# The Use of an Optimal Formulation to Deliver Pure Hypochlorous Acid (Free-Hypochlorite) in a Highly Concentrated Antimicrobial Wound Gel*, Tested in Real-World Practice at a Busy Wound Center

Jason Garrison, M.D., FACEP, FAAEM, UHM [1]; Sandra Corsi, MSN, APRN, AGPCNP-BC, CWS, DWC[1], Aurielle Ballard, BSN, RN, Riverside Advanced Wound Care Center, Newport News, Virginia

## BACKGROUND

Hypochlorite-Free Pure Hypochlorous Acid (pHA) as a wound cleanser is highly evidence-based and effective for bacterial control and pH regulation. While a liquid cleanser containing pure HOCl has an immediate effect, a gel form may allow for more prolonged germ removal and autolytic (slough) removal. It may be synergistic with the HOCl-based liquid cleanser. In our busy wound center, we selected wounds that may benefit from HOCl (hypochlorite-free) products, cleansing them first with a pure HOCl solution, followed by application of a pure HOCl-based antimicrobial wound gel. We report the results from a wide variety of wounds.

## METHODS

For patients, wound details are shown in Table 1.

- 33 patients were studied over the period of 5 months (October 2025-February 2026).
- Patients selected were patients with a total of 43 wound types classified as chronic, acute, pressure, inflammatory, and or surgical wounds, treated in an outpatient facility wound clinic, and at home health settings.
- Sample population included
  - 19 males (59%) and 13 females (41%), with an age range between 25 and 89 years.
- For patients, ***wound type, wound location, wound chronicity, and wound frequency dressing change*** refer to Figures 1, 2, 3, and 4.

**Figure 1:** Wound Type Percentage Per Patient

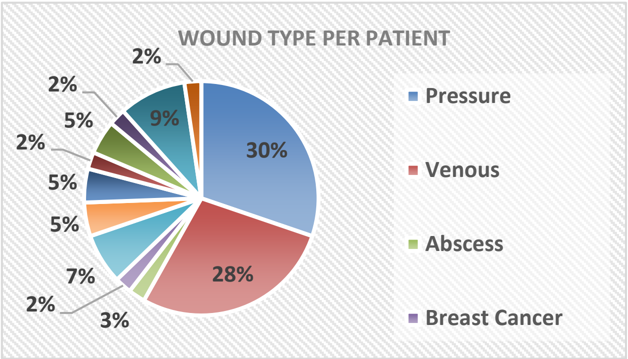
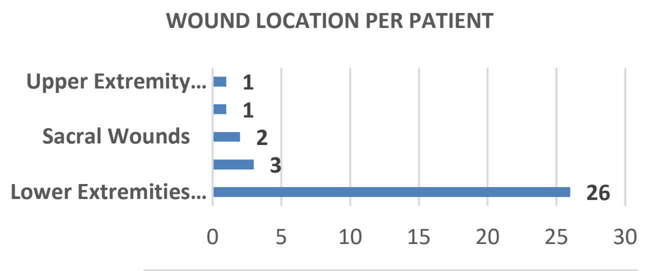



**Figure 2:** Wound Location Per Patient Number




| | Lower Extremities Wounds | Breast Wounds | Sacral Wounds | Cranial-Scalp wound | Upper Extremity Wound |
|---|---|---|---|---|---|
| Number | 26 | 3 | 2 | 1 | 1 |

