Integral Debridement: A New Paradigm in Wound Care

How Medical Technology Is Revolutionizing Slough Removal and Supporting Debridement

Supported by an educational grant from Urgo Medical North America

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Faculty Disclosures

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- **Kara Couch, MS, CRNP, CWCN-AP, FAAWC**
  Consultant, Speakers Bureau: Integra LifeSciences; Organogenesis Inc.; Reapplix; Solventum, Medical Surgical Business; Urgo Medical North America
- **Terry Swanson, NP, FAWMA, FMACNP**
  Expert Panel Member or Provision of Education, Consultant: B. Braun; Coloplast; Convatec; HARTMANN; L&R; Mölnlycke; Smith & Nephew; Solventum, Medical Surgical Business; Urgo Medical
- **Dot Weir, RN, CWON, CWS**
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Learning Objectives

- Explore the significance of sharp debridement as a fundamental method for skilled clinicians and how adjunct technologies can enhance or, in some cases, replace sharp debridement in wound care
- Examine the well-established benefits of pure hypochlorous acid (pHA) in removing germs and necrotic debris, including its use in instillation therapy to aid wound healing
- Assess how the combination of pHA exposure followed by the application of highly charged fiber dressings can enhance the removal of necrotic tissue, improving wound healing outcomes
- Recognize the underlying science of synergistic technologies and how they work together to facilitate more efficient desloughing and support the debridement process

pHA = pure hypochlorous acid preserved cleanser.

Sharp Debridement and Adjunctive Therapies

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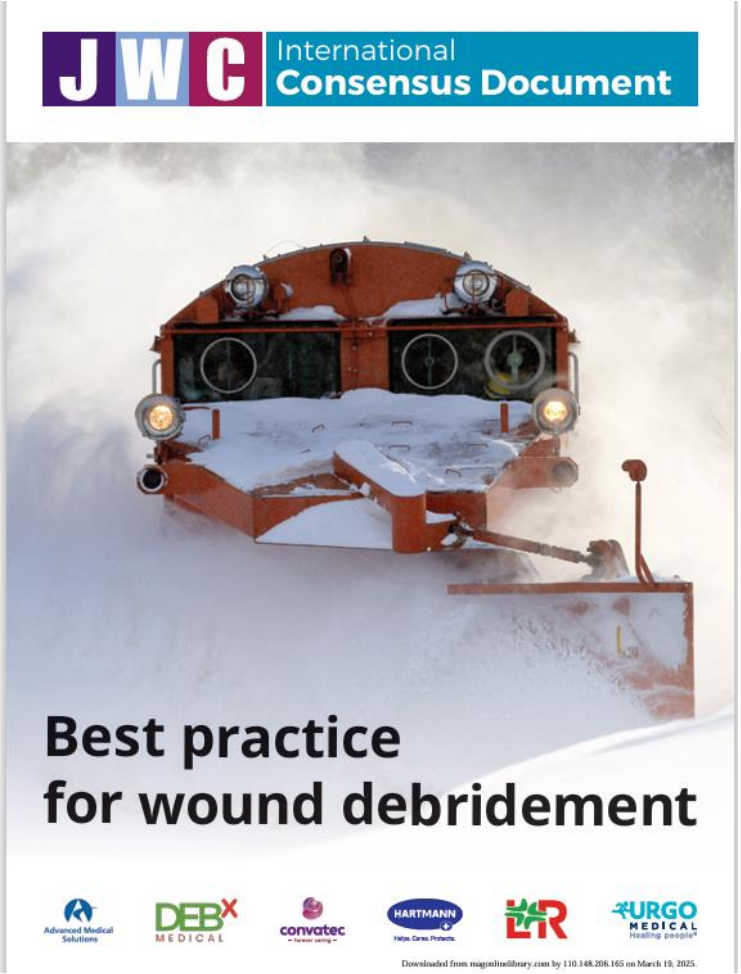
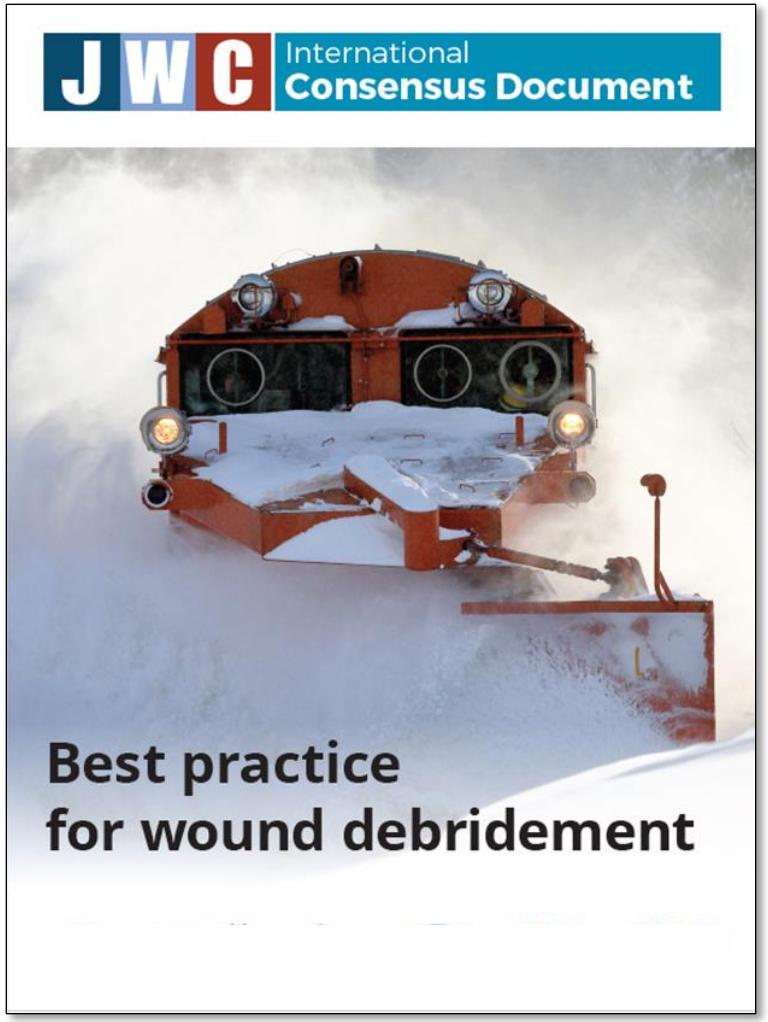
Best Practice for Wound Debridement



Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

What Is Debridement, and Why Is It Important?

- Definition
  - The removal of viable (living) and non-viable components, including necrotic tissue, slough microorganisms, biofilm, extracellular polymeric substance (EPS), and foreign materials
- Goals
  - Remove/reduce the presence of both microbial and non-microbial components using the most effective methods with the fewest side effects
  - Promote growth of new tissue, reduce inflammation in the wound bed, improve effectiveness of topical treatments, and reduce risk of infection



EPS = extracellular polymeric substance.

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Integral Debridement

- Definition
  - The combined use of different but complementary methods of debridement on the same wound
- Purpose
  - Allow healthcare professionals to make more informed decisions regarding the selection and application of debridement methods, tailoring for the individual requirements after assessing the patient, the wound, and their environment

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Factors that Influence Choice of Debridement Method

- Clinical need
- Clinical experience and competency
- How quickly devitalised tissue needs to be removed
- Level of inflammation
- Local access
- Patient age and level of health
- Patient perspective
- Presence of infection
- Risk of exposing non-tissue structures
- Treatment objectives
- Treatment setting
- Wound depth and type

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Surgical vs Selective Sharp Debridement

Table 2. Standalone debridement methods

Method	Example	Mechanism of Action	Key Indications	WBP	Referral
Selective Sharp**	Scalpel, scissors, or curette	Selective cutting away of devitalized tissue to promote wound healing and prevent infection while avoiding the excision of viable tissue	May be used for most wound types and in combination with gentler debridement methods to accelerate debridement. Wounds with a solid layer of necrotic tissue, slough, biofilm, or eschar, often when the devitalized tissue is starting to separate from healthy tissue	Not needed	See note*; wounds in challenging anatomical locations
Surgical**	Scalpel, scissors, or curette	Complete removal of necrotic tissue, slough, or eschar using precise incisions while excising into viable tissue where bleeding is observed	Extensive necrotic tissue, loose or adherent devitalized tissue, involvement of deep structures, biofilm, or complications, such as damage to blood vessels. When other methods of debridement have been ineffective or when immediate reconstruction is required. Wounds in functionally and cosmetically important areas, such as the face, hands, perineum, and feet. Often needed as an adjunct for gentler debridement methods.	Not needed	Specialist procedures

Note: *Refer in extensive, deep wounds, exposed tendon or bone, chronic venous insufficiency, clinical signs of deep or systemic infection, worsening wound or no progress after 2-4 wks of treatment; **HOCl or NaClO can be used as assisters before or during debridement to amplify efficacy; DFU, diabetic foot ulcer; NPWTi-d with ROCF, negative pressure wound therapy and instillation with dwell time with reticulated open-cell foam; WBP, wound bed preparation.

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Selective Sharp Debridement

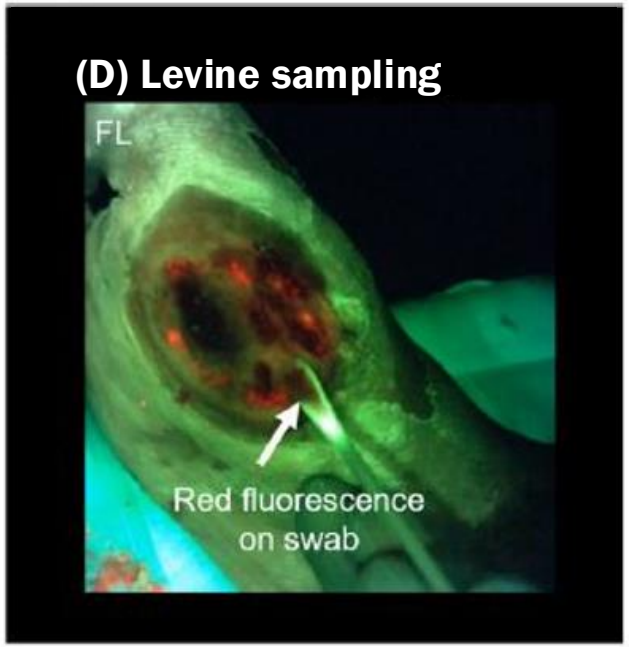
- Commonly performed in outpatient setting as part of routine wound care
- Confined to non-viable tissue, so low blood loss is anticipated
- If patient has bleeding tendencies, then appropriate precautions are taken
- Identify and manage procedural pain
- Skilled healthcare professional with necessary competency
- Equipment: Sterile scissors, curette, scalpel, and forceps
- Clean before and after

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Selective Sharp Debridement

- Use of sterile equipment with sharp edges
- **Skill level:** Requires education, skill competency, and confidence
- Only healthcare professionals who have received training in debridement

Fluorescence-Informed Treatment



Treatment Plan Changes

1. Extended cleaning and debridement
2. Debrided remaining red (bacterial load) fluorescence
3. Sampled region of red fluorescence
4. Prescribed antibiotics

Jones A, et al. *Int Wound J.* 2023;20(8):3279-3288.

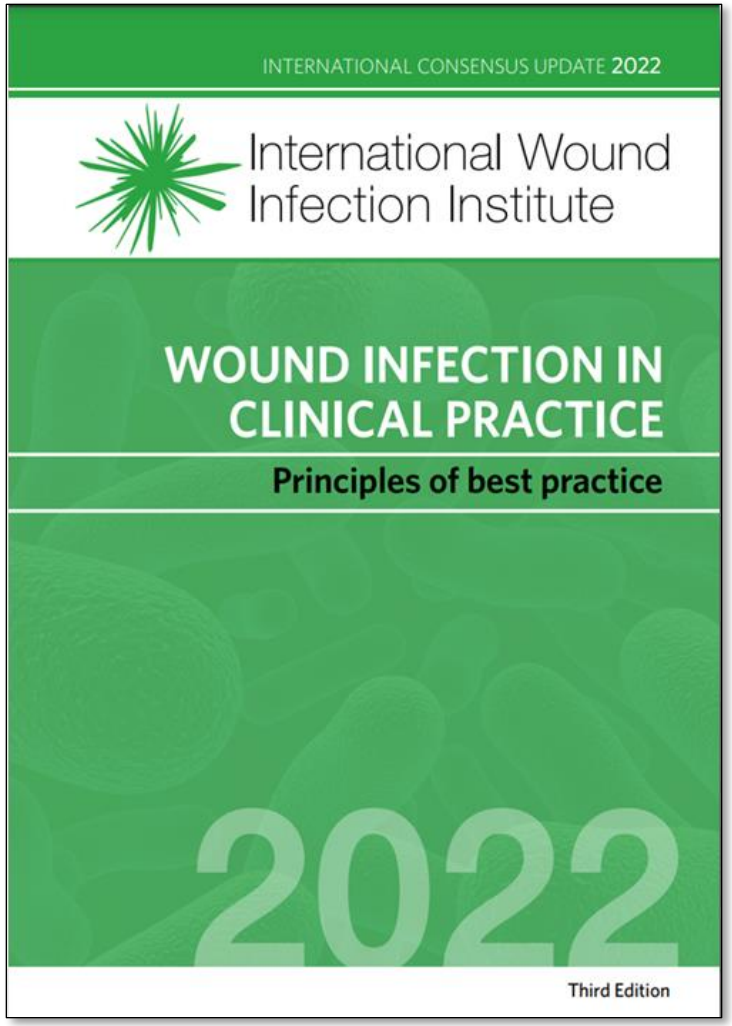
Surgical Debridement

- Performed in the operating room, or designated procedure room, at the bedside in post-acute settings
- Completed by a surgeon or trained wound care professional
- Excision into viable tissue
- Can include full-thickness wounds with extensive necrotic tissue, deep structures, or complex patients requiring debridement
- Requires anesthesia (depending on the patient and setting)
  - Topical (topical lignocaine/ prilocaine)
  - Local (injection of lignocaine)
  - Regional (a nerve block to specific area)
  - General anesthesia (multiple medications so that patient is unconscious)

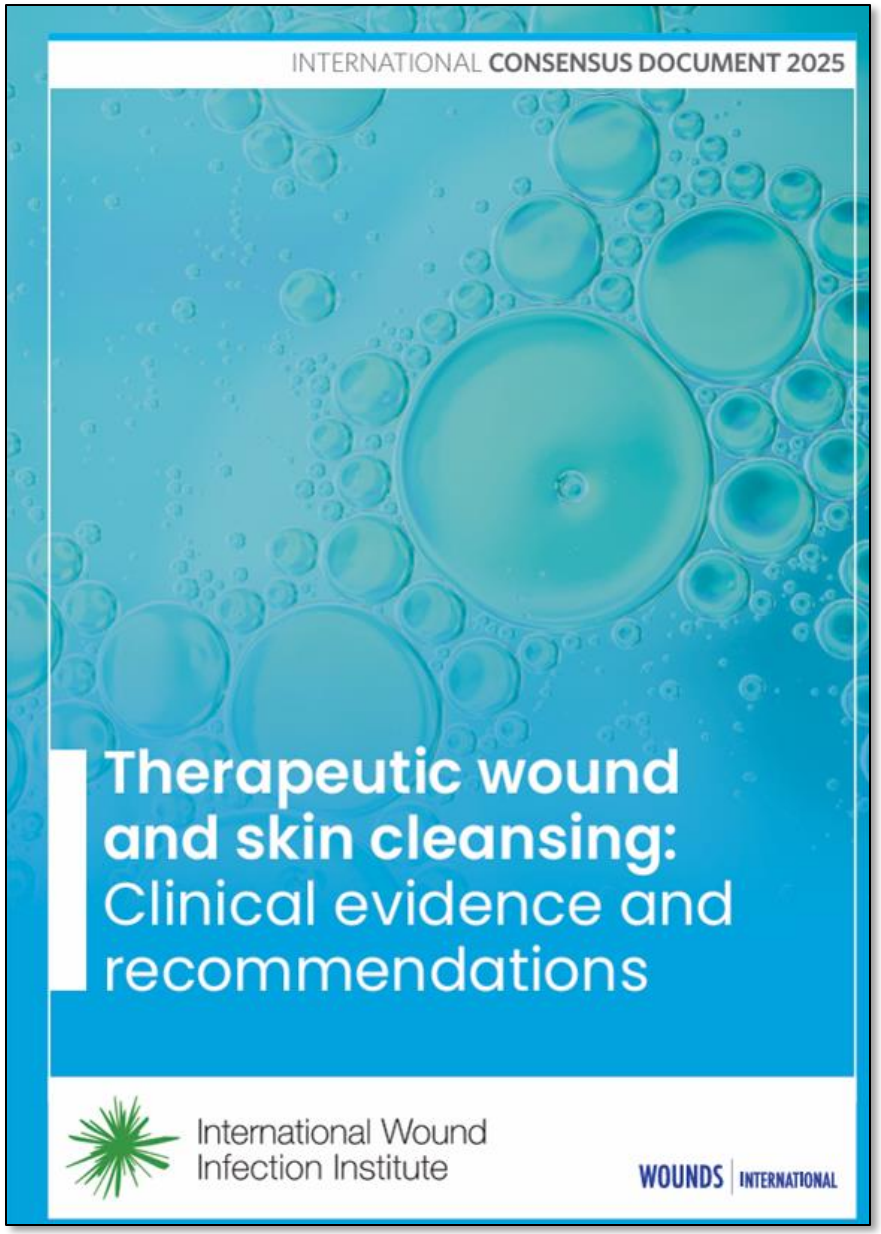
Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Post Debridement

- Cleanse again
- Apply topical dressing for management of short-term treatment goal
  - Infection
  - Continued debridement
  - Exudate management
  - Tissue replacement
- Standard of care for the etiology



International Wound Infection Institute. Accessed Apr 18, 2025. https://woundinfection-institute.com/



