Title
The Association of Frontal Alopecia with a History of Facial and Scalp Surgical Procedures

Journal
Skin Appendage Disorders, 8(1)

ISSN
2296-9195

Authors
Pham, Christine T
Juhasz, Margit
Ekelem, Chloe
et al.

Publication Date
2022

DOI
10.1159/000518156

Peer reviewed

Skin Appendage Disorders

Clinical Investigations – Review Article

Skin Appendage Disord 2022;8:13–19
DOI: 10.1159/000518156

Received: December 16, 2020
Accepted: June 4, 2021
Published online: September 14, 2021

The Association of Frontal Alopecia with a History of Facial and Scalp Surgical Procedures

Christine T. Pham[a, b] Margit Juhasz[b] Chloe Ekelem[b] Rosalynn R.Z. Conic[c] Kiana Hashemi[b] David Csuka[b] Ella Csuka[b] Tiffany Chao[a] Natasha Atanaskova Mesinkovska[b]

[a]University of California, Irvine, School of Medicine, Irvine, CA, USA; [b]Department of Dermatology, University of California, Irvine, Irvine, CA, USA; [c]Department of Dermatology, Case Western University, Cleveland, OH, USA

Keywords
Frontal fibrosing alopecia · Androgenetic alopecia · Surgical procedures · Facial procedures

Abstract
Introduction: The prevalence of frontal fibrosing alopecia (FFA) is increasing worldwide, though the pathogenesis remains unknown. Anecdotal reports describe alopecia occurring in an FFA pattern following facial surgical procedures, but this potential link remains unexplored. ***Objective:*** The objective of this study is to determine if a significant association exists between the diagnosis of FFA and a history of facial and scalp surgical procedures. ***Methods:*** This retrospective study comparing data from frontal alopecia patients to controls was conducted at a tertiary medical center. Additionally, a literature review was conducted on scarring alopecias occurring from scalp procedures. ***Results:*** Fifty percent of frontal alopecia patients ($n = 54$) reported a history of facial surgical procedures compared to 9.8% of controls ($n = 51$) (OR: 7.8 [95% CI: 2.77–25.98, $p < 0.001$]). Although no significant differences were observed in current daily facial sunscreen use, sunscreen use prior to alopecia onset was significantly higher in frontal alopecia ($p = 0.295$; $p = 0.021$). Sunscreen use was not a significant modifier in the association between frontal alopecia and facial surgical procedures ($p = 0.89$). ***Conclusions:*** A significant association exists between frontal alopecia clinically consistent with FFA and a history of facial surgery, the nature of which is unclear. The role of sunscreen use and frontal alopecia development in this setting needs to be better elucidated.

Introduction

Frontal fibrosing alopecia (FFA) is a lymphocyte-predominant, primary cicatricial disease with obliterated hair follicles in a distinct frontotemporal pattern [1, 2]. This disease remains most prevalent in postmenopausal women (average age of 62.5 years) although cases in men and young women are also observed [1]. The hair loss in FFA is typically gradual and may spontaneously remit, but it has a notorious progressive nature and irreversible damage, leading to significant psychosocial burden, decreased quality of life, self-esteem, and increased depression and anxiety [3]. Disease stability requires prompt treatment with topical and intralesional corticosteroids,

karger@karger.com
www.karger.com/sad

Correspondence to:
Natasha Atanaskova Mesinkovska, natashadermatology@gmail.com

Karger

as well as systemic medications such as antimalarials, anti-inflammatory antibiotics, or retinoids [4].

This condition was first described in 1994 and is considered a subset of lichen planopilaris (LPP) for its histopathologic similarities [5]. Both diseases are thought to result from a loss of immune privilege responsible for preservation of vital follicular components, including the epithelial hair stem cells in the bulge region. Immune-mediated, genetic, hormonal, and/or environmental triggers may serve as initial inflammatory insults to follicular homeostasis, though no hypothesis has been confirmed [6].

