Official Publication of the International Society of Hair Restoration Surgery

FORUM

HAIR TRANSPLANT FORUM INTERNATIONAL

VOLUME 36 | NUMBER 1
JANUARY/FEBRUARY
2026

IN THIS ISSUE

FORUM ePUB Official Publication of the ISHRS

Long-Term Multimodal Reconstruction of Extensive Post-Burn Scalp Alopecia Using Tissue Expansion and Follicular Unit Extraction: A 10-Year Follow-Up Case Report

Solon Eduardo Gouveia Souza, MD | *São Paulo, Brazil* | dr.solon.eduardo@gmail.com;
Mauro Speranzini, MD, FISHRS | *São Paulo, Brazil*

ABSTRACT

Introduction: Extensive scalp wounds following trauma, particularly burns, present a significant reconstructive challenge. Multidisciplinary long-term care is required to restore function and aesthetics while minimizing complications.

Methods: We report a 35-year-old male with second- and third-degree burns covering 70% of his body, including face, trunk, and upper limbs. Scalp reconstruction involved tissue expansion, rotational flaps, partial-thickness skin grafts, and multiple follicular unit excision (FUE) hair transplant sessions.

Results: Scalp expansion and flap rotation reduced scarred areas but left residual alopecia, which was successfully treated with four FUE sessions (totaling 2,946 scalp and 1,468 beard follicular units), achieving near-complete restoration. Graft survival was satisfactory, and the patient regained functional and aesthetic outcomes, with reintegration into social activities.

Discussion: Multimodal reconstruction, including biologic dressings, scalp expansion, and staged hair transplantation, is effective for post-burn scalp alopecia. Challenges include reduced vascularization, fibrosis, tissue rigidity, prolonged hospitalization, increased risk of infection, and other clinical complications, which require careful planning and multiple procedures to optimize graft survival.

Conclusion: Complex scalp reconstruction in burn patients is feasible with a combination of advanced wound care, tissue expansion, skin graft, flap rotation, and FUE transplantation, leading to durable aesthetic and functional outcomes.

Keywords: burn injury, chronic wound, flap rotation, follicular unit excision (FUE), hair transplantation, scalp reconstruction, skin graft, tissue expansion

INTRODUCTION

Extensive scalp burns often result in permanent cicatricial alopecia, posing significant reconstructive challenges. A simple surgical approach with scalp expansion and flap rotation may not be sufficient for adequate scalp coverage, and hair transplantation in scarred areas may be limited by poor graft growth in the post-operative period, hindering the achievement of natural hair restoration. Advances in hair transplantation[1-6] allow new strategies in the rehabilitation of burn survivors. We present a 10-year follow-up case of a male patient with extensive post-burn scalp alopecia successfully managed with combined surgical techniques.

CASE PRESENTATION

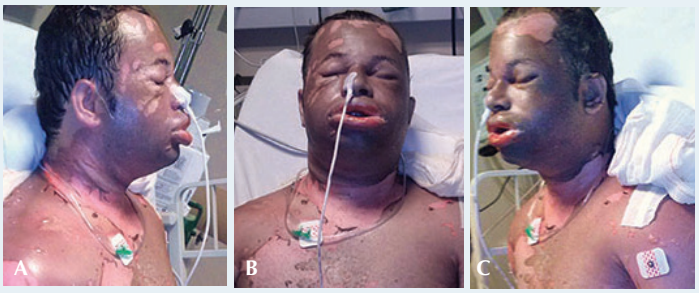
A 35-year-old male sustained second- and third-degree burns over 70% of his body surface (face, upper limbs, and trunk) in 2014, requiring a 4-month ICU stay (Figure 1). The burns were intentionally caused by another person, who poured boiling water and oil over the patient while he was sleeping on his side, with the left side of the body facing upward and sustaining most of injuries.

