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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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.

Q&A

**Please submit your questions,
at any point, via the question box.**

We want to hear from you!

Wound Bed Preparation And Debridement Modalities

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Polling Question

Integral debridement is a method of debridement that _____.

A. occurs in a delayed fashion
B. always utilizes sharp instruments
C. is tailored to the patient's individual needs
D. uses cautery

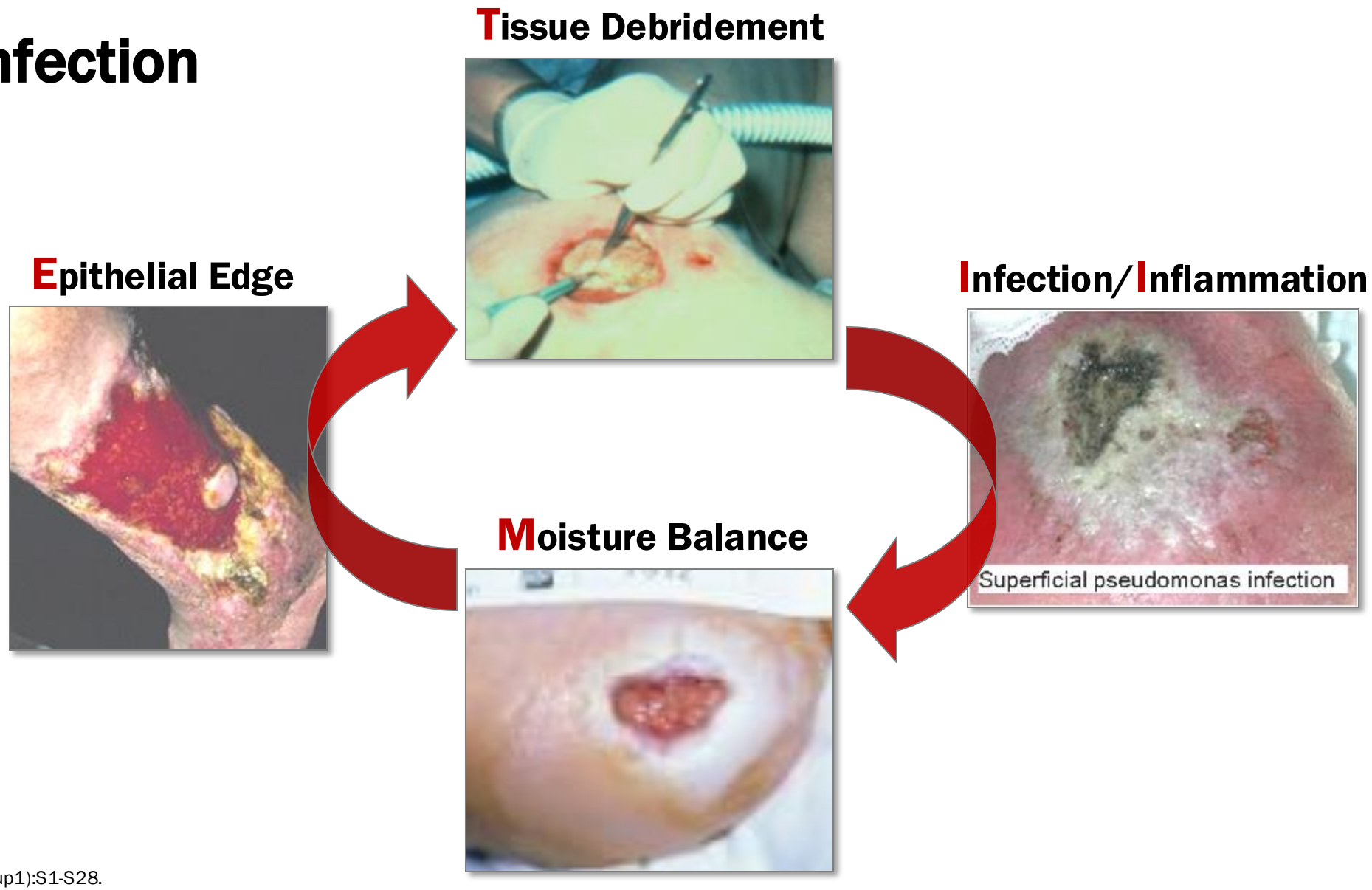
Types of Debridement

Strategy	Description	Examples
Mechanical	Removal of necrotic tissue by mechanical means	Wet-to-dry dressings, hydrotherapy, ultrasound, NPWT
Surgical (excisional/sharp)	Removal by surgical instrument	Scalpel, scissors, hydrosurgery, lasers, curettes
Biosurgical	Sterile larvae selectively digest necrotic tissue and bacteria	Sterile blowfly or horsefly larvae
Autolytic	Uses the body's own enzymes to dissolve necrotic tissue; assisted with moisture-retentive dressings	Films, hydrogels, hydrocolloids, honey, surfactants
Enzymatic	Application of enzymes to liquefy necrotic tissue	Collagenase, bromelain

NPWT = negative pressure wound therapy.

Types of Debridement

Wound Bed Preparation and TIME:
Tissue
Inflammation/Infection
Moisture
Edge



Schultz GS, et al. *Wound Repair Regen*. 2003;11(Sup1):S1-S28.

21 Years of TIME

2003 2004 2012 2016 2019 2024

T: Tissue Debridement
Remove Non-Viable or Deficient Tissue

Goals
- Remove necrotic tissue, micro-debris, and slough
- Reduce microbial bioburden

Types of debridement
- Autolytic
- Surgical/sharp
- Mechanical
- Enzymatic
- Biological
- Hydrosurgery
- Ultrasonic
- Chemical
- Honey


Autolytic


Surgical

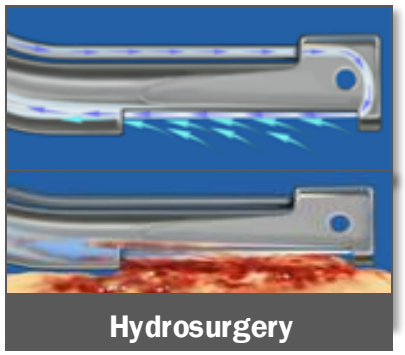

Ultrasonic


Mechanical


Enzymatic


Chemical/Oxidative


Biological


Hydrosurgery


Honey

WHS Guideline. 2007.

International Consensus Document On Wound Debridement, 2024

DEFINITION

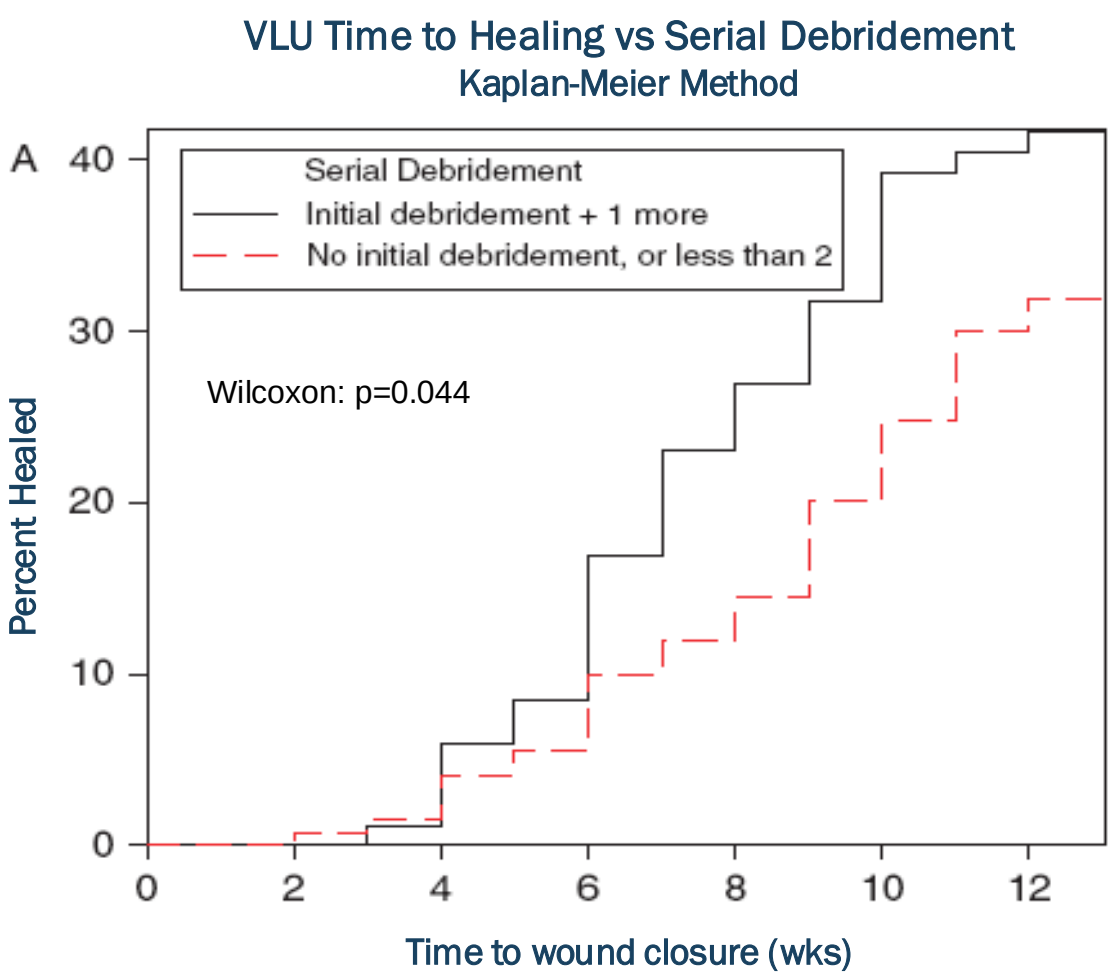
Debridement is the removal of viable and non-viable wound components, including necrotic material, slough, antimicrobial tolerant polymicrobial communities, and foreign materials. The primary goal of debridement is to reduce both microbial and non-microbial biomaterials using the most effective methods with the fewest side effects. These methods should be safely executable at the site of care.

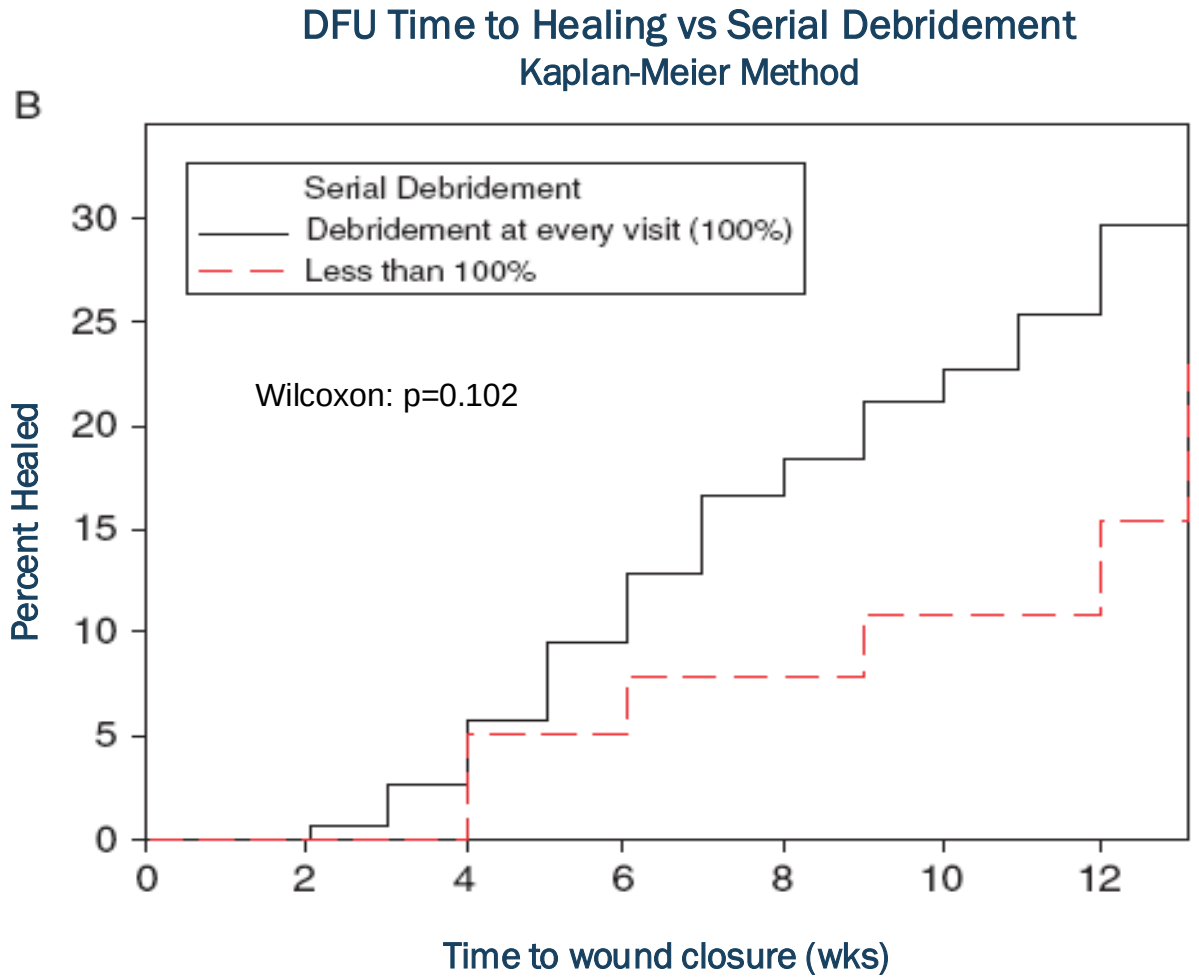
ACTION POINT

Debridement is a critical component of best practice in wound management due to its significant impact on the healing process. The rationale for debridement lies in the removal of devitalized tissue, microbial and non-microbial biomaterial, and bacterial colonies and debris from wounds. Devitalized tissue, such as necrotic or sloughy tissue, creates a barrier to wound healing. It hinders the migration of healthy cells and the formation of new blood vessels, impeding the wound's ability to progress through the healing phases. By removing this non-viable tissue, debridement promotes the growth of healthy granulation tissue and facilitates wound closure.

