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CASE REPORT

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Hair removal laser-induced Fox–Fordyce disease emerging on the axillary and pubic areas: Report of a case and review of literature

Mozhdeh Sepaskhah[1] | **Rahil Hamedpour**[2] | **Fatemeh Sari Aslani**[3]

[1]Department of Dermatology, School of Medicine, Molecular Dermatology Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

[2]Department of Dermatology, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran

[3]Department of Pathology, School of Medicine, Molecular Dermatology Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

Correspondence
Mozhdeh Sepaskhah, Department of Dermatology, School of Medicine, Molecular Dermatology Research Center, Shiraz University of Medical Sciences, Shiraz, Iran. Postal address: Department of Dermatology, Shahid Faghihi Hospital, P.O. Box 71348 44119, Zand Avenue, Shiraz, Iran.
Email: sepaskhah_m@yahoo.com

Key Clinical Message

Fox–Fordyce disease is a recognized adverse effect of depilating lasers. It should be considered among the differential diagnoses of the pruritic perifollicular papules that occur at the hair removal laser treatment site, including Alex/Diode laser.

Abstract

Fox–Fordyce disease (FFD) is an uncommon skin disorder affecting the apocrine sweat glands and presents as pruritic skin-colored papules, mainly on the axillary and pubic areas. Some predisposing factors are proposed, including hormonal changes. A few cases of FFD have been reported after hair removal by light- and laser-assisted devices. Herein, we report FFD in some areas (axillary and pubic areas) treated with Alex/Diode hair removal laser.

KEYWORDS

adverse effects, Fox–Fordyce disease, hair removal, laser therapy

1 | INTRODUCTION

Fox–Fordyce disease (FFD) is an uncommon inflammatory disorder affecting apocrine sweat glands.[1] Most of the patients are young women. The common presenting sign is small, skin-colored to yellow-brown, usually pruritic, perifollicular papules.[1,2]

Fox–Fordyce disease lesions usually involve the axillary and less frequently pubic and periareolar areas.[1]

The predisposing factors are not clearly defined. However, hormonal changes are discussed as one of the etiological factors.[1] About 16% of reported cases of FFD appeared after hair removal.[1,2] Laser-induced FFD has similar clinical features to classic FFD.[3] However, some differences are also mentioned.[4]

Herein, we report a young woman with FFD on both axillary and pubic areas after Alex/Diode laser hair removal.

2 | CASE HISTORY/EXAMINATION/PRESENTATION

A 23-year-old woman with skin phototype IV presented to a dermatology clinic with pruritic lesions on the armpit and bikini area that started soon after five sessions of

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Alex/Diode laser hair removal in these areas. She was referred 10 months after the initiation of the lesions. She also treated the hair on the face and lower extremities with this laser without developing lesions. She reported no adverse effects during sessions of Alex/Diode laser. There were no similar lesions in other family members. She did not report history of any other disease. The lesions started from both axillae and then extended to the pubic area. Pruritus was aggravated with heat and sweating. According to the patient, the laser device was a 755–805 nm Alex/Diode laser, but detailed device information is unavailable. The sweating was not affected after Alex/Diode laser hair removal.

Physical examination demonstrated multiple bilateral skin-colored perifollicular papules on axillary and pubic areas (Figure 1).

3 | METHODS (DIFFERENTIAL DIAGNOSIS, INVESTIGATIONS, AND TREATMENT)

The differential diagnoses were Fox–Fordyce disease, syringoma, and mucinosis. We performed a skin punch biopsy from the axillary lesions. Histopathological examination demonstrated a dilated spongiotic follicular infundibulum and filled with keratin material that contained dyskeratotic acantholytic cells and exocytosis of lymphocytes. There was upper dermal moderate perivascular lymphocytic and perifollicular lymphohistiocytic infiltration. Some of the histiocytes had foamy cytoplasm (Figure 2). Foamy histiocytes were weakly positive for Periodic acid-Schiff (PAS) stain (Figure 3). Mild perifollicular fibrosis was also present. So, the diagnosis of Fox–Fordyce disease was confirmed. The patient was treated with topical medications.

