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Use of Bovine Xenografts for Nasal Defects After Mohs Micrographic Surgery

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ABSTRACT

Background: Nasal defects after skin cancer excision can often be healed by second intention in certain circumstances.
Objective: We aim to demonstrate the utility of bovine collagen xenografts in supplementing second-intention healing of a variety of nose surgical defects.
Results: Thirty-nine patients underwent Mohs micrographic surgery of the nasal tip (33%), ala (23%), dorsum (31%), sidewall (10%), and root (3%) with the application of bovine collagen xenograft. The average defect size was 1.89 cm^2 (0.36 – 7.5 cm^2). The average time to re-epithelialization was 33 days (range, 11 – 60 days) at a rate of 19.4 days to healing per cm^2 of defect size, which represented an improved time to reepithelialization of over 40% compared to historical controls of second intention healing. Cosmetic outcomes were outstanding or acceptable in 77% of the cases.
Conclusion: Bovine collagen xenografting is a safe and effective method to enhance the second intention of healing Mohs excision defects of the nose, with overall excellent cosmetic results.

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INTRODUCTION

Nasal defects after Mohs micrographic surgery have a myriad of closure and reconstruction methods, including second intention, split or full-thickness skin grafts, local flaps, and pedicled flaps. Commonly, for superficial and smaller defects of the nose, second-intention healing results in cosmetic outcomes that are arguably superior to that of surgically sutured repairs.[1-3] This is especially true in the concave areas of the nose, such as the nasal sidewall, alar crease, and lateral nasal dorsum, where naturally shadowed contours hide light reflex or pigmentation differences normally revealing of nasal scars.[2] When used for appropriate wounds based on location, size, depth, and patient preference, second-intention healing has many advantages, including decreased overall surgical time, a smaller scar profile, and high levels of patient satisfaction.[4] However, its main disadvantages are prolonged healing time, daily bleeding and drainage from open wounds, and the possibility of wound infection.[5] Biologic dressings, or skin substitutes, are a useful option to overcome these disadvantages of second intention healing, with increasing use on acute surgical wounds to improve healing time, reduce wound complications, and alleviate the healthcare cost of prolonged wound care.

As of the last analysis in 2020, around 76 skin substitutes have been developed and commercially available in the United States.[6] While the majority of these products are designed for use in chronic non-healing wounds, their utility in the acute post-surgical setting has been recognized and increasingly explored.[7-13] Many different classification schemes have been utilized in the literature, categorized by cellular composition (amnion, epithelial, acellular allograft, cellular allograft, xenograft, composites, synthetics) and by intended skin layer replacement (epidermal, dermal, composite epidermal, and dermal).[6] To date, there have not been robust comparisons of products in terms of wound healing efficacy. Therefore, the selection of skin substitutes for regular use on acute surgical wounds is based on physician familiarity, overhead cost of the product, shelf life, insurance coverage, and patient considerations such as the need for frequent return visits for graft reapplication or wound debridement.

The authors have found bovine-derived collagen wound dressing (Puracol®, Medline Industries, Inc; Mundelein, IL) to be a cost-efficient workhorse skin substitute. As a xenograft, Puracol® is bovine-derived type 1 collagen in its native triple-helix formation, consisting of 88.4% collagen.[14] Its affordability,

long shelf-life, and convenience of use gives it distinct advantages over comparative skin substitute products for high-patient volume practice settings with a variety of wound sizes after surgery. It is indicated in use for partial and full-thickness wounds, surgical wounds, vascular wounds, and other surface wounds or abrasions.[15] Available sizes range from 5.1 x 5.7 cm^2 to 20.3 x 20.3 cm^2. Its shelf life is 3 years, with a cost of around $10 to $40 per unit, depending on size. Puracol® is considered the most cost-effective option of common xenograft skin substitutes available for use.[16]

The use of bovine-derived collagen wound dressing (BCWD, ie, Puracol®) has been investigated for wounds after Mohs micrographic surgery of the scalp and the lower extremities.[16,17] It was found to reduce the time to granulation of wounds with exposed bone, reduce the time to complete reepithelialization, diminish wound drainage, and decrease pain. Additionally, there is anecdotally reported evidence of improved cosmetic appearance after BCWD use compared to second-intention healing alone for scalp wounds.[16] In our experience, BCWD can be successfully used in any anatomic region with all of these same benefits. Here, we present a single-center case series experience with descriptive statistics of the use of BCWD in nasal defects after Mohs micrographic surgery.

MATERIALS AND METHODS

This study was approved by the institutional review board of Ascension St. Vincent Indianapolis. A retrospective review was performed at our single-site private practice of all applications of BCWD on Mohs micrographic surgery defects of the nose, performed between January 2022 and June 2023. Exclusion criteria were if any other forms of wound closures were additionally performed, such as a delayed full-thickness skin graft or flap or BCWD used in combination with a primary closure.

