JOJ Dermatology & Cosmetics
ISSN: 2689-4610

Clinical Case
Volume 7 Issue 1 -September 2025
DOI: 10.19080/JOJDC.2025.07.555701

JOJ Dermatol & Cosmet

Wound Healing of Auricular Defects After Mohs Surgery Using an At-Home, Patient-Applied Collagen-Mānuka Honey-Hydroxyapatite Dressing

Isaac Rodriguez PhD[1]*, Rachel Beem BS[1], Nathalie Dhir BSN[2] and Anir Dhir MD[2]

[1]*Department of Clinical Science & Innovation, SweetBio, Inc., Memphis, Tennessee, USA*

[2]*Arizona Mohs Surgery & Dermatology, Tucson, Arizona, USA*

Submission: September 16, 2025; **Published:** September 24, 2025

***Corresponding author:** Isaac Rodriguez, 460 S. Highland St. Suite 200, Memphis, TN 38111, Email: isaac@sweetbio.com

Abstract

Auricular (ear) wounds following Mohs micrographic surgery (MMS) are challenging to manage due to limited soft tissue and the avascular nature of cartilage. Secondary intention healing (SIH) is commonly used but often requires 6–10 weeks for closure. A collagen–Mānuka honey–hydroxyapatite dressing (CHD) has been developed to support wound repair and may shorten healing time with favorable scarring outcomes. We report three auricular MMS cases managed with the CHD applied at home every 3–4 days under a hydrocolloid cover.

Initial defects measured 6.25 cm^2, 3.61 cm^2, and 1.0 cm^2. All wounds demonstrated healthy granulation at two weeks and were epithelized by day 28 with minimal to no scarring. These results compare favorably with a recent multicenter study in which 54 auricular wounds treated with SIH had a mean healing time of 56.9 days. CHD-assisted SIH may reduce healing time, lower the need for clinic visits, lower the financial burden on the healthcare system, and provide a practical patient-directed option for auricular wound management.

Keywords: Mohs Surgery; Articular Defects; Collagen; Medical Grade Mānuka Honey; Wound Healing; Secondary Intention Healing

Abbreviations: MMS: Mohs Micrographic Surgery; MMPs: Matrix Metalloproteases; CHD: Collagen–Honey–Hydroxyapatite Dressing; DME: Durable Medical Equipment; SIH: Secondary Intention Healing

Introduction

The auricular region presents unique challenges for dermatologic surgery due to its complex three-dimensional anatomy, minimal soft tissue coverage, and underlying cartilaginous framework. Cartilage is avascular, relying on diffusion from the perichondrium for nutrient supply, which limits its healing potential compared with vascularized tissues [1]. As a result, wounds involving auricular cartilage are prone to delayed healing, complications such as chondritis, and aesthetic deformity [2]. Traditional reconstructive options such as full-thickness skin grafts often have poor take on avascular cartilage, limiting their reliability in this location [3].

Mohs micrographic surgery (MMS) is the standard of care for high-risk, non-melanoma skin cancers on cosmetically and functionally sensitive sites, including the ear. However, reconstructive planning following MMS in this region remains complex due to the limited availability of local tissue, increased likelihood of wound dehiscence, and the suboptimal outcomes with grafting techniques [4]. While various approaches have been described-including local flaps, delayed closure, and traditional secondary intention healing-clinical outcomes are inconsistent, and an evidence-based, reliable solution for auricular cartilage defects remains elusive.

A promising bioengineered option to overcome these challenges is VERIS™ (SweetBio, Inc., Memphis, TN, USA), a natural, advanced wound dressing formulated from a collagen derivative, Mānuka honey, and hydroxyapatite. Each component

plays a distinct, synergistic role in wound repair: collagen supports fibroblast migration, adhesion, and proliferation while modulating excess matrix metalloproteases (MMPs) [5-7]; Mānuka honey delivers antibacterial, anti-inflammatory, and growth factor–enhancing effects [8-11]; and hydroxyapatite provides structural reinforcement, additional sites for cell adhesion, and stimulation of angiogenesis and re-epithelialization [12-16]. Collectively, this collagen–honey–hydroxyapatite dressing (CHD) has been validated through multiple peer-reviewed studies, demonstrating both in vitro bioactivity and clinical efficacy across chronic ulcer and MMS wound models.