**Figure 3:** Wound Chronicity Per Patient Number

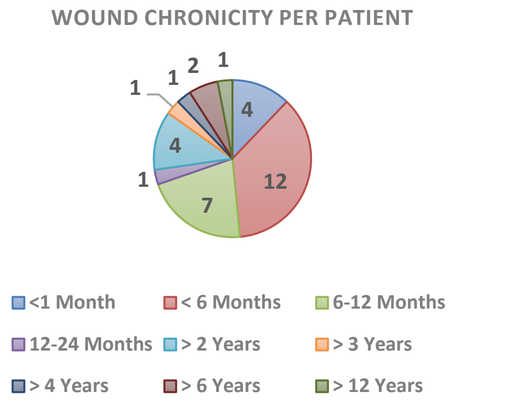
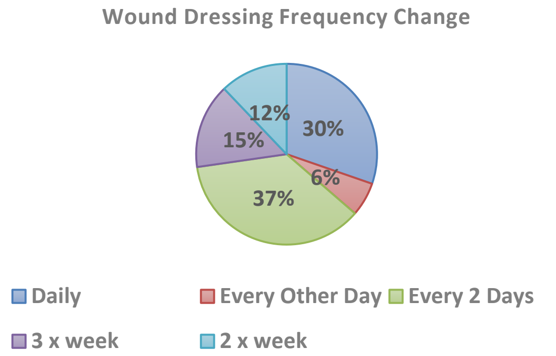



**Figure 4:** Wound Dressing Change Per Percentage




- Wound outcomes evaluated
  - Patient tolerance
  - Wound size change
  - Treatment change or discontinuation
  - Granulation
  - Wound bed healing evaluation

## RESULTS

- A high degree of patient tolerance and ease of application was noted among the study participants
- Most of the patients, 32 out of the 33 (97%), tolerated the treatment without any major side effects or complications
- 1 patient (3%) among the 33 had sacral wound deterioration. However, changing the second dressing to collagen resolved this patient's wound deterioration
- Foam secondary dressings were most suitable, providing better periwound protection and exudate management
- Slough removal was improved and, in some early cases, effective enough to transition to a collagen product
- Wound-healing progress was reported in most patients with wound slough burden reduction, granulation improvement, wound size reduction, and wounds becoming cleaner
- Daily reapplication and dressing changes provided the most effective treatment outcome. However, given the cost of dressing supplies and the availability of assisted care for some patients, most dressings were done every 2-3 days.

*Vashe Antimicrobial Wound Gel, Urgo Medical North America Fort Worth, TX

Poster is presented with support from Urgo Medical North America, Forth Worth, TX

**Case Study 1:**

84-year-old male with chronic nonhealing left lower leg venous insufficiency ulcers, nonhealing since 2023, multiple clusters episodically treated with oral antibiotics, inconsistent compression, suboptimal nutrition with albumin less than 3, complicated by MRSA colonization, metastatic melanoma, CKD, AF on Eliquis anticoagulation, Raynaud's, COPD, venous insufficiency with chronic lower extremity edema. He has had vascular interventions, including angioplasty and varicose ablations. Wound care attention to nutrition, consistent edema attention with compression dressings, wound hygiene and infection mitigation, dressing management for drainage and pain control. Wound clinic care was initiated in October; pure hypochlorous acid gel for biofilm management, with enterococcal colonization identified by surveillance culture, was added in November during regular 3X weekly dressing changes. Improvement in wound characteristics, with reductions in slough and drainage, followed by a progressive decrease in wound size, continues with topical pure hypochlorous acid gel*, achieving 80% wound reduction in the clustered wound area within 12 weeks.

**Case Study 2:**

A 70-year-old female with nonhealing left lower extremity venous insufficiency ulcers present over 14 months, unresponsive to OTC and local treatment, including Neosporin topical and peroxide, was referred to the wound clinic for care. Healing complicated with a history of anemia, leukopenia, HLD, vitamin D deficiency, and CKD 3 with no diabetes or vascular disease, screening ABIs remotely right 1.18 and left 1.20 without ischemic symptoms or diagnosed arterial disease, ambulatory, independent, nonsmoker. Significantly lower extremity edema without a history of DVT, but attributed to remote ankle fractures, had difficulty attending clinic appointments and declined home health assistance for dressing management, with family assistance due to suboptimal availability. Eventually, able to obtain and inconsistently use velcro compression; nutrition adjustments continue with BMI 38, better elevation, and avoidance of clinical infection, with some gradual improvement. The addition of a highly charged fiber dressing for debridement and microbial colony control was augmented by the availability of pure hypochlorous acid gel* for topical application, with dressing changes occurring 3 X weekly. Wound characteristics improved, including no clinical infection, healthy granulation tissue, reduced slough, decreased pain, and early epithelial migration.