During hospitalization, the patient underwent 17 debridements of necrotic burned tissue, 33 wound dressings under general anesthesia, and 6 skin graft procedures covering the thorax, face, left ear, scalp,

PAGE 6

CONTINUED FROM PAGE 1

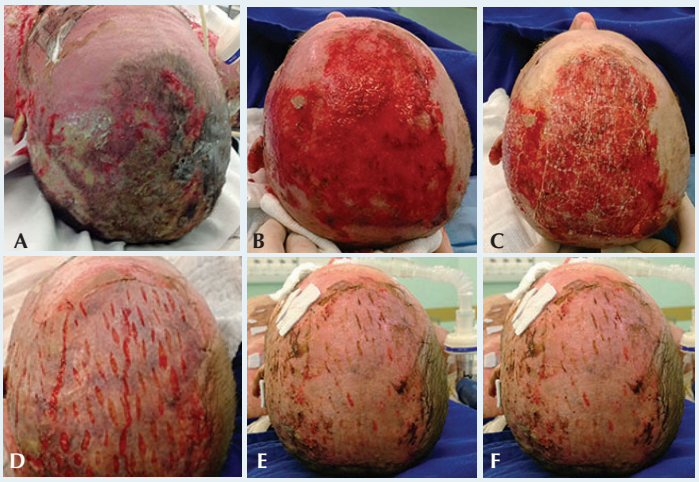
FIGURE 1. Patient with second- and third-degree burns affecting 70% of the body, predominantly on the head, trunk, and upper limbs. **A:** Right profile. **B:** Frontal view. **C:** Left profile.



and upper and lower limbs. Additionally, oral mucosa grafts were performed on the lips and full-thickness skin grafts on the left upper and lower eyelids to restore function and anatomy.

On February 27, 2014, a submucosal matrix (OASIS®–porcine small intestinal submucosa) was applied to the scalp to enhance wound healing and prepare the recipient site for subsequent skin grafting (Figure 2).

FIGURE 2. Scalp burn treatment evolution, head top view. **A:** Third-degree burn with necrotic tissue. **B:** 30 days later, clean wound with abundant granulation tissue. **C:** Wound treated with OASIS® matrix. **D:** Aspect after matrix integration. **E:** 15 days later partial-thickness meshed skin graft was performed. **F:** Final scalp aspect 4 months after hospitalization and multiple surgeries.



After hospital discharge, the patient was followed on an outpatient basis to address complications related to the initial trauma. In August 2014, he developed a deep venous thrombosis (DVT) of the left lower limb, which required anticoagulation and multidisciplinary management. To restore superior limb function, on June 23, 2016, two flaps were performed in the right and left axillary regions, together with a full-thickness skin graft to the left lower eyelid and a lateral Z-plasty of the left upper eyelid to correct cicatricial ectropion.

Although the scalp wound initially appeared to be resolved, chronic, hard-to-heal ulcers subsequently developed, necessitating rehospitalization and prolonged outpatient care. Substantial healing of the wounds was achieved only after the introduction of COLZEN® dressings (collagen, glycosaminoglycan, and chondroitin sulfate), a new product at the time. Within three weeks, the ulcers showed marked resolution (Figures 3 and 4).

The occipital region with preserved hair measured 16.5cm × 15.5cm, and the right parietal region measured 10cm × 12cm,

FIGURE 3. Evolution of scalp wounds after hospital discharge. **A:** Initial aspects of scalp after hospital discharge. **B:** Infection and hospitalization was required to treat with I.V. antibiotics and surgical procedures. **C:** Improvement with treatment. **D:** After three months of wound treatment with poor cicatrization, COLZEN dressing was used. **E:** After 7 days of treatment, great improvement was noted. **F:** After 24 days of treatment, the wound was almost closed.

