to incorporate minute precision. Currently, follicular unit extraction (FUE) is the gold standard method due to the ability to individually pick desirable follicular units, no suturing is required, and minimal scarring occurs [6].

Though serious complications of hair transplants are rare, the development of safety precautions has helped graft survival rates to improve. Among the most determinant factors are the type of graft preservation solution and perioperative medical treatment of recipient areas used [7]. A pre-surgery hair transplant test, in which one FU is transplanted alone and observed for significant adverse effects or inability to thrive, is recommended. The survival rate of transplanted hair is determined by factors such as oxidative stress, infection, edema, and recipient or donor dominance, which refers to the likelihood of the surrounding balding-prone tissue to effect the transplanted tissue [8]. Hair transplantation in scarring alopecia has low graft survival rates (50%) compared to non-scarring alopecia (>90%); some suspect this is due to recipient area dominance [9]. This paper seeks to review the current literature on the outcomes of hair transplantation in scarring alopecia.

Methods

Search Strategy

A primary literature search was conducted using PubMed with the search terms (“cicatricial alopecia” OR “scarring alopecia” OR “central centrifugal cicatricial alopecia” OR “morphea en coup de sabre” OR “discoid lupus erythematosus” OR “folliculitis decalvans” OR “lichen planopilaris” OR “frontal fibrosing alopecia” OR “pseudopelade of brocq” OR “tufted folliculitis” OR “dissecting cellulitis” OR “folliculitis keloidalis” OR “hair loss”) AND (“hair transplant” OR “hair transplantation” OR grafts OR “follicular unit extraction”).

Case Inclusion

Clinically relevant systematic reviews, randomized controlled trials, and case studies were included. Only articles from 1960s to present, which met the following inclusion criteria were included in this review: the report specified type of scarring alopecia that was studied, the authors included well-defined clinical outcomes of hair transplant treatment, and the manuscript was written in English. Reviewed studies were graded using the Oxford Center for Evidence-Based Medicine 2011 Levels of Evidence [10].

Results

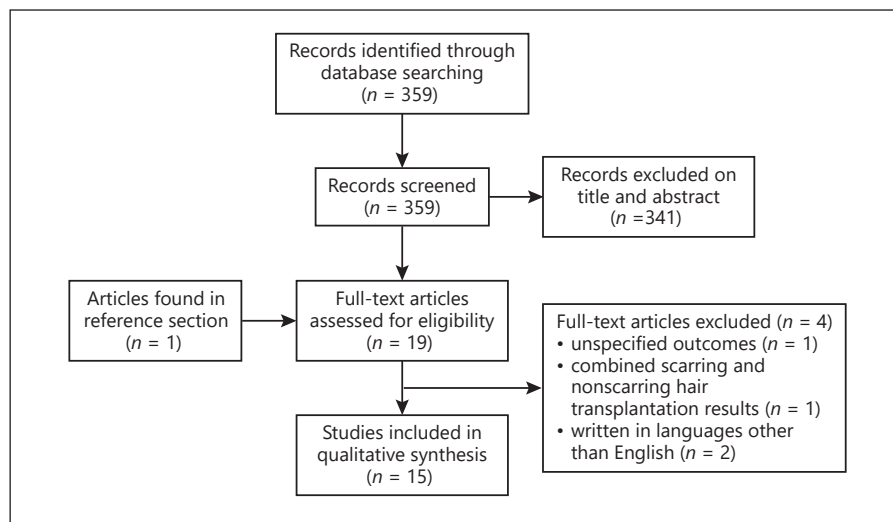
The primary literature search, outlined above, provided a total of 359 articles from PubMed. After removing duplicates and screening for clinically relevant material, a total of 19 reports were reviewed. One of the articles was found in the references of an article. Once articles were screened for clinically relevant material, four case studies were excluded due to ambiguous outcomes, combined scarring and non-scarring hair transplantation results, or languages other than English. A total of 15 reports were included for review. Of these studies, 6 are case reports and 8 are case studies (involving 2+ patients). There are a total of 34 patients (24 female, 5 male, 5 unknown). A total of 26 patients experienced moderate to positive results (78% positive outcome rate), as defined by the published clinical reports, while 8 patients experienced negative results or recurrence of disease. Primary literature search results are shown in the PRISMA Flow Diagram (Fig. 1). All included reports were rated a level 4 on the Oxford Levels of Evidence.