**Table 1: Patients' Wound Summary**

| Patient | Wound Type | Location | Chronicity | Start | Stop | Application | Secondary Dressing | Frequency | Compliance | Comorbid Affecting Factors | Outcome | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70 Female | Venous, Lymphedema | Bilateral Lower Extremities/Feet | <6 months | 10/6/2025 | 10/15/2025 | Riverside HH/in facility | Absorptive, Exudry | 3 x week | Compliant | N/A | Stopped 2/2 repeat hospitalization, rehab | Hosp 10/14-10/17 (AKI/AFIB); Hosp 11/16-constipation & debility (D/C from rehab, can't care for self)-while in hospital, inpatient wound team not following with outpatient recommendations |
| 77 Male | Cutaneous Abscess | Left Tight | 1 month | 10/3/2025 | 10/29/2025 | Commonwealth HH | Nonbordered absorptive (Zetuvit) | 3 x week | Compliant | N/A | Wound healed | 10/13/25 follow-up clean, smaller. 10/29/25 healed |
| 71 Male | Venous | Left Ankle | 4 months | 10/8/2025 | 11/10/2025 | Caregiver | Foam (Mepilex) | Q2 days | Compliant | Edema-In compression stockings | Stopped 2/2 complaints-continued to burn on application. Hyperesthesia is limited to wound areas, possibly due to ischemic or diabetic neuropathy. | 10/23/2025 (2 wk/ F/U): slight burning (30-45 min). The gel didn't harden. Using a contact layer. Not using barrier cream. No maceration to the periwound. 11/23/25 F/U improved vascular budding, no infection, but burns. |
| 28 Male | Pressure-Stage 3 | Right Plantar Foot | 5 months | 10/8/2025 | 1/12/2026 | Caregiver | Bordered foam (Mepilex) | Daily | Compliant | Paraplegia dependent edema | Wound improved, changed treatment | 10/29/2025 F/U: Reports found easy to apply; no evidence of topical irritation; remains moist between changes. Decreased size with no clinical infection, 12/22/2025. Improvement noted 01/12/2026: decrease in size. Transition to collagen. |
| 63 Male | Venous | Bilateral Lower Extremities | 10 months | 10/15/2025 | 12/1/2025 | Riverside HH | Vented, adaptive, absorbent, wrap | 2 x week | Compliant | N/A | N/A | 11/5/2025 Bilateral lower extremity ulcers with hypergranulation and minimal bleeding, improving in size and appearance. Tolerating well. 12/1/2025: No complaints, continued improvement. |
| 52 Female | Atypical Ulcer, Psoriasis | Right Leg | 1 month | 10/15/2025 | 11/10/2025 | Self | Adaptive touch, bordered foam | Q2-3 days | Compliant | PAD/DM2 with neuropathy/Edema/Psoriasis – Otezla stopped | Wound improved, changed treatment | 10/30 Tolerating well. No burning. Periwound skin irritation – reports gel tolerated without issues through the wound. 11/10/2025 F/U: Vascular base started—changed treatment. 12/1/2025 clean, smaller. Changed therapy. |
| 56 Male | Venous, Lymphedema | Right Leg | Chronic-4 years | 10/22/2025 | 12/29/2025 | Self/Clinic | Contact, (Adaptic touch), absorbent, as needed, drawtex, wrap | Q2 days | Compliant | Primary Lymphedema/CVI with recurrent cellulitis | Wound improved, changed treatment | Using RT Leg, the left is the control leg. 11/3/2025: Patient reports no burning or irritation. Improved appearance of the skin. Clinically cleaner appearance, no infection/inflammation. 11/19/2025 F/U: Gel makes drawer harder to remove, no complaints. Continue to see a better appearance. 12/30/2025: Switched to collagen. |
| 65. Female | Breast CA | Left Breast | 8 months | 10/30/2025 | Not Applicable (N/A) | Self | Age rop around the fungating edges, ABD. Add Flagyl gel on alternating days for odor control | Daily | Compliant | On chemotherapy | N/A | 11/20/25 F/U: Easy to use, no burning. Wound vascularized bed with fibrous slough covering, stable. 01/20/2026: Left breast with excoriated periwound. Necrotic neoplastic tissue is present with a mild odor. Large, full-thickness ulcerated cavity, moderately eroded firm mass with thick slough cover and vascularized bed. Thick edges with crusted rim. No fluctuance. |
| 83 Female | Venous | Left Lateral Malleolar | Acute< 3 | 10/31/2025 | 12/10/2025 | Adv Wound Clinic/11/12/2025 home health started | HCFD, Exudry, 2-layer wrap | 2x week | Complaint | AFib, Pacemaker | Wound improved, changed treatment | 11/7/25 – Follow-Up: The wound is painful, rated 10/10, reduced to 5/10 with medication. Two adjacent, rounded, tender, full-thickness ulcers with a thick, fibrous, adherent yellow slough bed. 11/18/25: Tolerating treatment, no burning. Wound improving. No infection. 12/10/2025: Treatment changed to collagen. |

