Successful use of a fractional 2940-nm laser in treating chronic, severe erosive pustular dermatosis of the scalp

Hailey E. Grubbs, BS, MS-IV,[a] and Chris W. Robb, MD, PhD[b]
Harrogate and Spring Hill, Tennessee

Key words: 2940 nm; erbium:YAG; erosive pustular dermatosis; erosive pustular dermatosis scalp; erosive pustulosis; fractional; fractional ablative; laser; profractional.

INTRODUCTION

Erosive pustular dermatosis of the scalp (EPDS) is a rare inflammatory condition first described in detail by Pye et al[1] in 1979 that causes chronic sterile pustular, crusting lesions and results in scarring alopecia. EPDS can occur after local trauma to the skin related to surgeries, skin grafting, solar damage, and treatment of actinic keratoses.[2] Historically, the most common treatments include local and systemic antibiotics and potent steroids, which are associated with multiple side effects and prove to be minimally effective. More recent evidence supports the use of topical dapsone 5% gel and tacrolimus as effective treatments.[3,4] Despite these options, EPDS remains a difficult condition to treat. In this report, we explore the use of fractional ablative laser therapy as a treatment for erosive pustular dermatosis of the scalp.

Abbreviations used:

EPDS: erosive pustular dermatosis of the scalp
TGF: transforming growth factor
YAG: yttrium aluminum garnet

CASE REPORT

A 73-year-old white woman presented to us with an 11-year history of EPDS. The patient reported that she had been treated with wound debridement, skin grafts, oral and topical steroids, azathioprine, and mycophenolate mofetil at other clinics. At the time of her initial visit to our office, she was using a 0.05% clobetasol cream as primary therapy. At this time, approximately 80% of our patient's scalp and forehead was affected by erosive, atrophic plaques with telangiectasia and hard crusts (Fig 1). In an attempt to minimize the use of steroids on her already atrophic, telangiectatic skin, we started the patient on methotrexate, which was discontinued shortly after because of severe headaches and nausea. A modified regimen of 100 mg of oral dapsone, dapsone 5% topical gel, and topical tacrolimus 0.1% was started. After 8 months, some improvement was noted (Fig 2), but the patient expressed interest in a more aggressive approach, which prompted the use of a fractional 2940-nm erbium:yttrium aluminum garnet (YAG) laser (ProFractional; Sciton, Inc, Palo Alto, CA) in her treatment plan.

Before laser therapy, a small test spot was treated using a 250-μm depth at 11% with no adverse event. Anesthetic 8% lidocaine and 8% tetracaine cream were applied 30 minutes before treatment and adequately controlled pain. Each session consisted of 1 pass and included 5 mm of healthy surrounding skin targeting 1 to 4 spots. Several different settings were tested during the first few treatments with depth ranging from 175 to 250 μm and density of 11% or 22%. After 4 treatments, a depth of 200 μm and density of 22% were chosen for successive sessions to maximize the laser's ablative effect. Posttreatment instructions were to keep the area occluded with Vaseline. The patient continued her dapsone and tacrolimus regimen between sessions. Treatments were spaced 3 to 5 weeks apart based on patient's schedule. Progress was documented via digital photography with an emphasis on

From Lincoln Memorial University-DeBusk College of Osteopathic Medicine[a] and the Skin and Allergy Center, Spring Hill.[b]
Funding sources: None.
Conflicts of interest: None disclosed.
Correspondence to: Chris Robb, MD, PhD, 3098 Campbell Station Pkwy A201, Spring Hill, Tennessee 37174. E-mail: dr.robb@gmail.com.

JAAD Case Reports 2019;5:188-90.
2352-5126

https://doi.org/10.1016/j.jdcr.2018.11.003

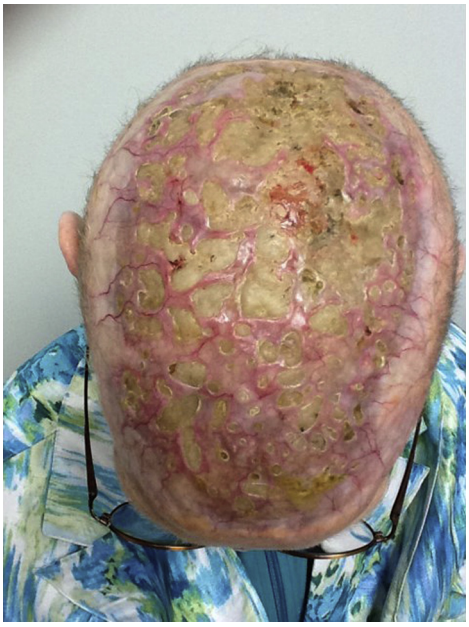

Fig 1. EPDS before treatment.