The process of applying BCWD at our practice is the following. After surgical clearance of skin cancer of the nose, BCWD were sutured to the existing epithelial wound edge and wound bed with 4-0 or 5-0 chromic gut. A non-bolstering pressure bandage was applied for 24 to 48 hours, and then patients continued daily wound care with petroleum jelly (Vaseline) and a non-stick gauze pad. Patients were instructed to shower with a bandage in place to avoid direct water pressure disturbing the graft. Patients returned for follow-up visits approximately every 4 weeks. Incidence of postoperative bleeding, drainage, pain, and surgical site infection were documented during these encounters. The date of complete re-epithelialization was recorded as either the patient-reported date or, if the patient could not recall, as the date of the follow-up visit upon confirmation of complete healing by one of the authors (JD, ES, and CWH). In addition, on follow-up visits where complete healing is noted, one of the authors (JD and ES) rated the cosmetic appearance of the final scar on a visual 3-point scale rating of "poor", "acceptable", or "outstanding". "Poor" outcomes were defined by significant atrophy, hypertrophy, notching, or other features requiring intralesional injection, surgical revision, or resurfacing. "Acceptable" outcomes were defined as minimal to slight atrophy or hypertrophy, not requiring further intervention. "Outstanding" outcomes were defined as a nearly imperceptible scar.

The medical records for all subjects were reviewed. Demographic data, medical history, and surgical data, including tumor type, location on the nose, number of Mohs stages, and depth of wound were coalesced. The primary outcome analyzed was time to re-epithelialization, which was compared to previously published historical controls of time to re-epithelialization of second intention healing of the nose.

RESULTS

Thirty-nine patients with 39 tumors were included in this study. The surgeries and subsequent follow ups ranged from January 2021 to June 2023. All tumors were treated with Mohs micrographic surgery and a single application of BCWD. No other reconstruction method was performed. Patient demographics are outlined in Table 1. The mean age at the time of surgery was 74 years, with a slight majority of patients of male gender (54%). Smoking, use of anticoagulants, and history of diabetes were also recorded. No patients were on immunosuppressive medication.

Procedural characteristics of the tumor type, location on the nose, and depth of tumor extirpation are described in Table 2. Basal cell carcinoma was the majority of the cases (77%), followed by squamous cell carcinoma (18%) and melanoma (5%). Location on the nose was categorized by nasal sidewall (10%), nasal root (3%), nasal dorsum (31%), nasal tip (33%), and nasal ala (23%). The majority of the wounds had depth to the fat (90%).

TABLE 1.

Patient Demographics	
Age in years, mean (SD)	74 (13.3)
Male gender, n (%)	21 (54)
Smoking, n (%)	
Yes	2 (5)
No	37 (95)
Anticoagulants, n (%)	
Yes	19 (49)
No	20 (51)
Diabetes, n (%)	
Yes	3 (8)
No	36 (92)

TABLE 2.

Procedure Characteristics	
Cancer type, n (%)	
Basal cell carcinoma	30 (77)
Squamous cell carcinoma	7 (18)
Melanoma	2 (5)
Nose Location, n (%)	
Sidewall	4 (10)
Root	1 (3)
Dorsum	12 (31)
Tip	13 (33)
Ala	9 (23)
Depth of wound, n (%)	
Fat	35 (90)
Muscle	2 (5)
Perichondrium	1 (2.5)
Cartilage	1 (2.5)

TABLE 3.

Outcomes	
Length of follow-up in days, mean (range)	50 (27-221)
Time to Re-epithelialization in days, mean (range)	33 (11-60)
Post-excision wound area in cm^2, mean (range)	1.7 (0.48-7.5)
Post-epithelialization wound area in cm^2, mean (range)	0.7 (0.12-3.75)
% wound contraction after re-epithelialization, mean	54 (-210-92)
Complications, n (%)	
Bleeding	10 (25.6)
Drainage	19 (48.7)
Pain	8 (20.5)
Infection	0 (0)
Physician rating of cosmetic outcome	
Poor	9 (23)
Acceptable	14 (35.9)
Outstanding	16 (41)

Table 3 depicts a descriptive analysis of outcomes. All 39 patients were followed until at least the time of reepithelialization, and 23 patients were followed after re-epithelialization, between one week and several months after healing. The mean follow-up time was 50 days. The mean post-excision wound surface area was 1.7 cm^2, and the mean time to re-epithelialization was 33 days. In terms of the rate of healing, this equates to 19.4 days per cm^2 of defect size (33 days/1.7 cm^2).