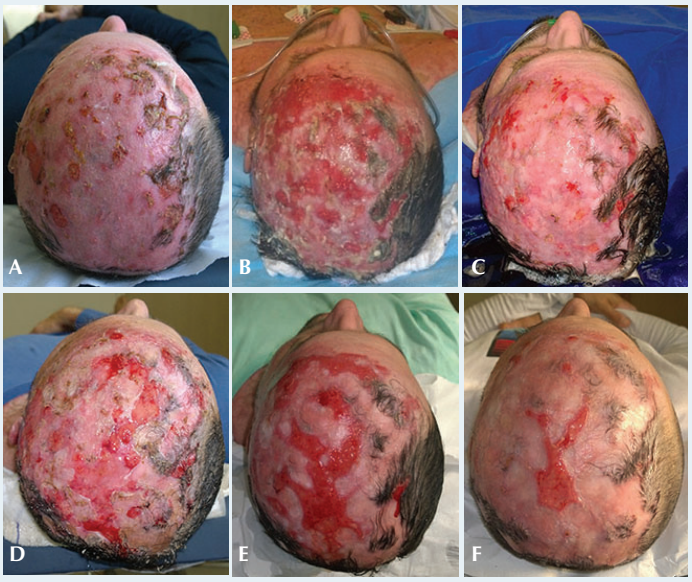
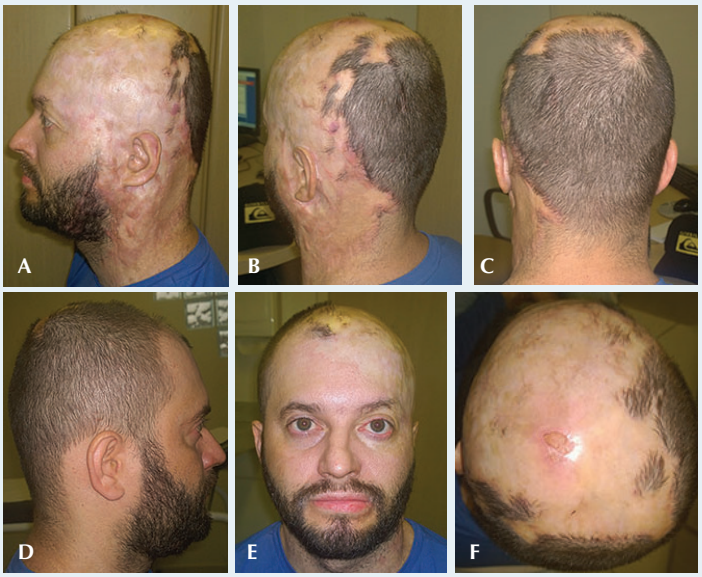


FIGURE 4. Final aspect 2 years after initial trauma. **A:** Left side. **B:** Left side. **C:** Posterior view. **D:** Right side. **E:** Frontal view. **F:** Top view.



with a total area of 375.75cm². Therefore, we opted for scalp expansion. On April 7, 2016, he underwent placement of two silicone expanders (rectangular and round) in the occipital and right parietal scalp regions.

The right parietal expander developed a late infection and was removed on August 17, 2016, approximately four months after placement (Figure 5), while the occipital expander remained functional and was later removed on January 25, 2017, at which time a rotation flap of the occipital scalp was performed to diminish the cicatricial area (Figure 6).

From 2017 to 2024, the patient underwent four FUE procedures (2017, 2019, 2022, and 2024). In total, 2,893 scalp follicular units and 1,468 beard follicular units were transplanted for scalp restoration. Beard grafts were also employed to reconstruct the left peripheral beard (sideburn and man-

FIGURE 5. Right parietal silicone expander infection. **A:** Right-side view with facial cellulitis. **B:** Silicon expander with purulent secretion.