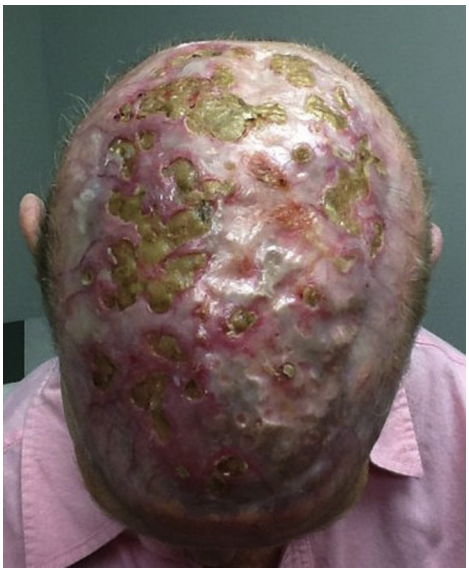

Fig 2. EPDS after 8-months of 100 mg oral dapsone, dapsone 5% topical gel, and topical tacrolimus 0.1%.

re-epithelialization and monitoring for new pustule formation.

Improvements were seen right away. Treated areas showed granulation and new skin growth when the patient returned for follow-up several weeks after her laser sessions. The patient was pleased with her results and reported only mild discomfort from the laser so sessions continued. After 13 treatments, badly eroded spots showed re-epithelialization and only 5 % of her scalp remained affected (Fig 3). She received 6 additional treatments,

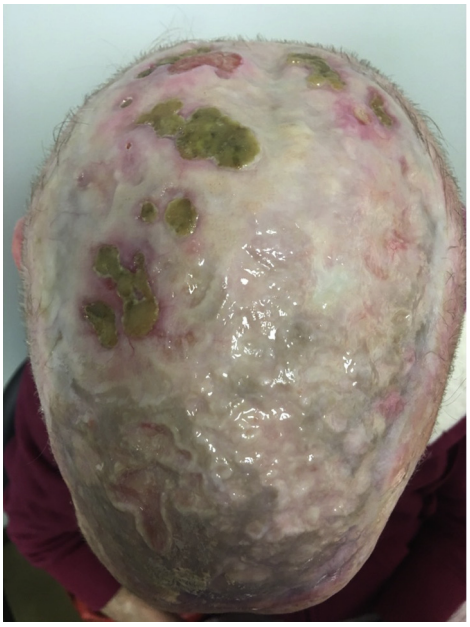

Fig 3. EPDS after 13 treatments with a 2940-nm erbium:YAG laser. Photograph taken 12 months after the initial session.

and almost all of her scalp was re-epithelialized. The 19 sessions spanned over 20 months, and there were no signs of recurrent ulceration or pustule formation during this period (Fig 4). Fractional ablative laser therapy combined with topical tacrolimus and dapsone proved successful in treating severe, recalcitrant EPDS and was well tolerated by our patient.

DISCUSSION

Fractional erbium:YAG produces its effect on the skin through a mechanism called *fractional photothermolysis*. Fractional photothermolysis forms microscopic treatment zones, which are small pockets of thermally damaged skin with surrounding areas of undamaged tissue.[5] This process elicits a heat shock response and stimulates natural wound healing leading to re-epithelialization and dermal remodeling.[6] Treatment effects manifest within hours, leading to increased expression of heat shock proteins and transforming growth factor (TGF)-β. Heat shock proteins are associated with collagen synthesis, the processing of abnormally folded proteins, and expression of growth factors such as TGF-β. TGF-β aids in wound healing by stimulating fibroblast migration, extracellular matrix and procollagen formation, and wound contraction.[7] Keratinocytes also move in and assist with removal of damaged epithelium.[5] It is possible that surrounding tissue not directly targeted by laser therapy could also exhibit some of these heat shock responses