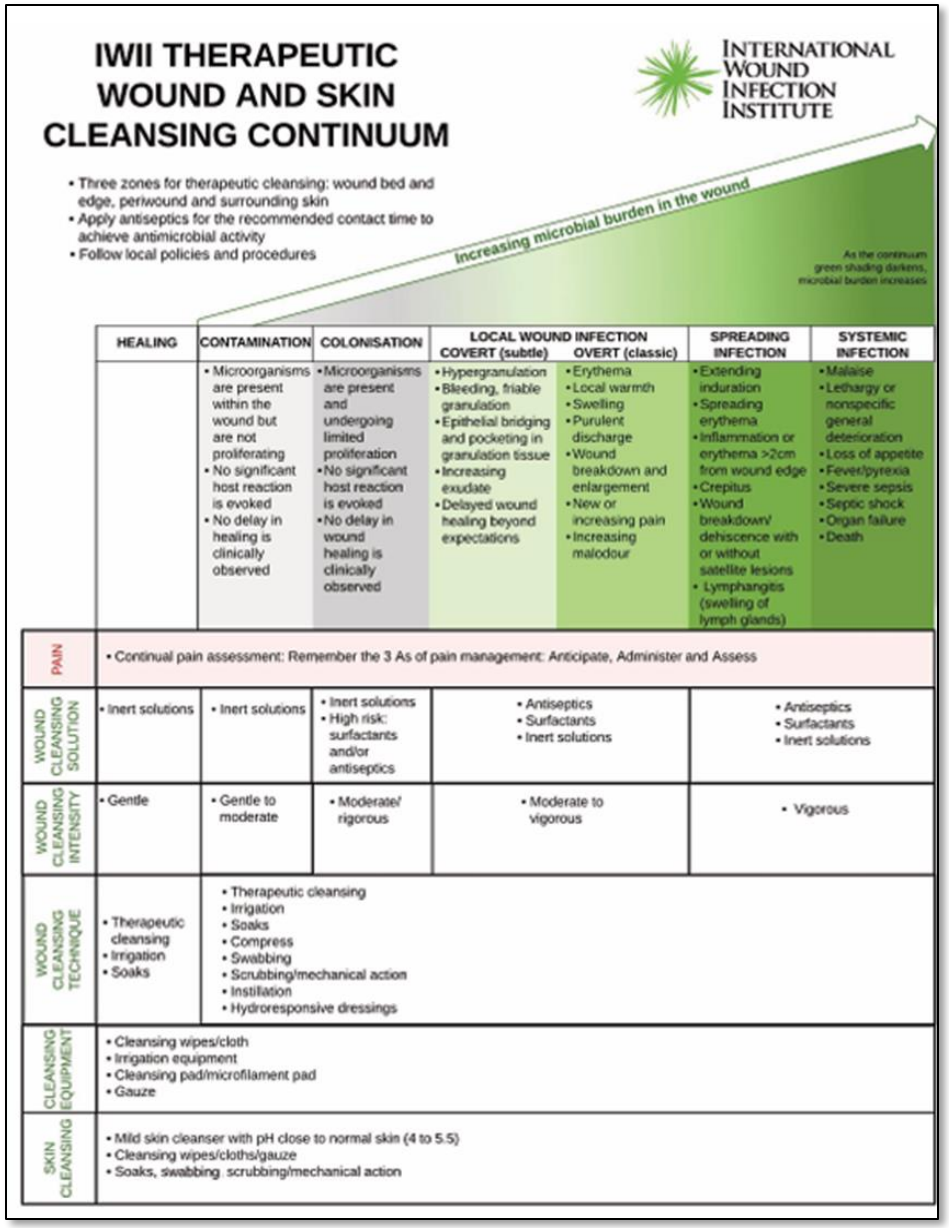


Figure 5. International Wound Infection Institute (IWII) Therapeutic Wound and Skin Cleansing Continuum

International Wound Infection Institute. Accessed Apr 18, 2025. https://woundinfection-institute.com/

Frequency of Debridement

Diabetic Foot Ulcers (DFUs)

- Conservative sharp wound debridement most frequent (podiatrist)
- Callous, slough, and infection were the top 3 most important determinants of frequency
- Debridement frequency was determined by clinical wound indications and staffing resources, with regional/remote podiatrists providing debridement less often than their metropolitan colleagues
- Second-weekly debridement supports healing of DFUs receiving standardized care in an interdisciplinary setting

Pressure Injuries (PIs)

- "More frequent debridement was associated with improved healing. **Wounds that were debrided weekly or more frequently were over 4x more likely to heal than wounds receiving debridement less often than weekly**"

DFU = diabetic foot ulcer; PI = pressure injury.

Nube VL, et al. *J Foot Ankle Res.* 2021;14(1):52-n/a. Nube VL, et al. *J Wound Care.* 2023;32(6):383–390. EPUAP, NPIAP, PPPIA. *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline*. Emily Haesier(Ed.). 2019.

Technical: Contact Ultrasound

Video courtesy Donna Larsen

Adjunctive Therapies/Assisters (Amplifiers) for Debridement

Table 1. Summary of debridement methods needing an adjunct procedure

Method	Example	Mechanism of Action	Key Indications	WBP	Referral
Oxidative	Cold atmospheric plasma	Oxidizing agents that break down biological structures in bacteria, yeast, and fungi, as well as non-microbial components including cytokines and proteases, or generate ROS and nitric oxide to remove devitalized tissue and reduce bioburden	Infected wounds	Needed	See note*
Autolytic	Alginates; hydrocolloids; hydro-desloughing wound dressings; hydro-responsive wound dressings; glucose oxidase and lactoperoxidase	Promotes moisture balance that facilitates the body's own breakdown of devitalized tissue	Moist wound types. When more effective debridement methods are not available or acceptable to patient; to avoid maceration, do not use on highly exuding wounds; best used as an adjunct with mechanical debridement; glucose oxidase and lactoperoxidase; hard-to-heal wounds	Not needed	See note*
Osmotic	Honey; hypertonic gels and dressings	Induction of hyperosmotic environment in wound bed; the hypertonic (excess) fluid helps soften and liquefy devitalized tissue, making it easier to remove	Pressure ulcers/injuries; DFUs; venous leg ulcers; highly exuding wounds; infected wounds; wounds with high bacterial burden	Not needed	See note*
Enzymatic	Collagenase and bromelain-enriched collagenase	Specific enzymes break down devitalized tissue	Neuroischemic DFUs, hard-to-heal wounds; bromelain; burns	Not needed	See note*
Chemical	Single-use topical gel with desiccating properties	Desiccation of devitalized tissue and biofilm, which sloughs off in 1-5 days	Most wound types	Needed	See note*
Chemo-mechanical	Amino-buffered hypochlorite gel	Special sodium hypochlorite gel creates a highly alkaline and oxidative environment that kills pathogens and biofilm; application time is 2-5 min and primary function is to remove or soften tissue	DFUs and leg ulcers	Needed	See note*
Surfactant	Poloxamer 188 (pluronic F68), non-ionic, amphiphilic surfactant	Hydrophilic surface attracts, softens devitalized tissue and debris, which is then trapped by the hydrophobic core; it is washed away with water or saline	Most wound types	Not needed	See note*

Note: *Refer in extensive, deep wounds, exposed tendon or bone, chronic venous insufficiency, clinical signs of deep or systemic infection, worsening wound, or no progress after 2-4 wks of treatment; DFU=diabetic foot ulcer; ROS=reactive oxygen species; WBP=wound bed preparation.

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Adjunctive Therapies/Assisters (Amplifiers) for Debridement

Table 3. Summary of assisters (amplifiers) of various debridement methods

Method	Example	Mechanism of Action	Key Indications	WBP	Referral
Hypochlorous acid (HOCl)	Stabilized solutions or gels	Mechanical disturbing of devitalized tissue and microbes during irrigation or in conjunction with mechanical debridement	Assists mechanical debridement in wounds with high bacterial burden	Needed	See note*
Sodium hypochlorite (NaClO)					

Note: *Refer in extensive, deep wounds, exposed tendon or bone, chronic venous insufficiency, clinical signs of deep or systemic infection, worsening wound or no progress after 2-4 wks of treatment.

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Clinical Pearls

- Integral debridement enhances the debridement effort by combining the types of debridement
  - Therapeutic vigorous cleansing with sharp debridement

    + post-debridement cleansing

    + a topical dressing that continues to deslough/debride while also providing moisture balance
  - If infection management is also required, then add an antimicrobial
- Work smarter, not harder, and promote wound healing through effective and appropriate debridement

The Well-Established Benefits of Using pHA (pure Hypochlorous Acid) to Remove Germs and Necrotic Debris

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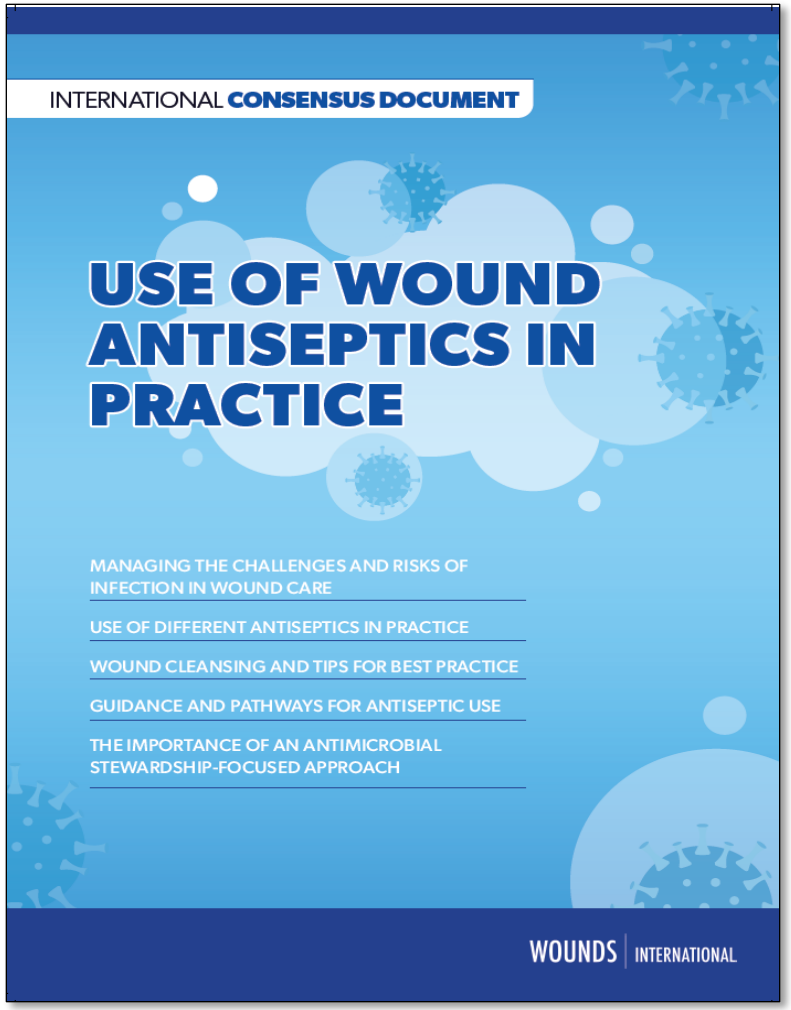
Director, Wound Care Services, George Washington University Hospital
Associate Research Professor of Surgery, School of Medicine and Health Sciences, George Washington University
Washington, D.C.

International Consensus Guidelines, 2023

Use of Wound Antiseptics in Practice

Wounds International
Oct. 2023



Mrozikiewicz-Rakowska B, Sanches Pinto D, Stuermer EK, Nair HKR, Sander J, Matiasek J, Lázaro-Martínez JL, Ousey K, Assadian O, Kim PJ, Percival SL. *Wounds Int.* 2023.

Ideal Antimicrobial Preservative Cleanser Properties

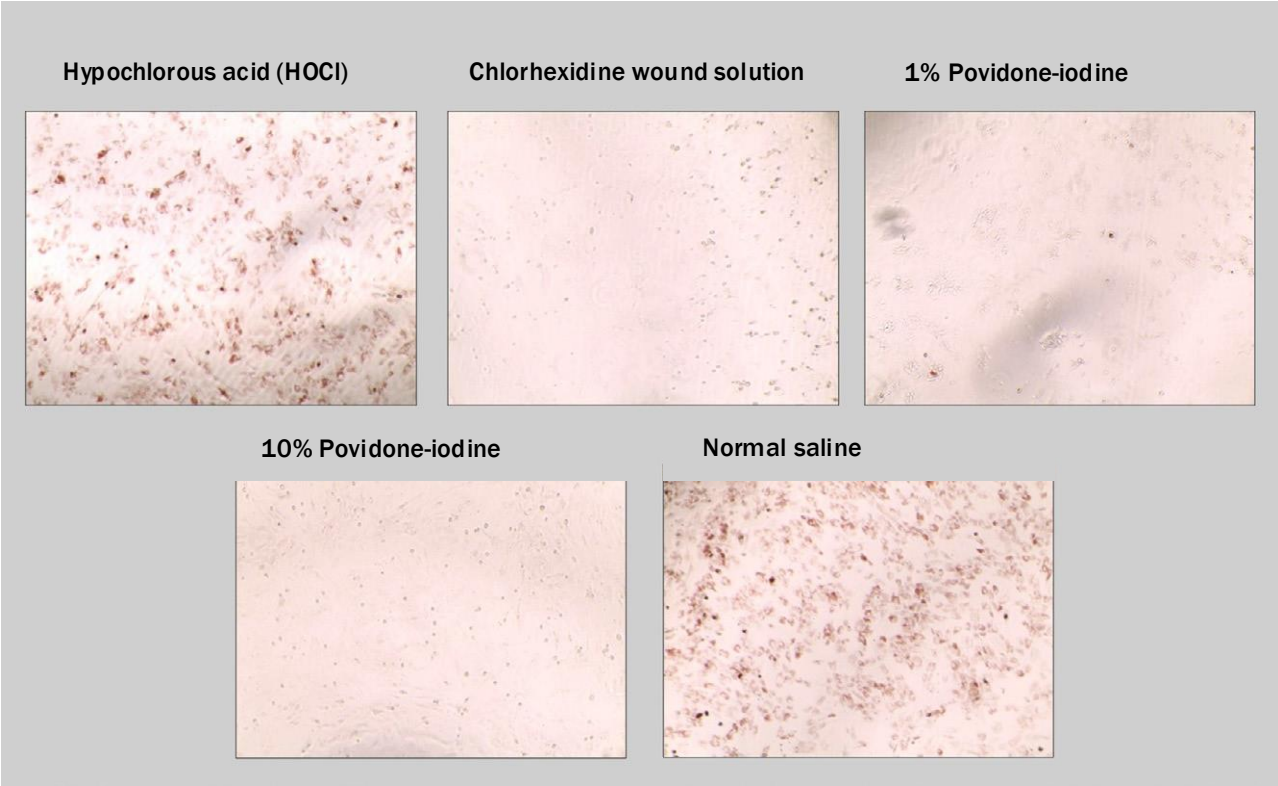
BOX 4 | Properties of an ideal antiseptic agent (To et al, 2016; Kramer et al, 2018; Babalska et al, 2021)

- Possess antimicrobial activity at the site of action against a broad spectrum of microorganisms, including Gram-positive and Gram-negative bacteria, fungi and viruses
- Ability to penetrate biofilm
- Does not cause resistance or cross-resistance
- Is fast-acting in acute wounds
- Can handle excess wound exudate (if it is a dressing)
- Cost-effective
- Non-traumatic
- Easy and safe to use
- Does not cause allergic reactions or pain
- Is not toxic, carcinogenic or mutagenic
- Tolerability should be equal to Ringer solution, physiological saline or an inert hydrogel
- Suitable chemical and physical properties – e.g. in regard to colour (does not colour the skin), smell and consistency.

Mrozikiewicz-Rakowska B, Sanches Pinto D, Stuermer EK, Nair HKR, Sander J, Matiasek J, Lázaro-Martínez JL, Ousey K, Assadian O, Kim PJ, Percival SL. *Wounds Int.* 2023.

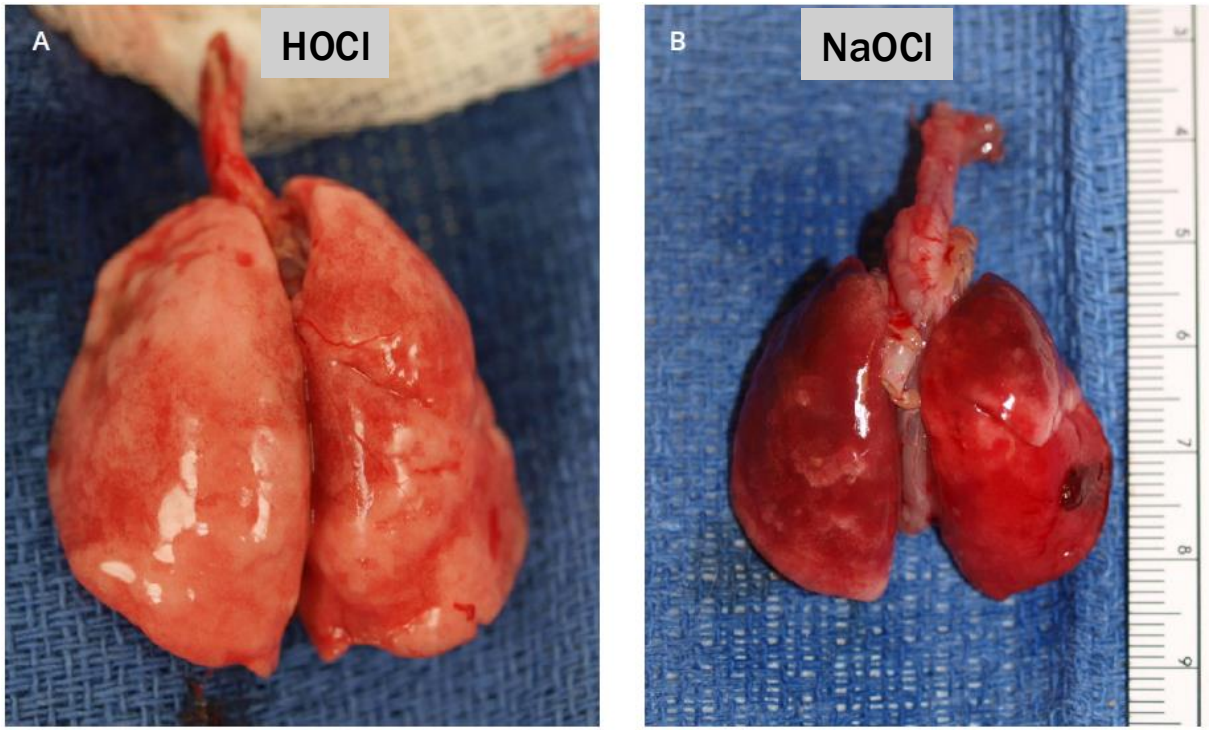
HOCl-Based Cleanser Is a Non-Cytotoxic Alternative to Dakin's Solution for Wound Bed Preparation

In vitro cytotoxicity



Representative images of fibroblasts from the neutral red dye assay. The presence of many stained cells indicates that the treatments to those cells were minimally cytotoxic.