Mayer D, Ciprandi G, Downie F, Hampton J, Hodgson H, Lazaro-Martinez JL, Probst A, Schultz G, Stuermer EK, Tettelbach WH. International Consensus Document on Wound Debridement. *J Wound Care*. In press.

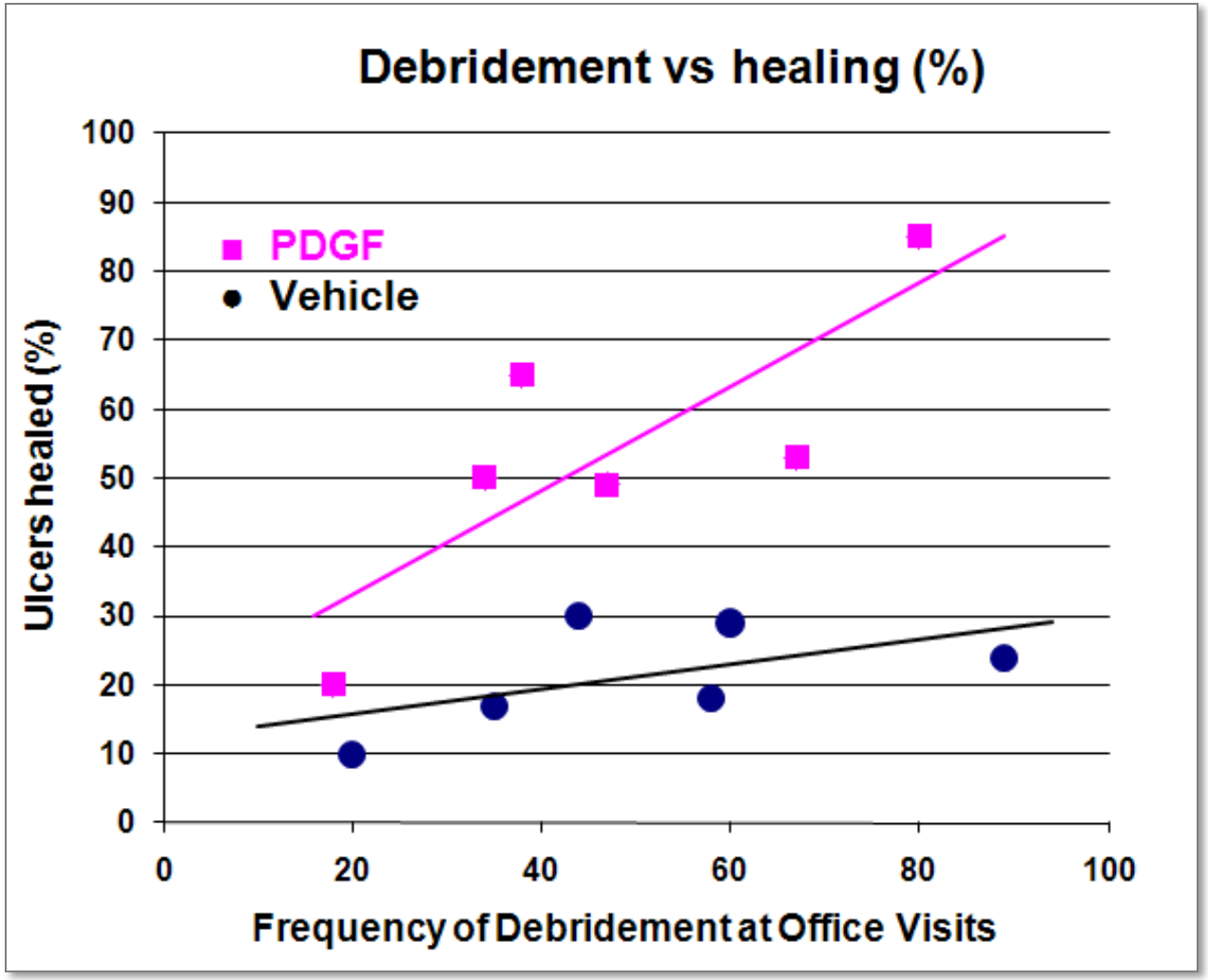
Frequent, Sharp Debridement Improves Healing Of Chronic VLUs and DFUs





Cardinal M, et al. *Wound Repair Regen*. 2009;17(3):306-311.

Frequent Sharp Debridement Improves Healing of Chronic DFU, Effect of Advanced Treatments: rhPDGF



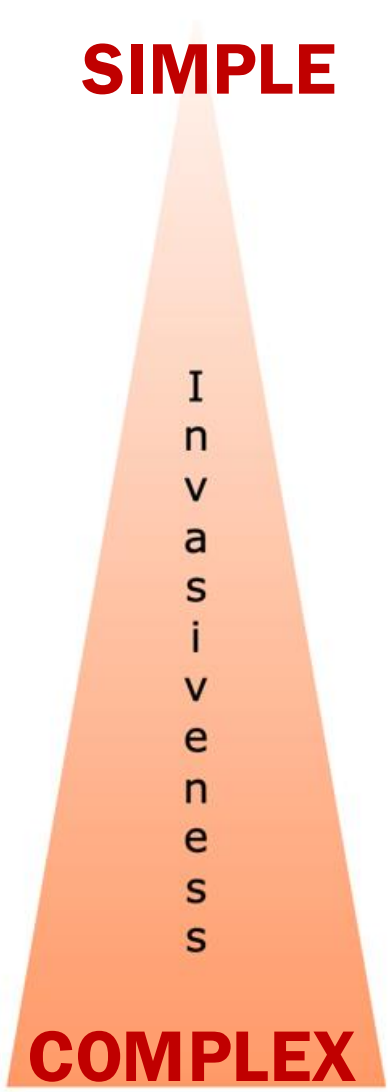
rhPDGF = recombinant human platelet-derived growth factor.

Steed DL, et al. *J Am Coll Surg*. 1996;183(1):61-64.

Methods of Debridement

- Autolytic: Hydrogel
- Sharp
- Enzymatic: Bromelain, collagenase
- Ultrasonic
- Mechanical
- Highly negative-charged fibers: Device

Complexity of Wound Debridement Procedures



Oxidative	Cold, atmospheric plasma
Autolytic/osmotic	Hydrogels, hydrocolloids, honey…
Enzymatic	Collagenase, Bromelain…
Chemical/chemo-mechanical	MSA, Surfactant, 68…
Biological	Larval therapy (maggots)
Mechanical	Wet-to-dry, gauze, microfilament GP
Technical	Hydrosurgery, ultrasound, idrNPWT
Sharp/surgical	Scissors, blade, dermatome…

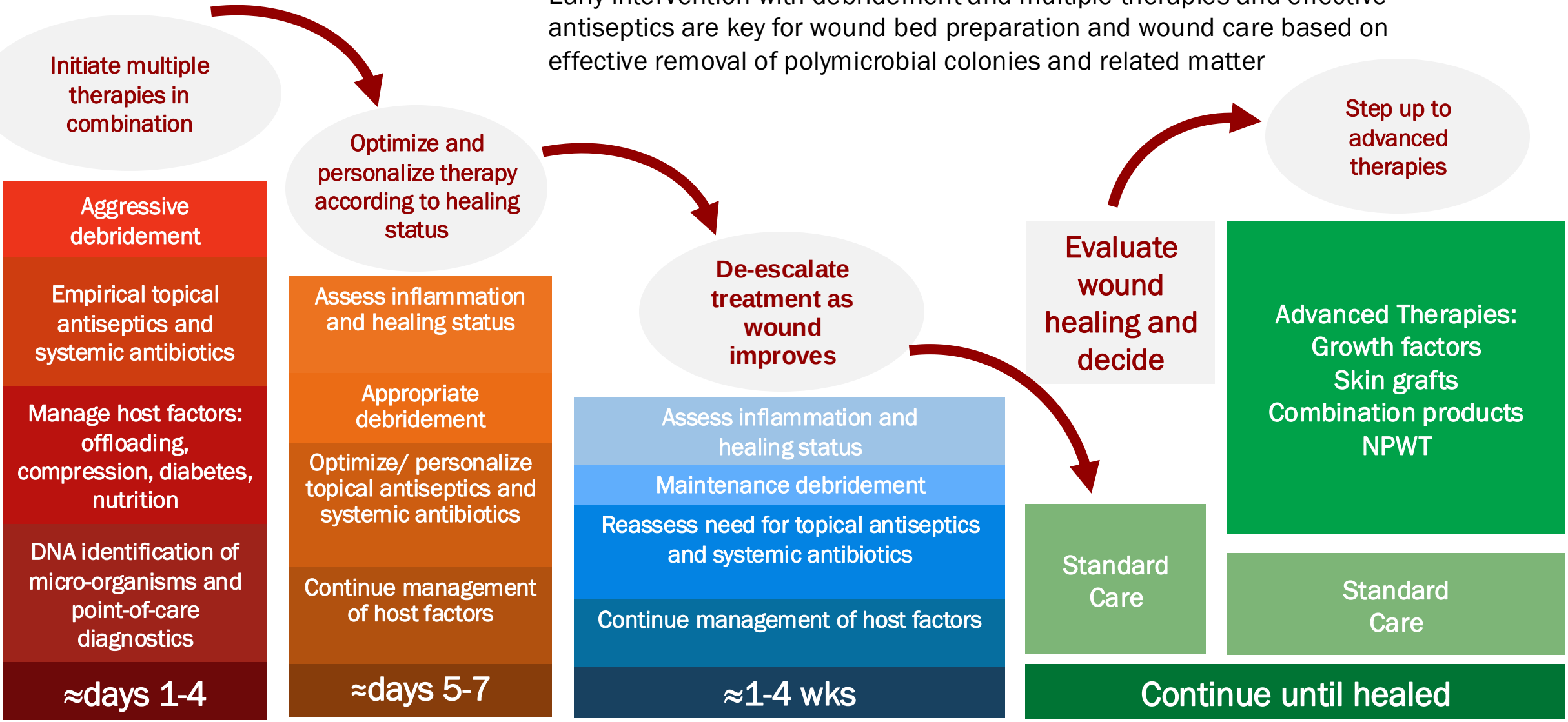
MAY NEED ADJUNCT MECHANICAL FORCE TO MAXIMIZE EFFECT

STANDALONE DEBRIDEMENT CATEGORIES

Mayer D, et al. *J Wound Care*. In press.

Step-Down, then Step-Up Treatment Strategy

Early intervention with debridement and multiple therapies and effective antiseptics are key for wound bed preparation and wound care based on effective removal of polymicrobial colonies and related matter



Schultz G, et al. *Wound Repair Regen*. 2017;25(5):744-757.

Microbial Colonies and Associated Debris Begin to Re-form 24hrs after Debridement

- “Slough or necrotic tissue can promote bacterial growth…[and] prevent the formation of granulation tissue, and subsequent re-epithelialisation, and interfere with wound contraction.” (IWII)
- “More frequent debridement was associated with improved healing. Wounds that were debrided weekly or more frequently were over four times more likely to heal than wounds receiving debridement less often than weekly.” (EPUAP, NPIAP, PPPIA)
- “Autolytic debridement… is insufficient to meet the debridement requirements of wound hygiene, as it takes a long time to occur, requires numerous dressing changes, and can increase the risk of infection in hard-to-heal wounds.” (*JWC* International Consensus Document)

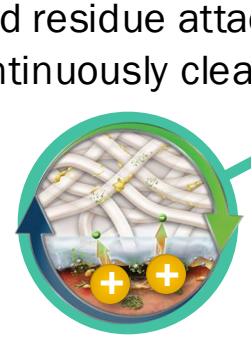
Schultz G, et al. *Wound Repair Regen*. 2017;25:744-757.

Continuous Debridement of Slough Is Needed

1. **Must be effective**
   Continuously remove slough and wound debris and mitigate re-formation of microbial colonies post-sharp debridement
2. **Must be accessible**
   All caregivers can incorporate sharp debridement throughout the continuum of care
3. **Must be easy and comfortable**
   Easy to use by healthcare providers and well tolerated by patients

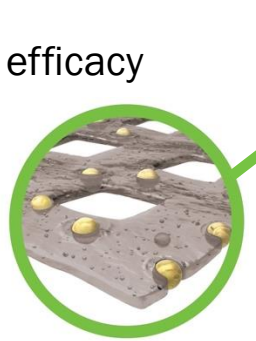
Charged fibers support the continuous debridement of slough

- Fibrin, microorganisms, and wound residue attach to negatively-charged fibers to continuously clean the wound bed
- Fibers form a gel to promote moist wound healing



Antimicrobial

- Fast, broad-spectrum, antimicrobial-barrier efficacy
- TLC-Ag healing matrix (antimicrobial layers impregnated with silver) promotes healing and atraumatic, pain-free removal



Lazareth I, et al. *Wounds.* 2008;20(6):158-166. Dissemond J, et al. *J Wound Care.* 2020;29(3):162-173. Desroche N, et al. Characterization of the antimicrobial spectrum and anti-biofilm activity of a new silver-containing dressing with poly-absorbent fibres and antimicrobial silver matrix. Poster EWMA, May 2016. Percival SL, et al. *J Wound Care.* 2015;24(11):498, 500-503, 506-510.