Preclinical data show that the CHD reduces gram-negative and gram-positive bacterial burden by 99.99% within 24 hours [17], suppresses macrophage production of MMP-9 (a key mediator of chronic wound pathology), and enhances fibroblast secretion of pro-healing growth factors including FGFb, VEGF, TNFα, SCF, and TGFβ [18,19]. Clinically, CHD treatment has been associated with accelerated wound healing, achieving up to twice the closure rate in chronic ulcers [20], mean closure times of 4.1 weeks in private practice podiatry [21], and full closure in 6 weeks for advanced secondary intention MMS wounds [22]. In a randomized controlled trial of MMS patients, CHD use was also correlated with statistically significantly reduced postoperative pain compared to standard of care [23].

In routine practice, the CHD is delivered through a durable medical equipment (DME) model with direct home shipping, ensuring timely access and reducing the need for repeat clinic visits. It is insurance-reimbursable, affordable, and supported by simple, image-based instructions for ease of use. In the present cases, the CHD was dispensed directly by the treating physician under a patient-pay model, providing the same benefits of immediate access and straightforward application. These case studies evaluate the clinical efficacy of an affordable, easy to use, at-home, patient-administered CHD wound dressings following auricular MMS.

Materials and Methods

Three patients underwent MMS for skin cancer on the ear, with wounds left to heal by advanced secondary intention healing. The physician provided the CHD to the patients to take home immediately after surgery via a patient pay model. Patients were instructed to apply for the CHD every 3-4 days and were scheduled for routine wound evaluations at standard follow-up visits (week 2 and 4). DuoDERM® Extra Thin hydrocolloid dressing (Convatec, Bridgewater, NJ, USA) was used as the secondary dressing to cover the CHD. All patients provided consent for the use of clinical images and de-identified data in this report.

Results

Patient 1 was an 85-year-old male with hypertension and a history of smoking. MMS was performed on the left ear, resulting in a post-operative wound measuring 2.5 × 2.5 cm. By week 2, the wound area had decreased by 36% to 2.0 × 2.0 cm and epithelialized by week 4.

Patient 2 was a 69-year-old female with a history of auricular MMS previously treated with a full-thickness skin graft (FTSG). That graft had healed poorly, and the patient expressed a desire to avoid grafting for future surgeries. In this new case, MMS was performed on the left ear, specifically the triangular fossa–superior antihelix, with a post-operative wound measuring 1.9 × 1.9 cm. By week 2, the wound area had decreased by 20% to 1.7 × 1.7 cm and epithelialized by week 4.

Patient 3 was a 47-year-old male who was immunocompromised due to long-term Imuran therapy for ulcerative colitis diagnosed at age 13. MMS was performed on the right ear, superior conchal bowl, creating a post-operative wound measuring 1.0 × 1.0 cm. By week 2, the wound area had decreased by 40% to 0.6 × 0.6 cm and achieved closure by week 4.

Across all three patients, the wounds demonstrated favorable granulation at week 2 with minimal to no visible scarring at week 4 (Figure 1)."

Discussion

Secondary intention healing (SIH) is a reliable option for auricular Mohs defects but is associated with prolonged closure times compared to other facial sites. Prior studies report healing intervals up to 10 weeks for full epithelialization [24,25]. In a recent multicenter analysis of 306 postoperative cutaneous surgical wounds, Gil-Lianes et al [26], reported a mean healing time of 56.9 days among 54 auricular cases, with defect size identified as a key determinant of outcome. Wounds ≤ 5.28 cm^2 were significantly more likely to close within 66 days, whereas larger wounds required longer [26].

In contrast, the present series achieved epithelialization by day 28 across three auricular defects measuring 1.0 cm^2, 3.61 cm^2, and 6.25 cm^2. These results demonstrate epithelialization four weeks earlier (2 times faster) than the average auricular outcome reported by Gil-Lianes et al., despite patient comorbidities including advanced age, prior poor graft take, and chronic immunosuppression. Importantly, in this series the CHD was dispensed directly to patients for self-application at home under a patient-pay model. This approach enabled consistent wound care without the need for frequent in-clinic dressing changes, reducing the treatment burden while maintaining excellent healing outcomes.

In standard practice, reconstruction with a full-thickness skin graft for auricular defects is reimbursed at $957.40 USD under CPT 15260 (Medicare, Arizona, USA), but this technique requires creating a second surgical site to harvest the graft, introducing an additional wound for the patient to heal, and grafts often demonstrate poor take on auricular cartilage. By contrast, in this case series the CHD treatment averaged only $125 USD for the entire treatment, required no graft harvest, and avoided the

How to cite this article: Isaac Rodriguez PhD, Rachel Beem BS, Nathalie Dhir BSN, Anir Dhir MD. Wound Healing of Auricular Defects After Mohs Surgery Using an At-Home, Patient-Applied Collagen-Mānuka Honey-Hydroxyapatite Dressing. JOJ Dermatol & Cosmet. 2025; 7(1): 555701. DOI: 10.19080/JOJDC.2025.07.555701

morbidity of a secondary donor site. The CHD therefore provides significant cost savings to the healthcare system (averaging $832 USD per patient) while eliminating the need for a secondary donor site and its associated risks of pain, delayed healing, and graft failure.