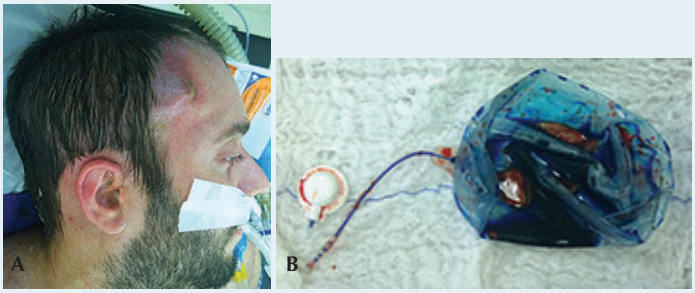
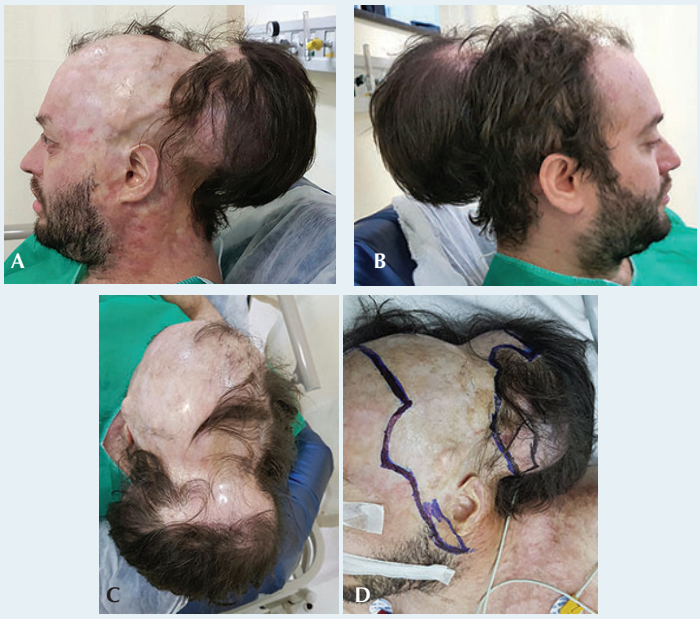
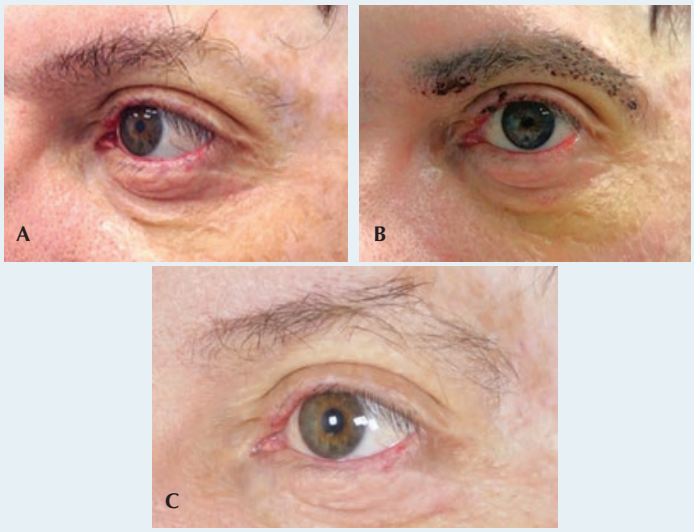


FIGURE 6. Final aspect of scalp expansion. **A:** Left side. **B:** Right side. **C:** Top view. **D:** Intra-operative view of the left side of the face with pen markings of all scarred tissue to be excised during the rotation of the expanded scalp flap.



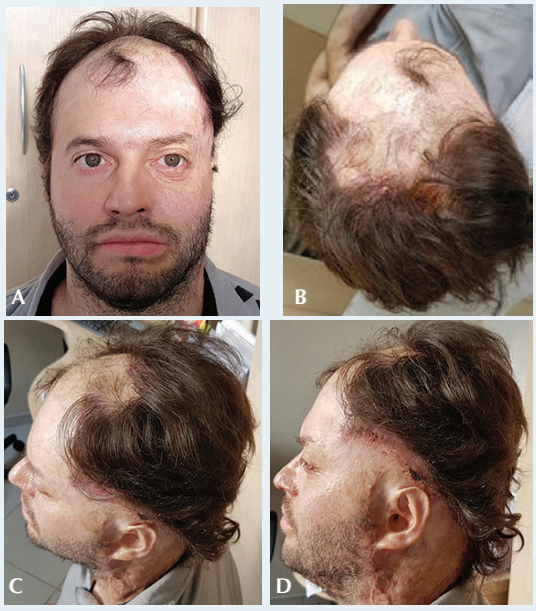
dibular angle) and to increase scalp density, contributing to improved coverage of the scarred region. Additionally, in November 2017, a FUT procedure was performed to reconstruct the right eyebrow and upper eyelid eyelashes, although growth in these areas was limited (Figure 7).