**Table 1: Cont.**

| Patient | Wound Type | Location | Chronicity | Start | Stop | Application | Secondary Dressing | Frequency | Compliance | Comorbid Affecting Factors | Outcome | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 Male | Venous, Lymphedema | Left Medical Malleolus | Chronic | 11/3/2025 | N/A | Self | Absorbant, exurdy patient preference | Q2 days | Unclear | Hx medical non-compliance | N/A | 11/19 – Follow-Up Cancelled 01/06/2026: Shallow ulcer with tiny openings. 01/20/2026: Clustered shallow erosion group on the lower leg and ankle with a surrounding healed pink hyperpigmented area within a hyperpigmented zone of vascular insufficiency. No erythema or Calor. No deep structures exposed. No joint instability or effusion. |
| 31 Female | Trauma/Soft Tissue Necrosis secondary to xylazine use | Left Leg | Chronic | 11/4/2025 | N/A | Self | Absorbant, exudry, kling, ACE | Daily | Compliant | Scarring, ongoing tobacco use | N/A | 11/19/25 – Follow-Up: Doing well. Easy application, no irritation. Cleaner appearance with a few vascular buds noted but remains dry with fibrous slough. 12/11/2025: Clinically cleaner edges. No cellulitis or vascular compromise. 12/15/2025: Patient reported not using treatment; encouraged to use. Stable fibrofatty bed appearance, not ischemic, no cellulitis. Wound has a thin yellow slough covering and a few stable red vascular buds on an otherwise dry, fibrous bed. Dry attached edges with minimal migration. 01/23/26: Stable fibrofatty bed appearance, not ischemic, no cellulitis. Dry attached edges with minimal migration. |
| 55 Male | Pressure-Stage 4 | Sacrum | Chronic- 6 years | 11/7/2025 | 12/5/2025 | Caregiver | Collagen + alginate, sacral dressing | Daily | Compliant | Quadriplegia, diarrhea | Wound improved, changed treatment | 12/5/25 – Palliative Program Follow-Up: Significantly smaller, cleaner, no infection. Easy to use. Changed to collagen gel. |
| 84 Male | Venous | Left Leg | Chronic-3 years | 11/7/2025 | N/A | Riverside HH | Contact (adaptic Touch), foam absorptive (Mepilex), compression wrap | 3 X weekly | Complaint | CVI, Metastasis Melanoma-holding immunotherapy at present | N/A | 11/21/25 – Follow-Up: No burning or discomfort from gel. Clean, no clinical infection. No pain. Home health notes continued improvement and no pain. 12/15/2025: Ulcers on the left proximal leg are improving with current treatment. No infection. Swelling controlled. Pure Hypochlorous Acid (pHA) gel is effective and well-tolerated. 