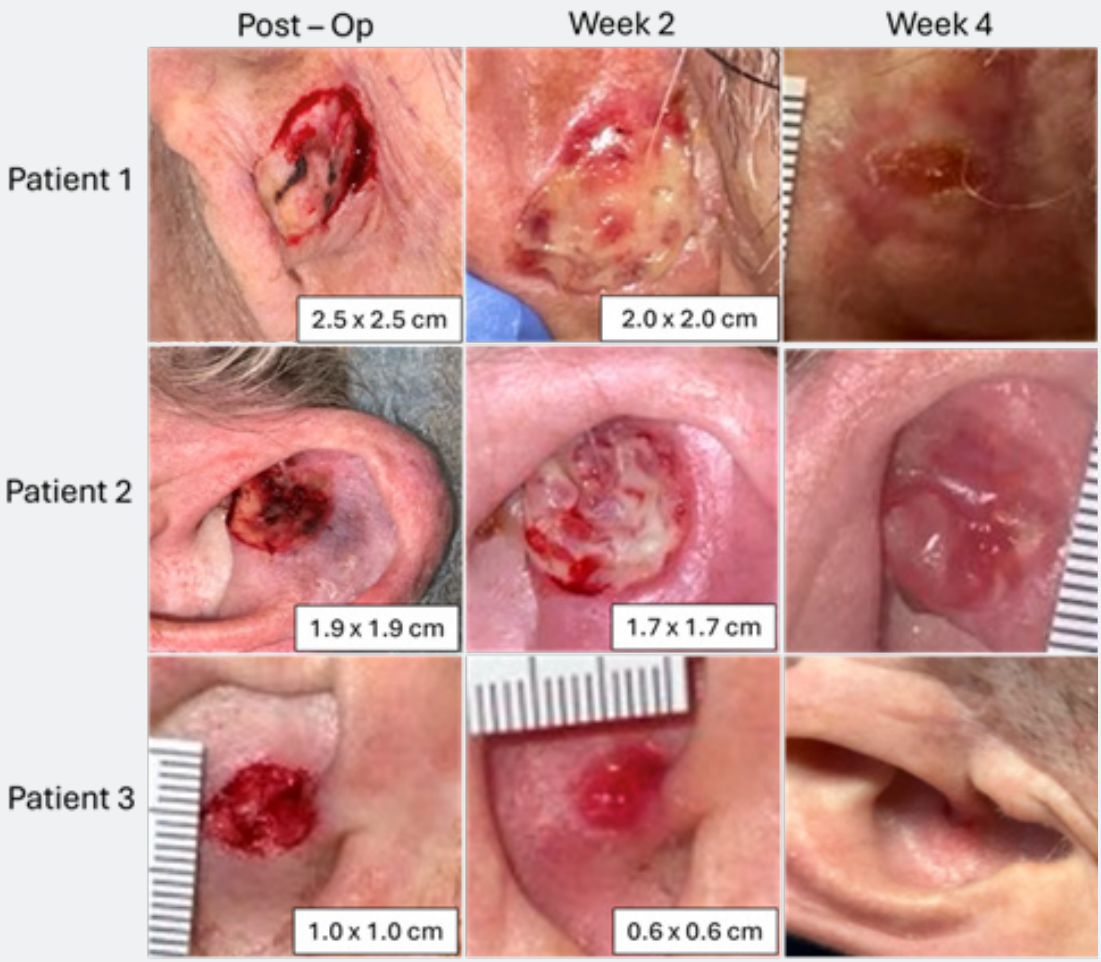

Figure 1: Post-operative, week 2, and week 4 images wounds for each patient.

Conclusion

These findings suggest that CHD-assisted SIH not only shortens healing time for auricular MMS wounds compared with historical controls but also provides a practical, affordable, and patient-centered modality that can be safely managed outside the clinic. Across three diverse patients, including one elderly, one with a prior failed graft, and one immunocompromised, all wounds achieved epithelialization by 4 weeks, a markedly accelerated timeline relative to the expected 6–10 weeks for auricular SIH.