4 | CONCLUSION AND RESULTS (OUTCOME AND FOLLOW-UP)

Topical mometasone furoate 0.1% cream was administered twice daily for 4 weeks. On the second visit, the lesions improved, and the pruritus subsided. Therefore, we changed mometasone cream to tacrolimus 0.1% cream to prevent corticosteroid adverse effects. Nevertheless, the pruritus recurred, and we started mometasone again. The patient was scheduled to receive systemic isotretinoin but was missed the follow-up.

The patient signed written informed consent to permit the case report publication without identifying data and to use the photography for publication. The researchers

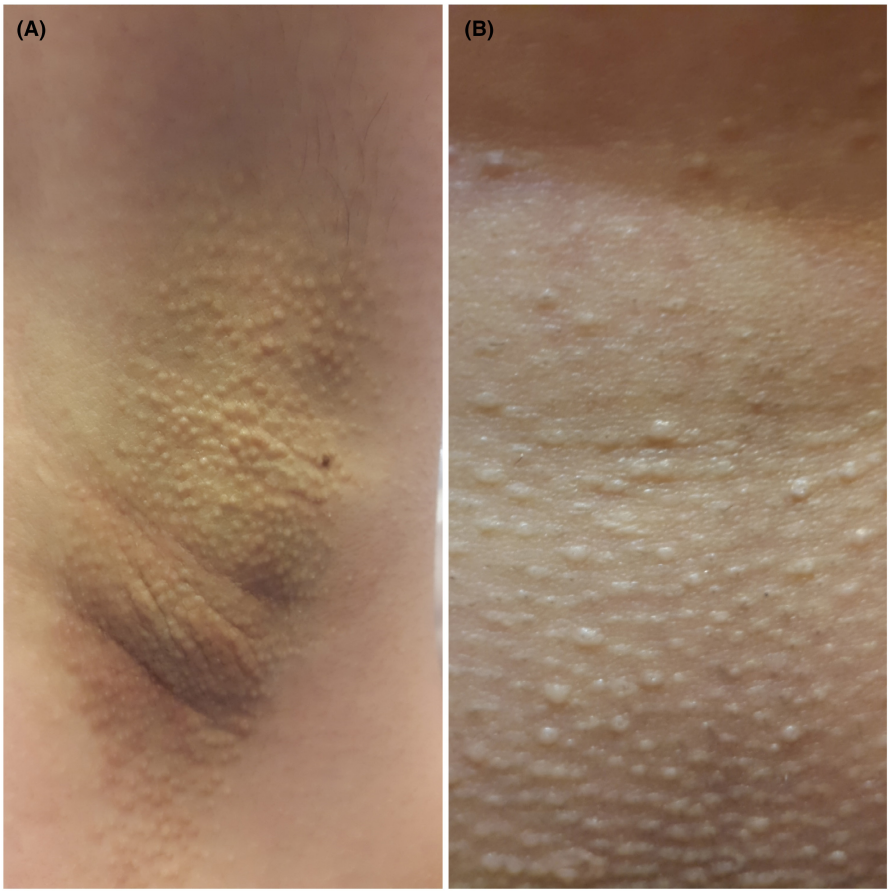

FIGURE 1 Clinical features. Multiple skin-colored, pruritic perifollicular papules on the axillary (A) and pubic areas (B) after Alex/Diode hair removal laser.