Gross examination of organs after lavage



Gross specimens of lungs treated with (A) pH=5 HOCl and (B) Dakin's solution (NaOCl). The Dakin's-treated lungs show increased fibrosis and hemorrhage compared with pH=5 HOCl

Slide courtesy of Dr. Greg Schultz.

Keyloun JW, Shupp JW. *Wounds*. Supplement, October 2019.

Microscopic Examination of Lungs after Lavage

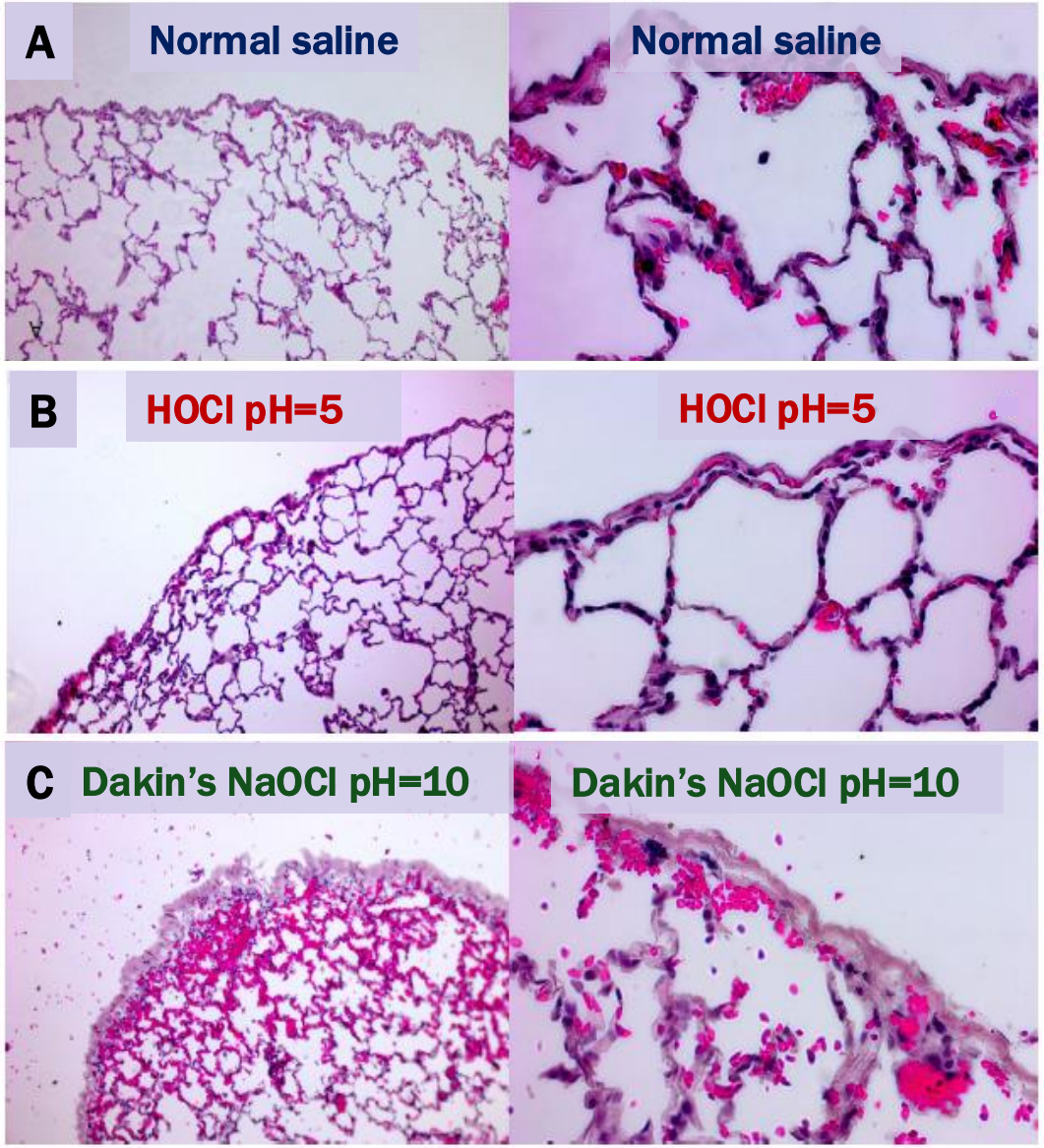
- Representative hematoxylin and eosin-stained images of lung tissue treated with

  (A) Normal saline

  (B) HOCl pH=5

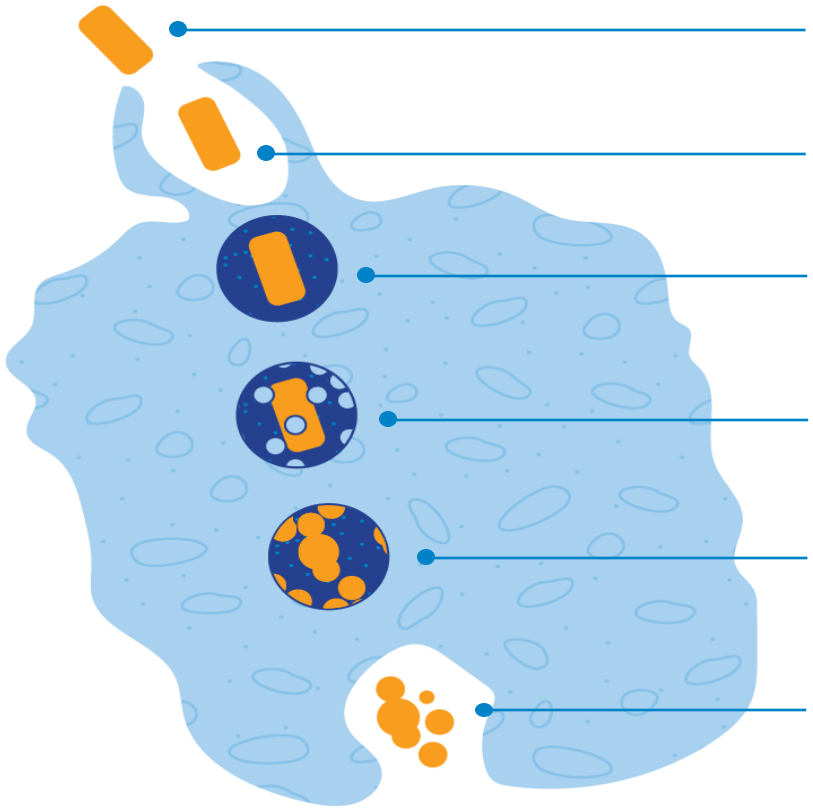
  (C) Dakin's solution

- Increased fibrosis and hemorrhage are appreciated in the Dakin's-treated tissue



Slide courtesy of Dr. Greg Schultz.
Keyloun JW, Shupp JW. *Wounds*. Supplement, October 2019.

Replicating the Body's Natural Response To Invading Pathogens



1 Pathogen is targeted by chemotaxis

2 Neutrophil forms pseudopods to engulf pathogen

3 Neutrophil then forms a phagosome, which surrounds pathogen

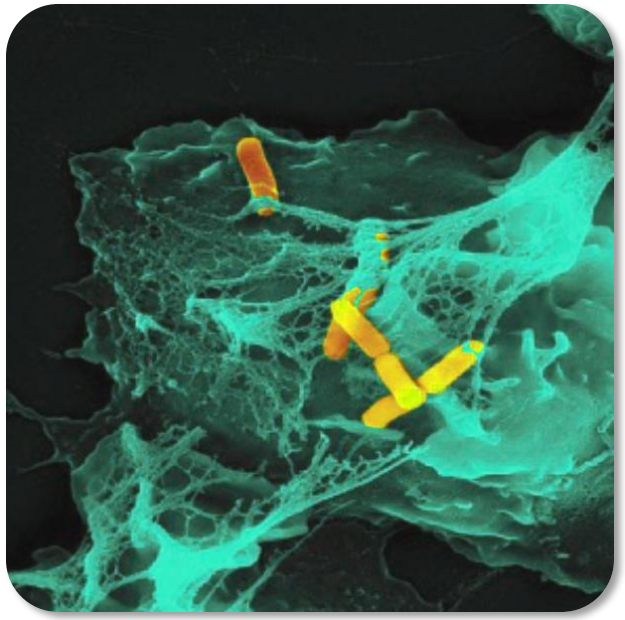
4 HOCl is generated

5 The pathogen is destroyed by HOCl action

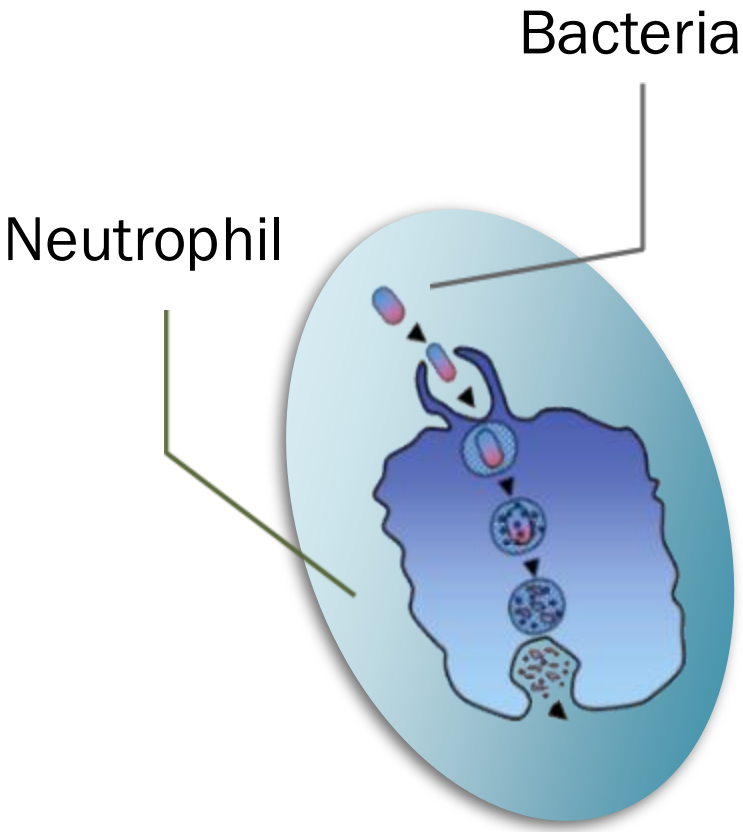
6 Residual material is removed by exocytosis

Couch KS, et al. Accessed April 30, 2025. www. steadmed.com/wp-content/uploads/2016/11/Vashe-Wound-Cleansing-Final-final.pdf. Niezgoda JA, et al. *Adv Skin Wound Care*. 2010;23(8):352-357.

HOCl: The Body's Natural Microbicide



Oxidative Burst Pathway



$H_2O + O_2$

↓ NADPH Oxidase

O_2^-

↓ Dismutase Superoxide

H_2O_2

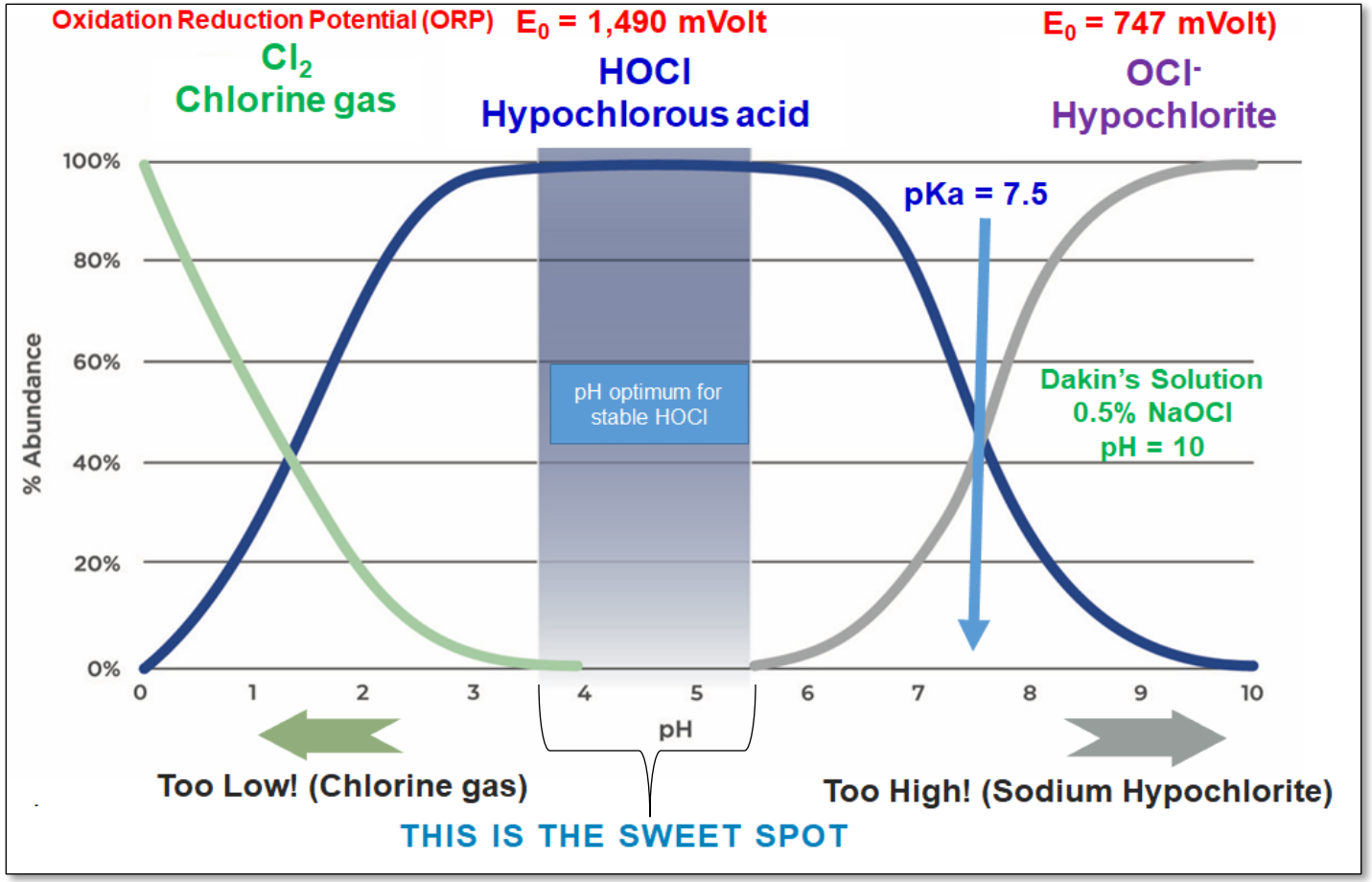
↓ Myeloperoxidase

HOCl

Slide courtesy of Dr. Greg Schultz.

HOCl Dissociation Curve

- Stabilized HOCl solution has the highest concentration of HOCl ~300 ppm
- Mimics normal pH of healthy, human skin
- Electrochemical manufacturing process allows for shelf stability in PET plastic



Slide courtesy of Dr. Greg Schultz

Modified from Robson M. The Scientific Bases for the Use of Hypochlorous Acid to Avoid Pitfalls. *Wounds*. 2019;suppl.

Comparative Minimum Bactericidal Concentration Of HOCl, NaOCl, and H_2O_2

Tested Against 3 Organisms at Room Temperature for 60 Minutes

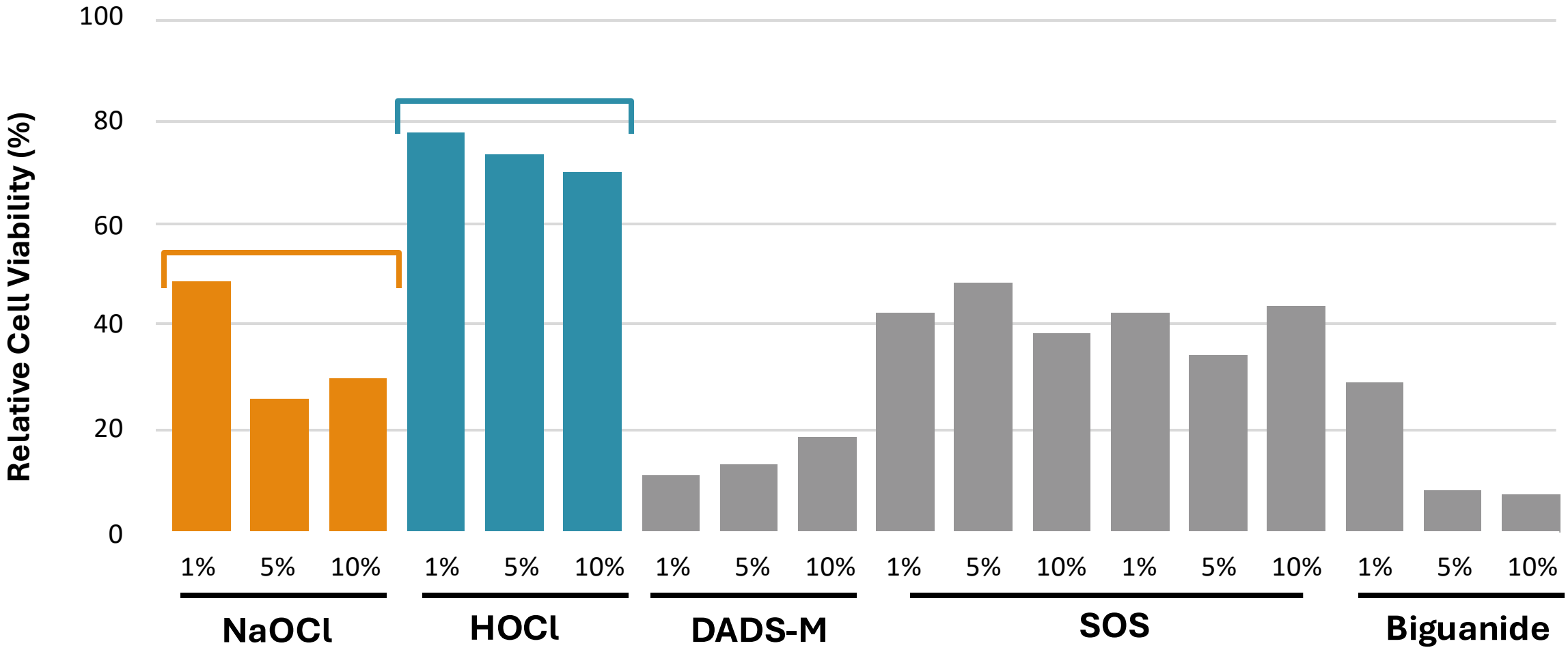
		MBC (µM)		
Pathogen	ATCC	HOCl	OCl^-	H_2O_2
Escherichia coli	25922	5.6	40	7,500
Pseudomonas aeruginosa	27853	6.2	10	>20,000
Staphylococcus aureus	29213	12.5	50	>20,000

ATCC = American Type Culture Collection; MBC = minimum bactericidal concentration..