Among the 15 reports included, CCCA, discoid lupus erythematosus (DLE), FFA, folliculitis decalvans, LLP, morphea coup de sabre, and pseudopelade of brocq were discussed. Hair transplantation methods and peri-operative care varied between studies. Transplant methods discussed included FUE, donor strip method, punch graft method, and otherwise not specified methods. Out of a total of reported 34 study patients, 26 patients had moderate to positive results while 8 patients experienced unsatisfactory results or recurrence of illness after hair transplantation. A summary of each article included in this review is provided in Table 1.

Discussion

This systematic review aimed to evaluate the efficacy of hair transplantation in patients with primary scarring alopecia. A review of 15 case studies and reports revealed

Fig. 1. Search algorithm used for systematic review. This flow diagram shows the number of studies identified, screened, included, and excluded for the study selection.



a 76% positive outcome rate with 8 of 34 patients experiencing negative results, including those with a diagnosis of LPP or FFA.

Hair transplantation has been successful in 3 patients previously diagnosed with CCCA [9, 11]. The cases employed a combination of pre-transplant tests, recipient site biopsy, and at least 6 months to 2 years of anti-inflammatory control post-transplant.

Although the scarring hair loss seen in morphea en coup de sabre can be categorized as a secondary scarring alopecia, we included the published hair transplantation results for completeness in this review. Two patients with morphea en coup de sabre are reported to have positive hair growth at 2 years post-transplant [12, 13]. Neither patient responded to systemic anti-inflammatory treatment with corticosteroids and hydroxychloroquine, suggesting that additional inflammatory control may not be required for graft survival in this condition.

There is old literature on successful hair transplantation without significant pre- or post-surgical treatment in 8 DLE patients who underwent punch graft transplants and were followed for the next 3 years [14]. The patients experienced an average of 72% graft survival. One patient with folliculitis decalvans is documented as having moderately successful hair growth results with FUE [11]. The patient applied minoxidil lotion for 6 months and observed a 40% graft uptake. This supports the claim that post-transplant topical minoxidil alone is at least partially efficacious in promoting graft survival. Patients with folliculitis decalvans who undergo hair transplantation in the future may also benefit from a

combination of anti-inflammatory treatment and topical minoxidil.

LPP variants include classical, FFA, and Graham-little-Piccardi-Lasseur syndrome and manifest as hyperkeratosis, loss of follicular ostia, and perifollicular erythema. Five case studies report that 6 of 8 patients with LPP experienced good or moderate graft survival rates [11, 15–18]. Although inconsistent follow-up periods (none to 3 years) make comparison difficult.

Literature regarding FFA and hair transplantation reports a majority of failed transplant vitality [15, 19–22]. Although hair growth for the patients who had successfully traversed at least 2 years of stable disease was initially excellent, recipient dominance lead to a recurrence of FFA at graft sites by 4 years post-transplant in multiple cases [20–22]. As with patients with CCCA, efficacy of hair transplantation in FFA appears to be directly correlated with the stability of inflammation prior to surgery. Suggestions to maximize assurance that a patient with FFA is a good candidate for hair transplantation include assessing disease activity with biopsies, waiting 2–5 years after hair loss ceases, using anti-inflammatory topical or intralesional medications pre- and post-surgery, and continuing follow-up to monitor efficacy.

Pseudopelade of Brocq (PPB) is a chronic primary scarring alopecia that is classically void of clinical symptoms or signs of inflammation, and is considered by some a variant of LPP or DLE [23]. Three patients experienced positive results with hair transplantation [11, 24, 25]. One patient used 5% minoxidil lotion for 6 months post-surgery and observed a 60% graft uptake, although no long

Table 1. Summary of studies on hair transplantation outcomes in scarring alopecia