01/06/2026: Scattered shallow erosions previously covered by black crusted areas. Ag nitrate wash to granule regions cleaned, revealing a clean epithelialized base. No maceration. Minimal drainage. Non-tender. No cellulitis. 12/1/2026: Numerous scattered shallow erosions previously covered by black crusted areas. Ag nitrate wash to granule regions cleaned, revealing clean epithelializing base. No maceration. Minimal drainage. Non-tender. No cellulitis. |
| 2005-199 | DFU/S/P TMA. S/P Surgical Dehiscence | Right Foot | 1 year 10 months | 11/7/2025 | N/A | Self | Absorptive, kerlix, compression ACE | Daily | Unclear | Hx noncompliance with offloading | N/A | 12/12/2025: Ulcer smaller in length, larger in width, with fibromuscular base and wet top. No bone visible. Progressing with swelling and moisture at inside lip. |
| 33 Male | Non-Healing Surgical Wound | Left Knee | 3 months | 11/12/2025 | N/A | Self | Silver Contact (vented dressing), absorptive (Mepilex), kling, ACE compression | Q 1-2 days | Compliant | Tendon/bone exposure, edema, joint fluid. Ordered CTA, vascular study | N/A | 11/26/25 – Follow-Up: Tolerating treatment. Some granular rims were noted around the exposed hard white patellar bone. No clinical infection. Further workup pending. 12/17/2025: The wound is contracting and measuring smaller. No signs of infection. 01/08/2026: Exposed patella in the wound is desiccated but hard. No drainage, purulence, or clinical infection. |
| 72 Female | Scalp ulcer, sarcoidosis | Cranial Vertex | Chronic >2 years | 11/19/2025 | N/A | Self | Highly charged fiber dressing (HCFD) | Daily | Compliant | DMII controlled, On MTX, steroid taper completed | N/A | 01/19/2026 – Phone Follow-Up: No issues. Easy to use. Tolerating. 01/19/2026: Ulcer size increased with crusting and trauma from the bump. No bone exposure. Delayed healing, possibly due to frequent dressing changes. |
| 57 Male | Venous Lymphedema | Left Leg | Chronic 2 years | 11/25/2025 | 1/6/2026 | Self | Bordered foam (Mepilex), 2 Layer Wrap | Daily | Compliant | Eczema on Dupixent; CVI with 2/2 lymphedema | Wound improved, changed treatment | 12/09/2025: Wound appears slightly larger upon measurement but visually seems stable or smaller. No signs of infection. 01/06/2026: Shallow wound with granular buds centrally. Skin bridge noted. Changed to collagen gel. |
| 65 Male | Trauma | Left Anterior Leg | 4 months | 11/20/2025 | 12/11/2025 | Self | Absorptive, Kling | Q2 Days | Compliant | Calciphylaxis suspected | | 12/11/2026 – Treatment Stopped: Discontinued due to burning |