Slide courtesy of Dr. Greg Schultz.

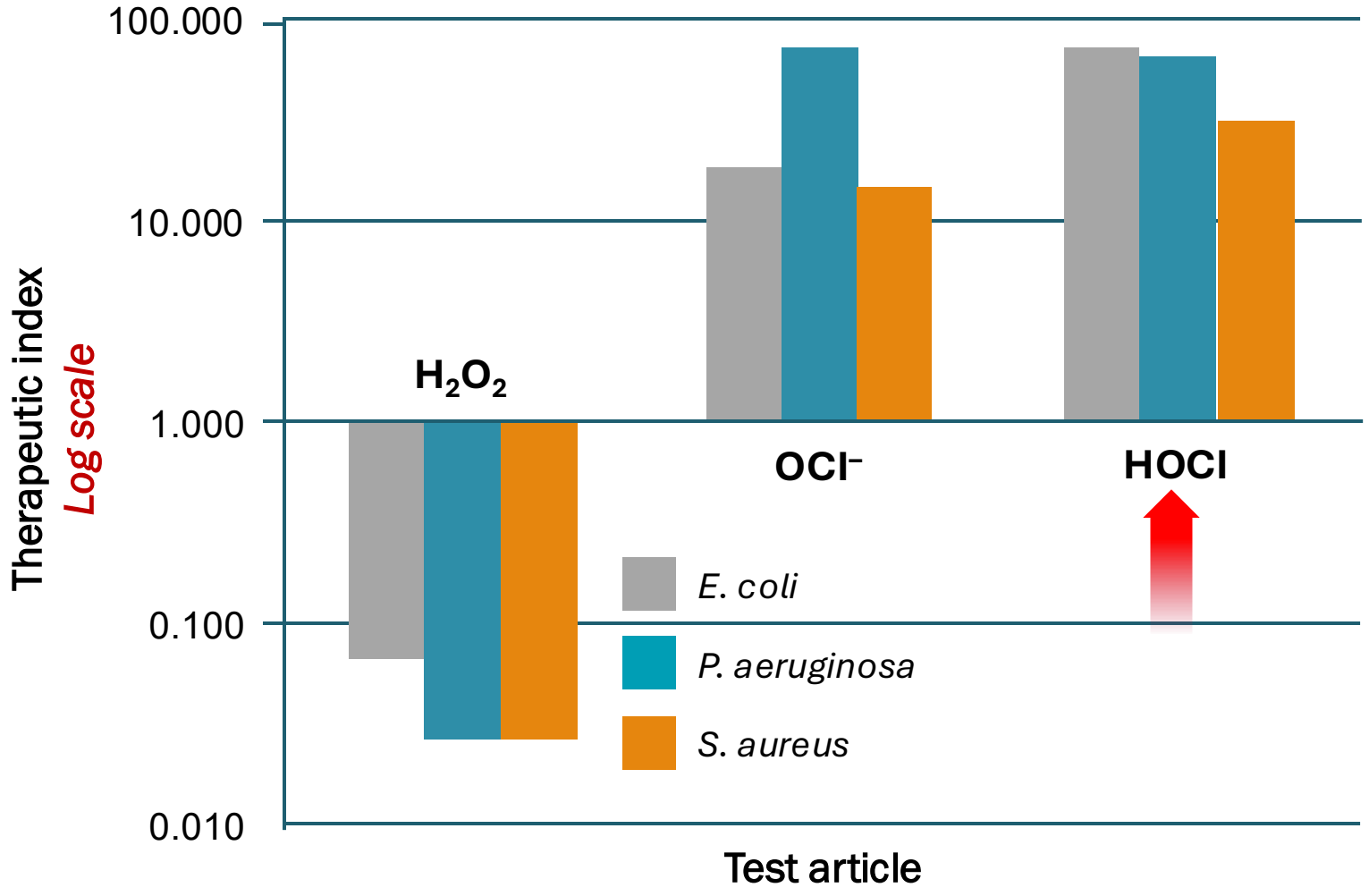
Wang L, et al. *J Burns Wounds*. 2007;6:e5.

Cytotoxicity of Various Liquid Antiseptic Formulations Against Human Fibroblast Cultures after 6 Hours



Slide courtesy of Dr. Greg Schultz.
DADS-M = modified diallyl disulfide-oxide; SOS = superoxidation solution.
Ortega-Peña S, et al. *Int Wound J.* 2017;14(3):470-479.

Relative Therapeutic Index of HOCl, OCl^-, and H_2O_2

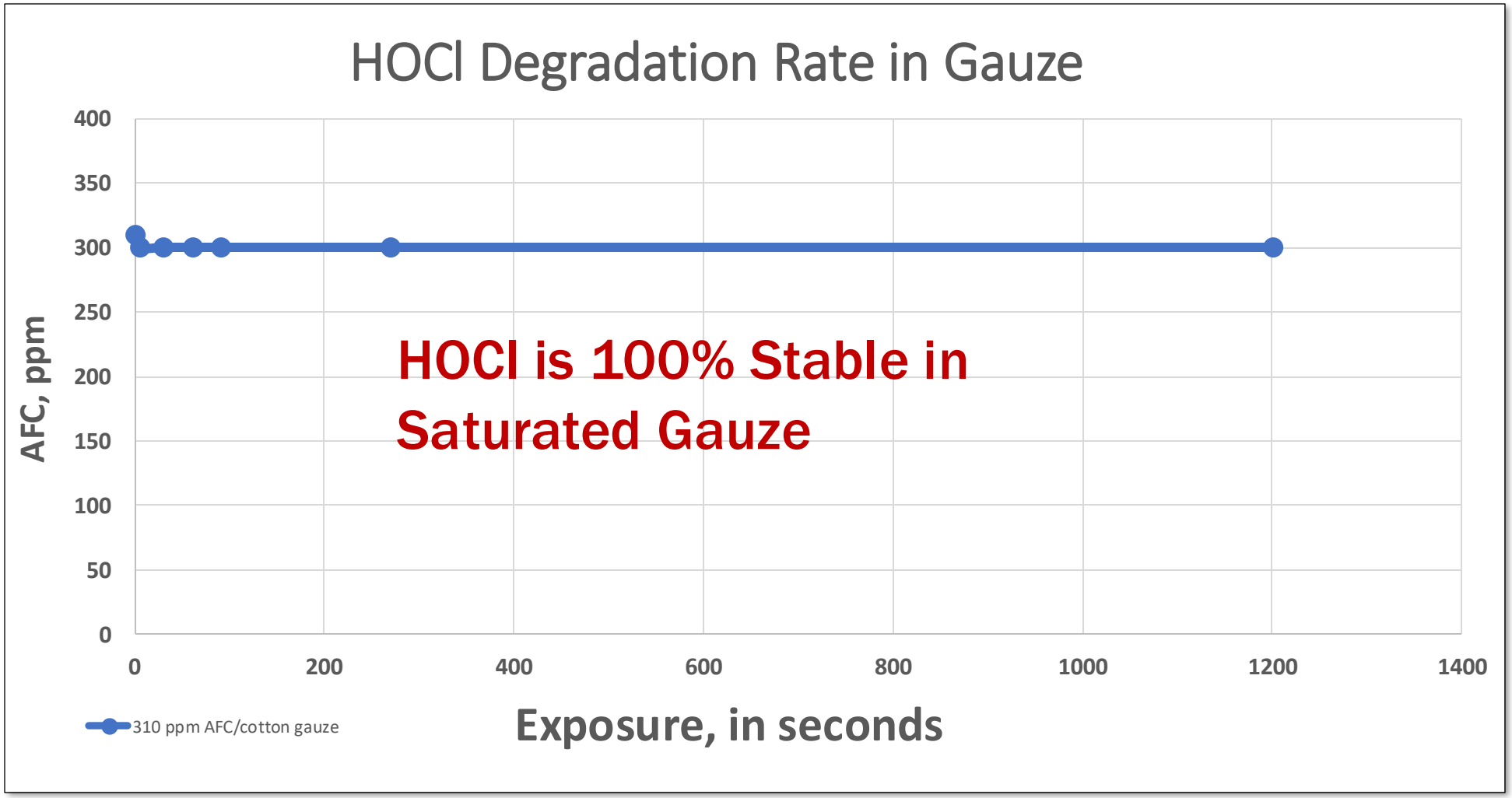


- Relative therapeutic index of hypochlorous acid (HOCl; pH 4.0) hypochlorite (OCl^-; pH 10.5) hydrogen peroxide (H_2O_2; pH 7.0)
- Therapeutic index is expressed as a ratio of the CT50 concentration (µg/mL) on L929 cells divided by the minimum bactericidal concentration (µg/mL)
  - *S. aureus* 29,213
  - *P. aeruginosa* 27,853
  - *E. coli* 25,922
- The higher the therapeutic index, the safer the test article will be

Slide courtesy of Dr. Greg Schultz.

Wang L, et al. *J Burns Wounds*. 2007;6:e5.

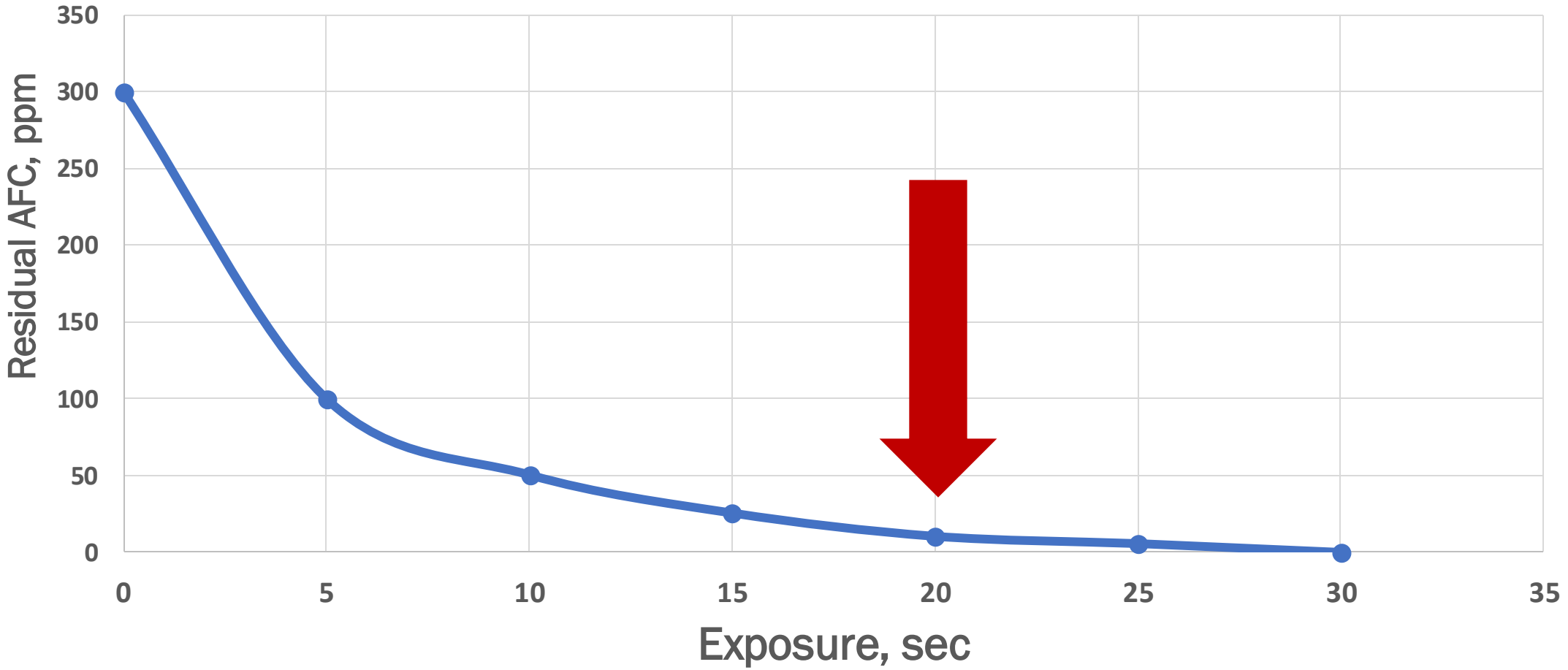
Soaking with Gauze as the Delivery System



Urgo laboratory data.

HOCl-Based Cleanser Safety Profile Is Due to Rapid Biodegradation at the Wound/Gauze Interface

HOCl is rapidly consumed in direct contact with tissue protein



Urgo laboratory data.

NPWT and Instillation (NPWTi) with HOCl-Based Cleanser

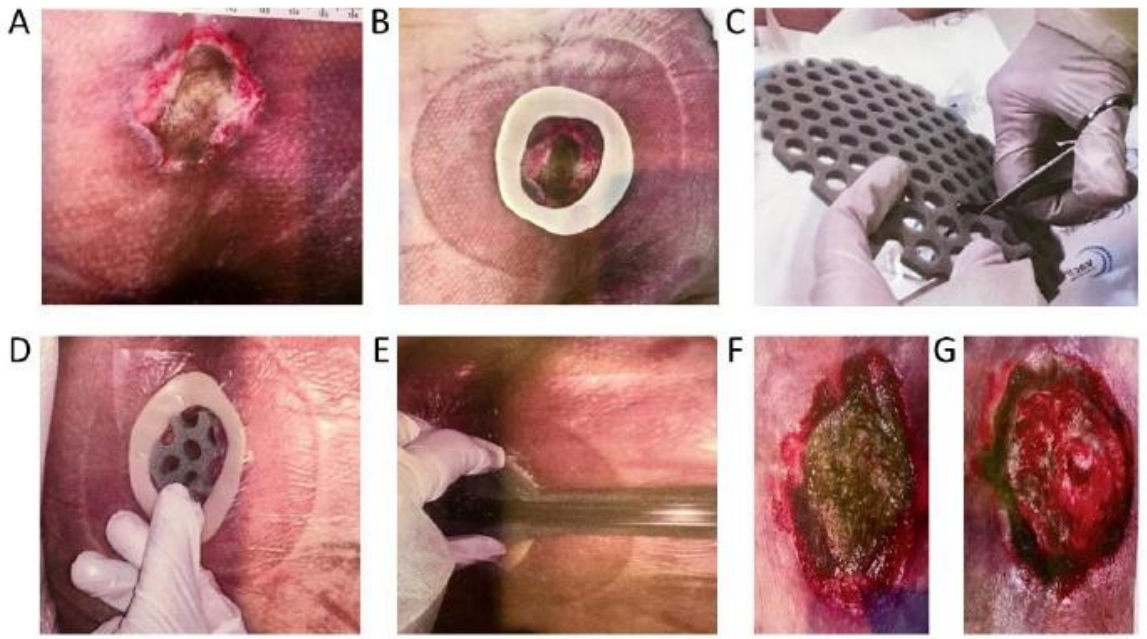


Figure 2: Wound management of coccyx pressure ulcer. A) Wound at presentation. B) Protected wound edges. C) ROCF-CC contact layer cut to fit wound. D) ROCF-CC contact layer applied to wound. E) Dressing applied and NPWTi-d initiated. F) Wound appearance after 3 days of NPWTi-d. G) Wound appearance after 6 days of NPWTi-d.

Fernandez et al., J Trauma Treat 2017, 6:5
DOI: 10.4172/2167-1222.1000410

Journal of Trauma & Treatment

Case Report Open Access

Initial Experience Using a Novel Reticulated Open Cell Foam Dressing with Through Holes during Negative Pressure Wound Therapy with Instillation for Management of Pressure Ulcers

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Trauma Surgical Critical Care Unit, Trinity Mother Frances Health System, TX, USA

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Rec date: December 11, 2017; **Acc date:** December 21, 2017; **Pub date:** December 23, 2017

Abstract

Several published reviews and recommendations exist for the use of negative pressure wound therapy (NPWT) with instillation and a dwell time (NPWTi-d) in acute and chronic wounds. Specific dressings for use with NPWTi-d have also been developed, including a reticulated open cell foam dressing with through holes (ROCF-CC) that assists in removing thick wound exudate and infectious materials. ROCF-CC is especially helpful for wound cleansing when debridement is not possible or appropriate in patients.

We report our initial experiences in using NPWTi-d with ROCF-CC in patients with pressure ulcers. An algorithmic approach was used to determine appropriate treatment to reach the goals of therapy (i.e., wound bed preparation, granulation tissue formation, and removal of infectious materials). Previous therapies included honey and gauze soaked in Dakin's solution. All patients received antibiotics and debridement when possible.

Five patients (3 females and 2 males) received NPWTi-d with ROCF-CC (instillation of saline or a hypochlorous solution with a dwell time of 10 minutes, followed by 2-3 hours of -125 mmHg NPWT). Patient comorbidities included obesity, diabetes mellitus, hypertension, and peripheral artery disease. Mean age of patients was 65.2 years (range: 50-82 years). After an average of 6 days of therapy (range 2-9 days), all wounds treated with NPWTi-d with ROCF-CC showed rapid granulation tissue formation.