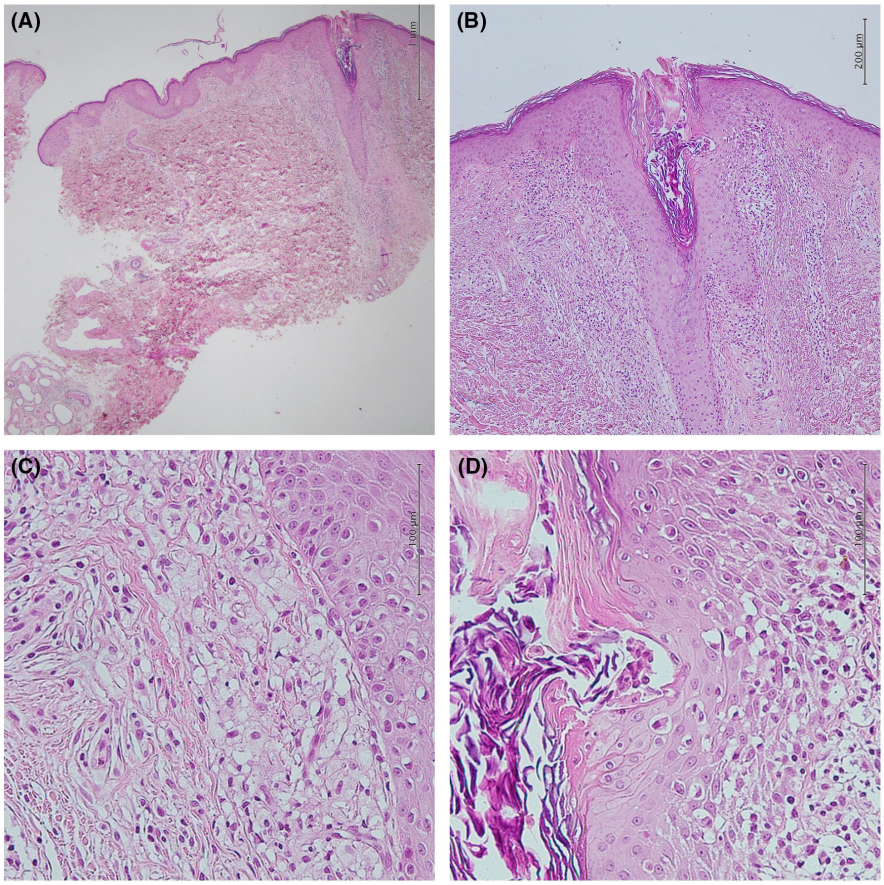

FIGURE 2 Histopathological features. (A) Dilated follicular infundibulum, filled with keratin material and dilated apocrine sweat glands (*Hematoxylin* and eosin [H&E] stain, 40×). (B) Spongiotic follicular infundibulum, upper dermal moderate perivascular lymphocytic, and perifollicular lymphohistiocytic infiltration (H&E stain, 100×). (C) Foamy cytoplasm of some of the perifollicular histiocytes (H&E stain, 400×). (D) Severely spongiotic follicular infundibulum with dyskeratotic acantholytic cells and exocytosis of lymphocytes (H&E stain, 400×).

committed to maintaining patient confidentiality. The institutional ethics committee approved the case report (ethics code: IR.SUMS.REC.1402.300).

5 | DISCUSSION

Fox–Fordyce disease is an inflammatory disorder that follows obstruction of apocrine sweat gland ducts. The etiological factors are not fully identified. Hormonal changes are among the proposed factors.[1]

The female preponderance, postpubertal age of presentation, and resolution of lesions during pregnancy, menopause, and oral contraceptive pills (OCPs) consumption support the role of hormones.[5]

The FFD lesions are tiny skin-colored to yellow-brown perifollicular papules, pruritic in more than two-thirds of the cases. The most commonly involved site is the axilla, followed by pubic and periareolar areas. Decreased hair growth (even without laser hair removal) and anhidrosis are infrequent findings.[1]

A few cases of laser or light hair removal-induced FFD were reported during the past decade.[1–10] The clinical and histopathologic features of 13 laser or light hair removal-induced FFD are summarized in Tables 1 and 2.