Case: Pressure Ulcer (Day 1)

Excisional debridement performed. Collagenase applied.

Case: Non-Healing Wound, Abdominal Wall

Day 1

Day 47

Collagenase applied daily for 6 wks

The Need for Debridement Options

Current State

- Feeling stuck in a pigeonhole of 5 ways to prepare a wound bed

Clinician Wants

- To safely clean a wound and “do no harm” to healthy tissue
- Something with wide variety of use cases and safe with other modalities

Market

Evolutionary

vs

Revolutionary

How Charged Fibers Work

Biomaterials behave in predictable ways within complex tissue environments

- Steric exclusion
- Hydrophobic interactions
- Hydrogen bonds

Electrostatic Interactions

- Negatively-charged fibers have a high attraction to positively charged fibers

Meaume S, et al. *J Wound Care*. 2014;23(3):105-116.

Combining Technologies

Highly Charged Fiber (HCF)* dressings to support debridement in conjunction with debridement via clostridial collagenase

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INTRODUCTION

Complex wounds need highly effective debridement to heal optimally, or to be prepared optimally for primary closure via surgery. Debridement can be done via excision, but this acute procedure can be subsequently augmented with the use of enzymatic products such as clostridial collagenase. Additional debridement support may be obtained, via the use of newly available highly charged fiber dressings that can be used synergistically with other modalities such as excisional debridement, or enzymatic debridement. In particular we studied wounds treated with collagenase with conjunctive use of HCF dressings, and we report our results.

METHOD

Five cases of complex wounds are presented, two of these were destined for surgical closure pending appropriate wound bed preparation. Three wounds were planned and destined for secondary closure. Cases 1-5 details and images shows how the wounds progressed via the judicious use of sharp debridement, enzymatic debridement, and debridement support from Highly Charged Fiber (HCF) dressings.

RESULTS

We found that the use of the HCF dressing allows the continuation of slough removal, post excisional debridement and collagenase debridement enzyme, allowing successful surgical closure in two wounds, and stepdown to secondary closure in three others following optimal cleansing/ debridement of the wounds.

CASE 1 – RIGHT ISCHIAL PRESSURE ULCER

61 yo male with paraplegia with h/o multiple pressure ulcers including progressive right ischial ulcer with necrotic debris, despite wound management and offloading.
Medical history: Paraplegia
Treatment:

- Clostridial Collagenase utilized following office excisional debridements.
- Negatively Charged Densed fibers added to Clostridial Collagenase to expedited debridement
- Taken to OR for flap closure once wound bed preparation deemed adequate
- Placental allograft placed to optimize healing.
- Incisional V.A.C.® Therapy initiated with a 3M™ Prevena™ Customizable Dressing immediately following closure

CASE 2 – NON HEALING SURGICAL WOUND LOWER BACK

74 yo female s/p spine surgery complicated by PE requiring antigoagulation that resulted in hematoma and secondary dehiscence. | Medical history: DVT, PE (On anticoagualants) | Treatment:

- Clostridial Collagenase utilized following office excisional debridements.
- Negatively Charged Densed fibers added to Clostridial Collagenase to expedited debridement
- Taken to OR for flap closure once wound bed preparation deemed adequate
- Placental allograft placed to optimize healing.
- Incisional V.A.C.® Therapy initiated with a 3M™ Prevena™ Customizable Dressing immediately following closure

CASE 2 – CONT'D

CASE 3 – THIGH WITH FULL THICKNESS NECROSIS

70yo female s/p recurrent ventral hernia repair with postoperative dehiscence and tissue necrosis.
Medical history: Obesity, Pace maker
Treatment:

- Clostridial Collagenase utilized following office excisional debridements.
- Negatively Charged Densed fibers added to Clostridial Collagenase to expedited debridement
- Secondary healing without need for surgical intervention

CASE 4 – THIGH WITH FULL THICKNESS NECROSIS

49 yo male with paraplegia with failed flap with extensive full thickness necrosis thigh.
Medical history: Paraplegia | Treatment:

- Excisional debridement in office.
- Clostridial Collagenase utilized following office excisional debridements.
- Negatively Charged Dense fibers added to Clostridial Collagenase to expedited debridement
- NPWT initiated

CASE 5 – THIGH WITH FULL THICKNESS NECROSIS

57 yo male with paraplegia with right ischial pressure ulcer extending to bone (Stage 4). Presents with extensive debris with deep tissue necrosis | Medical history: Paraplegia | Treatment:

- Clostridial Collagenase utilized following office excisional debridements.
- Negatively Charged Dense fibers added to Clostridial Collagenase to expedited debridement
- Taken to OR for flap closure once wound bed preparation deemed adequate
- Placental allograft placed to optimize healing.
- Incisional V.A.C.® Therapy initiated with a 3M™ Prevena™ Customizable Dressing immediately following closure

CONCLUSION

The results show that though more research is indicated in this area, the combination of established debridement methods, such as excisional debridement and enzymatic debridement, can likely be supported by the continuous slough removal properties of the Highly Charged Fiber (HCF) dressings.

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6. N. Desroche et al, Evaluation of the anti-biofilm activity of a new poly-absorbent dressing with a silver matrix*using a complex in vitro biofilm model. Poster Wounds UK 2017.
7. Lazareth I, et al. The role of a silver releasing lipido-colloid contact layer in venous leg ulcers presenting inflammatory signs suggesting heavy bacterial colonization: Results of a randomized controlled study. Wounds. 2008;20(6):158–66
8. Dalac S., Sigal L., Addala A., et al Clinical evaluation of a dressing with poly absorbent fibres and a silver matrix for managing chronic wounds at risk of infection: a non-comparative trial. J Wound Care, Vol 25, No 9, September 2016

Cases

Case Summary: Right ischial pressure ulcer

61y Male with paraplegia, Hx of multiple pressure ulcers (PUs), including progressive right ischial ulcer with necrotic debris despite wound management and offloading

- Medical Hx: Paraplegia
- Treatment
  - Clostridial collagenase utilized following office excisional debridements
  - Negatively-charged dense fibers added to Clostridial collagenase to expedite debridement
  - Taken to OR for flap closure when wound bed preparation was deemed adequate
  - Placental allograft placed to optimize healing
  - Incisional NPWT (iNPWT) initiated with 3M™ Prevena™ (incision management system) immediately following closure

PU = pressure ulcer; iNPWT = incisional negative pressure wound therapy.

Necrotic Pressure Ulcer (Day 1)

Debridement supported with negatively-charged fibers applied daily

Necrotic Pressure Ulcer (Days 1, 7)

Necrotic Pressure Ulcer (Day 7)

Necrotic Pressure Ulcer (Day 7)

Necrotic Pressure Ulcer (Day 7)

Debridement supported with negatively-charged fibers applied daily until definitive surgical closure performed

Necrotic Pressure Ulcer (6 Wks)

Case Summary: Non-healing surgical wound, abdomen

70y Female s/p recurrent ventral hernia repair with post-operative dehiscence and tissue necrosis

- Medical Hx: Obesity, pacemaker
- Treatment
  - Clostridial collagenase utilized following office excisional debridements
  - Negatively-charged dense fibers added to Clostridial collagenase to expedite debridement
  - Secondary healing without need for surgical intervention

Non-Healing Wound, Abdomen (Day 1)

Non-Healing Wound, Abdomen (Day 7)

Non-Healing Wound, Abdomen (Day 7)

Non-Healing Wound, Abdomen (Day 21)

Non-Healing Wound, Abdomen (Day 21)

Non-Healing Wound, Abdomen (Day 21)

Non-Healing Wound, Abdomen (6 Wks)

Non-Healing Wound, Abdomen (8 Wks)

Non-Healing Wound, Abdomen (8 Wks)

Non-Healing Wound, Abdomen (10 Wks)

Case Summary: Thigh with full-thickness necrosis

- 49y Male with paraplegia; failed flap with extensive full-thickness necrosis, thigh
- Medical Hx: Paraplegia
- Treatment
  - Excisional debridement in office
  - Clostridial collagenase utilized following office excisional debridements
  - Negatively-charged dense fibers added to Clostridial collagenase to expedite debridement
  - NPWT initiated

Necrosis, Left Thigh (Day 1)

Left thigh with full-thickness necrosis

s/p Removal eschar

Necrosis, Left Thigh (Day 1)

Necrosis, Left Thigh (Day 1)

Collagenase application followed by non-adherent

Negatively-charged dense fibers

Necrosis, Left Thigh (Day 7)

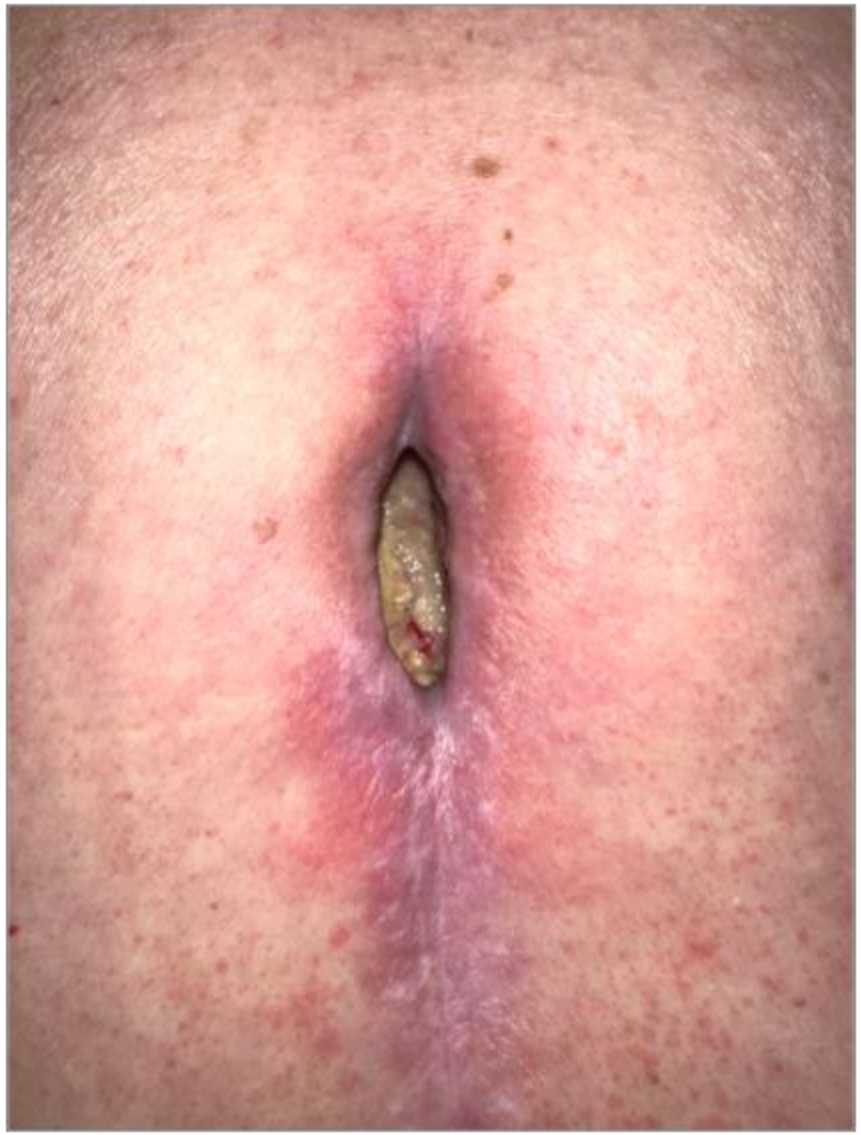
Necrosis, Left Thigh (Day 7)

Collagenase application followed by non-adherent and negatively-charged fibers

Case Summary: Non-healing surgical wound, lower back

- 74y Female s/p spine surgery complicated by PE requiring anticoagulation that resulted in hematoma and secondary dehiscence
- Medical Hx: DVT, PE (on anticoagualants)
- Treatment:
  - Clostridial collagenase utilized following office excisional debridements
  - Negatively-charged dense fibers added to Clostridial collagenase to expedited debridement
  - Taken to OR for flap closure once wound bed preparation deemed adequate
  - Placental allograft placed to optimize healing
  - Incisional NPWT (iNPWT) with customizable iNPWT dressing initiated immediately following closure

Non-Healing Wound, Spine (Day 1)



Non-Healing Wound, Spine (Day 1)

Non-Healing Wound, Spine (Day 1)

Non-Healing Wound, Spine (Day 10)

Non-Healing Wound Spine (Day 10)

Case Summary: Right ischial pressure ulcer

57yo Male with paraplegia; right ischial pressure ulcer extending to bone (Stage 4)

- Presents with extensive debris with deep tissue necrosis
- Medical history: Paraplegia
- Treatment:
  - Clostridial collagenase utilized following office excisional debridements
  - Negatively-charged dense fibers added to Clostridial collagenase to expediteddebridement
  - Taken to OR for flap closure once wound bed preparation deemed adequate
  - Placental allograft placed to optimize healing
  - iNPWT with iNPWT customizable dressing initiated immediately following closure

Right Ischial Ulcer (Day 1)