We also noted improved removal of devitalized tissue and subsequent granulation tissue formation in patients receiving hypochlorous solution compared to patients receiving saline during NPWTi-d with ROCF-CC. All patients were eventually transferred to a skilled nursing facility. In our clinical practice, NPWTi-d with ROCF-CC provided effective and rapid removal of the thick exudate and infectious materials and promoted excellent development of underlying granulation tissue.

Keywords: Negative pressure wound therapy; Instillation; Thick exudate; Devitalized tissue; Wound cleansing

Introduction

Pressure ulcers (PrUs) are challenging complex wounds that develop due to localized injuries to the skin, particularly over bony prominences, because of pressure or when pressure is combined with shear and/or friction [1]. Although the definition and staging of PrUs was recently redefined by the National Pressure Ulcer Advisory Panel (NPUAP) in 2016 [2], there is still much debate regarding these changes among the healthcare community.

In our institution, high-risk operative patients with complex chronic wounds, such as PrUs, have been treated with a variety of dressings. Traditional dry/moist gauze wound dressings, low adherent dressings, and semipermeable films mitigate against fluid and environmental microbial penetration but allow the egress of air and water vapor. Moist occlusive dressing have been utilized, as these dressings support the inflammatory phase by creating a low oxygen tension environment (thereby increasing angiogenesis, iron metabolism, glucose metabolism, cell proliferation/survival and activating factors such as hypoxia-inducible factor-1), which has also been shown to increase the rate of re-epithelialization [3-5].

Hydrocolloids and hydrogels have also been used in our institution. Under the appropriate setting, these dressings absorb a certain amount of exudate but keep a moist environment; hydrocolloids are impermeable to air and are long-lasting but do not function well in exudative wounds. In a dry wound environment, hydrogels may be used to help promote moisture in the wound.

For highly exudative wounds, alginate dressings (a seaweed-derived non-woven fiber dressing) are typically used because of their ability to absorb copious amounts of fluid. We have also used autolytic debridement in wounds with a moist wound environment; however, this form of therapy is not capable of removing devitalized tissue as well as surgical debridement and is not an adequate replacement for sharp surgical debridement [6-8].

Negative pressure wound therapy (NPWT) is commonly used for the management of both acute and chronic complex wounds at our institution. This therapy has typically been associated with higher costs; however, several studies have shown an overall savings in direct and indirect costs, in a large part due to decreases in operating room

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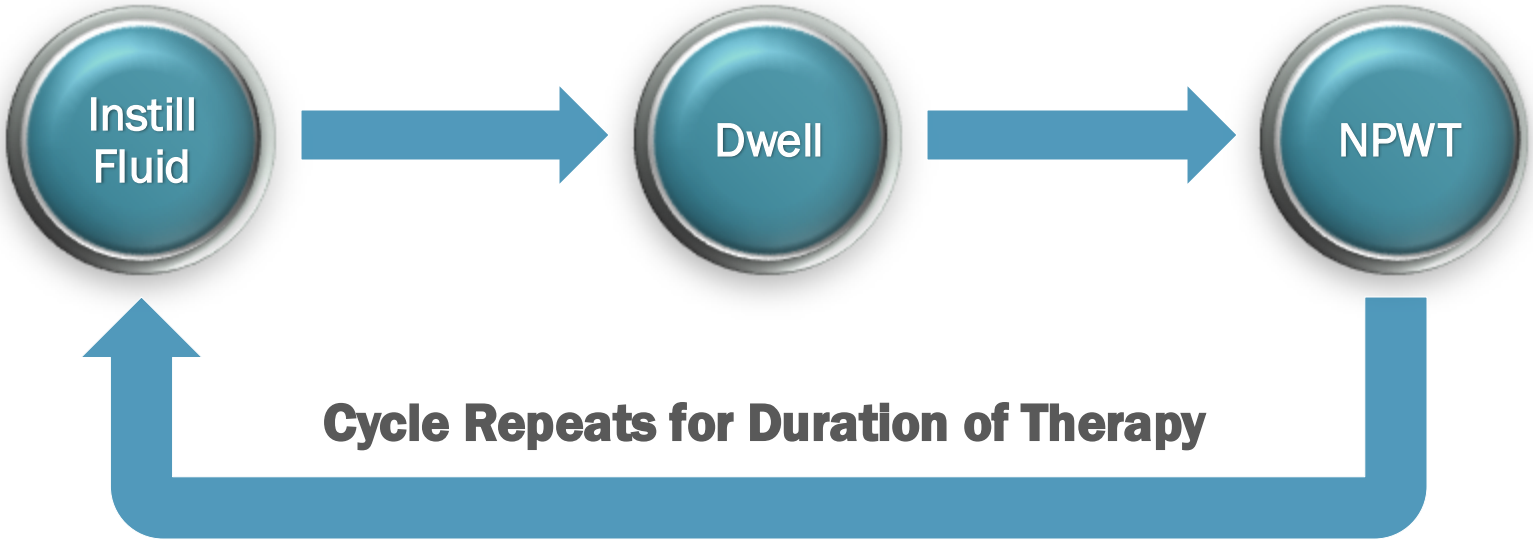
Cleanse, Manage, and Prepare the Wound



Video courtesy of Ralph Napolitano, DPM.
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Wound Cleansing

Photo courtesy of Garrett A. Wirth, MD, MS, FACS.
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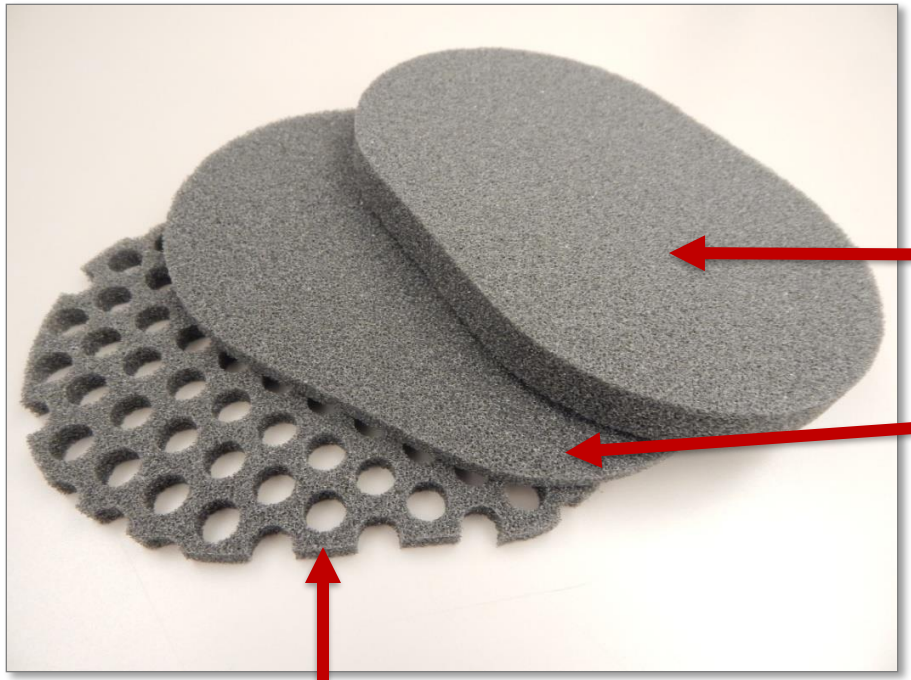
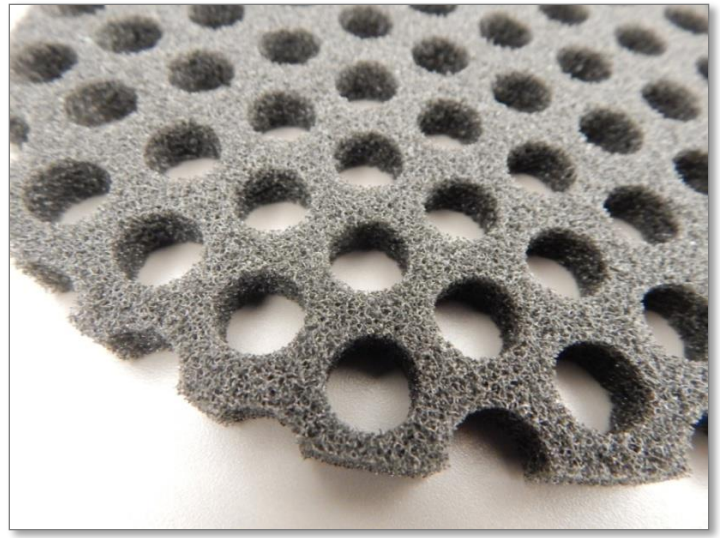
NPWTi-d Dressing (ROCF-CC)



Thick cover layer
- 1.6cm thickness

Thin cover layer
- 0.8cm thickness

Contact layer
- 0.8cm thickness
- 1.0cm circular holes
- 5mm spacing

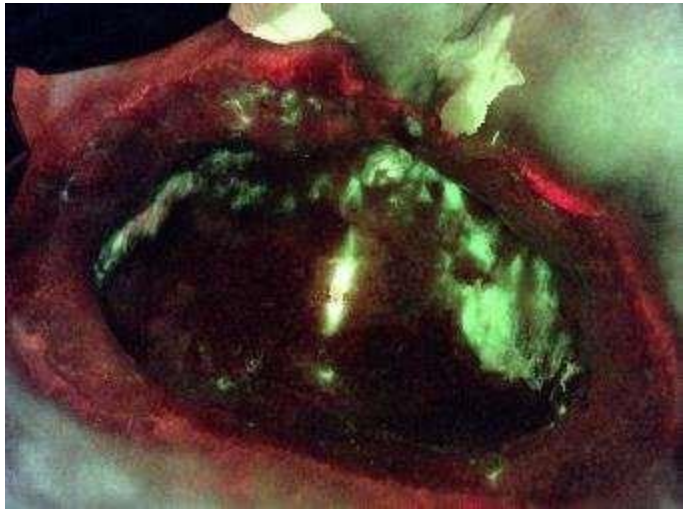


NPWTi-d = negative pressure wound therapy with instillation and dwell; ROCF-CC = reticulated open-cell foam dressing with through holes.

Fluorescence Imaging and NPWT

Standard NPWT device under dressing

Wound bed



Sacrum pressure ulcer. Detection of red bacterial fluorescence after 2 days prompted earlier dressing change and switch to an instillation NPWT device.

Images courtesy of Kara Couch.
Used with permission.

Raizman R, et al. *J Wound Care*. 2019;28(12):824-834.

Case: Crush Injury

- 61y Male was struck by a car and pinned to his vehicle; his legs were amputated at the scene of the accident
- Underwent above-knee amputation (AKA) closure but developed further tissue damage from the crush injury
- Hyperbaric oxygen therapy (HBOT) was initiated and surgical debridement of the wounds to prep for eventual skin grafting
- He had 2 rounds of NPWTi-d and was then grafted using standard NPWT

AKA = above-knee amputation; HBOT = hyperbaric oxygen therapy.

Crush Injury

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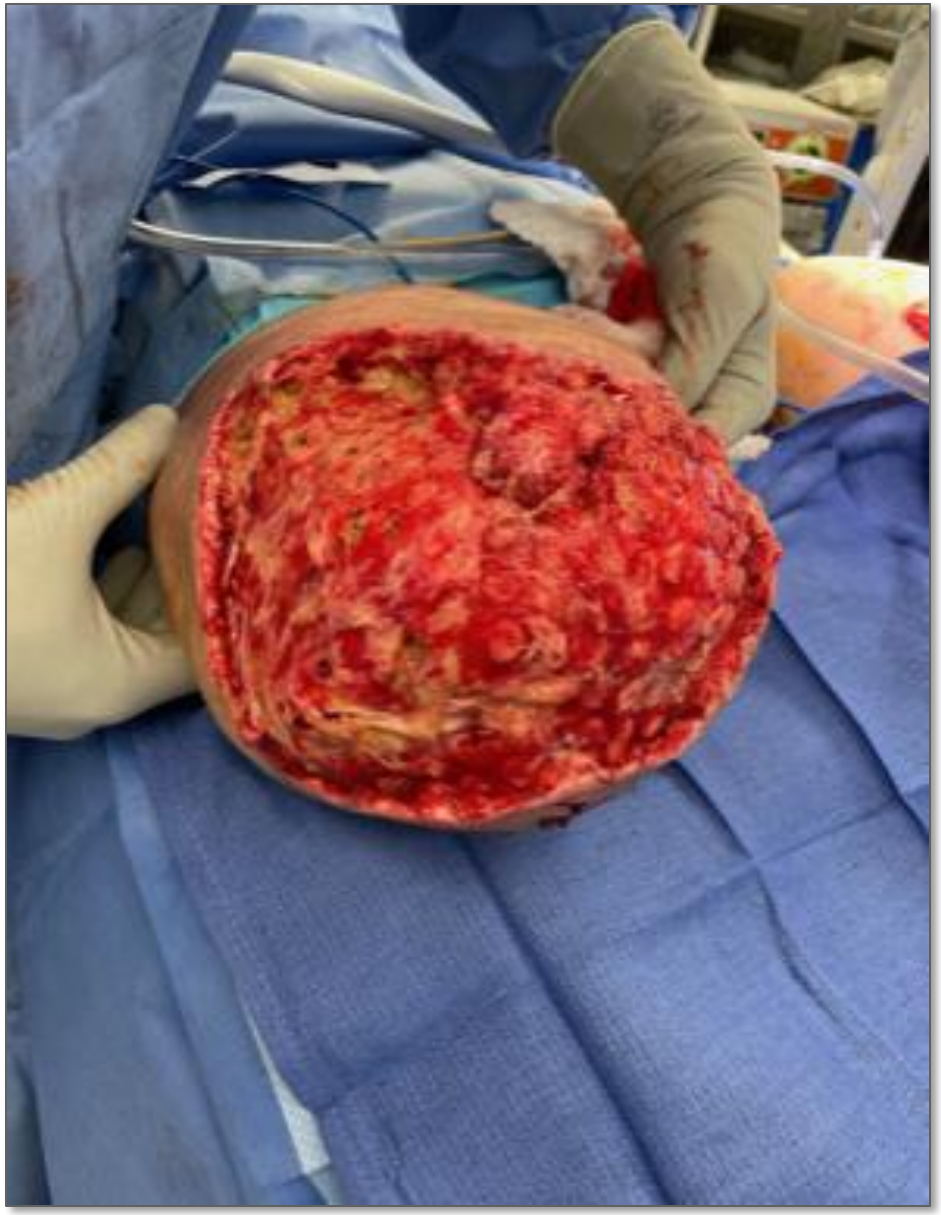

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Clinical Pearls

- Understanding the mechanism of action for topical therapy is critically important
- pH matters greatly in wound healing
- The wound microbiome is very fragile and must be treated carefully to preserve necessary cells

Improving Wound Healing Outcomes Using pHA and Highly Charged Fiber Dressings

Dot Weir, RN, CWON, CWS
Clinician, Holland Hospital Wound and Ostomy Clinic
Holland, MI

The opinions and experiences expressed in my presentation are my own and do not reflect opinions of Holland Hospital.

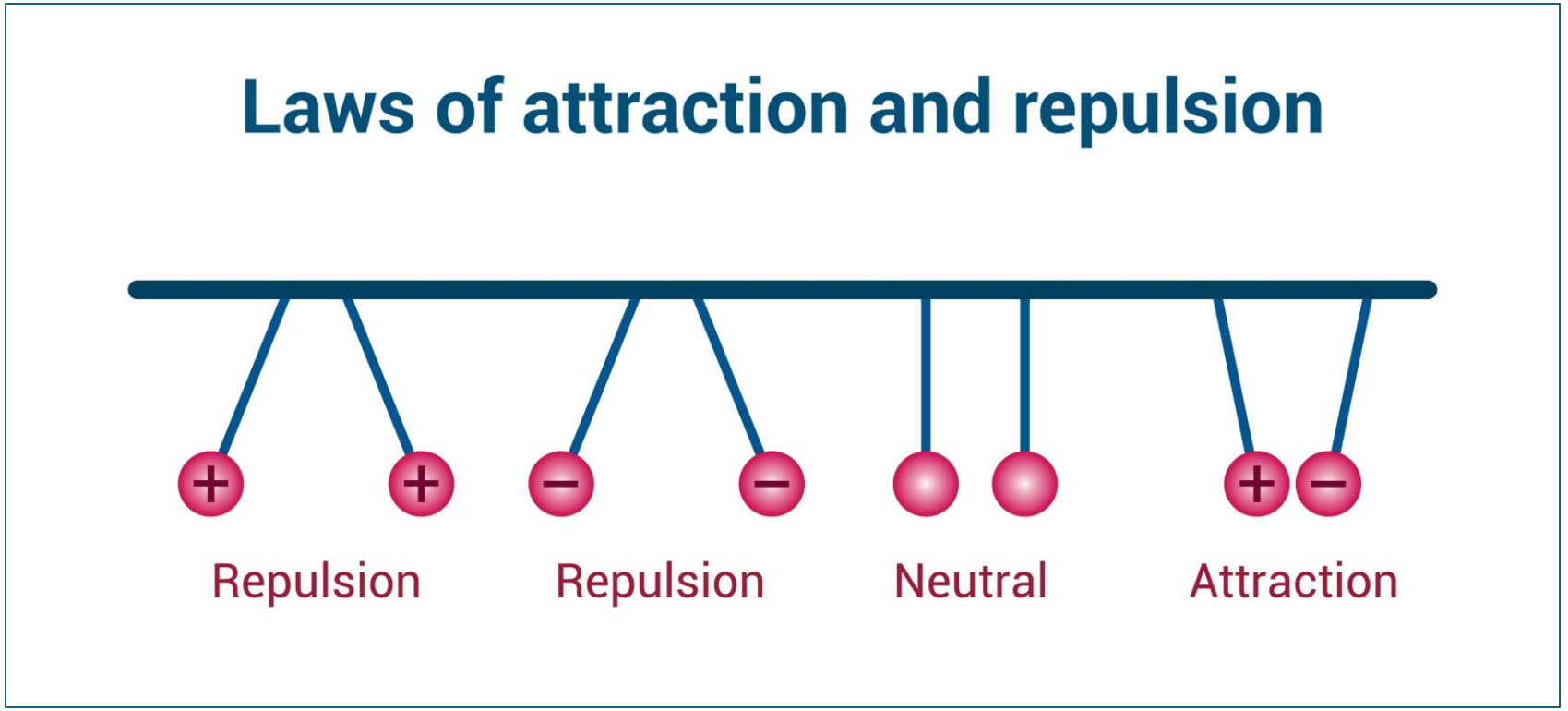
New Concept: Charged Fiber Technology

- Absorbent fiber dressing with TLC-Ag matrix
- Lipido-colloid technology with silver salts
- Cleaning action plus antimicrobial barrier protection

TLC = technology lipido-colloid.