The ability for patients to self-apply the dressing at home, with minimal clinical oversight, highlights the potential of this approach to reduce healthcare utilization, improve patient satisfaction, and broaden access to advanced wound care. The CHD's in vitro bioactive properties, combined with ease of use and compatibility with standard secondary dressings, may explain the consistent outcomes observed even in high-risk clinical scenarios.

Future prospective studies with larger cohorts are needed to confirm these results, quantify long-term cosmetic and functional outcomes, and evaluate cost-effectiveness compared to traditional reconstructive strategies. If validated, CHD-assisted SIH could represent a paradigm shift in managing auricular MMS defects by accelerating healing, reducing treatment burden, and lowering costs to the healthcare system.

Author Disclosures

A.D. is a consultant to SweetBio, Inc. I.R. and R.B. are employees of SweetBio, Inc. N.D, which declaress no conflicts of interest related to this work.

How to cite this article: Isaac Rodriguez PhD, Rachel Beem BS, Nathalie Dhir BSN, Anir Dhir MD. Wound Healing of Auricular Defects After Mohs Surgery Using an At-Home, Patient-Applied Collagen-Mānuka Honey-Hydroxyapatite Dressing. JOJ Dermatol & Cosmet. 2025; 7(1): 555701. DOI: 10.19080/JOJDC.2025.07.555701