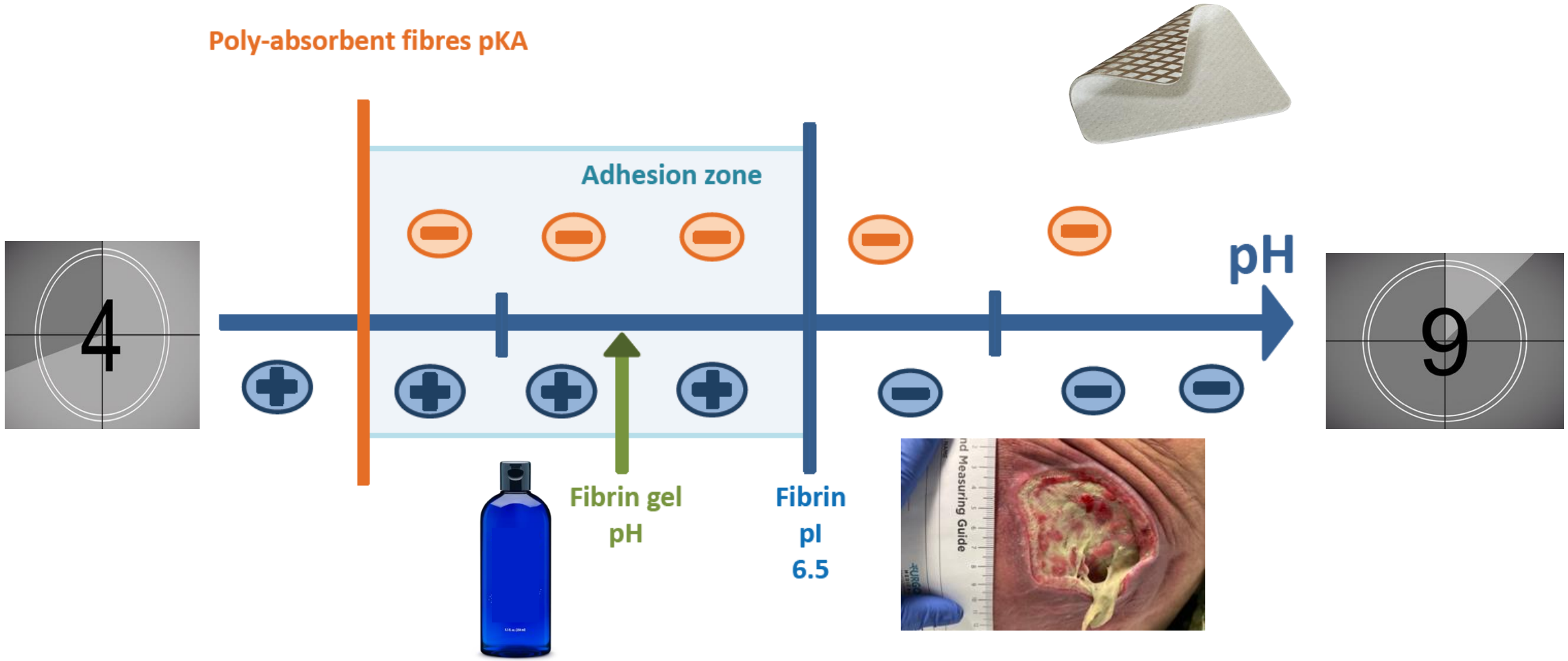
Right Ischial Ulcer (Day 1)

Right Ischial Ulcer (6 Wks)

Right Ischial Ulcer (6 Wks)

Right Ischial Ulcer (6 Wks)

Synergy Between HOCl and Negative Fibers



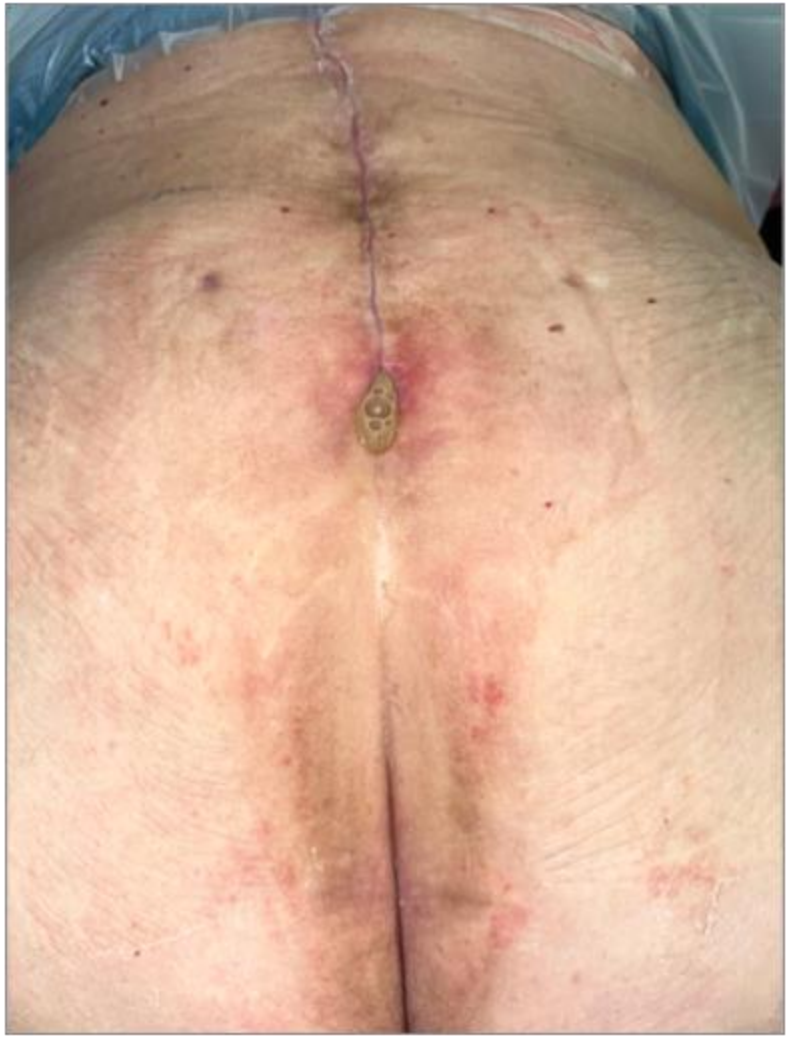
Case Summary: Non-healing surgical wound, lower back

74y Female s/p spine surgery complicated by PE requiring anticoagulation that resulted in hematoma and secondary dehiscence

Medical Hx: DVT, PE (on anticoagualants)

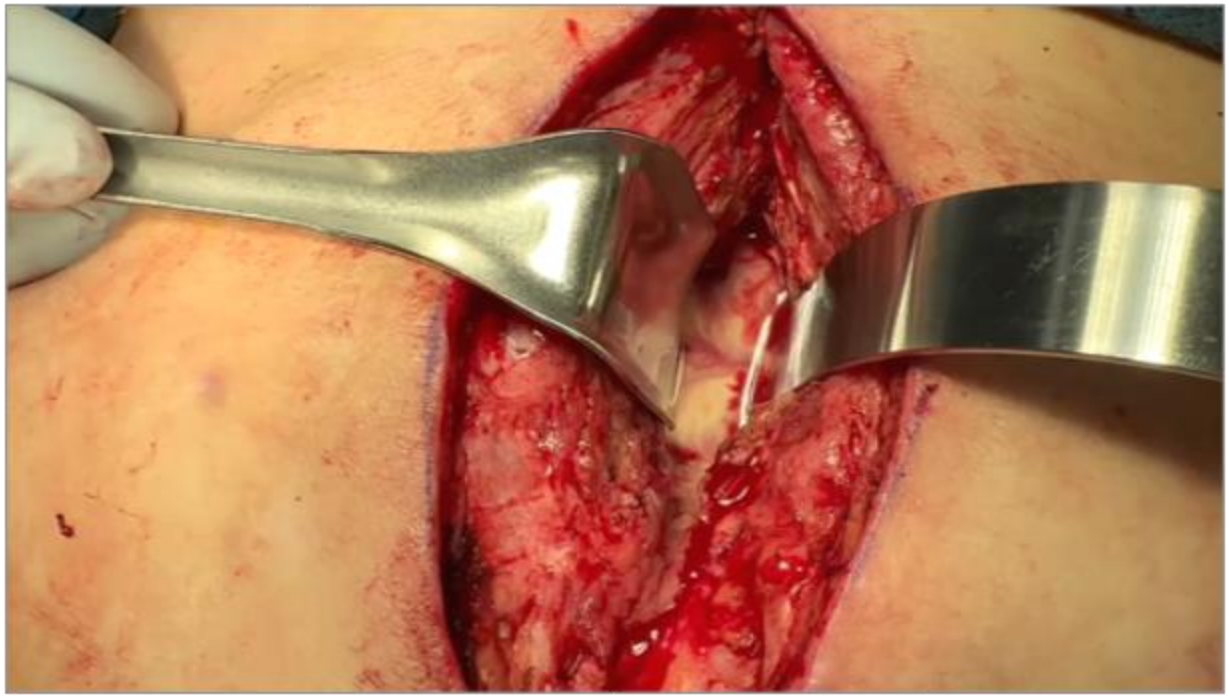
- Treatment:
  - Taken to OR for surgical closure with finding of deep tissue abscess
  - Underwent drainage of abscess, debridements
  - Intraoperatively, pHA utilized as 10-minute soak
  - NPWTi-d initiated with pHA
  - Returned to OR 72 hrs for definitive surgical closure
  - Intraoperatively, pHA utilized as 10-minute soak
  - Placental allograft placed to optimize healing
  - NPWT initiated for incisional management immediately following closure

Non-Healing Surgical Wound, Back (Day 1)



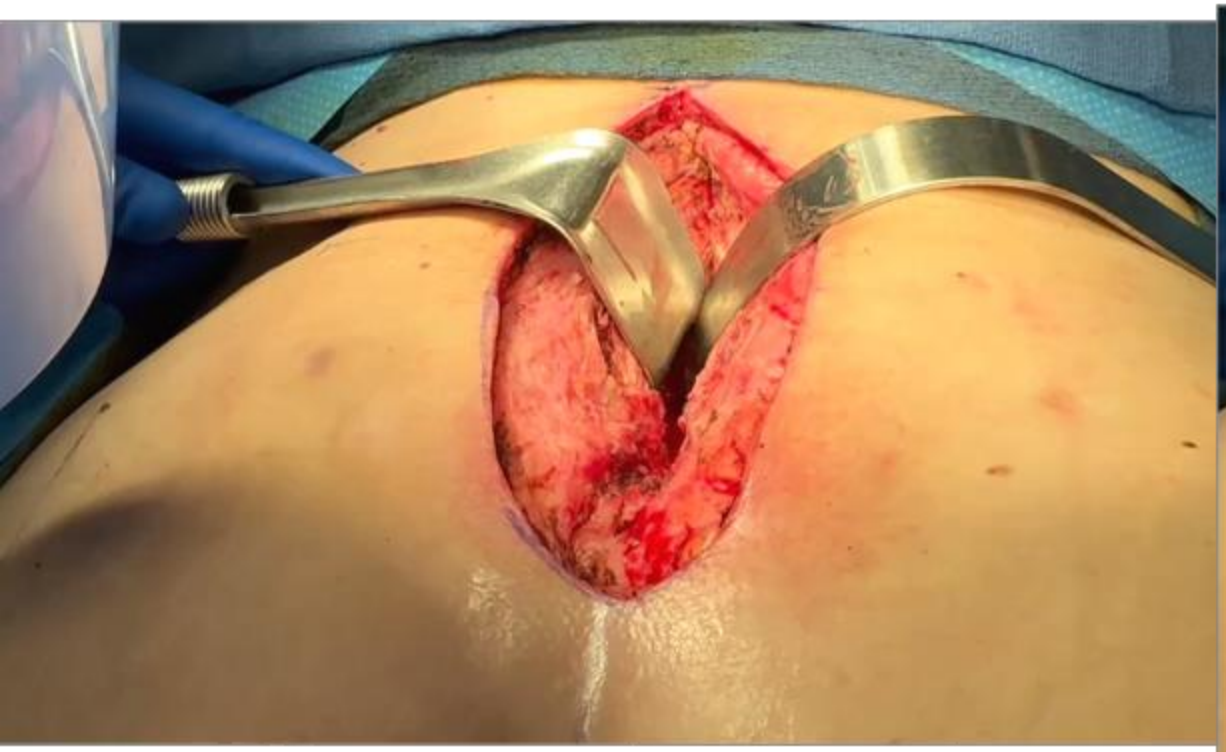
Non-Healing Surgical Wound, Back (Day 1)

Non-Healing Surgical Wound, Back (Day 1)



Non-Healing Surgical Wound, Back (Day 1)