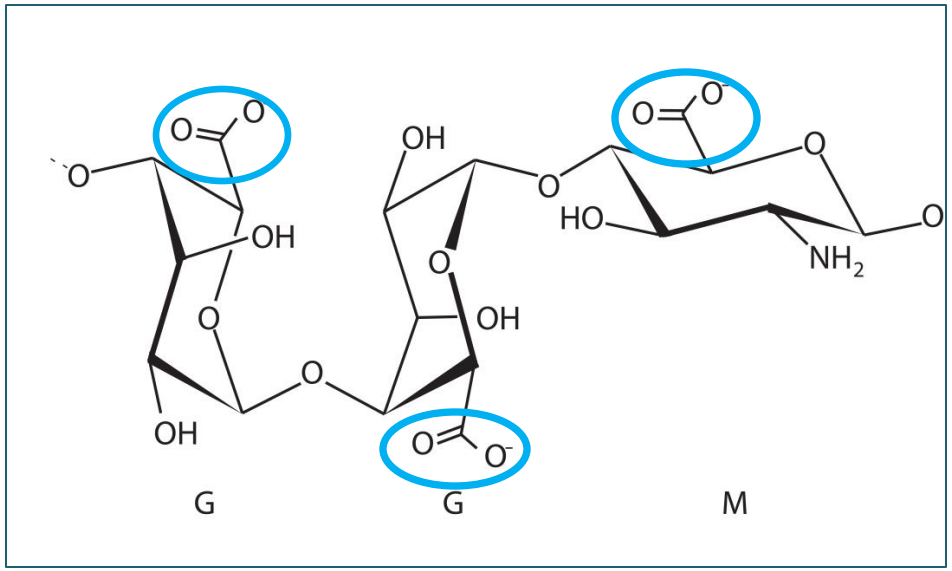
Opposites Attract

Works by electrostatic interactions

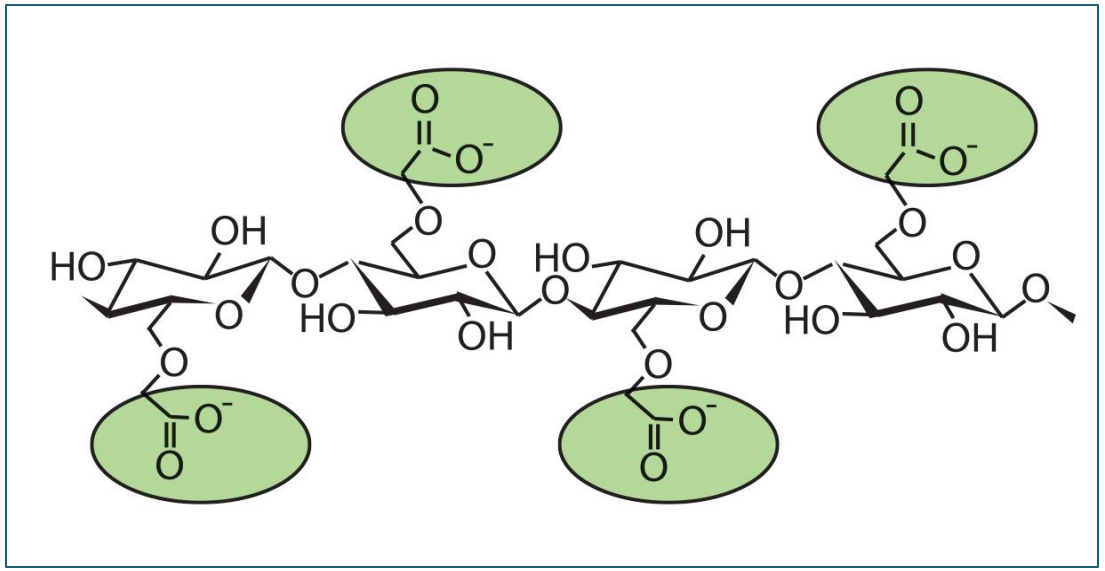


Many Absorbent Dressings Have Negative Charges

Alginates



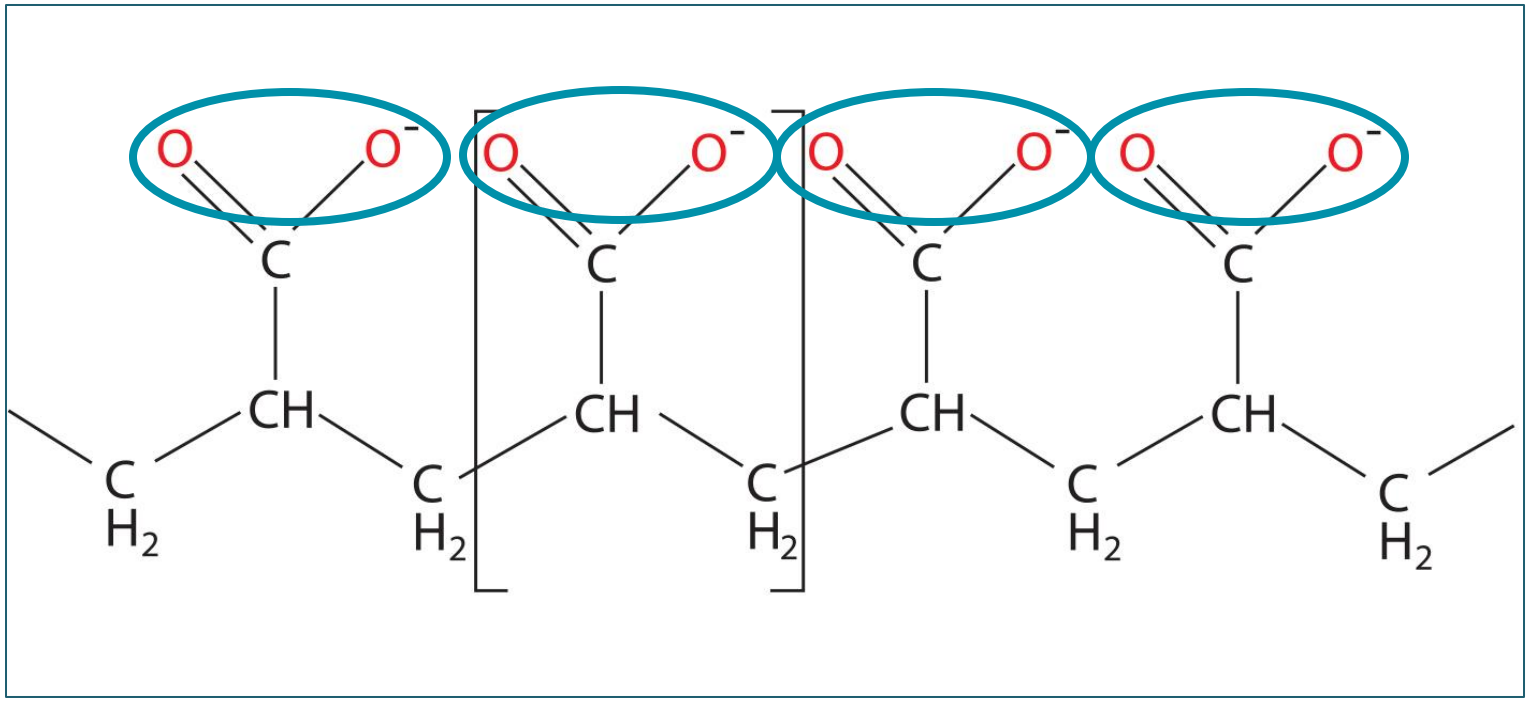
CMC Gelling Fiber



CMC = carboxymethyl cellulose.

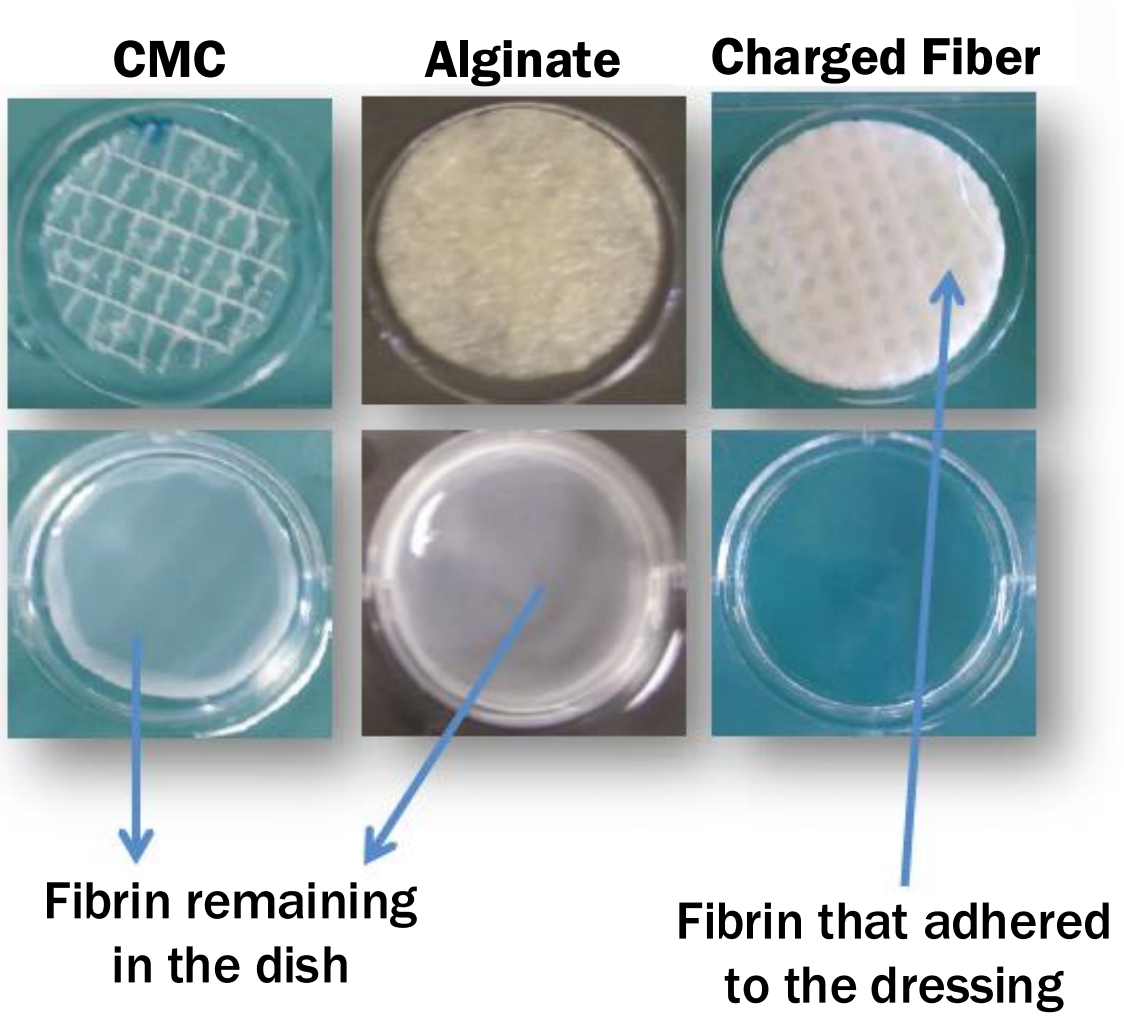
TLC-Ag Matrix Dressing

- Negative charges closer together/densely packed
- More negative charges per square inch of the dressing

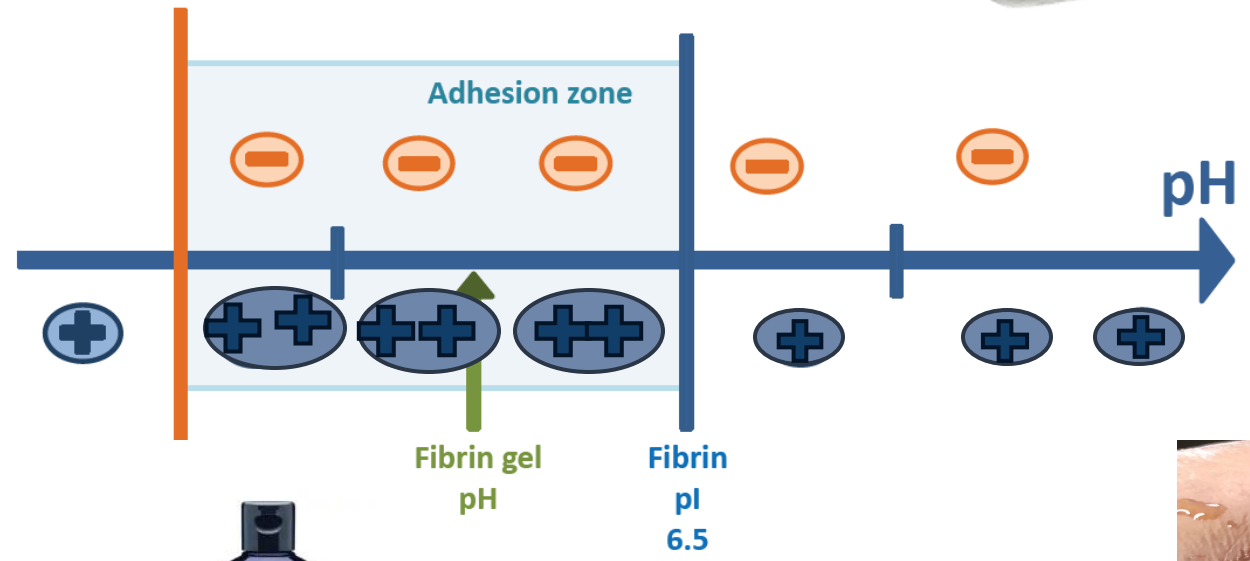


Fibrin Attraction

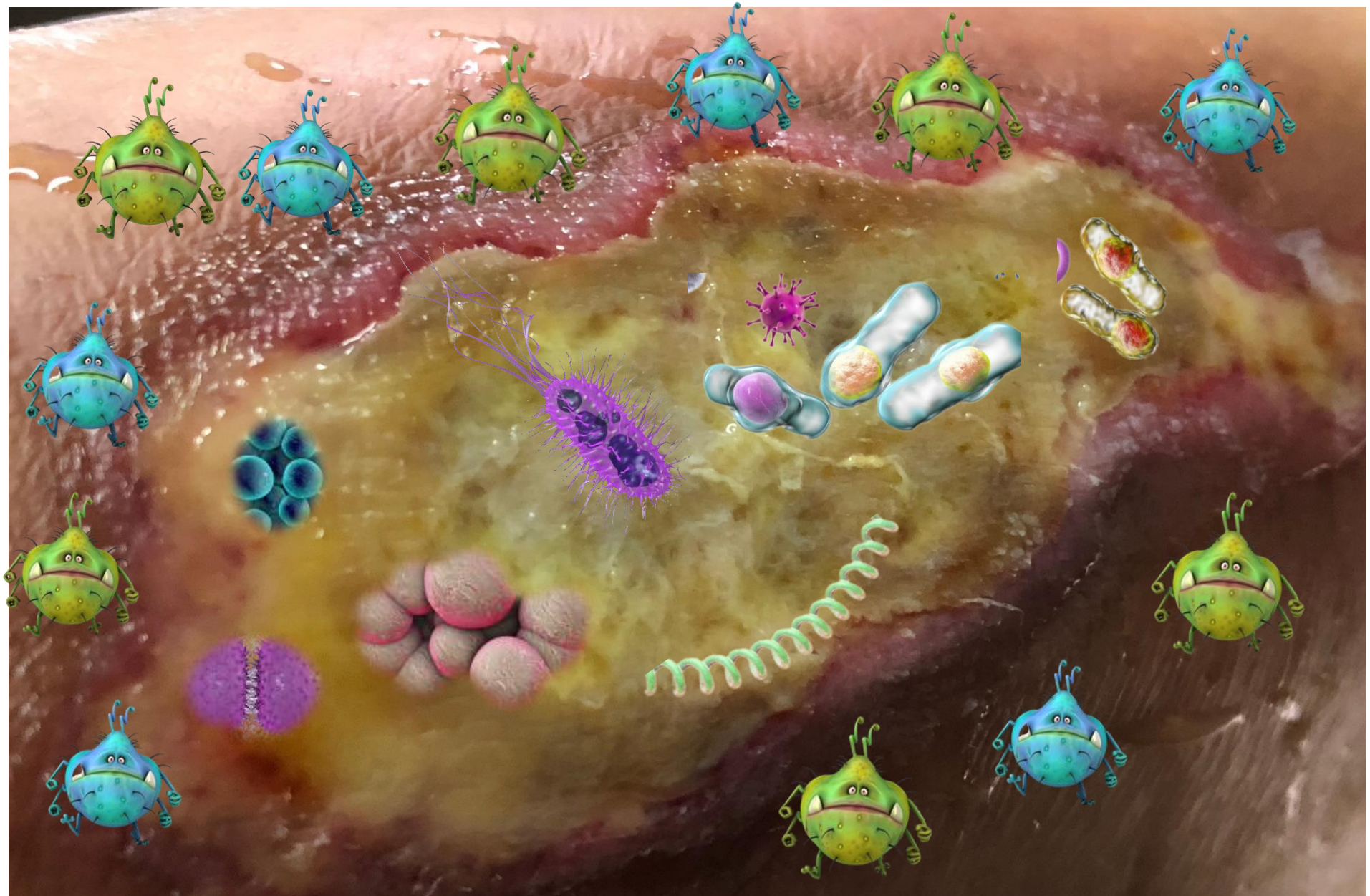
- Positively charged fibrin gel in petri dish
- Charged fiber technology dressing removed all fibrin



Synergy Between Hypochlorous Acid (HOCl) and Negative Fibers?