The association of alopecia onset with surgical procedures has been a topic in past literature, largely abandoned as serendipitous and incidental. Since the introduction of the surgical facelifts in 1901, facial cosmetic procedures have increased in demand [7]. The American Society of Plastic Surgeons reports that almost 400,000 people had antiaging surgeries in 2018 – 206,529 people had blepharoplasties, 121,531 had rhytidectomies, and 38,795 had brow/forehead lifts [8]. Previously published works describe cases of temporary alopecia along surgical incisions on scalp reconstruction or galeatomy and among facelift patients who did not receive tumescent infiltration [9–11]. One review showed that alopecia was the most frequent side effect for endoscopic and coronal brow lifts, techniques which involve incisions along the hair line [12]. Prompted by the frequency of cases of scalp surgical scars observed in clinic, anecdotal reports describe onset of alopecia occurring in an FFA pattern following facial surgical procedures [13, 14]. We conducted a single-center, cross-sectional study to evaluate if an association exists between frontal alopecia and facial and scalp surgical procedures. In addition, to better understand this link, we performed a literature review to identify all reported cases of scarring alopecia with connections to surgical procedures of the scalp and face.

Materials and Methods

This retrospective study was approved by the Institutional Review Board of the University of California, Irvine. Patient data were obtained from an electronic alopecia registry in 2019, supported with photography. The inclusion criteria were confirmation of a clinical and/or histologic diagnosis of FFA for the study population by board-certified dermatologists. The term "frontal alopecia" was used for our study group given a newly reported entity called botulin-induced frontal alopecia (BIFA) which presents very similarly, making it unclear whether it is a separate diagnosis or the same as FFA [15]. Patients with androgenetic alopecia (AGA) were chosen as the control group and clinically confirmed by board-certified dermatologists as AGA is a nonscarring hair loss that affects the majority of patients and was feasible to age and gender-match.

Data gathered included: (1) patient demographics (age, sex, race), (2) detailed medical history including dermatologic concerns, thyroid disease, neurologic injury/insult history (including head trauma), and cerebrovascular accident history, (3) scalp hair loss history (onset, hair styling), (4) facial procedure history (including but not limited to invasive, medically necessary reconstructive surgeries, rhytidectomy [facelift], blepharoplasty [eyelid lift], eyebrow lift [brow and forehead lifts]), and (5) current and past use of sunscreens. Clinically appreciable surgical scars were documented with photography (Fig. 1). Data from frontal alopecia patients were compared to control patients using the *t* test. Statistical significance was considered at $p < 0.05$. Odds ratios for procedures prior to hair loss were adjusted for age, race, and sunscreen use.

A literature review was performed using the PRISMA guidelines to gather information on scarring alopecias related to surgical procedures. Peer-reviewed articles were identified using the database PubMed from 1968 to 2020 and the search terms "scarring alopecia," "alopecia," frontal fibrosing alopecia," "frontal alopecia," "lichen planopilaris," "procedure," and "surgery." Articles not written in English or not involving human subjects were excluded. Identified studies were subjected to full-text review.

Results

Hair Registry Results

A total of 54 frontal alopecia (52 female and 2 male) and 51 matched controls (49 female and 2 male) patients were identified (Table 1). All patients with frontal alopecia were clinically and dermatoscopically consistent with FFA. Histologic reports were available for 21 out of 54 frontal alopecia patients, from which 18 out of 21 were consistent with pathologic findings of FFA, while 3 out of 21 were consistent with AGA. The average age of patients with frontal alopecia was 64.6 ± 10.2 years and 61.8 ± 13.8 years for controls; there were no significant differences in gender or mean age between the 2 groups ($p = 0.95, 0.28$). The majority of patients were Caucasian ($n = 80$), followed by Asian ($n = 10$), Middle-Eastern ($n = 8$), Hispanic ($n = 4$), and Black ($n = 3$). No significant differences between the groups were observed for hair styling of a tight ponytail or bun (35.2% frontal alopecia vs. 23.5% control, $p = 0.42$), thyroid disease (33.3% frontal alopecia vs. 35.3% control, $p = 0.24$), history of forehead actinic damage treatment (24.1% frontal alopecia vs. 15.7% control, $p = 0.56$), cerebrovascular accident (3.7% frontal alopecia vs. 2% control, $p = 0.86$), and neurologic disease (0% frontal alopecia vs. 5.9% control, $p = 0.22$). There was significance with the control group for history of migraines (7.4% frontal alopecia vs. 25.5% control, $p = 0.031$).