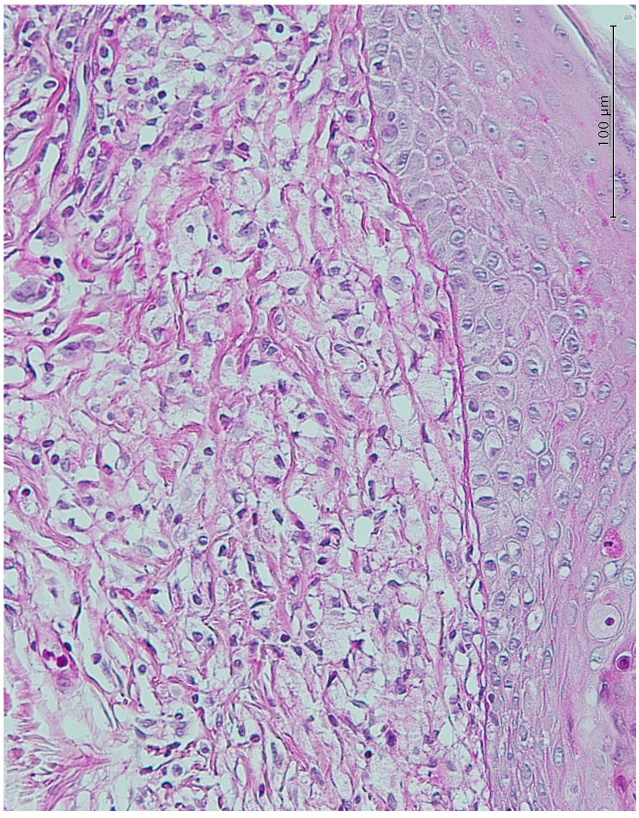

FIGURE 3 Histopathological features. Weakly positive Periodic acid-Schiff (PAS) stain of foamy histiocytes (PAS stain, 400×).

TABLE 1 Clinical features of light/laser hair removal-induced Fox–Fordyce disease cases in the literature.

Reference	Age (years)/ Gender	Hair removal device	Treated area(s)	Location of FFD	Time of lesions appearance	Pruritus	Interval between first symptoms and referral	Treatment
Tetzlaff et al.[4]/2011	41/F	Alexandrite 755 nm laser	Forearms, axilla, legs, and bikini areas	Axillae	Three months after 6 sessions	Yes	2–3 years	Clobetasol propionate 0.05% spray, fluocinolone 0.1% cream, Tacrolimus ointment, tretinoin 0.04% gel microsphere
Yazganoglu et al.[6]/2012	26/F	IPL (810–945 nm) laser	Axillary and pubic area	Axillae	After 2 sessions of treatment	Yes	10 months	Topical 0.05% retinoic acid gel, Topical 0.1% hydrocortisone-17-butyrate cream
Helou et al.[7]/2013	27/F	810-nm Diode laser	Axillae, pubic and periumbilical regions	Axillae, periumbilical, and pubic areas	Three months after the second session	Yes	1 month	Topical 0.1% hydrocortisone 17-butyrate cream
Bernad et al.[8]/2014	29/F	Diode laser	Axillae, pubic region, and legs	Axillae	One month after completing three sessions	Yes	2 months	Clobetasol 0.05% cream
Alés-Fernández, et al.[5]/2015	24/F	IPL	Axillae	Axillae	After 3 sessions of laser	No	4 months	Tretinoin 0.05% cream
Sammour et al.[3]/2016	29/F	IPL	Axillae	Axillae	2 months after the last session	No	N/A	N/A
	42/F	Alexandrite laser	Axillary and inguinal areas	Axillae	6 months after the completion of 4 sessions	Yes	N/A	N/A
	24/F	Unknown	Axillary areas	Axillae	4 years after the last session	Yes	N/A	N/A
	32/F	Diode laser	Inguinal and axillary areas	Inguinal area	2 months after the completion of 3 sessions	Yes	N/A	N/A
	38/F	Unknown	Axillae	Axillae	3 months after the last session	No	N/A	N/A
Elisa et al.[9]/2019	17/F	810 nm Diode Laser	Axillae	Axillae	4 weeks after second session	Yes	8 months	Topical methylprednisolone aceponate
Byth LA & Byth J[2]/2020	27/F	Long pulsed alexandrite laser	Axillae, groin	Axillae	12 months after treatment	No	N/A	N/A
	25/F	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zargari & Azimi[10]/2020	26/F	Diode 800 nm	Face, axillae, pubic and periumbilical regions, and extremities	Axillae	After 2 sessions	Yes	1 year	Topical tacrolimus
The present case	23/F	Alex Diode laser (755–805 nm)	Face, Axilla, pubic area, and lower extremities	Face, lower extremities, axillae and pubic area	After 5 sessions	Yes	10 months	Topical mometasone furoate 0.1% cream, topical tacrolimus