Author	Patient number and gender	Average age	Transplant technique	Peri-transplant medications	Outcome
<i>Central Centrifugal Cicatricial Alopecia</i>					
Callendar, et al. [9], 2014	2 F	35 years old	Punch graft	Fluocinonide ointment 0.05%; halobetasol propionate ointment 0.05%; ILTAC 5 mg/mL; clobetasol propionate foam 0.05%; fluocinolone acetonide shampoo 0.01%; fluocinolone acetonide ointment 0.025%; minoxidil 5%; betamethasone valerate foam 0.12%	<i>Positive</i> 2 week follow-up: healed well, no postoperative scarring; hair growth observed 4 month follow-up: hair growth improved 2 years+ follow-up: continued hair growth
Tyagi, et al. [11], 2010	1 unspecified sex	Sample 15–30 years old (no average.)	Follicular unit extraction (FUE)	5% Minoxidil lotion	<i>Positive</i> 6 month follow-up: 60% graft uptake
<i>Coup de Sabre</i>					
Park, et al. [13], 2002	1 F	22 years old	Follicular unit transplantation (FUT)	Corticosteroids; hydroxychloroquine	<i>Positive</i> 10 month follow-up: excellent follicular unit (FU) survival results in two transplanted areas (85, 90%), lengths of 10–14 cm of transplanted hairs; distinct oblique terminal anagen hair prominent, some follicles had new perifollicular fat tissues 25 month follow-up: normal hair growth, no shedding of transplant hair observed
Dai, et al. [12], 2017	1 F	38 years old	Follicular unit transplantation (FUT)	Corticosteroids; hydroxychloroquine	<i>Positive</i> 12 month follow-up: excellent FU survival results in two transplanted areas (85, 90%) 24 months follow-up: normal hair growth, no shedding of transplanted hair observed
<i>Discoid Lupus Erythematosus</i>					
Nordstrom [14], 1976	2 M/6 F	46.5 years old	Punch graft	Unspecified	<i>Positive</i> 15–39 week follow-up: mean survival rate of hair in grafts was 72%; average of 16.68 hair/grafts implanted and average of 11.98 hair/grafts remained
<i>Frontal Fibrosing Alopecia</i>					
Nusbaum, et al. [21], 2010	1 M	44 years old	Follicular unit transplantation (FUT)	Halcinonide 0.1%; intralesional triamcinolone acetonide 2.5 mg/mL; oral finasteride 1 mg; hydroxychloroquine 200 mg	<i>Negative</i> 15 month follow-up: continued excellent hair growth; (patient was lost to follow-up for 4 years) 5 year follow-up: discontinued therapy, marked hair loss, advancement of alopecia, loss of follicular orifices
Jiménez, et al. [20], 2013	3 F	70 years old	Unspecified	Topical steroids and tacrolimus; intralesional and topical steroids; finasteride 2.5 mg/d; minoxidil	<i>Negative</i> 10–14 month follow-up: 90–100% growth of FU 18 month–2.5 year follow-up: grafts began disappearing 4 year follow-up: most grafts began disappearing, pts began having follicular damage; 2 pts had recurrence of FFA

Table 1. (continued)

Author	Patient number and gender	Average age	Transplant technique	Peri-transplant medications	Outcome
Cranwell, et al. [22], 2016	1 F	46 years old	Artificial hair transplant	Hydroxychloroquine 400 mg; methotrexate 20 mg; folic acid 5 mg; naproxen 1,000 mg; intralesional triamcinolone 5 mg/mL w/lignocaine 1%; dutasteride 0.1 mg; minoxidil 1 mg; roxithromycin	<i>Negative</i> 6 month follow-up: developed folliculitis 12 month follow-up: implants well-tolerated with mild peri-implant inflammation, uncontrolled folliculitis implants eventually surgically removed
Liu, et al. [15], 2017	1 F	44 years old	Follicular unit extraction (FUE)	Topical fluocinonide cream 0.05%; intralesional triamcinolone acetonide 2.5 mg/mL; topical fluocinonide solution 0.05%	<i>Positive</i> 13 month follow-up: hair grafts survived and achieved best results at this time 4 year follow-up: hair growth was stable, no signs of disease reactivation
Rogers [19], 2013	1 F	65 years old	Unspecified type (800 grafts)	Unspecified	<i>Negative</i> 1 year follow-up: very poor growth in all grafts
<i>Lichen Planopilaris</i> Liu, et al. [15], 2017	1 F	61 years old	Follicular unit extraction (FUE)	None was given as patient did not exhibit hair loss or disease activity	<i>Positive</i> 10 month follow-up: hair grafts survived and reached optimal growth 3 years and 4 months follow-up: condition remained stable
Podda, et al. [16], 2000	2 unspecified sex	Unspecified	Punch graft	Unspecified	<i>Positive</i> 10–12 week follow-up: 95% graft survival 4 month follow-up: more transplants were performed 9 month-1 year follow-up: no graft loss, no scarring, no hypo- or hyperpigmentation, acceptable cosmetic results
Cevasco, et al. [17], 2007	3 unspecified sex	Unspecified	Unspecified	Unspecified	<i>Negative</i> Pt 1: progressive disease with clinical symptoms worsening and no response to treatment Pt 2: unstable disease with minimal response to treatment, minimal regrowth of hair and minimal reduction of symptoms <i>Positive</i> Pt 3: stabilization of the disease with greater than minimal response to treatment, greater than minimal regrowth of hair and greater than minimal reduction of symptoms
Saxena, et al. [18], 2010	1 M	24 years old	Follicular unit extraction (FUE)	5% Minoxidil lotion	<i>Positive</i> 10 month follow-up: 80% of grafts survived and showed optimal growth
Tyagi, et al. [11], 2010	1 unspecified sex	Sample 15–30 years old (no average)	Follicular unit extraction (FUE)	5% Minoxidil lotion	<i>Positive</i> 6 month follow-up: 70% graft uptake