Color version available online

Fig. 1. Frontal alopecia patient with a rhytidectomy scar located at the frontal hairline of a 77-year-old female patient (**a**) in comparison to the frontal hairline of a 68-year-old control patient with androgenetic alopecia (**b**).

Table 1. A summary of demographic data gathered from frontal alopecia and age-matched controls at a hair specialty clinic at a single, tertiary medical center

	Frontal alopecia (n = 54) n (% of total patients)	Control (n = 51) n (% of total patients)	p value
Gender			
Female	52 (96.3)	49 (96.1)	0.95
Male	2 (3.7)	2 (3.9)	
Mean age, years	64.6±10.2	61.8±13.8	0.28
Ethnicity			
White	44 (81.5)	36 (70.6)	
Asian	3 (5.6)	7 (13.7)	
Hispanic	3 (5.6)	1 (2.0)	0.23
Middle-Eastern	2 (3.7)	6 (11.8)	
Black	2 (3.7)	1 (2.0)	
Onset of alopecia, years	58.8±11.5	52.5±16.0	0.032*
Hair styling in ponytail or bun	19 (35.2)	12 (23.5)	0.42
Medical history			
Thyroid disease	18 (33.3)	18 (35.3)	0.24
Treatment of actinic damage on forehead or scalp	13 (24.1)	8 (15.7)	0.56
Cerebrovascular accident	2 (3.7)	1 (2.0)	0.86
Progressive neurologic disease		3 (5.9)	0.22
Migraines	4 (7.4)	13 (25.5)	0.031*

Statistical significance was observed with mean age onset of alopecia and migraines. * Indicates significance.

A significant number of frontal alopecia patients (n = 27, 50%) reported a history of surgical scalp or facial procedures in contrast to controls (n = 5, 9.8%, $p < 0.001$) (Table 2); 50% of frontal alopecia patients did not report a history of surgical facial procedures. The most common facial surgical procedures performed on frontal alopecia patients included rhytidectomies [n = 14, 51.9% (% of patients with history of procedures), control: n = 3, 60%, p = 0.012], blepharoplasties (n = 6, 22.2%, control: n = 1, 20%, p = 0.101) and brow lifts (n = 5, 18.5%, control: n =

Table 2. A summary of surgical procedures performed and sunscreen use on frontal alopecia and age-matched controls at a hair specialty clinic at a single, tertiary medical center

	Frontal alopecia *n* (% of total patients)	Control *n* (% of total patients)	*p* value
Total patients	27 (50)	5 (9.8)	<0.001*
Total procedures[1]	36	6	
	n (% of total patients with history of procedures)	*n* (% of total patients with history of procedures)	*p* value
Rhytidectomy	14 (51.9)	3 (60)	0.012*
Blepharoplasty	6 (22.2)	1 (20)	0.101
Brow lift	5 (18.5)		0.077
Head trauma involving open wounds	5 (18.5)	1 (20)	0.769
Mohs micrographic surgery	2 (7.4)		0.195
Maxillofacial surgery	2 (7.4)		0.195
Acoustic neuroma surgery	1 (3.7)		0.33
Craniofacial surgery	1 (3.7)		0.33
Orbital decompression surgery		1 (20)	0.30
Unspecified facial procedure	1 (3.7)		0.33
Mean age at time of procedure	53.4±12	52.2±13.1	0.838
Mean time between procedure and disease onset, years	9±9.9	6.6±6.6	0.61
	Odds ratio	95% CI	*p* value
Procedures performed prior to hair loss adjusted for age and race			
Control	Ref		<0.001*
Frontal alopecia	7.8	(2.77–25.98)	
Sunscreen use	Frontal alopecia *n* (% of patient respondees)	Control *n* (% of total respondees)	*p* value
Sunscreen use on face	44 (83)	35 (70)	0.295
Mean length of sunscreen use, years	22.6±14.7	16.7±12.5	0.076
Sunscreen use before alopecia onset	38 (74.5)	23 (54.8)	0.021*
Sunscreen use on face + facial procedures before alopecia onset	23 (45)	4 (9.5)	0.002*
Frontal alopecia and facial and scalp procedures separately for sunscreen as a modifier			0.89
	Odds ratio	95% CI	*p* value
OR hair loss associated with procedures adjusted for age and race and sunscreen use			
Control	Ref		0.01*
Frontal alopecia	6.4	2.17–22.04	
OR hair loss associated with procedures with just accounting for sunscreen use			
Control	Ref		<0.001*
Frontal alopecia	7.03	2.49–23.37	