Abbreviations: F, Female; FD, Fox–Fordyce disease; IPL, Intense Pulse Light; N/A, Not available.

TABLE 2 Histopathologic features of light/laser hair removal-induced Fox–Fordyce disease cases in the literature.

Reference	Hair Follicle	Dilation of the follicular infundibulum	Spongiosis of the follicular infundibulum	Follicular hyperkeratosis	Dyskeratosis in the follicular infundibulum	Periductal lymphohistiocytic infiltrate	Mast cells	Perifollicular fibrosis	Perifollicular and periductal foam cells	Apocrine secretory unit dilation
Tetzlaff et al.[4]/2011	–	+	+	+	+	+	–	+ mild	+	+
Yazganoglu et al.[6]/2012	–	+	NM	+	NM	+	–	NM	–	NM
Helou et al.[7]/2013	–	+	NM	+	NM	+	–	NM	–	+
Bernad et al.[8]/2014	NM	NM	+	+	NM	+	–	NM	+	NM
Alés-Fernández, et al.[5]/2015	NM	NM	+	NM	NM	+	NM	NM	+	+
Sammour et al.[3]/2016	+	+	NM	+	+ very rare	+	–	+ mild	+	+
	+	+	NM	+	+ rare	+	+ a few	+ mild	–	+
	Shave biopsy was not diagnostic									
	Biopsy was not performed									
	Biopsy was not performed									
Elisa et al.[9]/2019	NM	+	NM	+	+	+	–	+	+ few	+
Byth & Byth[2]/2020	Biopsy was not performed.									
Zargari & Azimi[10]/2020	–	+	NM	+	–	+	–	NM	NM	NM
The present case	–	+	+	+	+	+	–	+ mild	+	+

Abbreviation: NM, Not mentioned.

All cases are women, which may reflect the more prevalent laser hair removal in women. Pruritus was a common but not general symptom.[2]

Fox–Fordyce disease may occur at limited sites undergone laser hair removal or at all sites.[7,10] The variable density of apocrine glands and different skin phototypes are propounded as possible causes of sparing of laser hair removal FFD in some laser-treated areas and patients.[10]

Variable histopathological features of FFD are described in FFD lesions, including hyperkeratosis, dilation of the follicular infundibulum, follicular plugging, acanthosis, spongiosis, dyskeratotic cells in the infundibulum, perifollicular lymphohistiocytic infiltrate with mast cells, apocrine secretary unit dilation, perifollicular fibrosis, and perifollicular xanthomatosis.[1,3] While perifollicular xanthomatosis is generally reported in FFD cases and considered the hallmark of classic FFD, some laser hair removal cases lack foam cells.[3,6,7] The absence of hair follicles and mast cells was presented as the difference points of laser hair removal-induced FFD vs. classic FFD.[4] However, these were not uniform in the subsequent cases.[3]

Laser or light devices used in hair removal destroy the hair by targeting melanin in the hair shaft and bulb and destroying bulge stem cells. The thermal energy results in follicular infundibulum injury, dysmaturation, and, subsequently follicular obstruction.[2,5,9] So, hair removal laser may trigger FFD by follicular obstruction in susceptible patients.