**Table 1: Cont.**

| Patient | Wound Type | Location | Chronicity | Start | Stop | Application | Secondary Dressing | Frequency | Compliance | Comorbid Affecting Factors | Outcome | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 84 Male | Pyoderma Gangrenosum | Left Leg | 4 months | 11/21/2025 | N/A | Riverside HH | Polymem, ABD, Kling, Spandigrip (compression) | 2x week | Compliant | Pyoderma Gangrenosum, Shellfish, Allergy. Iron deficiency anemia. PVD. Chronic DVT | N/A | 12/16/2025 – Home Health Note: Improved pain. Wound improving with less exudate and more red base. 01/07/2026: Lateral mixed, smaller. Cleaned today only. No debridement needed. |
| 70 Female | Venous | Left Lateral-Posterior Leg | 14 months | 12/1/2025 | N/A | Self | HCFD | Q2 days | Compliant | Hyperlipidemia. Hypertension. CKD. | N/A | 12/15/2025: Improving left lateral posterior ankle ulcer. No significant depth. Controlled edema. No infection. Healthy surrounding tissue. 01/19/2026: Left lower leg granulated calf ulcer base showing contraction. Thick slough. Edges with a budding floor. Yellow thin slough cover. Stable leg edema with chronic fibrotic hyperpigmentation of chronic venous insufficiency. No clinical infection. |
| 33 Male | DFU | Right Plantar Foot | 2 months | 12/2/2025 | 12/11/2025 | Self | Ag ribbon surround, absorptive (Exudry), kling | Q2 days | Compliant | Location/ travel. Being referred to the clinic in MD for HBO proximity | N/A | 12/05/2025 – Vascular Follow-Up: Picture reviewed. Healthy vascular bed. Cleaner. No clinical infection. 12/11/2025: Large full-thickness oval submetatarsal plantar ulcer (right foot) with thickened macerated callus, avascular rim, fibrous-vascular floor with undermining surrounding. No bogginess or fluctuance. Malodorous calls from moisture without surrounding erythema or calor. |
| 52 Female | A1 pulley release; post-surgical dehiscence | Right 4th Palmar Finger | 2 weeks | 12/3/2025 | 12/9/2025 | Self | HCFD, Coban | Daily | Compliant | DMI | 12/9/2025 Changed to collagen | 12/05/2025 – Follow-Up: Improved fill. Edges dry. No clinical infection. |
| 62 Male | Venous | Left Lateral posterior Leg | > 2 years | 12/3/2025 | 1/7/2026 | Self | Contact, (Adaptic touch), ABD, Kling, Spandigrip compression | Q2 days | Compliant | Lymphedema, hx dressing intolerance | Wound improved, changed treatment | 01/07/2026: Improved wound bed characteristics but no significant change in size. Changed to collagen. |
| 67 Female | Venous | Right Leg | 1 year | 12/4/2025 | 1/8/2026 | Self | Absorbtant | Q2-3 Days | Complaint | Lymphedema. Obesity. DM2 | Wound improved, changed treatment | 12/16/2025: Granular mixed base, slightly fibrous, crusted debris. Hyperpigmentation to surrounding area is improved but still noted. 01/08/2026: Healing well with two skin bridges and edge migration noted. Remainder shows vascular budding granular base. Minimal debris. No infection. Cleaned. No debridement required. Changed to collagen gel. |
| 77 Male | Cutaneous Blister | Flank. Scalp | < 1 month | 12/5/2025 | 1/7/2026 | Self | Border Foam | Every 2 days | Complaint | HTN. Afib. Obesity. HX Skin cancer | Wound improved, changed treatment | 12/18/2025: Left anterolateral abdomen with clustered varied size round lesions, several desquamated. Crusting surface, distinct defined rims with minimal local erythema not consistent with cellulitis. No fluctuance or bogginess. Areas are tender. 01/07/2026: Left lateral abdominal abscess appears resolved. Scalp abscess shows improvement with reduced number of lesions and crusty purulent caps. |
| 67 Female | Pyoderma Gangrenosum | Bilateral Lower Extremities | Right Leg: 3 months Left. Leg: 12 months | 12/5/2025 | 12/19/2025 | Spouse | Polymem, Euxdry.Kerlix | Daily | Compliant | HTN. Pyoderma Gangrenosum | Treatment changed | 12/10/2025: Stable bilateral lower leg (R > L). Irregular shaped shallow ulcers with exquisite tenderness out of proportion. Yellow adherent slough cover and necrotic SQ/dermal debris. Few vascular budded areas with dermal level ulceration scattered throughout. 12/19/2025: Improvement in drainage and pain control. Yellow slough and vascular buds are present, more on the left leg. Changed to Santyl. |