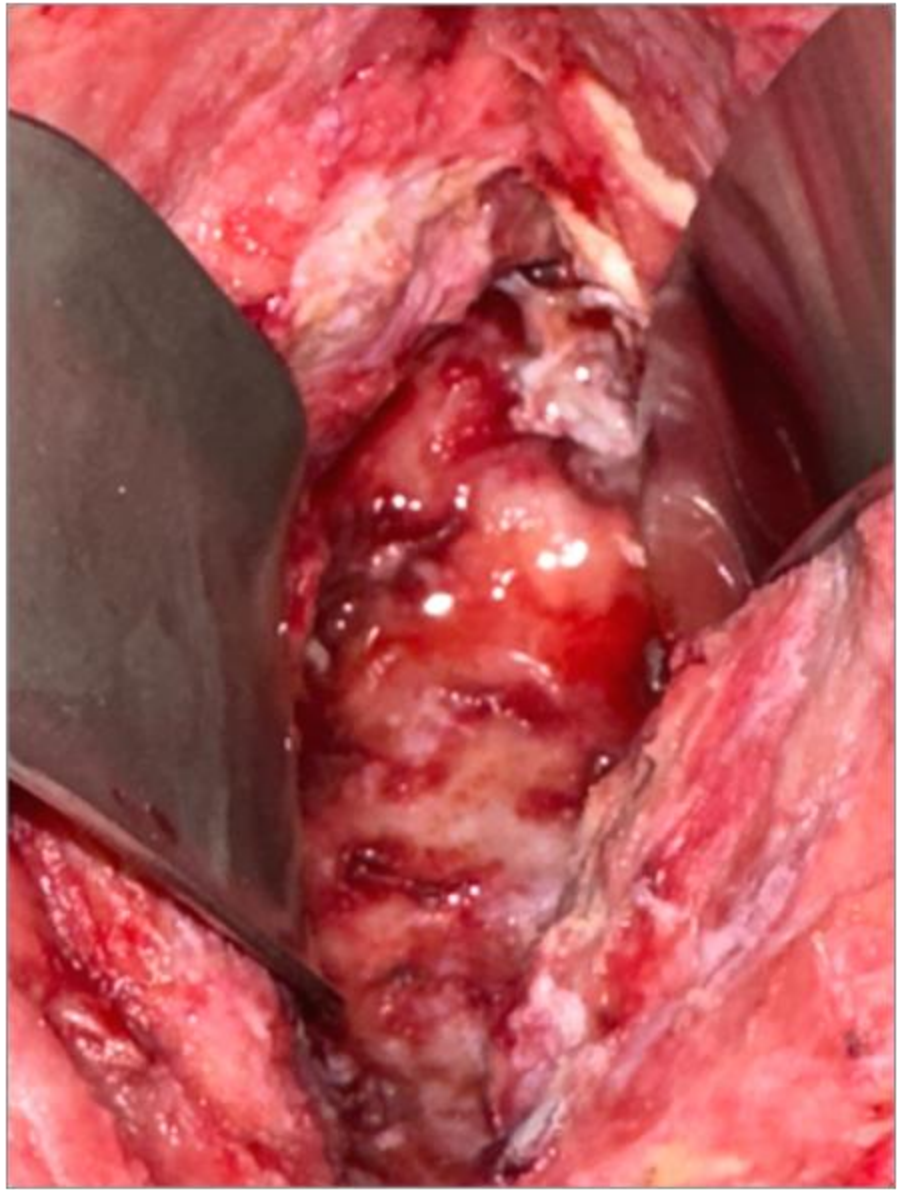
Non-Healing Surgical Wound, Back (Day 1)



Non-Healing Surgical Wound, Back (Day 1)

Non-Healing Surgical Wound, Back (Day 3)

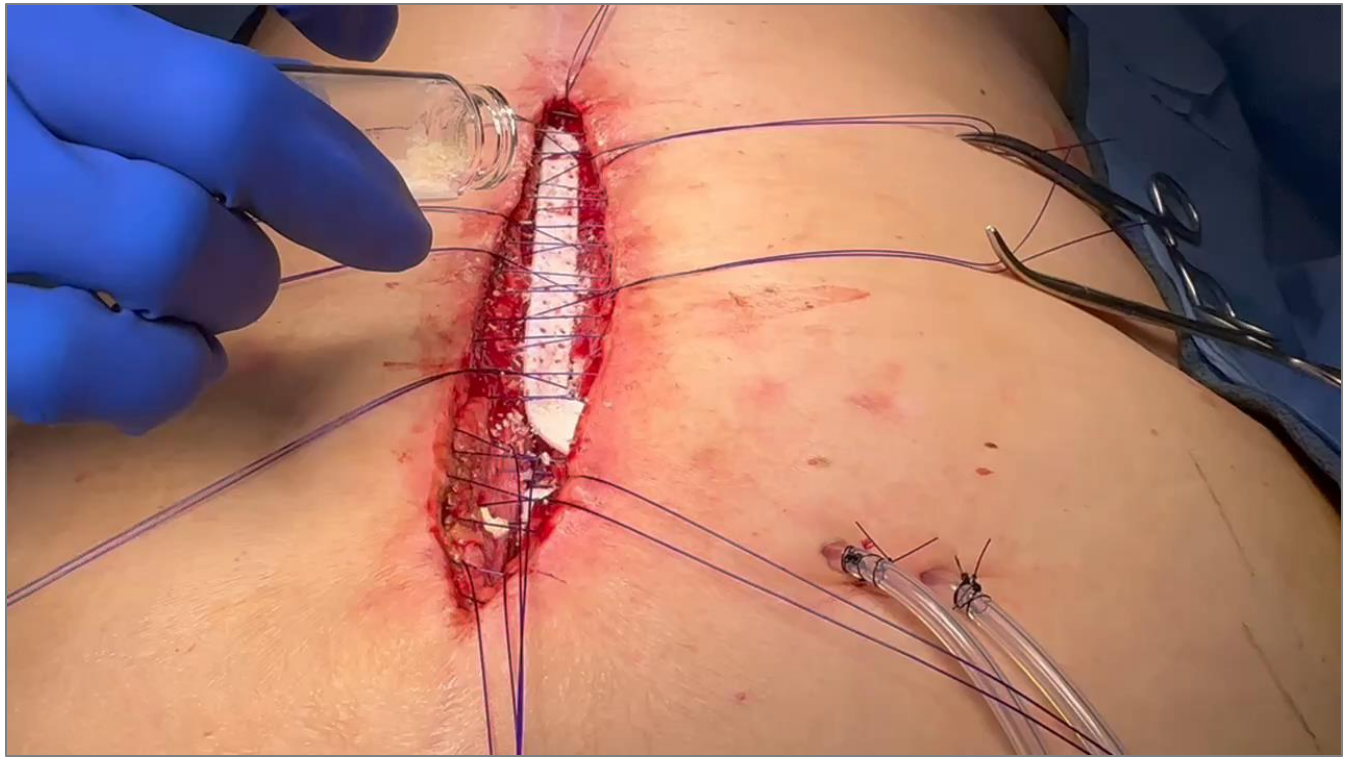
Non-Healing Surgical Wound, Back (Day 3)



Non-Healing Surgical Wound, Back (Day 3)

Non-Healing Surgical Wound, Back (Day 3)

Non-Healing Surgical Wound, Back (Day 3)

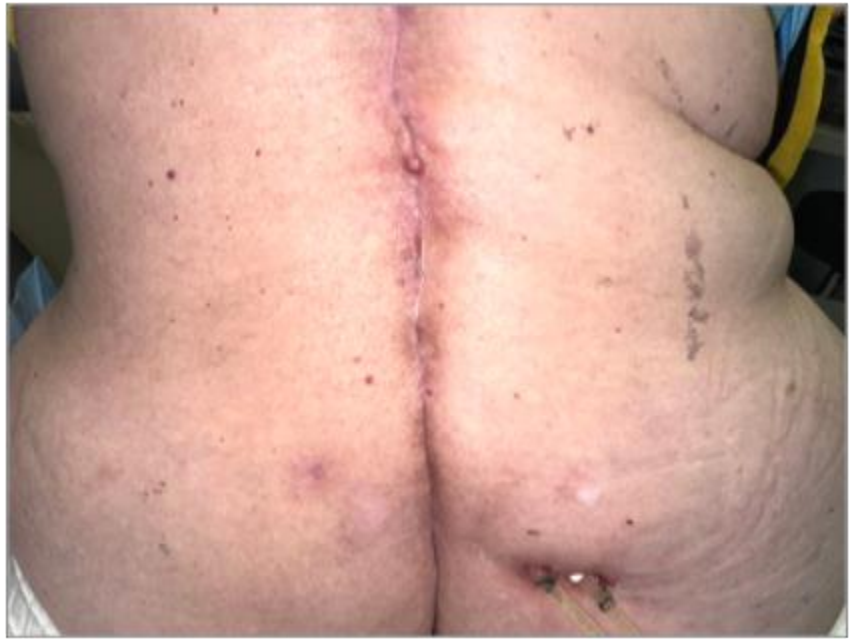


Non-Healing Surgical Wound, Back (Day 3)

Non-Healing Surgical Wound, Back (2 Wks)

Non-Healing Surgical Wound, Back (4 Wks)

Non-Healing Surgical Wound, Back (6 Wks)



Pure Hypochlorous Acid (pHA) in Removing Germs and Necrotic Debris

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Thousand Oaks, CA

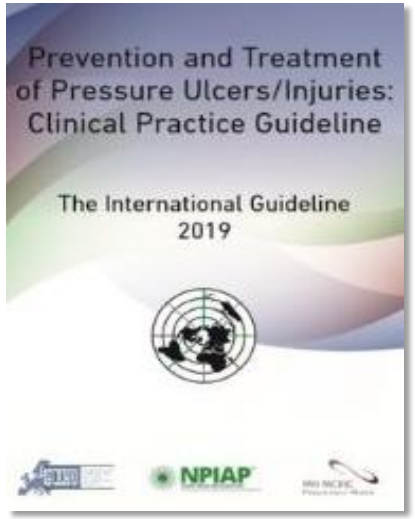
Why Is There a Lack of Standardization in Wound Care?

- One of the main reasons is because **to standardize** wound care, the products in **protocols need to check all the following**

- **Effective** in eradicating pathogens
- **Suitable pH** for both intact and non-intact skin
- **Non-cytotoxic:** Safe for key cells
- **Practical** to use in everyday treatment

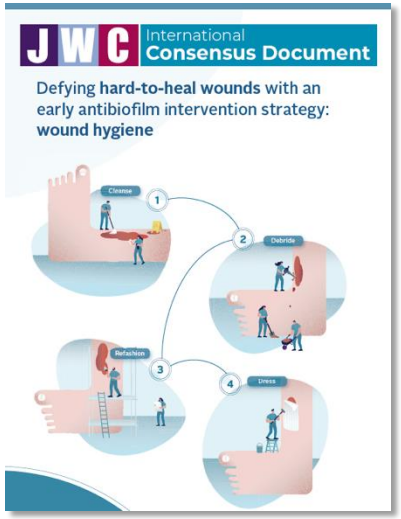
What Can Be Done?

November 2019



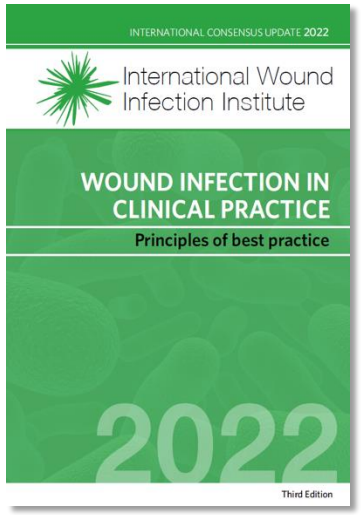
National Pressure Injury Advisory Panel
International Guidelines

March 2020



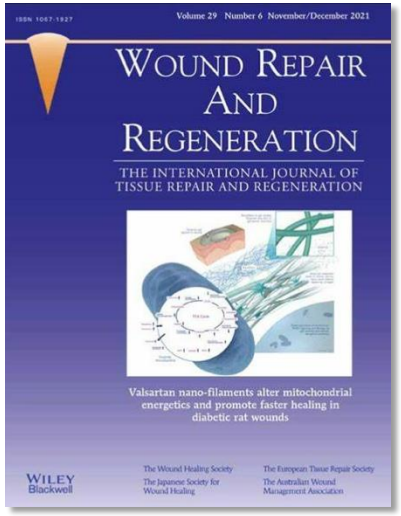
JWC International Consensus Guidelines:
Hard-to-heal wounds

March 2022



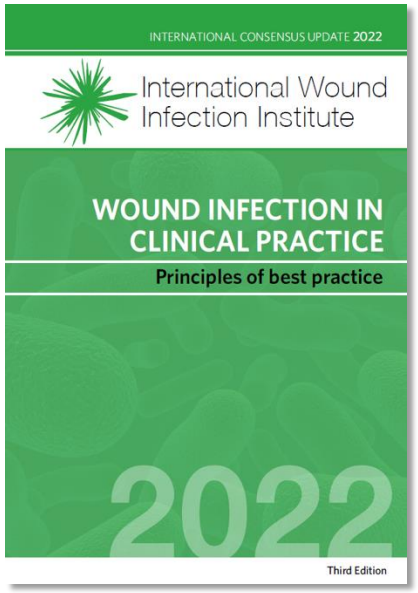
International Wound Infection Institute:
Wound Infection in Clinical Practice

April 2022



Wound Repair and Regeneration:
Treatment Guidelines

Objective Clinical Truth Consensus and Guidelines



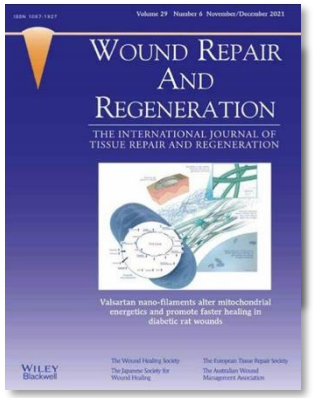
		Cleanse/ Irrigate	Topical	Wound Care	
Super-oxidised solutions (Hypochlorous acid [HOCl] antimicrobial preservative)	■ Broad-spectrum action against bacteria, virus and fungi, including MRSA[183, 266] ■ Eradicates bacterial and fungal biofilms[266, 281]	✓	✓	✓	■ Sometimes available as a blend with NaOCl[280] ■ Has an anti-inflammatory effect through reducing activity of histamines, matrix metalloproteinases, mast cell and cytokine activity[183] ■ Dose-dependent cytotoxicity, but non-cytotoxic at concentrations that achieve antimicrobial action[280]

pHA Meets All Consensus Guidelines for Wound Cleansing

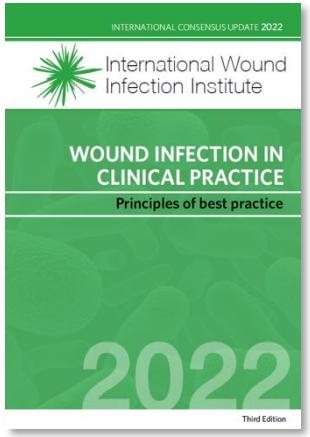
- **Effective** in eradicating pathogens
- **Non-cytotoxic:** Safe for key cells

pHA = pure hypochlorous acid.