References

1. Brent B (1992) Auricular repair with autogenous rib cartilage grafts: two decades of experience with 600 cases. Plast Reconstr Surg 90(3): 355-374.
2. Adams LA, Sykes JM (2013) Complications of auricular surgery. Facial Plast Surg Clin North Am 21(4): 631-648.
3. Zitelli JA, Fazio MJ (1991) Reconstruction of the ear after Mohs surgery. J Dermatol Surg Oncol 17(9): 791-796.
4. Cook JL (2001) Reconstruction of the ear following Mohs surgery. Dermatol Clin 19(2): 321-332.
5. Daowei Li, Haizhu Sun, Liming Jiang, Kai Zhang, Wendong Liu, et al. (2014) Enhanced biocompatibility of PLGA nanofibers with gelatin/nano-hydroxyapatite bone biomimetics incorporation. ACS Appl Mater Interfaces 6(12):9402-9410.
6. Mohamad Pezeshki-Modaress, Sareh Rajabi-Zeleti, Mojgan Zandi, Hamid Mirzadeh, Niloofar Sodeifi, et al. (2014) Cell-loaded gelatin/chitosan scaffolds fabricated by salt-leaching/lyophilization for skin tissue engineering: in vitro and in vivo study. J Biomed Mater Res A 102(11): 3908-3917.
7. Pezeshki-Modaress M, Mirzadeh H, Zandi M (2015) Gelatin-GAG electrospun nanofibrous scaffold for skin tissue engineering: fabrication and modeling of process parameters. Mater Sci Eng C Mater Biol Appl 48: 704-712.
8. Scott A Sell, Patricia S Wolfe, Andrew J Spence, Isaac A Rodriguez, Jennifer M McCool, et al. (2012) A preliminary study on the potential of Manuka honey and platelet-rich plasma in wound healing. Int J Biomater 2012: 313781.
9. Massimiliano Gasparrini, Sadia Afrin, Tamara Y Forbes-Hernández, Danila Cianciosi, Patricia Reboredo-Rodriguez, et al. (2018) Protective effects of Manuka honey on LPS-treated RAW 264.7 macrophages. Food Chem Toxicol 120: 578-587.
10. Johnston M, McBride M, Dahiya D, Owusu-Apenten R, Nigam PS (2018) Antibacterial activity of Manuka honey and its components: an overview. AIMS Microbiol 4(4): 655-664.
11. Minden-Birkenmaier BA, Bowlin GL (2018) Honey-based templates in wound healing and tissue engineering. Bioengineering (Basel) 5(2): 46.
12. Rumi Okabayashi, Miho Nakamura, Tamaki Okabayashi, Yumi Tanaka, Akiko Nagai, et al. (2009) Efficacy of polarized hydroxyapatite and silk fibroin composite dressing gel on epidermal recovery from full-thickness skin wounds. J Biomed Mater Res B Appl Biomater 90(2): 641-646.
13. Vilardell AM, Cinca N, Jokinen A, et al. (2016) Real-time protein and cell binding measurements on hydroxyapatite coatings. J Funct Biomater 7(3): 23.
14. Kenichiro Kawai, Barrett J Larson, Hisako Ishise,Antoine Lyonel Carre, Soh Nishimoto, et al. (2011) Calcium-based nanoparticles accelerate skin wound healing. PLoS One 6(11): e27106.
15. Isaac A Rodriguez, Scott A Sell, Jennifer M McCool, Gunjan Saxena, Andrew J Spence, et al. (2013) A preliminary evaluation of lyophilized gelatin sponges enhanced with platelet-rich plasma, hydroxyapatite and chitin whiskers for bone regeneration. Cells 2(2): 244-265.
16. Majeed AA, Al Naimi RA (2012) Role of hydroxyapatite in healing of experimentally induced cutaneous wound in rabbits. Iraqi J Vet Sci 26(1): 41-47.
17. Williams M, Rodriguez I, Strombergsson A, Fabbri S, Westgate S (2021) A novel bioengineered wound product with in vitro capabilities to reduce bacteria. Biomed Transl Sci. 1(1): 1-3.
18. Rodriguez I, Conti T, Bionda N (2021) Microenvironment influence of a novel bioengineered wound product, APIS®: a preliminary in vitro analysis of inflammatory marker and growth factor secretion. Int J Biomater 2021: 6612870.
19. Rodriguez I, Conti T, Bionda N (2022) A preliminary direct comparison of the inflammatory reduction and growth factor production capabilities of three commercially available wound products. Int J Mol Sci 23(18): 10670.
20. Isaac Rodríguez, Alejandra Alvarez, Cara Massey, LaDawn Miller, Rene Rannou, et al. (2023) Novel bioengineered collagen with Manuka honey and hydroxyapatite sheet for treatment of lower extremity chronic wounds in an urban hospital wound care setting. Wounds 35(1): E35-E38.
21. Isaac A Rodriguez, Axel Strombergsson, Robert Weinstein, Amanda Maloney, Christopher Hendrix, et al. (2023) Preliminary clinical evaluation using a novel bioengineered wound product to treat lower extremity ulcers. Int J Low Extrem Wounds 22(1): 139-145.
22. McMurray SL, Wallace MM, Stebbins WG, Clayton AS (2021) Use of a novel biomaterial to enhance secondary intention healing. Dermatol Surg 47(6): 843-844.
23. Arnaud K, Wallace MM, Wheless LE, Stebbins WG, Clayton AS (2023) Novel biomaterial containing gelatin, Manuka honey, and hydroxyapatite enhanced secondary intention healing versus standard secondary intention healing in Mohs surgical defects: randomized controlled trial. Dermatol Surg 49(12): 1160-1164.
24. Levin BC, Adams LA, Becker GD (1996) Healing by secondary intention of auricular defects after Mohs surgery. Arch Otolaryngol Head Neck Surg 122(1): 59-63.
25. Schwartzman G, Cartron AM, Khachemoune A (2021) Review and reappraisal of assessment parameters of second intention healing after Mohs micrographic surgery. Arch Dermatol Res 314(1): 17-23.
26. A Gavillero Martín, M Juliá Roca, I Serra-Guillén, A Rodríguez-Hernández, E Manrique-Silva, et al. (2025) Secondary intention healing time of postoperative surgical cancer skin defects: A multicenter observational study. Actas Dermosifiliogr 116(1): 47-54.
37. Sagban TH, Jaccob AA, Yaqoub AA (2024) Khadim, H. Steroid misuse in Iraqi women. Iraqi J Pharm Sci 33: 195-208.
38. Romano C, Maritati E, Gianni C (2006)Tinea incognito in Italy: 15-year survey. Mycoses 49: 383-387.
39. Ravindran S, Prabhu SS, Nayak SU (2021) Topical steroid damaged skin: A clinical study. J Pak Assoc Dermatol 31(3): 407-414.

How to cite this article: Isaac Rodriguez PhD, Rachel Beem BS, Nathalie Dhir BSN, Anir Dhir MD. Wound Healing of Auricular Defects After Mohs Surgery Using an At-Home, Patient-Applied Collagen-Mānuka Honey-Hydroxyapatite Dressing. JOJ Dermatol & Cosmet. 2025; 7(1): 555701. DOI: 10.19080/JOJDC.2025.07.555701

DOI: 10.19080/JOJDC.2025.07.555701

How to cite this article: Isaac Rodriguez PhD, Rachel Beem BS, Nathalie Dhir BSN, Anir Dhir MD. Wound Healing of Auricular Defects After Mohs Surgery Using an At-Home, Patient-Applied Collagen-Mānuka Honey-Hydroxyapatite Dressing. JOJ Dermatol & Cosmet. 2025; 7(1): 555701.
DOI: 10.19080/JOJDC.2025.07.555701