**Table 1: Cont.**

| Patient | Wound Type | Location | Chronicity | Start | Stop | Application | Secondary Dressing | Frequency | Compliance | Comorbid Affecting Factors | Outcome | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 Female | Chronic Skin Ulcer | Right Breast | 6 years | 12/11/2025 | N/A | Home Health | Abd Pad | 2x week | Complaint | Breast cancer. Soft tissue radio necrosis. Lymphedema of the right extremity. DM2 | N/A | 12/11/2025 – Follow-Up: Improved. Fewer openings/involvement. Cleaner. No issues with application. 01/22/2026: Wound bed continues maturing. Less crusting at the cephalad central area. Some crusting in the axillary area with maturing epithelium. Shallow erosions on removal. No clinical infection. No deep structures exposed. |
| 25 Male | Chronic Skin Ulcer | Right Leg | 7 months | 12/11/2025 | 12/26/2025 | Self | Mepilex, Kling, Spandigrip | QOD | Complaint | Obesity. Marijuana | Unknown. Patient self-discharged from clinic. | 12/19/2025 – Patient MyChart Message: Wound getting worse. Visible yellowish-looking stuff around the wound. 12/26/2025: Patient self-discharged from clinic. |
| 64 Female | Chronic Skin Ulcer | Left Ankle | 5 months | 12/20/2025 | N/A | Self | HCFD | Q2-3D | Complaint | Chronic Venous Insufficiency. Hyperlipidemia. Hypertension. DM2. Smoker. Peripheral Arterial Disease | N/A | 01/13/2026: Patient cancelled follow-up due to insurance. No additional appointments made. |
| 83 Male | Trauma | Right Posterior Calf | 3 months | 12/18/2025 | 1/20/2026 | self | Mepilex changed to HCFD | QOD | Complaint | Eczema, CKD. Hypertension. Hyperlipidemia. | Wound improved, changed treatment | 01/05/2026: Heavy slough burden. Requires debridement. Tender. Added HCFD AD. 01/05/2026: Mixed base. No infection. Intermittent pain with/without compression. Non-compliance with daily compression is reported. 01/20/2026: Heavy drainage and yellow adherent slough. Healthy granulation tissue is present with slowly migrating tapered edges. Changed to collagen. |
| 64 Male | Pressure | Sacral | 1 year | 1/7/2026 | 1/22/2026 | Caregiver | Border Foam | Daily | Complaint | Hypertension. Parkinsons. Impaired Gait-Mobility | Wound deterioration. Treatment changed. | 01/22/2026: Worsened. Becoming larger and deeper. Sacral wound was previously almost closed but has deteriorated. Patient is on an air loss mattress but is not being repositioned adequately. Treatment changed to collagen. |
| 74 Male | Venous | Left Leg | Chromic-12 yrs | 1/26/2026 | | HH | Abd Pad/Compression Stockings | 3x weekly | N/A | Lymphedema DM2. Afib | N/A | 02/09/2026 – Follow-Up |
| 89 Female | Chronic Skin Ulcer | Right Ankle | 5 Months | 1/22/2026 | 2/4/2026 | Self | Border Foam | 3x weekly | Complaint | Hypercholesterolemia. CHF. Afib. PAD | Wound improved, changed treatment | 02/04/2026: Small round ulcer with eschar cap. Mild inflammation to surrounding area. No bone or tendon exposed. No undermining. No crepitus. No streaking erythema, Calor, or significant edema. Changed to collagen gel. |

## REFERENCES

1. Chaffin, A et al. A 12-Month Retrospective Review of Pressure Injury Plastic Surgical Flap Techniques Utilizing Pure Hypochlorous Acid (pHA) Preserved Wound Solution for Wound Bed Preparation Wound Manag Prev. 2024;70(4). https://doi:10.25270/wmp.24001.
2. Mallow PJ, Black J, Chaffin AE, et al. The economic and quality effects of wound cleansing with pure hypochlorous acid: evidence-based evaluation and clinical experience. *Wounds*. 2024;36(10):S1-S13. doi:10.25270/wnds/24101. https://pubmed.ncbi.nlm.nih.gov/39432725/
3. Faust, Elizabeth. Wound Cleansing With a Hypochlorous Acid–Preserved Wound Cleanser in Pediatric Patients With Burns. Wound Manag Prev. 2022;68(2):8-10. Pediatric Wounds and HAPWOC (hmpgloballearningnetwork.com)

## CONCLUSION

Formal studies on gel formulation may be warranted, but our positive real-world experience allows us to add it to our formulary. This pure HOCl-based antimicrobial wound gel regimen, used as a primary dressing following the HOCl liquid cleanser as the first cleaning step, allows greater contact and effectiveness, with killing and debriding power to enhance the wound-healing trajectory.