Statistical significance was observed with history of facial surgical procedures, rhytidectomy, sunscreen use before alopecia onset, OR of frontal hair loss associated with procedures adjusted for age, rage, and sunscreen use, and OR of frontal hair loss associated with procedures with just accounting for sunscreen use. * Indicates significance. [1] Indicates total number of procedures performed; 6 FFA patients had multiple procedures performed. FFA, frontal fibrosing alopecia; OR, odds ratio.

Table 3. Summary of literature review on scarring alopecia after surgical intervention

Author	Study type (quality level)	Demographics	Procedure	Results
Chiang et al. (2012) [13]	Case series (4)	4 M, 6 F (AGA: 4 M, 3 F) Mean age: 52.4 yo	Hair transplants (n = 7; 4 M, 3 F) Face-lifts (n = 3; 3 F)	36.4 mo mean f/u: 4 M and 3 F with hair transplant developed LPP 9 mo mean f/u: 3 F with face-lifts developed FFA
Donovan (2012) [17]	Retrospective study (4)	17 patients (15 M, 2 F; 16 AGA, 1 traction alopecia) Mean age: 44.7 yo	Hair transplants with grafts Post-transplant diagnoses confirmed with biopsies	4–36 mo: 17 pts developed LPP 9 pts: LPP confined to recipient areas 8 pts: LPP outside of recipient areas
Crisóstomo et al. (2011) [16]	Case series (4)	50 yo M w/AGA 46 yo M w/AGA	Hair transplant	50 yo M: LPP at 6 yr f/u 46 yo M: LPP at 2 yr f/u
Kossard et al. (2005) [14]	Case report (5)	75 yo M w/AGA	Hair transplants between 1971 and 1994 1971–1988: 7 procedures using plugs 1989–1994: mini or micro transplants	5 yr follow-up after 1994: developed FFA over an 18-mo period

M, males; F, females; w/, with; yo, years old; mo, month; yr, year; f/u, follow-up; pts, patients; FFA, frontal fibrosing alopecia; LPP, lichen planopilaris; AGA, androgenetic alopecia.

0, 0%, p = 0.077). In contrast, control patients had rhytidectomies (n = 3, see prior), blepharoplasty (n = 1, see prior), head trauma (n = 1, 20%, frontal alopecia: n = 5, 18.5%, p = 0.769), and orbital decompression surgery (n = 1, 20%, frontal alopecia: n = 0, 0%, p = 0.30). The average length of time between procedure and alopecia onset was 9 ± 9.9 years for frontal alopecia patients and 6.6 ± 6.6 years for controls (p = 0.61). Mean age at time of facial procedure was comparable for both groups: 53.4 ± 12 years in the frontal alopecia group and 52.2 ± 13.1 years in the control group (p = 0.84). The association between facial surgical procedures and frontal alopecia was statistically significant with age and race adjustments (OR 7.8 [95% CI 2.77–25.98, p < 0.001]).

Comparable numbers of patients reported current routine use of facial sunscreen: n = 44/53 respondees, 83% of frontal alopecia patients who responded and n = 35/50 respondees, 70% of control patients who responded, p = 0.295 (Table 2). The length of sunscreen use and age of alopecia onset was obtained. The average reported length of sunscreen use was longer in the frontal alopecia group (22.6 ± 14.7 years, range 0–50 years) than control patients (16.7 ± 12.5 years, range 1–65 years, p = 0.076). While 74.5% of frontal alopecia patients (n = 38/51 respondees) used sunscreen prior to alopecia onset, only 54.8% of control patients (n = 23/42 respondees) had prior sunscreen use, with significance (p = 0.021). Twelve patients (frontal alopecia [n = 3], control [n = 9]) were unsure of how long they used sunscreen as related to onset of alopecia, thus were excluded from the analysis for this subset. No significance was observed when frontal alopecia and procedures were run separately for sunscreen as a modifier (p = 0.89). The association between facial and scalp surgical procedures and frontal alopecia adjusted for age and race and sunscreen use was statistically significant (OR 6.4 [95% CI 2.17–22.04, p = 0.01]) along with the association between facial and scalp surgical procedures and frontal alopecia just accounting for sunscreen use (OR 7.03 [95% CI 2.49–23.37, p < 0.001]).