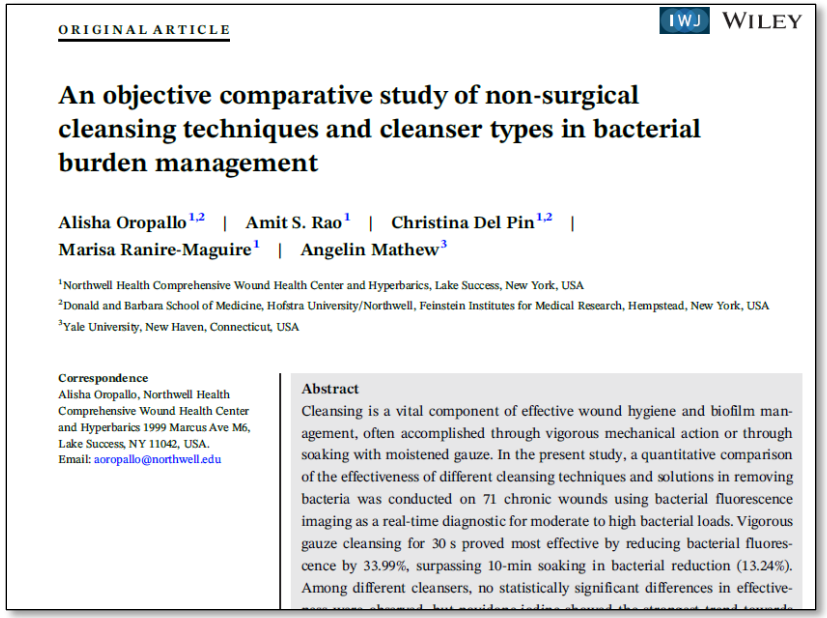


Necrotic Tissue Is a Buffet for Bacteria



Non-Antiseptic vs Antiseptic Solutions

- Cleansing solutions with antiseptic properties were more efficacious in reducing bacteria than the non-antiseptic/surfactant solutions studied (saline and soap/water)
- Most wounds in the saline group (62.5%) demonstrated a positive change (increase) in bacteria (likely due to unmasking of bacteria covered by dead skin in the periwound)



ORIGINAL ARTICLE

IWJ WILEY

An objective comparative study of non-surgical cleansing techniques and cleanser types in bacterial burden management

Alisha Oropallo[1,2] | Amit S. Rao[1] | Christina Del Pin[1,2] | Marisa Ranire-Maguire[1] | Angelin Mathew[3]

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Abstract
Cleansing is a vital component of effective wound hygiene and biofilm management, often accomplished through vigorous mechanical action or through soaking with moistened gauze. In the present study, a quantitative comparison of the effectiveness of different cleansing techniques and solutions in removing bacteria was conducted on 71 chronic wounds using bacterial fluorescence imaging as a real-time diagnostic for moderate to high bacterial loads. Vigorous gauze cleansing for 30 s proved most effective by reducing bacterial fluorescence by 33.99%, surpassing 10-min soaking in bacterial reduction (13.24%). Among different cleansers, no statistically significant differences in effective-

Oropallo A, et al. *Int Wound J*. 2024;21(2):e14730.

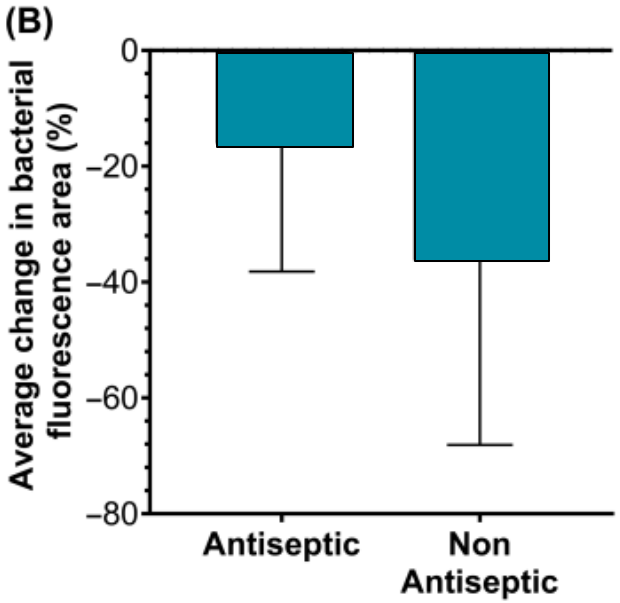
Non-Antiseptic vs Antiseptic Solutions

- Cleansers with antiseptic properties led to a significantly greater reduction in bacteria than non-antiseptics and surfactants (saline, soap)
- There was no statistically significant difference between antiseptic cleansers

How do we select the best antiseptic cleanser?

What are the tie-breakers?

- Cytotoxicity
- Debridement
- pH



Oropallo A, et al. *Int Wound J*. 2024;21(2):e14730.

CLINICAL MANAGEMENT EXTRA

Therapeutic Indices of Topical Antiseptics in Wound Care: A Systematic Review

Geng, Ryan S.Q. MSc; Sibbald, R. Gary MD, MEd, FRCPC (Med, Derm), FAAD, MAPWCA, JM; Slomovic, Jacqueline MD; Toksarka, Olivia; Schultz, Gregory PhD*

Author Information

Advances in Skin & Wound Care ():10.1097/ASW.0000000000000233, October 3, 2024. | **DOI:** 10.1097/ASW.0000000000000233

Goal: to determine the therapeutic index values of topical antiseptics used in wound care for bacterial species commonly isolated from chronic wounds

Therapeutic Index Calculation

$$\frac{\text{Mean cytotoxic concentration in mammalian cells}}{\text{Mean MBC of bacterial species}}$$

MBC = minimum bactericidal concentration.

Highest Therapeutic Indices over 1.0

- The therapeutic indices for the topical antiseptics included in this study were generally low, with most ranging between 0.5-3.0
- Of the topical antiseptics with adequate data points, the highest indices over 1.0 for the bacterial species included in this study were:
  - MRSA: PHMB 12.1, octenidine 3.33, chlorhexidine 2.55 (HOCl not tested)
  - *S. aureus:* HOCl 6.31, octenidine 12.15
  - *P. aeruginosa:* HOCl 8.81, PHMB 1.14
  - *E. coli*: HOCl 5.49, octenidine 1.33, hydrogen peroxide 1.19, chlorhexidine 1.15

PHMB = polyhexamethylene biguanide.

Geng RSQ, et al. *Adv Skin Wound Care*. 2025;38(1):10-18.

2 Weeks

Venous Leg Ulcer

Day 0: Application of new dressing

Day 7: Tissue softer

Day 14

Day 28

Day 35

Day 42

- 62 y/o
- PMH: RA, CVI, PG, HTN
- On multiple anti-inflammatory meds
- Negatively charged dressing and 2-layer wrap

3-27: 12.5cm^2

4-5: 5.4cm^2

4-13: 5.5cm^2

4-26: 5.2cm^2

6-21

RA = rheumatoid arthritis; CVI = chronic venous insufficiency; PG = pyoderma gangrenosum; HTN = hypertension.

Arterial Ulcer: R Medial Malleolus

- 93y Female
- PMH: Anemia, HTN, CVA, DM, kidney disease, arthritis, multi-level vascular disease
- Pain level: 5+

Day 0: 1.0cm x 1.5cm x 0.1cm
Before and after HOCl soak

CVA = cerebrovascular accident; DM = diabetes mellitus.

Arterial Ulcer: R Medial Malleolus

Day 14: 0.7cm x 1.2cm x 0.1cm
Began negatively charged dressing

Day 19: 1.0cm x 1.1cm x 0.1cm

Arterial Ulcer: R Medial Malleolus

Day 33: 1.2cm x 1.5cm x 0.1cm
Pre-Cleaning

Day 49: 0.9cm x 1.6cm x 0.1cm

Traumatic Hand Injury

- 15y Male
- No PMH
- Traumatic wound from ATV accident
- Previously using xeroform petrolatum gauze
- Quite tender, he wanted to perform own dressings

Day 0

Traumatic Hand Injury

Day 6

- Taught him to soak with pHA and apply negatively charged dressing
- Instructed to change every other day or when soiled

Day 11

- He was playing baseball, so changed it daily
- No sharp debridement, closed at day 20
- Encouraged him to use his experience as a science project

Day 20

pHA = pure hypochlorous acid preserved cleanser.

Clinical Pearls

- Highly charged fiber dressings are a newer concept to complement and enhance integral debridement
- Reducing the pH of the wound surface can improve the interaction with the negatively charged dressings
- Education as to the appearance of the surface exudate should be provided for realistic expectations

The Science of Synergistic Technologies For Desloughing and Debridement

Abigail E. Chaffin, MD, FACS, CWSP, MAPWCA
Professor and Chief, Division of Plastic Surgery
Tulane University
New Orleans, LA

Slough

Complex mixture of

- Exudate proteins
- Degraded ECM proteins
- WBC
- Planktonic microorganisms
- Biofilm microorganisms

- Common occurrence in hard-to-heal wounds
- May **impair healing**

ECM = extracellular matrix.

Slough

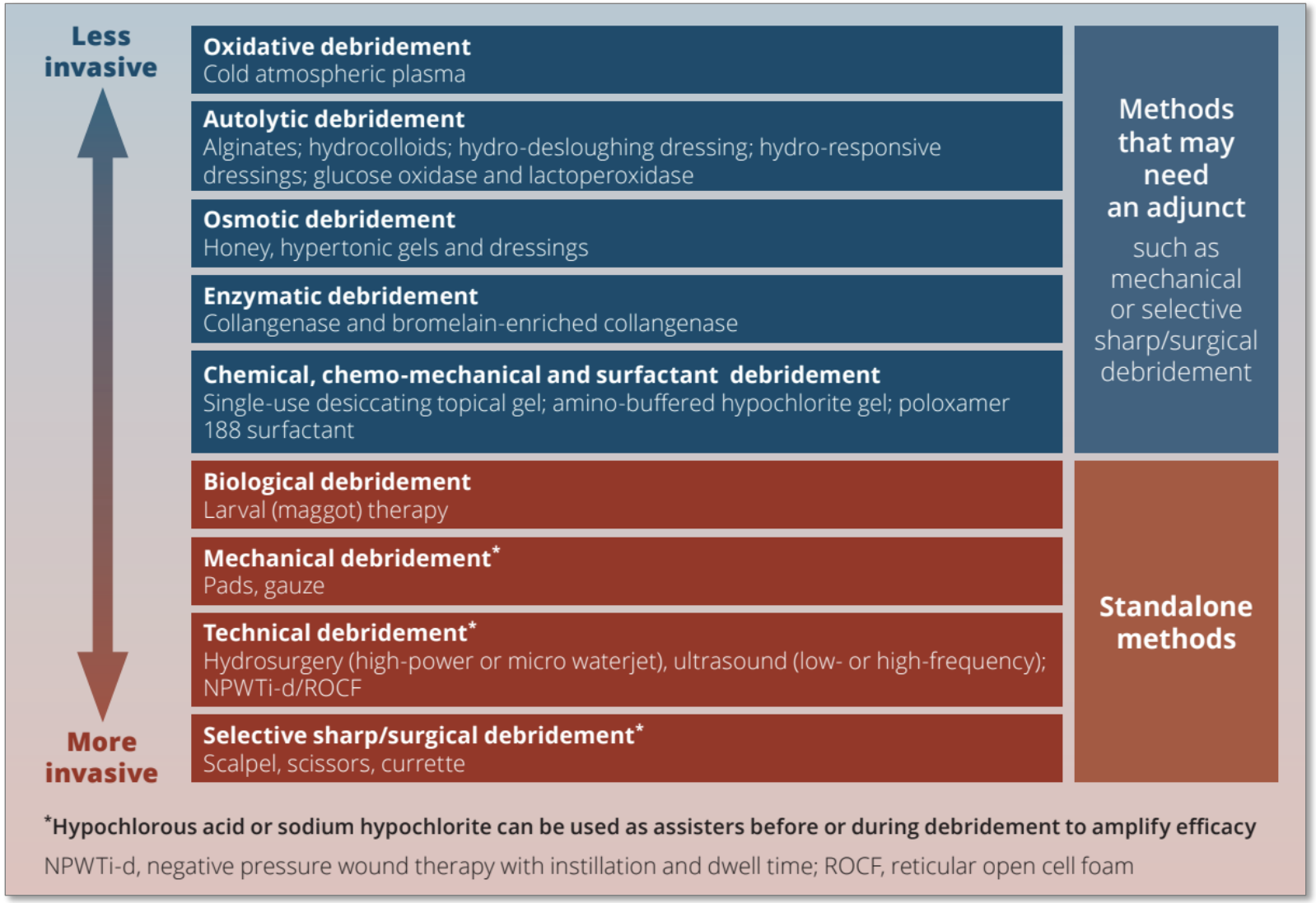
Loose Slough

- Lightly adherent to the wound bed
- Yellow or tan
- Usually easily removed from wound bed
- Dead cells, debris, fibrin

Adherent Slough – PRO-INFLAMMATORY

- Layer of devitalized tissue tightly adherent to the wound bed
- More challenging to remove
- Fibers, degraded ECM proteins, exudate, WBC, bacteria

Methods of Debridement



Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Integral Debridement

- Emphasizes the importance of **tailoring debridement methods to individual patient needs,** preferences and environments, local resources, skill levels of different caregivers/clinicians

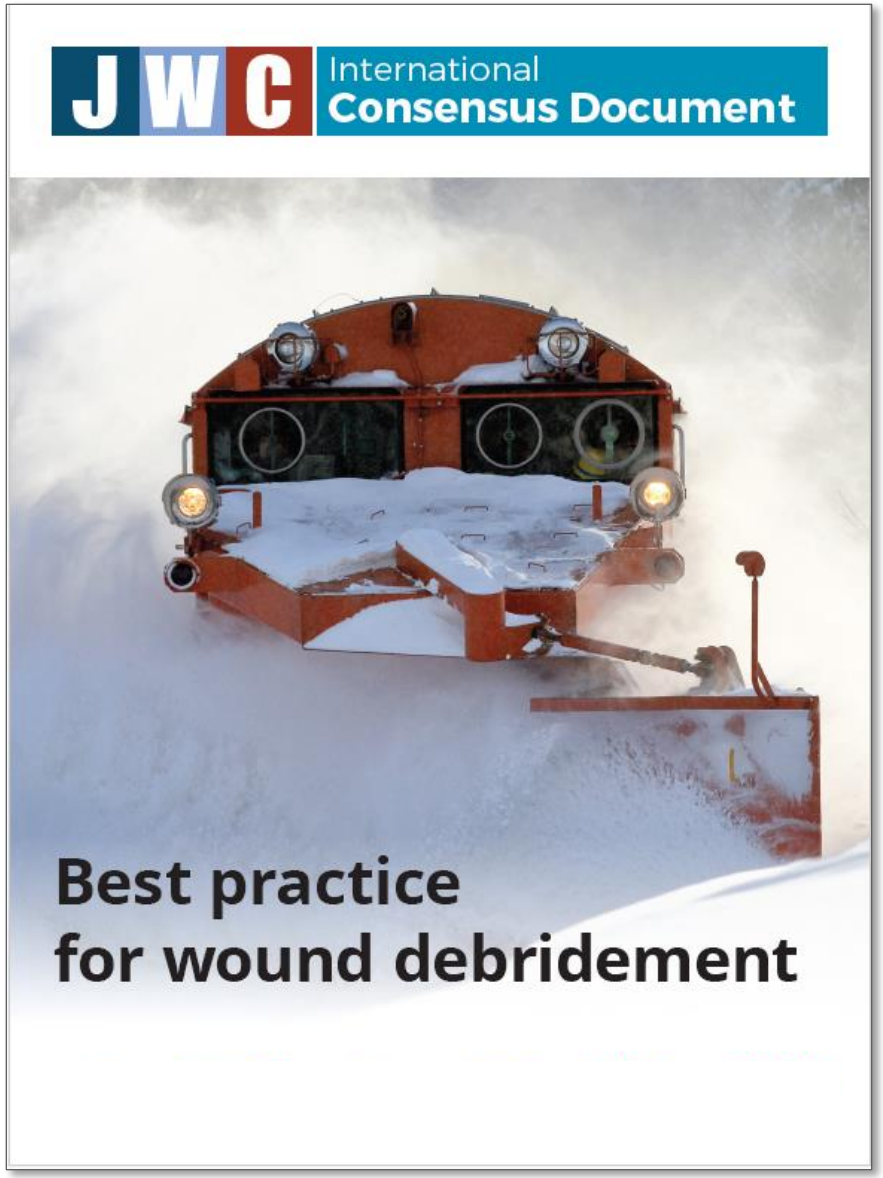
- DIFFERENT CARE SETTINGS MAY REQUIRE DIFFERENT APPROACHES
- Health professional's level of training may limit their scope of practice

- CONSIDER the clinical context and patient perspectives when selecting the appropriate debridement method
- **Ensures that debridement care is not only effective but also aligned with the unique needs and goals of each patient**

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Recently Published Data

- Dieter Mayer, et al. *Journal of Wound Care*
- HOCl can be used to **assist (amplify)** various standalone debridement methods, such as mechanical debridement, selective sharp/surgical debridement, and technical methods, including NPWTi-d with ROCF
- It has properties that enable it to remove germs and debris in a way that differentiates it from saline
- **SYNERGISTIC technology** with other forms of debridement



Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C. Mayer DO, et al. *J Wound Care.* 2024;33(Supp6b):S1-S32.

HOCl-Based Cleanser: Assister/Amplifier of Mechanical Debridement

- Mechanical disruption of devitalized tissue and microbes during irrigation or in conjunction with mechanical debridement

Table 3. Summary of assisters (amplifiers) of various debridement methods

Method	Example	Mechanism of Action	Key Indications	WBP	Referral
Hypochlorous acid (HOCl)	Stabilized solutions or gels	Mechanical disturbing of devitalized tissue and microbes during irrigation or in conjunction with mechanical debridement	Assists mechanical debridement in wounds with high bacterial burden	Needed	See note*
Sodium hypochlorite (NaClO)					

Note: *Refer in extensive, deep wounds, exposed tendon or bone, chronic venous insufficiency, clinical signs of deep or systemic infection, worsening wound or no progress after 2-4 wks of treatment.