According to Guidelines: Cleansers Should Be Effective in Reducing Bacterial Bioburden

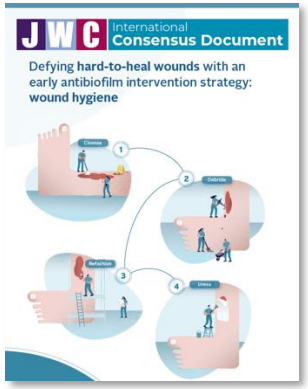


"Using topical antimicrobials to reduce bacterial (and fungal) bioburden in chronic wounds to levels that do not impair healing is based on the principle that the topical antimicrobial treatments can effectively kill the planktonic and bacteria without killing an unacceptable amount of wound cells (fibroblasts, keratinocytes, vascular endothelial cells) that are required to actually heal the wound."



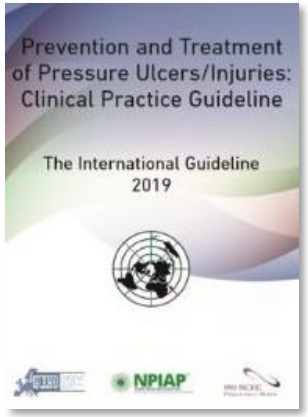
"Topical antiseptics are non-selective and may be cytotoxic. This means they may kill skin and tissue cells involved in wound repair (eg, neutrophils, macrophages, keratinocytes, and fibroblasts), thereby impairing the healing process."

According to Guidelines: Cleansers Should Be Effective in Reducing Bacterial Bioburden



"To initiate and support wound healing, the [bacteria] must therefore be disrupted/removed."

"Saline or water rinses/flushes will not remove bacteria. **Cleansing with intent and appropriate tools/solutions prepares the wound bed for debridement.** It is essential that the periwound skin is cleansed to remove further sources of contamination."



"Use topical antiseptics in tissue-appropriate strengths to control microbial burden AND to promote healing in pressure injuries."

Pure Hypochlorous Acid (HOCl)

Effective against various pathogens,* ie,

- Multi-drug-resistant bacteria
- Viruses
- Fungi
- Spores

Demonstrated to eradicate

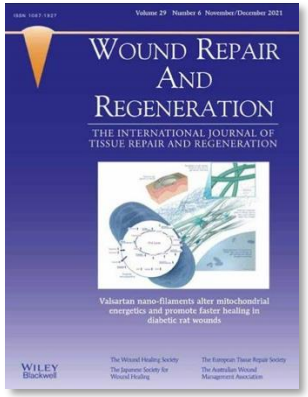
99.999% in 15 seconds

*HOCl-preserved cleansers assists in the management of hard-to-heal chronic wounds by penetrating and disrupting the polysaccharide/protein matrix of wound pathogen biofilms.

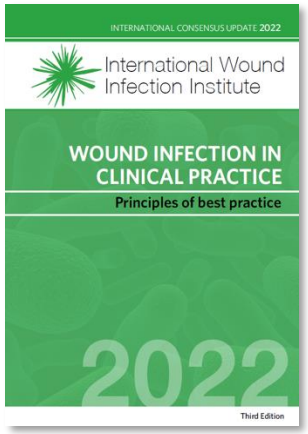
Meets All Consensus Guidelines for Wound Cleansing

- **Effective** in eradicating pathogens
- **Non-cytotoxic:** Safe for key cells

According to Guidelines: Minimize Harm



"Microbicidal agents that have a **high therapeutic index (TI)** against typical wound pathogens should be more effective in reducing bacterial bioburden **while not killing wound cells.**"

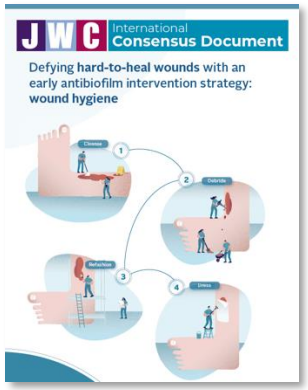


"Topical antiseptics are non-selective and may be cytotoxic. This means they may kill skin and tissue cells involved in wound repair, thereby impairing the healing process."

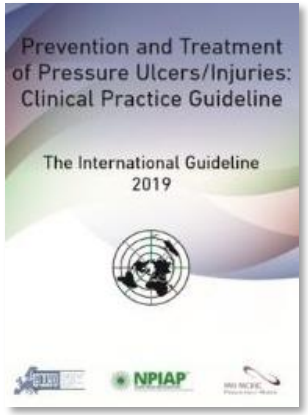
"Many older antiseptics, including hydrogen peroxide, traditional sodium hypochlorite (eg, EUSOL and Dakin's solution), and chlorhexidine are no longer recommended for use in open wounds due to the risk of tissue damage associated with their use."

TI = therapeutic index.

According to Guidelines: Minimize Harm



“Highly cytotoxic solutions, such as those containing povidone-iodine and hydrogen peroxide, are not recommended. Ideally, a skin cleanser designed for daily used should be chosen, to balance the need to disrupt the microbial load while maintaining skin integrity.”



"Newer antiseptics do not have the same cytotoxicity concerns.”

“Cytotoxicity is the main concern when applying a topical agent to an open wound. Antiseptics have been found, primarily using *in vitro* models, to be cytotoxic to cells essential to the wound healing process, including fibroblasts, keratinocytes, and leukocytes.”

“Cytotoxicity of cleansing solutions may be concentration dependent.”

Defining “Non-Cytotoxic”

Biocompatibility and toxicity data for pHA

Animal Model	Results
Eye Irritation (Rabbit)	No ocular irritation
Skin Sensitization (Guinea Pig)	No skin sensitization, no delayed- contact hypersensitivity
Primary Dermal Irritation (Rabbit)	No dermal irritation, no erythema or edema
Acute Oral Toxicity (Rat)	No oral toxicity (LD50>5g/kg)
Cell-Based Assay	
Bacterial Mutagenicity	Non-mutagenic
Cytotoxicity	Biocompatible with fibroblasts and keratinocytes

1. Sampson CM, Sampson MN. Hypochlorous acid: A safe and efficacious new wound therapy. Poster presented at: World Union of Wound Healing Societies; 2008; Toronto, Ontario, Canada. 2. Data on file with Urgo Medical North America.

Comparative cytotoxicity testing of HOCl and commonly used wound irrigants against human dermal fibroblasts and keratinocytes (n=5 per group, $p<0.01$)

Wound Irrigant	Results	Grade
Hypochlorous Acid (@ 4 times the normal % of Vashe Wound Solution)	Pass	0
Saline (0.9% NaCl, pH 5.0)	Pass	0
Dakin’s Solution (0.25%)	Fail	3
Dakin’s Solution (0.5%)	Fail	3
Chlorhexidine gluconate (4%)	Fail	3
Hydrogen peroxide (3%)	Fail	3
Povidone iodine (7.5%)	Fail	3
Povidone iodine (10%)	Fail	3

1. Block SS. Disinfection, sterilization, and preservation. Philadelphia: Lea & Febiger; 2000

How does the definition of non-cytotoxic impact wound progression?

Any pH above 5.5 Could Be Hazardous for Wounds

Table 3. *The optimum growth pH for the most prevalent microorganisms isolated from wounds*

Wound-associated microorganisms	*Optimum pH for growth*
Staphylococcus aureus	7.0–7.5
Enterococcus faecelis	7.0–9.0
Pseudomonas aeruginosa	6.6–7.0
Coagulase-negative staphylococci	7.0–7.5
Anaerobic bacteria	6.0–7.0
Escherichia coli	6.0–7.0
Klebsiella spp.	5.5–7.0
Candida spp.	7.0–8.0

Jones EM, et al. *Adv Wound Care* (New Rochelle). 2015;4(7):431-439.

Take-Home Messages

High pH products are likely harmful to wounds; lower pH wound environment is associated with healing

- The presence of bacteria, proteases, defective extracellular matrices (ECM), and change in pH make chronic wounds very difficult to treat
- pH plays a role in wound healing
- pH could be used as a simple tool to quickly recognize a non-healing wound
- Targeting pH and making the wound environment acidic could benefit the healing process

ECM = extracellular matrix.

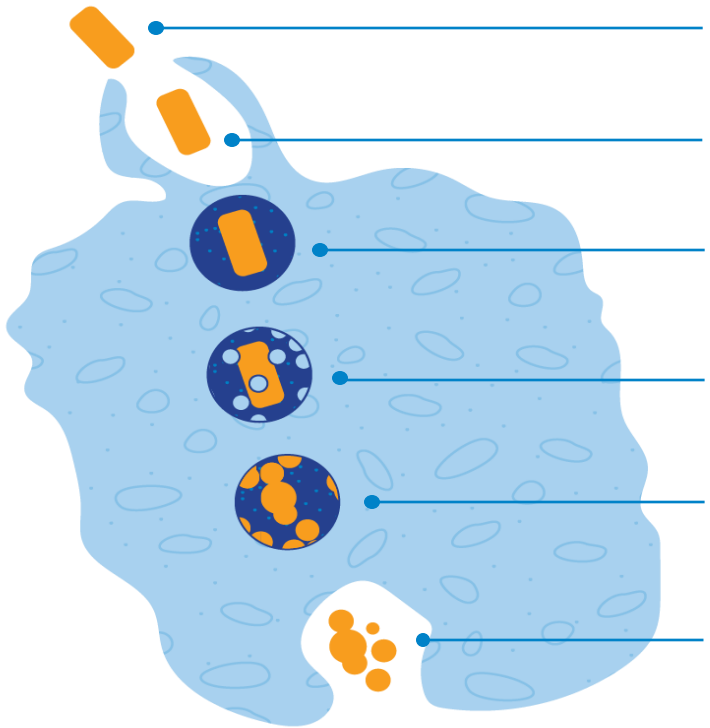
Jones EM, et al. *Adv Wound Care* (New Rochelle). 2015;4(7):431-439.

Meets All Consensus Guidelines for Wound Cleansing

- Meets all consensus guidelines
- Effective in eradicating pathogens
- Non-cytotoxic: Safe for key cells

Replicating the Body's Natural Response to Fighting Pathogens

Oxidative Burst Pathway



1 Pathogen is targeted by chemotaxis

2 Neutrophil forms pseudopods to engulf pathogen

3 Neutrophil then forms a phagosome, which surrounds pathogen

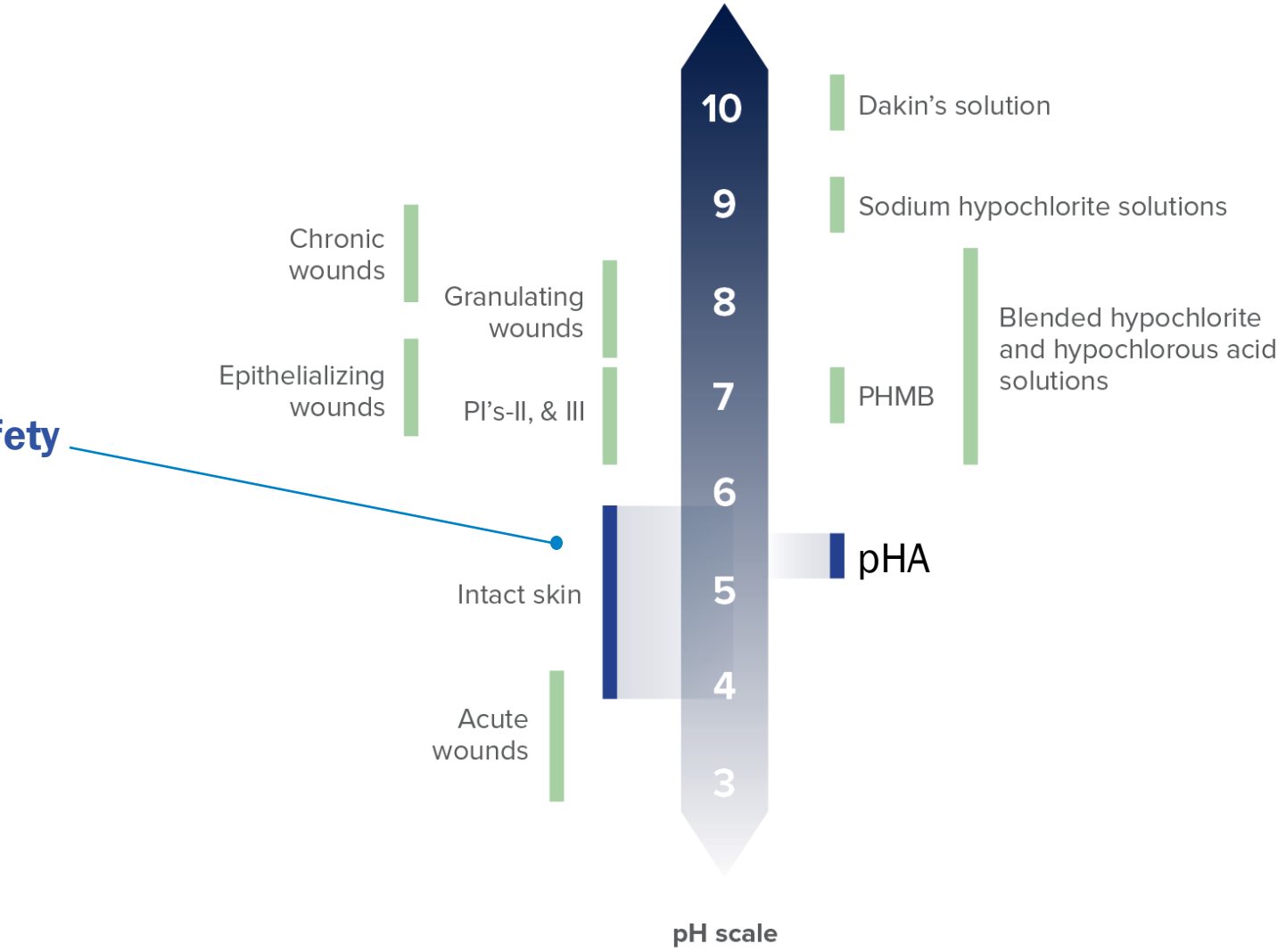
4 **Hypochlorous acid (HOCl) is generated**