FIGURE 7. Graft growth after FUT in the left eyebrow and superior eyelash. **A:** Pre-operative. **B:** Two days after the procedure. **C:** Late post-operative.



The rotation of the expanded scalp flap was effective in reducing the scarred area; however, it was not sufficient to improve overall coverage, leaving a large bald region in the frontal and right temporoparietal scalp. The occipital flap successfully covered the parieto-temporal defect but produced nuchal scarring and misdirected temporal hairs, which pointed forward, creating difficulty for combing and an unaesthetic appearance. This required excision and reimplantation with corrected angulation, as well as additional follicular units placed in the nuchal region (Figure 8).

FIGURE 8. After scalp expansion and occipital flap rotation, a large hairless scarred area remained in the frontal and left temporoparietal regions. **A:** Frontal view. **B:** Top view. **C:** Top view. **D:** Left side.



The first FUE procedure (09/21/2017) was performed as a small test session to evaluate graft integration, given the uncertainty about the viability of hair transplantation in scar tissue that had undergone multiple prior interventions. A total of 450 follicular units were transplanted.

In this surgery, we employed an unpublished technique originally developed by the Brazilian surgeon Dr. José Cândido Muricy, which was described to the author by his daughter, Dr. Maria Angelica Muricy, during an ABCRC (Associação Brasileira de Cirurgia da Restauração Capilar; Brazilian Association of Hair Restoration Surgery) meeting in 2016. The technique consists of excising scar tissue using punches and subsequently placing follicular units into the resulting orifices, with the objective of reducing scar tissue and potentially improving graft survival.

In the present case, a punch with an external diameter of 0.95mm was used to remove the scar tissue. The excised sites were immediately filled with follicular unit grafts, resulting in a one-to-one correspondence between the number of punches performed and the number of grafts implanted. This approach differs fundamentally from conventional techniques employing blades or needles, in which incisions are made without removal of scar tissue. Considering the internal diameter of the punch (0.75mm) and an average penetration depth of 4mm, the procedure effectively removes a

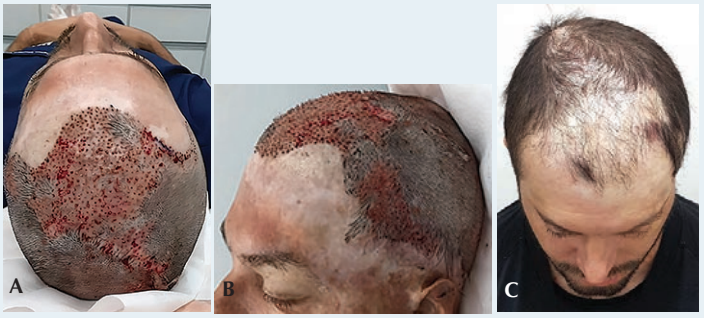
PAGE 8

CONTINUED FROM PAGE 7

cylindrical volume of scar tissue with an estimated internal surface area of 9.42mm². Consequently, a portion of the rigid, diseased scar tissue is physically eliminated and replaced with healthy follicular tissue.

We hypothesize that the reduction of scar tissue and its substitution with follicular units may improve the local tissue environment and facilitate graft survival; however, this assumption remains unproven. The outcome was successful, and subsequent sessions were performed using conventional FUE, as graft survival proved reliable (Figure 9).

FIGURE 9. First FUE immediate post-operative aspect. **A:** Top view. **B:** Left side; notice that hair in the temporal region are misdirected. **C:** Late post-operative aspect, top view.



A second FUE procedure was performed on 02/21/2019, using 1,522 follicular units, with good graft integration. For the third and fourth procedures, cervical beard and scalp hair were used, as scalp expansion had substantially reduced the donor area density. On 12/10/2022, surgery was performed using 988 beard follicular units and 200 scalp follicular units to reconstruct the left sideburn and increase density in the frontal region. For the fourth procedure (01/17/2024), 774 scalp follicular units and 480 beard follicular units were used to increase density in the frontal region, reconstruct the left sideburn, and restore the entire left temporoparietal area, including removal of misdirected units and repositioning them with correct orientation. In total, 2,946 scalp follicular units and 1,468 beard follicular units were transplanted, achieving good scalp coverage and a natural appearance, 10 years and multiple surgeries after the initial trauma (Figure 10).