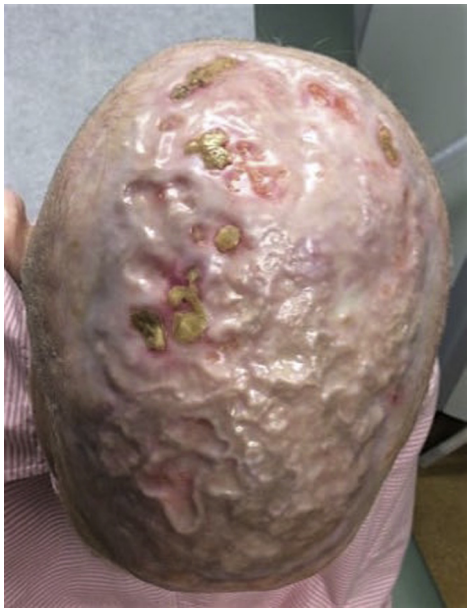

Fig 4. EPDS after 19 treatments with 2940-nm erbium:YAG laser, 20 months after initiation of laser therapy.

because of the active thermal bystander effect.[8] Nearby cells are damaged but remain viable and potentially aid in the wound healing process.

Photomicrodebridement likely plays an additional role in the healing of the ulcers seen in EPDS. Photomicrodebridement causes disruption of bacterial biofilms on chronic wounds and removes unhealthy, damaged scar tissue around the borders in a less invasive manner compared with traditional wound debridement.[9] Further studies using bacterial cultures before and after treatments could strengthen this theory. Given these concepts, it is possible that the fractional ablative therapy promotes wound healing by both destruction of old tissue and stimulation of the body's natural healing process.

In this report, re-epithelialization and recurrence of pustules were the primary components used to measure success. The addition of an erbium:YAG laser to our patient's topical regimen elicited significant improvement over traditional therapies. Re-epithelialization occurred in all spots treated, and no additional pustules formed despite the micro trauma induced during the fractionally ablative process. Additionally, our patient reported a decrease in pruritus and pain over the treatment course, and improvements in skin texture and psychosocial stress were also noted.

Use of a fractional erbium:YAG laser may be a promising option for difficult-to-treat cases of EPDS. Fractional ablative therapy poses fewer side effects and risks than chronic immunosuppressant medications. We present a very severe, chronic presentation of EPDS, which could explain the large number of treatments required to see significant improvement. Fractional ablative laser therapy may prove even more successful and require fewer sessions for milder cases. Although more studies are needed, our patient's positive response and tolerance to treatment indicates that this may be a useful treatment modality for other patients with recalcitrant EPDS.

REFERENCES

1. Pye RJ, Peachey RDG, Burton JL. Erosive pustular dermatosis of the scalp. *Br J Dermatol*. 1979;100(5):559-566.
2. Van Exel CE, English JC. Erosive pustular dermatosis of the scalp and nonscalp. *J Am Acad Dermatol*. 2007;57(2 Suppl): S11-S14.
3. Broussard KC, Berger TG, Rosenblum M, Murase JE. Erosive pustular dermatosis of the scalp: a review with a focus on dapsone therapy. *J Am Acad Dermatol*. 2012;66(4):680-686.
4. Tardio NB, Daly TJ. Erosive pustular dermatosis and associated alopecia successfully treated with topical tacrolimus. *J Am Acad Dermatol*. 2011;65(3):e93-e94.
5. Manstein D, Herron GS, Sink RK, Tanner H, Anderson RR. Fractional photothermolysis: a new concept for cutaneous remodeling using microscopic patterns of thermal injury. *Lasers Surg Med*. 2004;34(5):426-438.
6. Capon A, Mordon S. Can thermal lasers promote skin wound healing? *Am J Clin Dermatol*. 2003;4(1):1-12.
7. Helbig D, Bodendorf MO, Grunewald S, Kendler M, Simon JC, Paasch U. Immunohistochemical investigation of wound healing in response to fractional photothermolysis. *J Biomed Opt*. 2009;14(6):064044.
8. Purschke M, Laubach HJ, Anderson RR, Manstein D. Thermal injury causes DNA damage and lethality in unheated surrounding cells: active thermal bystander effect. *J Invest Dermatol*. 2010;130(1):86-92.
9. Shumaker PR, Kwan JM, Badiavas EV, Waibel J, Davis S, Uebelhoer NS. Rapid healing of scar- associated chronic wounds after ablative fractional resurfacing. *Arch Dermatol*. 2012;148(11):1289-1293.