5 **The pathogen is killed by HOCl action**

6 Residual material is removed by exocytosis

The Importance of pH

pH promotes effectiveness and safety



pHA = pure hypochlorous acid.

pHA cleanser is efficacious, safe, and versatile for streamlined, standardized use in clinical practice

General cleansing

Soaking

Packing

NPWTi-d

NPWTi-d = negative pressure wound therapy with instillation and dwell.

pHA Cleanser in Clinical Practice

- Safe for patients 23 wks gestation and up
- Can be used on all wound types

PIs (stage I-IV)

Diabetic ulcers

Burns

Post-op

Chronic

pHA Cleanser in Clinical Practice

Available and appropriate for use across all care settings

Inpatient; acute

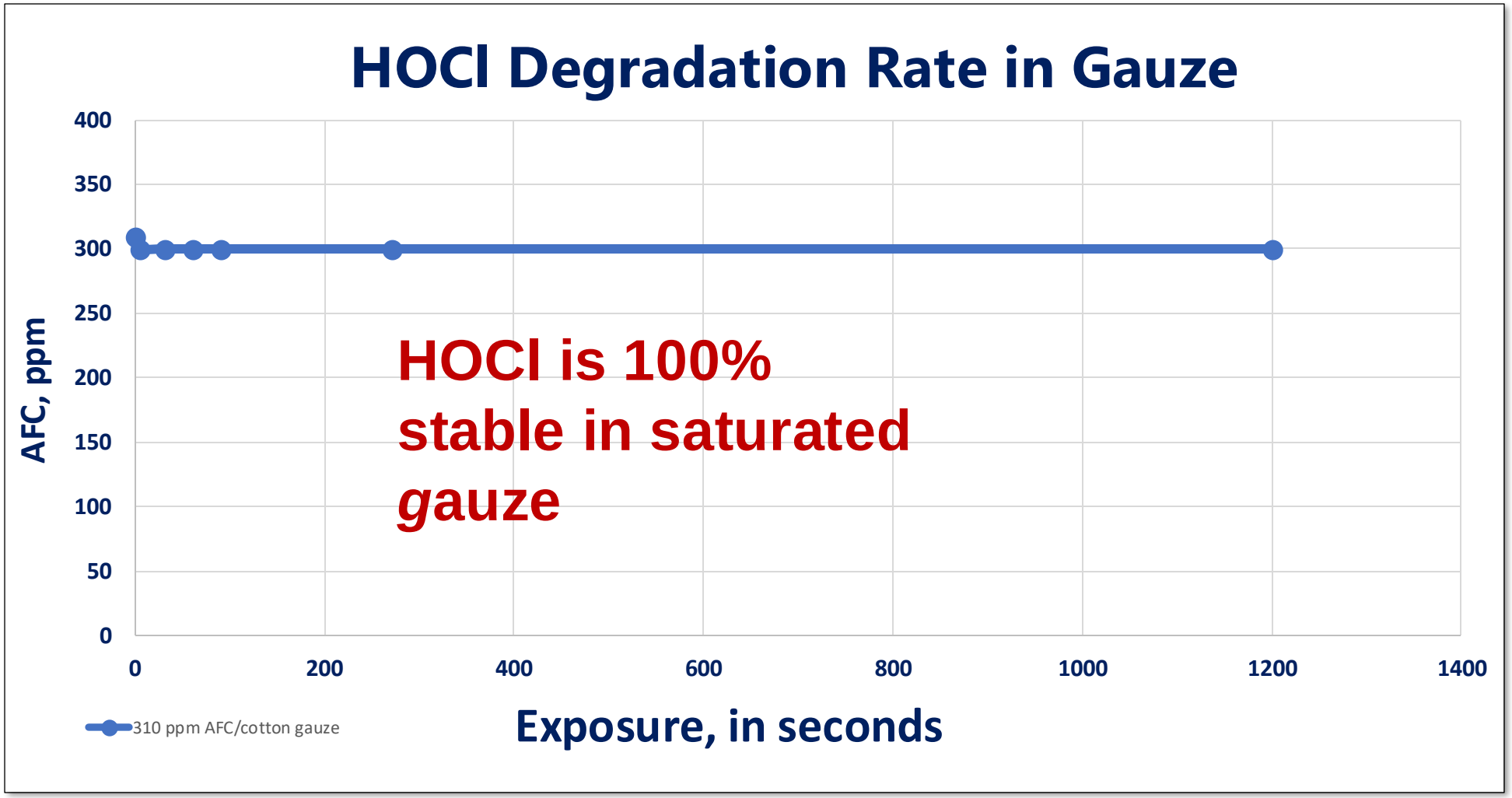
Outpatient: LTAC, SNF

Available OTC

pHA Behavior in Gauze and Tissue

- How much pHA should be poured onto standard 4x4 gauze and packing to achieve maximal effect?

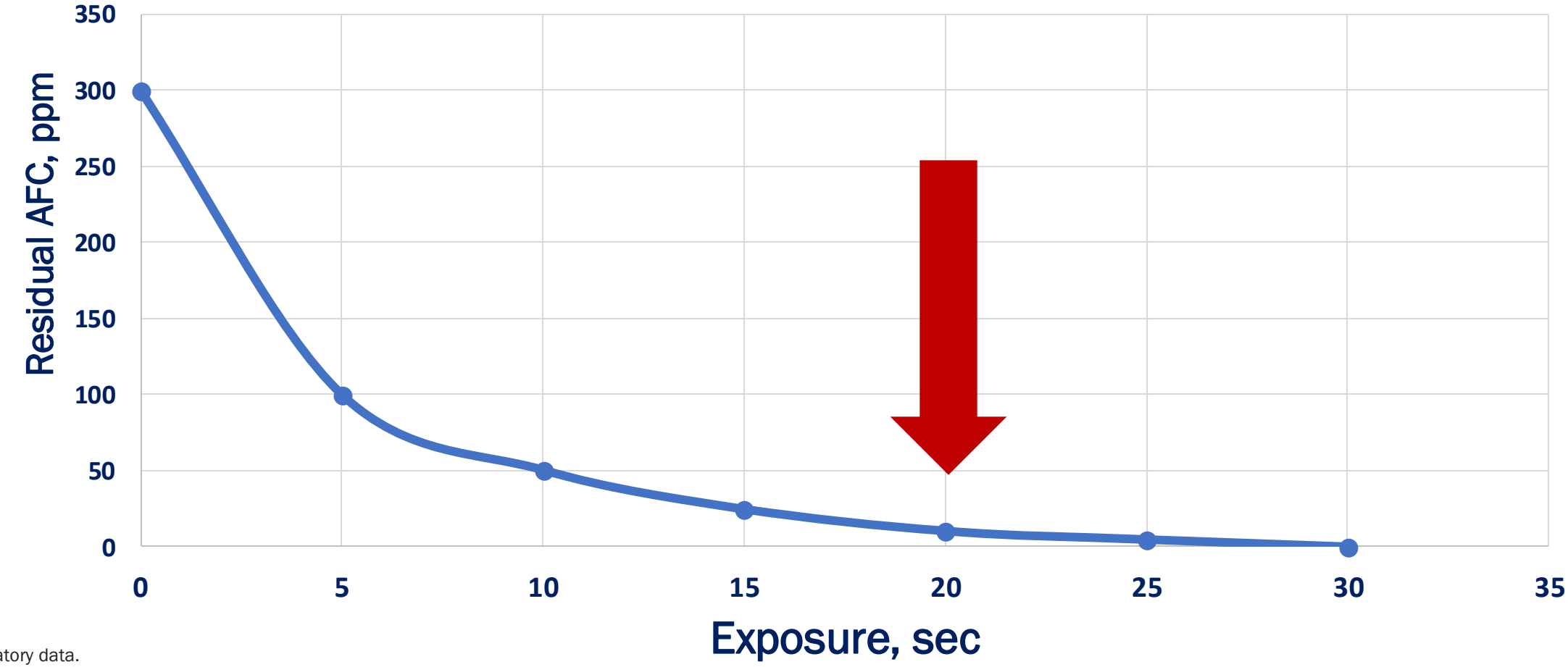
Soaking with Gauze as the Delivery System



Urgo laboratory data.

HOCl 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.

Proven Efficacy

- Bacteria die 3-6 logs — most with 5 logs minimum — within seconds of HOCl exposure

Organism	Time to kill	% Reduction
MRSA	15 seconds	99.999%
VRE	15 seconds	99.999%
Escherichia coli	15 seconds	99.999%
Acinetobacter baumannii	15 seconds	99.999%
Bacteroides fragilis	15 seconds	99.999%
Candida albicans	15 seconds	99.999%
Enterobacter aerogenes	15 seconds	99.999%
Enterococcus faecium	15 seconds	99.999%
Haemophilus influenzae	15 seconds	99.999%
Klebsiella oxytoca	15 seconds	99.999%
Klebsiella pneumoniae	15 seconds	99.999%

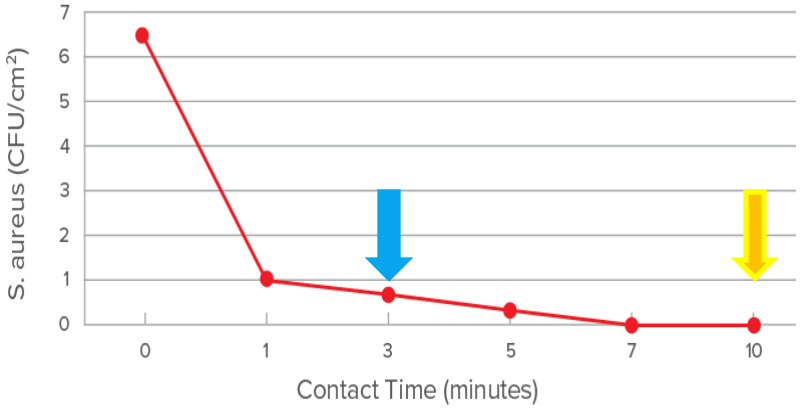
Organism	Time to kill	% Reduction
Micrococcus luteus	15 seconds	99.999%
Proteus mirabilis	15 seconds	99.999%
Pseudomonas aeruginosa	15 seconds	99.999%
Serratia marcescens	15 seconds	99.999%
Staphylococcus epidermidis	15 seconds	99.999%
Staphylococcus haemolyticus	15 seconds	99.999%
Staphylococcus hominis	15 seconds	99.999%
Staphylococcus saprophyticus	15 seconds	99.999%
Streptococcus pyogenes	15 seconds	99.999%
Staphylococcus aureus	15 seconds	99.995%
C. difficile endospores	15 seconds	99.93%

pHA Wound Solution data developed from USP 51 Antimicrobial testing. Bohn GA, Champion S, Eldridge K. Can the use of hypochlorous acid change your dressing selection? Poster Presentation: Symposium for Advanced Wound Care; 2013; Orlando, FL. Nerandzic MM, et al. *PLoS One*. 2013;8(7):e68706.

If Bacteria Die within Seconds, Why Soak for 5-10 Min?