Literature Review

The literature search identified one retrospective study, two case series, and one case report included in the review for a total of 22 males and 8 females (Table 3) [13, 14, 16, 17]. With procedures such as facelifts and hair transplants, subsequent diagnoses of FFA and LPP developed. Cases of FFA have been described 3–18 months after facelift surgeries in women (n = 3) with no prior alopecia, and 5 years after multiple hair transplantations in a 75-year-old man with AGA [13, 14]. Postsurgical LPP cases have been reported in patients with a history of AGA (F: n = 5; M: n = 20) and one traction alopecia (M: n = 1) who underwent hair transplants 4 months to 9 years prior [13, 16, 17]. In a retrospective study with 17 patients (AGA (n = 16), traction alopecia (n = 1), mean age 44.7 years old) who underwent hair transplants, 9 patients developed LPP confined to graft recipient areas, while 8 patients developed LPP outside of the recipient areas, with one patient developing LPP also at the occipital donor area. For these patients, all hair loss occurred within a 4- to 36-month follow-up [17].

Discussion

In the quest for "graceful aging," cosmetic procedures on face and scalp are increasingly common, ranging from invasive surgeries to noninvasive injectables, peels, lasers, or tight wigs [18]. Albeit dermal injury to the hairline is common with all of the above. It is unclear how these facial surgical procedures can be associated with frontal alopecia as we observe in this study. As previously explored in the literature, hypothetically surgical injuries such as subgaleal dissections in rhytidectomies and lifts can cause temporary alopecia in cases with incision within hair-bearing areas [10, 12]. The purported effect is via incisional insult to hair follicles, dermal nerves, or vessels, causing postsurgical ischemia. It is possible that perifollicular nerve damage, lasting one to a few months, may affect the hair follicle's ability to progress through the growth cycle.

The phenomenon of cutaneous trauma inducing a nonspecific, inflammatory response at the site of injury, with inflammation spreading to nontraumatized areas, has been reported in many inflammatory skin conditions including psoriasis, lichen planus, vitiligo, and LPP [18, 19]. Postsurgical inflammation may spread through the hairline causing scarring and permanent hair loss months to years after the initial insult [20, 21]. It is possible that triggered inflammation may propagate autoimmune hair follicle damage in FFA-susceptible individuals. The main conflict in associating these surgical procedures with the onset of frontal alopecia is the significant chronological delay between the 2 events. Prior reports describe permanent alopecia cases occurring anywhere from 3 months to 9 years after facial or scalp surgical procedures, which supports our data where mean time between facial surgery and frontal alopecia diagnosis was 9 ± 9.9 years [13, 14, 16].

The relative recent emergence of FFA has been dated to the 1990s. According to the American Academy of Cosmetic Surgery, the number of facial surgical procedures has increased dramatically, with face lifts having a 6.6-fold increase from 1990 to 2000 [22]. A 100.75% increase in completed facial procedures between 2000 and 2017 is largely accounted for by the advent of noninvasive treatments, including botulinum toxin, filler injection, and laser resurfacing [23]. Noninvasive procedures, such as hyaluronic acid filler injections, have been associated with reversible alopecia in patients with mild ischemia post-filler. Those with severe ischemia and tissue necrosis can experience permanent hair loss, but there has been no association with frontal hairline loss [24]. The most notable exception is an observational study of women who had repeated botulinum toxin injections on the face with reported recession of the hairline. The authors named this condition botulin-induced frontal alopecia (BIFA). Those cases were distinguished from classic FFA, as trichoscopy demonstrated lack of scarring or atrophy; however, no biopsies were performed [15]. The diagnosis of BIFA has made us questions whether this frontal alopecia is a separate entity or the same as FFA. All of the cases clinically and dermatoscopically were consistent with FFA and were treated as such in clinic.