FIGURE 10. **A to D:** Post-operative after the second FUE procedure. **E to H:** Post-operative after the third FUE procedure. **I to L:** Post-operative after the fourth FUE procedure.

DISCUSSION

The management of extensive scalp wounds following trauma, particularly burns resulting in large cicatricial areas, requires a multidisciplinary team and long-term treatment. Intervention planning should prioritize functional recovery first, followed by aesthetic restoration and minimization of complications. For large defects in the hair-bearing scalp, tissue expansion is an excellent strategy, as it can reduce scar tissue and facilitate the planning of subsequent hair transplantation procedures.[7-10]

However, the scalp expansion phase can cause significant aesthetic deformity and pain. In the present case, one expander developed an infection, although the literature reports a relatively low infection rate of approximately 8.25%.[10] Expansion can also produce additional suture-related scarring and may result in misalignment or improper angulation of hair during flap rotation, as observed in our patient.

During hospitalization, porcine small intestinal submucosa (OASIS) was used, a biologic matrix applied as advanced therapy for complex wounds, that may reduce inflammation, enhance granulation tissue formation, and potentially accelerate healing, but despite increasing evidence, most data for acute wounds remain low-level, derived from case reports and small case series.[10-14]

Chronic scalp wounds delayed reconstruction and only improved after treatment with the biologic dressing COLZEN (cerium citrate, bovine collagen, calcium alginate), that was introduced in Brazil at the time. Cerium nitrate has been shown to stabilize wounds, reduce microbial load, and modulate inflammation, particularly in deep burns.[15] Calcium alginate promotes a moist healing environment, stimulates re-epithelialization and collagen synthesis, and facilitates autolytic debridement.[16,17]

Hair transplantation in scarred tissue is a viable and effective approach to restore areas of cicatricial alopecia, includ-

ing those resulting from burns, trauma, surgery, and chronic ulcers. The main technical challenges involve reduced vascularization, fibrosis, and tissue rigidity, which can compromise graft survival. Nevertheless, graft survival rates between 77% and 90% have been consistently reported, with high aesthetic and functional satisfaction among both adult and pediatric patients.[18-22]

CONCLUSION

This case highlights the complexity of treating major burn survivors, who often require long-term multidisciplinary care. The patient, followed continuously since 2014, experienced multiple systemic complications, including DVT, underscoring the chronicity of his medical needs. Integration of grafts in scarred areas remains a constant challenge, and multiple procedures are preferred to reduce the risk of complications and increase follicular unit survival. Extensive post-burn scalp alopecia can be successfully treated using a multimodal approach that combines tissue expansion, flap rotation, FUT, and FUE hair transplantation with the strategic use of beard grafts. Long-term follow-up demonstrated durable results, restoring both aesthetics and social reintegration.

Acknowledgments

The author thanks surgeons Jonas Vazquez Coutinho, Maria Manoela Meyer, Camila Maya Kunisawa and Karine Tiemy Otomo for their collaboration, particularly during the critical care phase and extends gratitude to surgical instrument technician Almir Retamero for his invaluable support throughout these surgeries. Special thanks to Dr. Maria Angelica Muricy for sharing her father's technique for hair transplantation in scarred areas, first discussed during a 2016 congress. The author also acknowledges Suk Won Soh, Pablo Cirino, and Jonas Vasquez for their assistance during the first and second FUE procedures.