Best Practice for Wound Debridement. *J Wound Care*. 2024;33(6):Sup C.

Cases

Total Knee Arthroplasty (TKA) Dehiscence Wound

- 70y Female
- DM, peripheral arterial disease (PAD)
- Right TKA performed 6 wks prior
- Early initiation of PT for ROM

- Superficial wound dehiscence
- Threatens prosthetic joint
- Plan operative excision and local flap reconstruction

TKA = total knee arthroplasty; PAD = peripheral arterial disease; ROM = range of motion.
Image: MedlinePlus. National Library of Medicine (U.S.) Updated June 2024. medlineplus.gov

TKA Dehiscence Wound

- Day 6
- Novel dressing changed 3 times
- pHA soaks
- 70% reduction in slough

- Able to start in operating room with a much cleaner operative wound
  - Decreased slough = Decreased wound colonization

pHA = pure hypochlorous acid preserved cleanser.

TKA Dehiscence Wound

- OR

- Excision of wound
- Irrigation with pHA

- Local tissue advancement closure
- Good perfusion of tissue
- Incisional negative pressure wound therapy (iNPWT)/knee immobilizer

pHA = pure hypochlorous acid preserved cleanser.
iNPWT = incisional negative pressure wound therapy.

TKA Dehiscence Wound

- Post-op day (POD) 8

- Incision intact with 4mm superficial open area superiorly
- Reapply novel dressing
- Change q2 days by home health

- No signs of infection
- Continue knee immobilizer

POD = post-op day.

TKA Dehiscence Wound

Healed at 2 wks

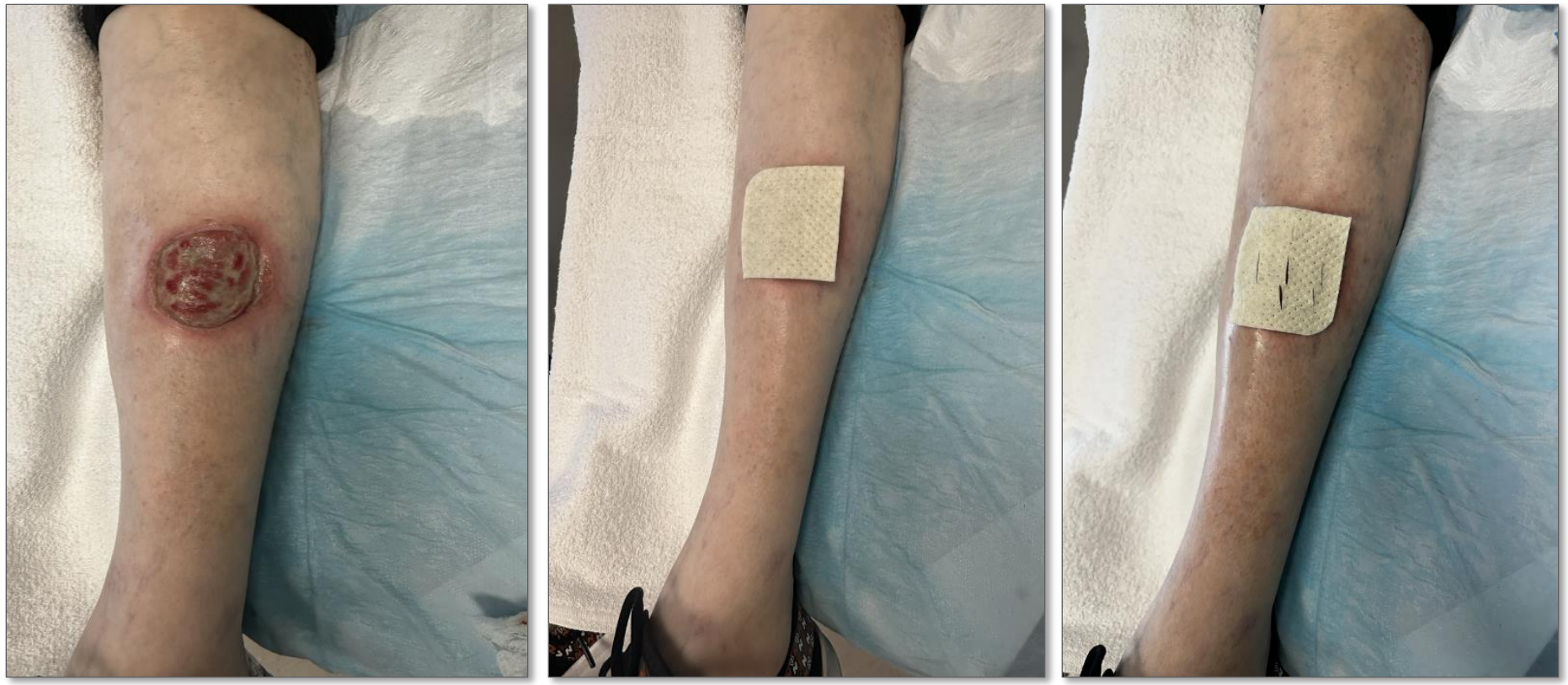
Pyoderma Wound

- 68y Female
- Dermatology: Biopsied proven pyoderma gangrenosum (PG) to left lower extremity (LLE)
- Adherent slough
- Concern to avoid sharp debridement to not risk pathergy

PG = pyoderma gangrenosum; LLE = left lower extremity.

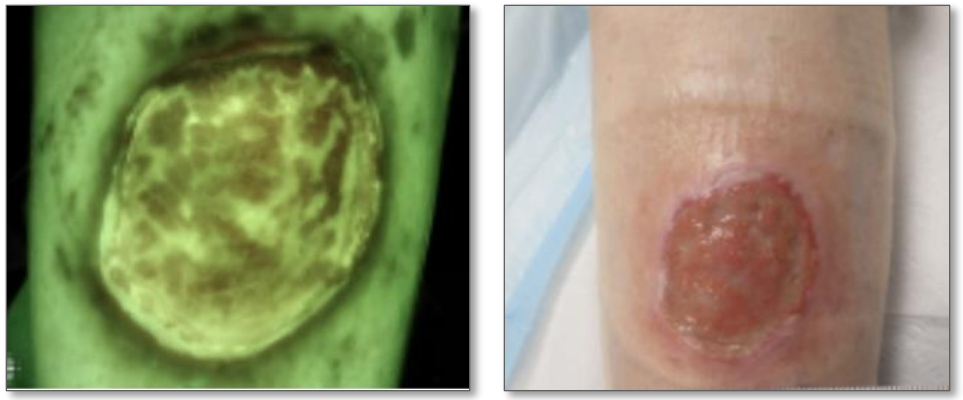
Synergistic Debridement

- pHA soaks
- Highly-charged fiber dressing

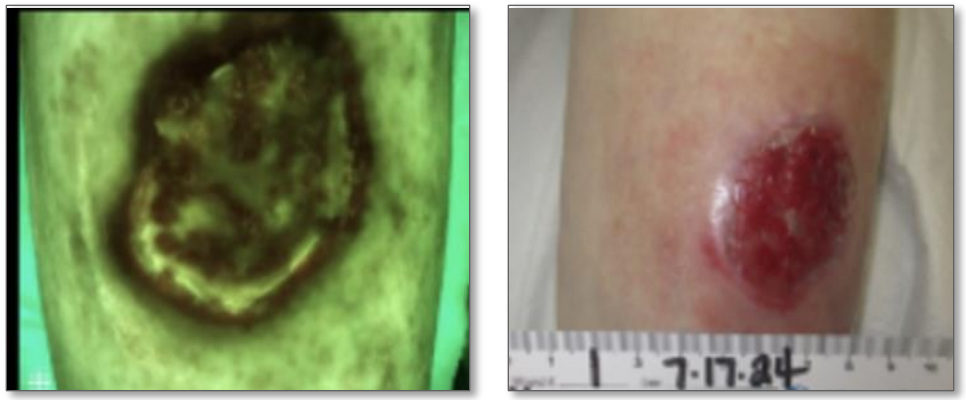


pHA = pure hypochlorous acid preserved cleanser.

Reduction in Bacterial Fluorescence



4 wks



7 wks

5 Months: Healed

Infected Calciphylaxis

- 71y Female
- ESRD, spontaneous calciphylaxis

SURGICAL CULTURE	Final
Organism 1	ESCHERICHIA COLI
QUANTITATION	MODERATE

ANAEROBIC CULTURE	Final
Organism 1	BACTEROIDES FRAGILIS
QUANTITATION	MODERATE

ESRD = end-stage renal disease.


Wound Solution
for wounds, skin and burns
Rx Only
ON
SMART INSTILL™ Feature
Step 3 of 5
Estimating instill fluid volume...
Press 'Cancel' to exit SMART INSTILL™ Feature
Cancel
NOT FOR HOME USE

Infected Calciphylaxis

Infected Calciphylaxis: Staged STSG

STSG = split-thickness skin graft.

Infected Calciphylaxis

Venous Gangrene

- 62y Female
- Morbid obesity: BMI 62
- Diabetes mellitus (DM)
- HgA1c = 12
- Venous gangrene to LLE

Venous Gangrene

Wound = 1800cm^2

Venous Gangrene

- NPWTi with pHA cleanser
  - Adequate excisional debridement
  - Duo port
    - Fill port proximal/high
    - Suction port distal/low
  - Start on suction before instillation

pHA = pure hypochlorous acid preserved cleanser.

Venous Gangrene

- Transfer to LTACH 1 month
- Continue NPWTi with pHA cleanser
- IV antibiotics per ID
- 5-layer compression
- Wound now 662cm^2

- **STSG 662 cm^2**
  - NPWT/5-layer compression wrap

pHA = pure hypochlorous acid preserved cleanser.
LTACH = long-term acute care hospital.

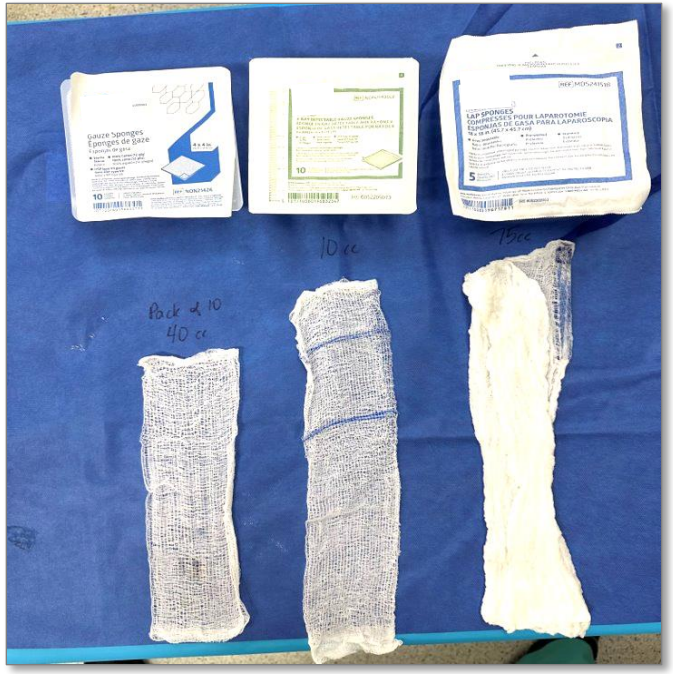
Venous Gangrene

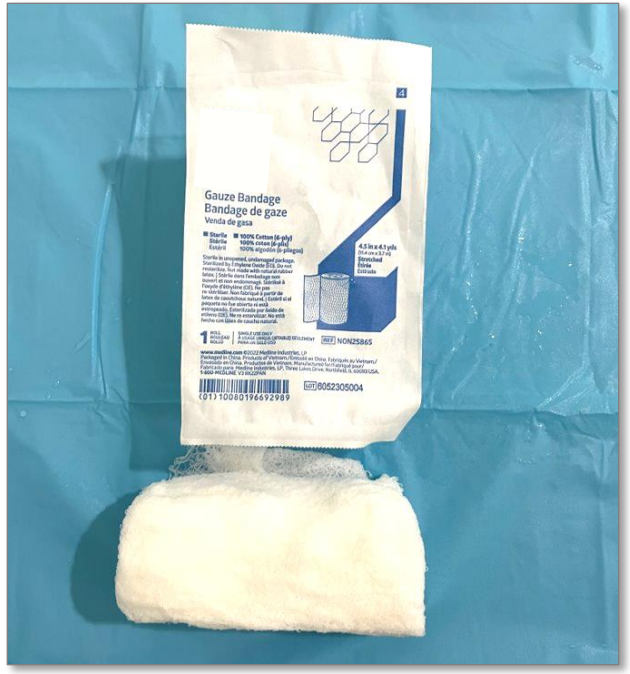
Groin Abscess Wound

- 62y Female
- Diabetes
- Heavy smoker
- Spontaneous necrotic abscess at right groin
- Presented to ED
- Thin coverage over pulsatile femoral artery

Groin Abscess Wound

	OR Xray Gauze (1)	OR 4x4 Gauze (10)	OR Lap Sponge (1)	Rolled Gauze Bandage (1)
Amount of pHA to saturate	10cc	40cc	75cc	124cc
Cost	$0.63	$2.52	$4.75	$7.81



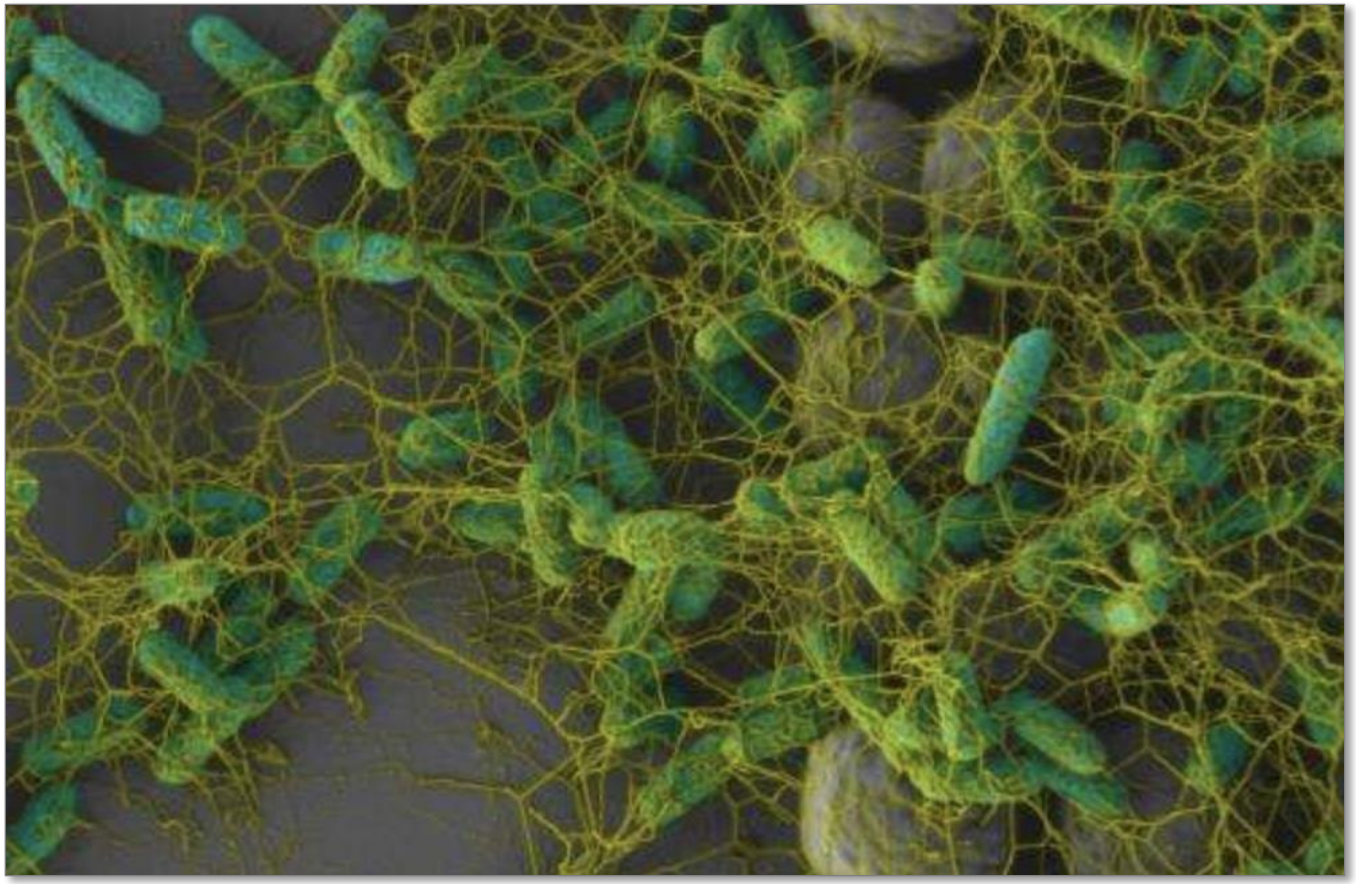


pHA = pure hypochlorous acid preserved cleanser.

Groin Abscess Wound

Groin Abscess Wound

- OR Cultures
  - *Bacteroides fragilis*
  - Methicillin-resistant *Staphylococcus aureus*
  - *Enterococcus faecalis*
  - *Morganella morganii*
  - *Escherichia coli*



DePas WH, et al. *Proc Natl Acad Sci U S A.* 2013;110(7):2629-2634.

Abscess Wound

2 wks post-op

3 months post-op

Clinical Pearls

- Application of pHA solution to wounds with slough prior to application of a highly charged fiber dressing may help accomplish improved slough removal and more rapid wound healing. **SYNERGY**
- Utilization of the concept of integral debridement, by all wound clinicians, may allow for **better wound preparation prior to surgery** for improved wound and surgical site healing outcomes
- Integral debridement concepts applied post-operatively may **improve wound healing times and decrease healing complications**

pHA = pure hypochlorous acid preserved cleanser.