Topical treatments, including steroids, retinoids, calcineurin inhibitors, and clindamycin, are among FFD's most frequently used treatments. Other, less frequently used, managements include lasers, botulinum toxin injection, OCPs, oral isotretinoin, benzoyl peroxide, antihistamines, modified liposuction, and excision.[1] The medications applied in the previous laser hair removal-induced FFD cases are presented in Table 1.

6 | CONCLUSION

FFD is a recognized adverse effect of laser hair removal (including Alex/Diode laser) and should be considered among the differential diagnoses of lesions at the hair removal laser site.

AUTHOR CONTRIBUTIONS

Mozhdeh Sepaskhah: Conceptualization; data curation; supervision; writing – original draft; writing – review and editing. **Rahil Hamedpour:** Data curation; writing – original draft; writing – review and editing. **Fatemeh Sari Aslani:** Data curation; visualization; writing – original draft; writing – review and editing.

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FUNDING INFORMATION

None.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ETHICS STATEMENT

The researchers committed to maintaining the patient confidentiality. Institutional ethics committee approved the case report (ethics code: IR.SUMS.REC.1402.300).

CONSENT

The patient signed written informed consent to permit the publication of the case report without identifying data and to use the photography for publication. The researchers committed to maintaining the patient confidentiality. Institutional ethics committee approved the case report (ethics code: IR.SUMS.REC.1402.300).

ORCID

Mozhdeh Sepaskhah https://orcid.org/0000-0002-8773-0019

REFERENCES

1. Salloum A, Bouferraa Y, Bazzi N, et al. Pathophysiology, clinical findings, and management of fox-Fordyce disease: a systematic review. *J Cosmet Dermatol*. 2022;21(2):482-500.
2. Byth LA, Byth J. Fox-Fordyce disease: insights from cases induced by laser hair removal. *Australas J Dermatol*. 2020;61(2):188-189.
3. Sammour R, Nasser S, Debahy N, El Habr C. Fox-Fordyce disease: an under-diagnosed adverse event of laser hair removal? *J Eur Acad Dermatol Venereol*. 2016;30(9):1578-1582.
4. Tetzlaff MT, Evans K, DeHoratius DM, Weiss R, Cotsarelis G, Elenitsas R. Fox-Fordyce disease following axillary laser hair removal. *Arch Dermatol*. 2011;147(5):573-576.
5. Alés-Fernández M, Ortega-Martínez de Victoria L, García-Fernández de Villalta MJ. Lesions in the axilla after hair removal using intense pulsed light. Fox-Fordyce disease. *Actas Dermosifiliogr*. 2015;106(1):61-62.
6. Yazganoğlu KD, Yazici S, Büyükbabani N, Ozkaya E. Axillary fox-Fordyce-like disease induced by laser hair removal therapy. *J Am Acad Dermatol*. 2012;67(4):e139-e140.
7. Helou J, Maatouk I, Moutran R, Obeid G. Fox-Fordyce-like disease following laser hair removal appearing on all treated areas. *Lasers Med Sci*. 2013;28(4):1205-1207.
8. Bernad I, Gil P, Lera JM, Giménez de Azcárate A, Irarrazaval I, Idoate M. Fox Fordyce disease as a secondary effect of laser hair removal. *J Cosmet Laser Ther*. 2014;16(3):141-143.
9. Elisa R, Caterina F, Angela B, Laura A, Luca P, Franco R. Axillary fox-fordyce disease induced by laser hair removal. *J Dermatol Res Ther*. 2019;5:71.
10. Zargari O, Azimi SZ. Fox Fordyce disease: a side effect of laser therapy. *J Cosmet Laser Ther*. 2020;22(3):126-127.

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