References

1. Speranzini M. FUE graft placement with dull needle implanters into premade sites. *Hair Transplant Forum Int'l.* 2016;26(2):49-56.
2. Speranzini M. Graft placement using the dull needle implanter (DNI) technique. *Hair Transplant Forum Int'l.* 2017;27(2):45-56.
3. Speranzini M, Souza SEG. The spin maneuver. *Hair Transplant Forum Int'l.* 2021;31(6):218-220.
4. Speranzini M, Souza SEG. Forty steps to harvest a graft. *Hair Transplant Forum Int'l.* 2021;31(2):37-49.
5. Speranzini M, Souza SEG. Advancements in Graft Placement Techniques. *Facial Plast Surg.* 2024 Apr;40(2):223-233.
6. Speranzini M, Nakano C, Souza SEG. (2025). Implantation of hair follicles. In RH True, AK Garg, S Garg (Eds.). *Practical Guide to Hair Transplantation* (2nd ed.). Thieme; 2025.
7. Epstein JS. Scalp reconstruction: the role of tissue expansion. *Hair Transplant Forum Int'l.* 2006;16(5):171-172.
8. Mangubat EA. Scalp repair using tissue expanders. *Facial Plast Surg Clin North Am.* 2013 Aug;21(3):487-496.
9. Ahmad M, Mohmand H. Tissue expansion and hair restoration. *Hair Transplant Forum Int'l.* 2013 Mar;23(2):50-51.
10. Saleh Y. Scalp reconstruction using tissue expander. *Egypt J Plast Recontr Surg.* 2004;28(1):71-75.
11. Yeh DD, Nazarian RM, Demetri L, et al. Histopathological assessment of OASIS Ultra on critical-sized wound healing: a pilot study. *J Cutaneous Pathol.* 2017;44(6):523-529.
12. Somani AK. Application expansion of small intestinal submucosa extracellular matrix in complex and surgical wounds. *J Wound Care.* 2023;32(Sup1a):S20-S27.
13. Simman R. Role of small intestinal submucosa extracellular matrix in advanced regenerative wound therapy. *J Wound Care.* 2023;32(Sup1a):S3-S10.
14. Simman R. Role of small intestinal submucosa extracellular matrix in advanced regenerative wound therapy. *J Wound Care.* 2023;32(Sup2):S3-S10.
15. Reese AD, Keyloun JW, Garg G, et al. Compounded cerium nitrate-silver sulfadiazine cream is safe and effective for the treatment of burn wounds: a burn center's 4-year experience. *J Burn Care Res.* 2022 May;43(3):716-721.
16. Mazurek Ł, Kuś M, Jurak J, et al. Biomedical potential of alginate wound dressings—from preclinical studies to clinical applications: a review. *Int J Biol Macromol.* 2025;309(Pt 2):142908.
17. Xu F, Gao Y, Xin H, et al. A review on multifunctional calcium alginate fibers for full-time and multipurposed wound treatment: from fundamentals to advanced applications. *Int J Biol Macromol.* 2025;290:139133.
18. Barrera A. The use of micrografts and minigrafts for the treatment of burn alopecia. *Hair Transplant Forum Int'l.* 2001;11(2):43-44.
19. Jung S, Oh SJ, Koh SH. Hair follicle transplantation on scar tissue. *J Craniofac Surg.* 2013;24(4):1239-1241.
20. Barusco MN. Complications and difficult cases: transplanting into alopecic areas resulting from the removal of a large congenital melanocytic nevus (congenital hairy nevus). *Hair Transplant Forum Int'l.* 2015;25(5):192-193.
21. Popescu FM. FUE as first intention for hair reconstructive surgery on skin grafts. *Hair Transplant Forum Int'l.* 2019;29(1):1-6.
22. Jin F, Wang Y, Wang Y, et al. Treatment of scarring alopecia in children using follicular unit hair transplantation. *Pediatr Dermatol.* 2022;39(2):333-337.

Editors' Note: This case documents a detailed and sustained effort at hair restoration using different techniques over a period of time. The authors state that they have used an unpublished technique involving small round punches in the recipient area to create recipient sites. The authors feel that the use of round punches in the recipient area helps with the removal of scar tissue. This approach is a throwback to the days of micrografting and punch grafting, when small round punches were routinely used to create recipient sites. The case demonstrates the need for extensive and sustained work, as well as the utilization of different techniques, to achieve a satisfactory result. The editors would like to compliment the authors for their work. ■