At last, the use of sunscreens has been implicated in the development of FFA, a relationship we had to explore in our patients [25–28]. Our results showed no significant difference in current facial sunscreen use and mean length of sunscreen use overall between patients with frontal alopecia and controls. After factoring age of alopecia onset, statistical calculations point to a significant increase in sunscreen use prior to hair loss diagnosis in the frontal alopecia group ($p = 0.021$). However, sunscreen use was not found to be a significant modifier in the association between FFA and procedures ($p = 0.89$). The absence of conclusive evidence for the role of sunscreen in our population may be explained by the Southern California location where sunscreen use is common and needs to be further delineated in future studies. Limitations of this study include a small sample size from a single academic center, recall bias, and accuracy of data in the medical record. The role of hormonal therapy was not addressed in our patient population but can present a bias that warrants further exploration. It is known that in FFA, the 2p22.2 locus contains a functional missense mutation of *CYP1B1*, encoding an enzyme important in estrogen metabolism [27]. Also, the majority of our patient population is Caucasian, and ethnic populations may not be well represented. Data were collected from a specialty hair clinic and may be centered towards patients with more advanced disease.

Conclusions

This study highlights a significant association between a previous history of facial surgical procedures and frontal scarring alopecia, with unclear etiology. Facial procedures associated with frontal scarring alopecia include surgeries such as rhytidectomies, blepharoplasties and brow lifts. Further research needs to be completed to elucidate whether a true causal relationship between these procedures and FFA pathogenesis exists. Sunscreen use prior to surgery may represent a confounder that needs to be better studied. Future directions include collabora-

tion to collect cross-sectional data from larger, diverse patient populations, and prospective cohort studies to substantiate any causal claims.

Statement of Ethics

The manuscript is previously unpublished and is not currently under consideration for publication in any other journals. The study has been approved by the University of California, Irvine Institutional Review Board (IRB: 20163076).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

The authors received no funding to complete this research.

Author Contributions

All authors, Christine T. Pham, Margit Juhasz, Chloe Ekelem, Rosalynn R.Z. Conic, Kiana Hashemi, David Csuka, Ella Csuka, Tiffany Chao, Natasha Atanaskova Mesinkovska, have taken part in writing, editing, and reading the manuscript and agree with its content.