Table 1. (continued)

Author	Patient number and gender	Average age	Transplant technique	Peri-transplant medications	Outcome
<i>Pseudopode of Brocq</i>					
Tyagi, et al. [11], 2010	1 M/5 F	15–30 years old (no average)	Follicular unit extraction (FUE)	5% Minoxidil lotion	<i>Positive</i> 6 month follow-up: 60% graft uptake
Moreno-Arias, et al. [25], 2002	1 F	41 years old	Punch graft	17-valerate of betamethasone 0.1% lotion	<i>Positive</i> 2 year follow-up: micrografts look well, no progression of disease, no inflammation 3 year follow-up: no evidence of disease
Stough, et al. [24], 1968	1 F	50 years old	Punch graft	Unspecified	<i>Positive</i> Unknown follow-up duration: all 74 autografts resulted in successful hair growth. 16 homographs all failed to grow
<i>Folliculitis Decalvans</i>					
Tyagi, et al. [11], 2010	1 unspecified sex	Sample 15–30 years old (no average)	Follicular unit extraction (FUE)	5% Minoxidil lotion	<i>Positive</i> 6 month follow-up: 40% graft uptake

term follow-up was reported [11]. Similar to patients with LPP, this case report supports the use of topical minoxidil post-transplant, as a treatment option for PPB.

The literature reports compiled here emphasize the need for control of scarring alopecias when considering hair transplant surgery [6, 24]. However, the authors were unable to find evidence on how to precisely diagnose disease activity or the timing post-disease-activity when performing surgery is appropriate. The commonly suggested “two year” rule for hair transplant surgery post-disease-activity was not substantiated in this review [4, 15, 25]. There was a wide versatility of topical, intralesional, and systemic medications necessary for proper immunomodulation of graft recipient tissue. This review raises the need for affirming that inflammatory and scarring diseases on the scalp are well controlled, and defining the timing for a minimum of 2 and recommended up to 5 years prior to surgery.

This review was limited by the scarcity of documentation on hair transplantation in patients with scarring alopecia. Measurement of graft survival, follow-up time, as well as peri-transplant medication protocols are not yet standardized and should be developed through further observational studies and case series. There is an obvious lack of robust and well-controlled scientific studies on hair transplantation in scarring al-

pecia patients. The biggest challenge encountered in this review is the positive reporting bias in the literature where only cases with viable and positive outcomes are reported. Thus, we conclude that no concrete, evidence-based recommendations can be made regarding this topic at this time. We need better studies to elucidate the role of hair transplantation in treating primary scarring alopecia.

Conclusion

Hair transplantation surgery may represent a viable treatment option for controlled CCCA, en coup de sabre, DLE, pseudolade de brocq, and folliculitis decalvans, whereas LPP and FFA have reported both negative and positive results. However, data must to be interpreted with caution, as we suspect a positive-result publication bias and a higher incidence of negative transplant outcomes in this population than what is published.

Disclosure Statement

The authors have no conflicts of interest to disclose.

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