Mean post-excision and post-epithelialization wound areas were 1.7 cm^2 and 0.7 cm^2 respectively, demonstrating a mean wound contraction of 54%. Rates of complications were overall low, with 25.6% experiencing bleeding, 48.7% experiencing drainage, and 20.5% experiencing pain at the surgical site. Antibiotic prophylaxis for 7 days was used in all cases. No incidences of infection requiring the need for further antibiotics during the course of healing occurred. The majority of healed wounds had "outstanding" (41%) or "acceptable" (35.9%) cosmetic outcomes, with 23% of wounds rated as "poor".

DISCUSSION

Skin substitutes have gained increased interest in recent years as useful tools to aid in second-intention healing for wounds after skin cancer excision. While the successful and effective use of BCWD (Puracol®) has already been reported for wounds of the scalp and lower extremity, its application for nasal defects has not been investigated until now.[16,17]

The predominant benefit seen with the use of BCWD in established studies is an increased rate of healing compared to second-intention healing. In a case series of 11 scalp wounds with calvarium exposed healed with BCWD, wounds reepithelialized 70% faster compared to historical controls of scalp wounds healed by second intention healing alone.[16] This is similar to our experience. The rate of healing of our case series demonstrated a re-epithelialization rate of 19.4 days per cm^2 of defect size. As a historical comparison, 2 studies have published a case series of nasal defects healed with second intention healing.[18,19] Yeh et al featured 6 patients with nasal defects with an average defect size of 0.77 cm^2 and an average time to reepithelialization of 25.7 days, equating to 33.4 days per cm^2 of defect size.[18] Jin et al performed a separate case series of 10 patients with nasal defects with an average defect size of 0.39 cm^2 and an average time to re-epithelialization of 17.7 days, equating to 45.7 days per cm^2 of defect size.[19] Therefore, in our case series, BCWD increased the rate of healing by 42 to 58% compared to second-intention healing alone.

In our experience, BCWD may also enhance cosmetic outcomes of nasal defects over second-intention healing. An atrophic or "divoted" contour is of predominant cosmetic concern when choosing second-intention healing to heal a post-Mohs defect of the nose. The addition of BCWD to the nasal wound defects can result in a more favorable and "filled" contour. Of the 39 surgical defects, 30 (77%) had an outstanding or acceptable cosmetic result (Figure 1). The 9 surgical defects rated as "poor" were all of size 1 cm^2 or larger, including one patient with a 3 x 2.5 cm defect of the nasal ala to the depth of cartilage who refused a flap or graft. Three of the defects had predictable

FIGURE 1. 1.0 x 1.0 cm defect of the nasal dorsum treated with a single application of BCWD. Left photo is immediately after tumor extirpation. Middle photo with BCWD sutured in place with chromic gut. Right photo on follow-up at month 4. This is an example of a typical cosmetic outcome of a scar rated as "outstanding" with minimal to no contour deformity, good light reflection, and minimal to no residual dyspigmentation or erythema.

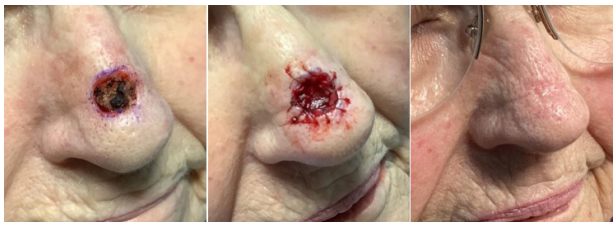
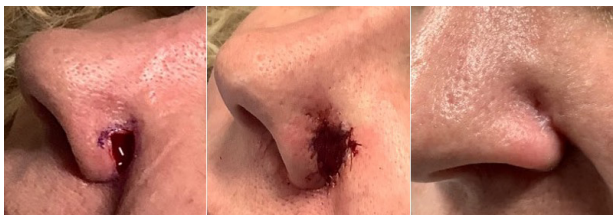


FIGURE 2. 1.1 x 1.1 cm defect of the left nasal ala treated with a single application of BCWD. Left photo is immediately after tumor extirpation. Middle photo with BCWD sutured in place with chromic gut. Right photo demonstrates the scar at follow-up 3.5 months after surgery. The scar was rated as a "poor" cosmetic outcome due to the presence of webbing.



anatomic region-associated complications, such as webbing of the medial canthus and nasolabial fold and alar notching (Figure 2). The other defects all exhibited atrophy or hypertrophy that resolved to good patient satisfaction after laser resurfacing, dermabrasion, or intralesional steroid injections.

Patients should be counseled to expect shrinkage of the wound defect due to inherent wound contraction. Nasal defects healed by the second intention demonstrate wound contraction by 59 to 79%.[20] Our case series showed a similar mean wound contraction of 54%, suggesting that BCWD does not affect this natural beneficial process.

CONCLUSION

BCWD is an effective and safe skin substitute that facilitates second-intention healing for excisional wounds of the nose through faster healing time, excellent cosmetic outcome, and minimal pain, bleeding, and drainage.

DISCLOSURES

The authors have no conflicts of interest to disclose.

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