References

1 Starace M, Brandi N, Alessandrini A, Bruni F, Piraccini BM. Frontal fibrosing alopecia: a case series of 65 patients seen in a single Italian centre. J Eur Acad Dermatol Venereol. 2019;33(2):433–8.
2 Ross EK, Tan E, Shapiro J. Update on primary cicatricial alopecias. J Am Acad Dermatol. 2005;53(1):1–40; quiz 38–40.
3 Williamson D, Gonzalez M, Finlay AY. The effect of hair loss on quality of life. J Eur Acad Dermatol Venereol. 2001;15(2):137–9.
4 Pham CT, Hosking AM, Cox S, Mesinkovska NA. Therapeutic response of facial papules and inflammation in frontal fibrosing alopecia to low-dose oral isotretinoin. JAAD Case Rep. 2020;6(5):453–6.
5 Kossard S. Postmenopausal frontal fibrosing alopecia. Scarring alopecia in a pattern distribution. Arch Dermatol. 1994;130(6):770–4.
6 Photiou L, Nixon RL, Tam M, Green J, Yip L. An update of the pathogenesis of frontal fibrosing alopecia: what does the current evidence tell us? Australas J Dermatol. 2019 May;60(2):99–104.
7 Rogers BO. A chronologic history of cosmetic surgery. Bull N Y Acad Med. 1971;47(3):265–302.
8 2018 National Plastic Surgery Statistics. American Society of Plastic Surgeons 2018 [cited 2018].
9 Koulaxouzidis G, Torio-Padron N, Momeni A, Lampert F, Zajonc H, Bannasch H, et al. [Soft tissue reconstruction with a temporoparietal fascial flap (TPFF)]. Oper Orthop Traumatol. 2012;24(1):32–42.
10 Fogli AL. Temporal lift by galeapexy: a review of 270 cases. Aesthetic Plast Surg. 2003 May–Jun;27(3):159–66; discussion 166.
11 Jones BM, Grover R. Reducing complications in cervicofacial rhytidectomy by tumescent infiltration: a comparative trial evaluating 678 consecutive face lifts. Plast Reconstr Surg. 2004;113(1):398–403.
12 Cho MJ, Carboy JA, Rohrich RJ. Complications in brow lifts: a systemic review of surgical and nonsurgical brow rejuvenations. Plast Reconstr Surg Glob Open. 2018;6(10):e1943.
13 Chiang YZ, Tosti A, Chaudhry IH, Lyne L, Farjo B, Farjo N, et al. Lichen planopilaris following hair transplantation and face-lift surgery. Br J Dermatol. 2012;166(3):666–370.
14 Kossard S, Shiell RC. Frontal fibrosing alopecia developing after hair transplantation for androgenetic alopecia. Int J Dermatol. 2005;44(4):321–3.
15 Di Pietro A, Piraccini BM. Frontal alopecia after repeated botulinum toxin type a injections for forehead wrinkles: an underestimated entity? Skin Appendage Disord. 2016;2(1–2):67–9.
16 Crisóstomo MR, Crisóstomo MC, Crisóstomo MG, Gondim VJ, Crisóstomo MR, Benevides AN. Hair loss due to lichen planopilaris after hair transplantation: a report of two cases and a literature review. An Bras Dermatol. 2011;86(2):359–62.
17 Donovan J. Lichen planopilaris after hair transplantation: report of 17 cases. Dermatol Surg. 2012;38(12):1998–2004.
18 Taguti P, Dutra H, Trüeb RM. Lichen planopilaris caused by wig attachment: a case of Koebner phenomenon in frontal fibrosing alopecia. Int J Trichology. 2018;10(4):172–4.
19 Rotunda AM, Bhupathy AR, Dye R, Soriano TT. Pemphigus foliaceus masquerading as postoperative wound infection: report of a case and review of the Koebner and related phenomenon following surgical procedures. Dermatol Surg. 2005;31(2):226–31.
20 Celik M, Tuncer S, Buyukcayir I. Modifications in endoscopic facelifts. Ann Plast Surg. 1999;42(6):638–43.
21 De Letter M, Vanhoutte S, Aerts A, Santens P, Vermeersch H, Roche N, et al. Facial nerve regeneration after facial allotransplantation: a longitudinal clinical and electromyographic follow-up of lip movements during speech. J Plast Reconstr Aesthet Surg. 2017;70(6):729–33.
22 Gottlieb S. Plastic surgery rockets as baby boomers search for youth and beauty. BMJ. 2001;322(7286):574.
23 2017 Plastic Surgery Statistics Report. ASPS National Clearinghouse of Plastic Surgery Procedural Statistics 2017. 2019.
24 Yang Q, Qiu L, Yi C, Xue P, Yu Z, Ma X, et al. Reversible alopecia with localized scalp necrosis after accidental embolization of the parietal artery with hyaluronic acid. Aesthetic Plast Surg. 2017;41(3):695–9.
25 Thompson CT, Chen ZQ, Kolivras A, Tosti A. Identification of titanium dioxide on the hair shaft of patients with and without frontal fibrosing alopecia: a pilot study of 20 patients. Br J Dermatol. 2019 Jul;181(1):216–7.
26 Moreno-Arrones OM, Saceda-Corralo D, Rodrigues-Barata AR, Castellanos-González M, Fernández-Pugnaire MA, Grimalt R, et al. Risk factors associated with frontal fibrosing alopecia: a multicenter case-control study. Clinical Exp Dermatol. 2019 Jun;44(4):404–10.
27 Tziotzios C, Petridis C, Dand N, Ainali C, Saklatvala JR, Pullabhatla V, et al. Genome-wide association study in frontal fibrosing alopecia identifies four susceptibility loci including HLA-B*07:02. Nat Commun. 2019;10(1):1150.
28 Aldoori N, Dobson K, Holden CR, McDonagh AJ, Harries M, Messenger AG. Frontal fibrosing alopecia: possible association with leave-on facial skin care products and sunscreens; a questionnaire study. Br J Dermatol. 2016;175(4):762–7.