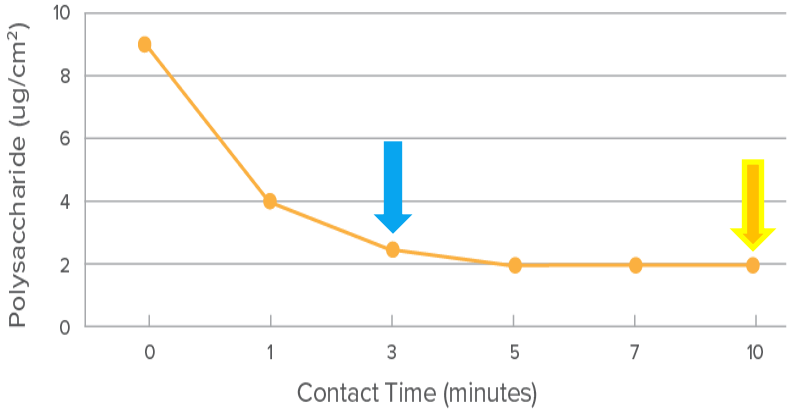
- Soaking for 5-10min allows time to kill adherent bacteria in more realistic 3D conditions — like in a wound — and break down polysaccharides and proteins

Effect of HOCl on adherent colonies of *S. aureus* bacterial numbers



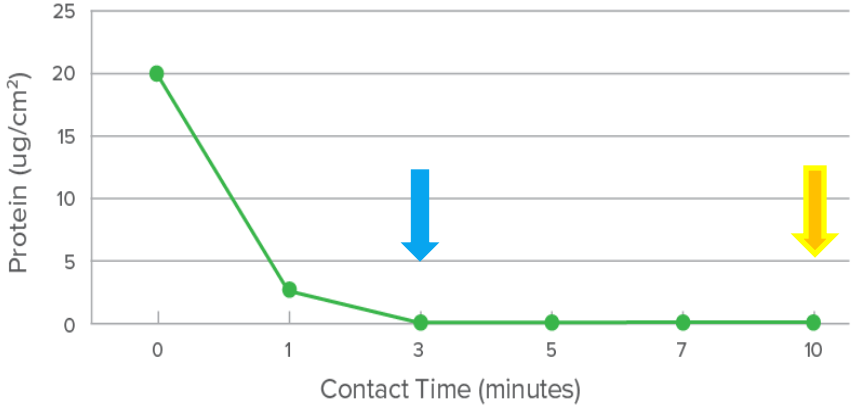
Rapid killing of adherent colonies of *S. aureus*

Effect of HOCl on polysaccharide levels within *S. aureus* slime



Rapid breakdown of polysaccharides in adherent colonies of *S. aureus*

Effect of HOCl on protein levels within *S. aureus* slime

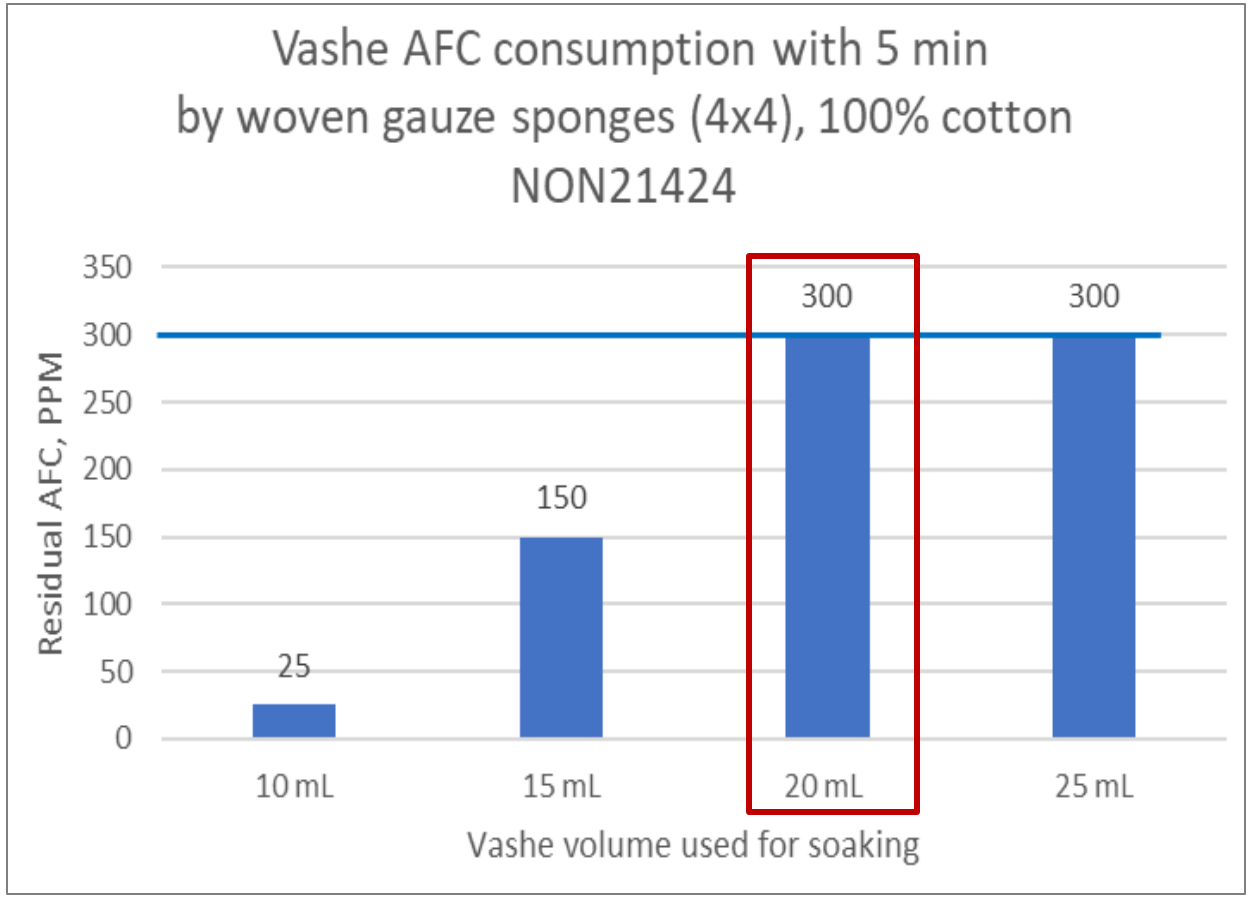


Rapid breakdown of proteins in adherent colonies of *S. aureus*

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

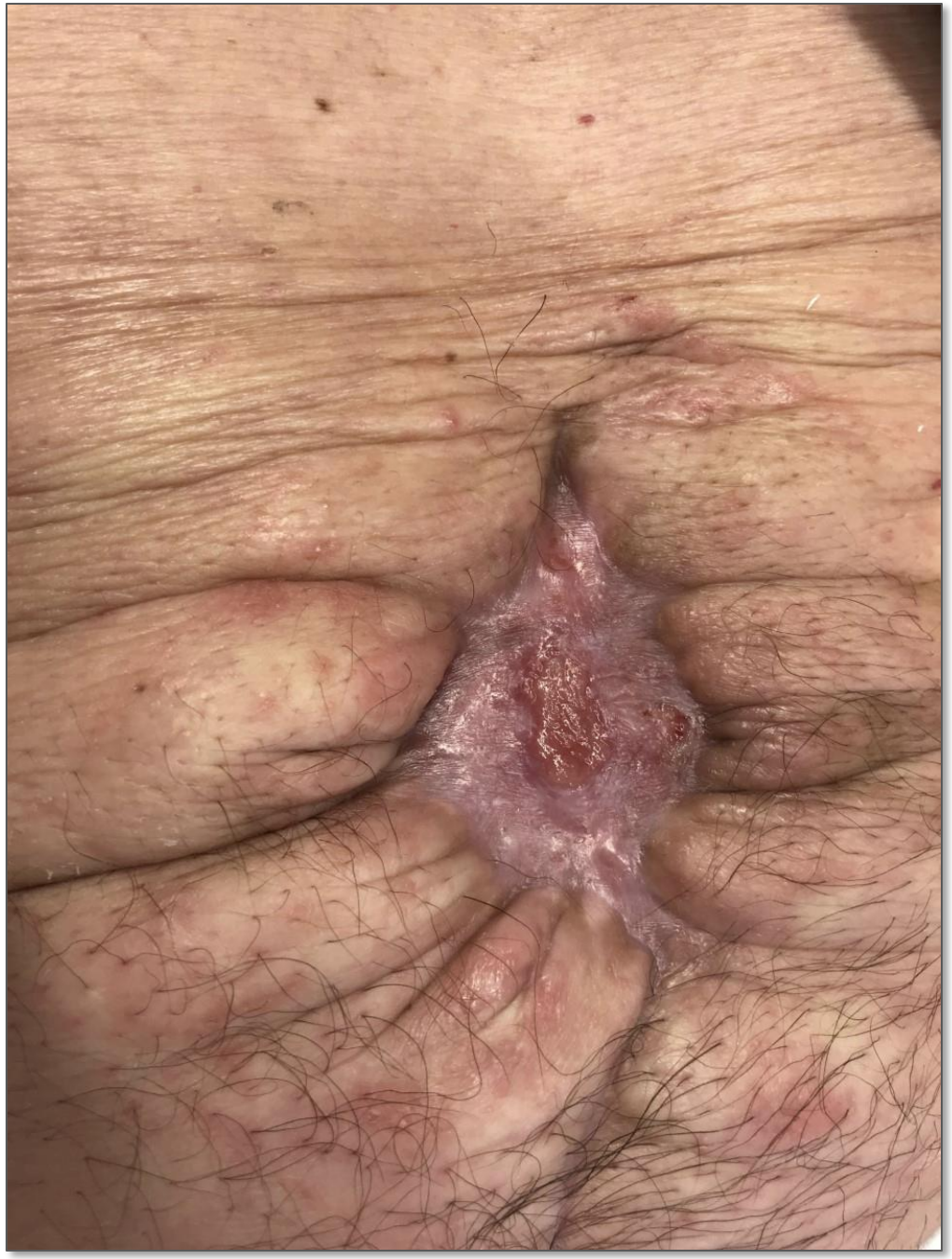
The Right Amount of HOCl in 4x4 Gauze

- The ideal amount of HOCl in a 4x4-inch gauze is ≈30ml (or ≈1oz)
  - *Less than that means losing HOCl concentration in the gauze in 5min*



Urgo laboratory data.

Case Studies







cm
Depth

How Synergistic Technologies Work Together for Efficient 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
- Microorganisms

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

Slough

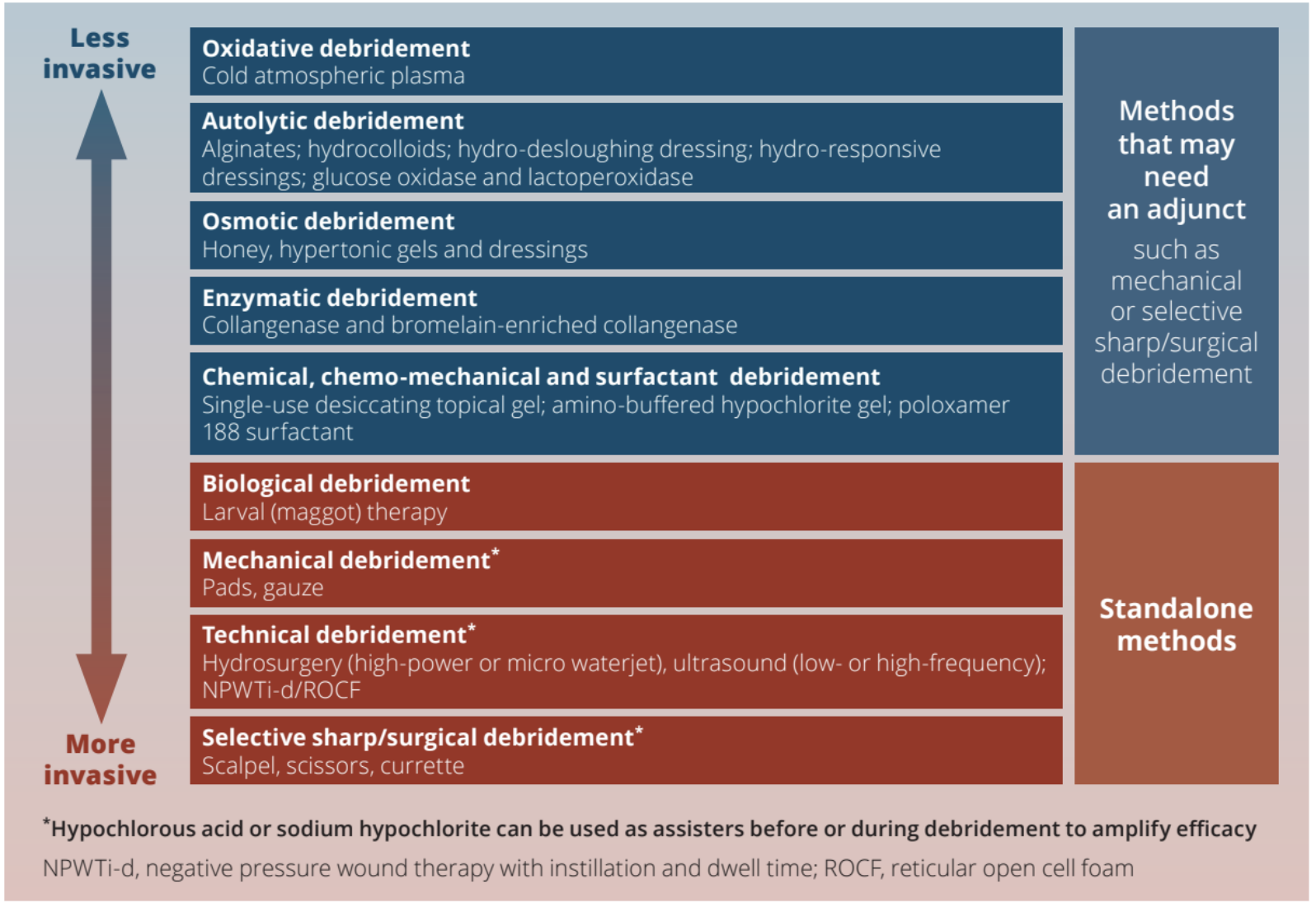
Loose Slough

- Lightly adherent to the wound bed
- Yellow or tan
- Usually easily removed from the 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



J Wound Care. 2024;33(6):SUP C. Accessed March 11, 2025. https://www.journalofwoundcare.com/docs/debridementConsensus.pdf

Integral Debridement

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

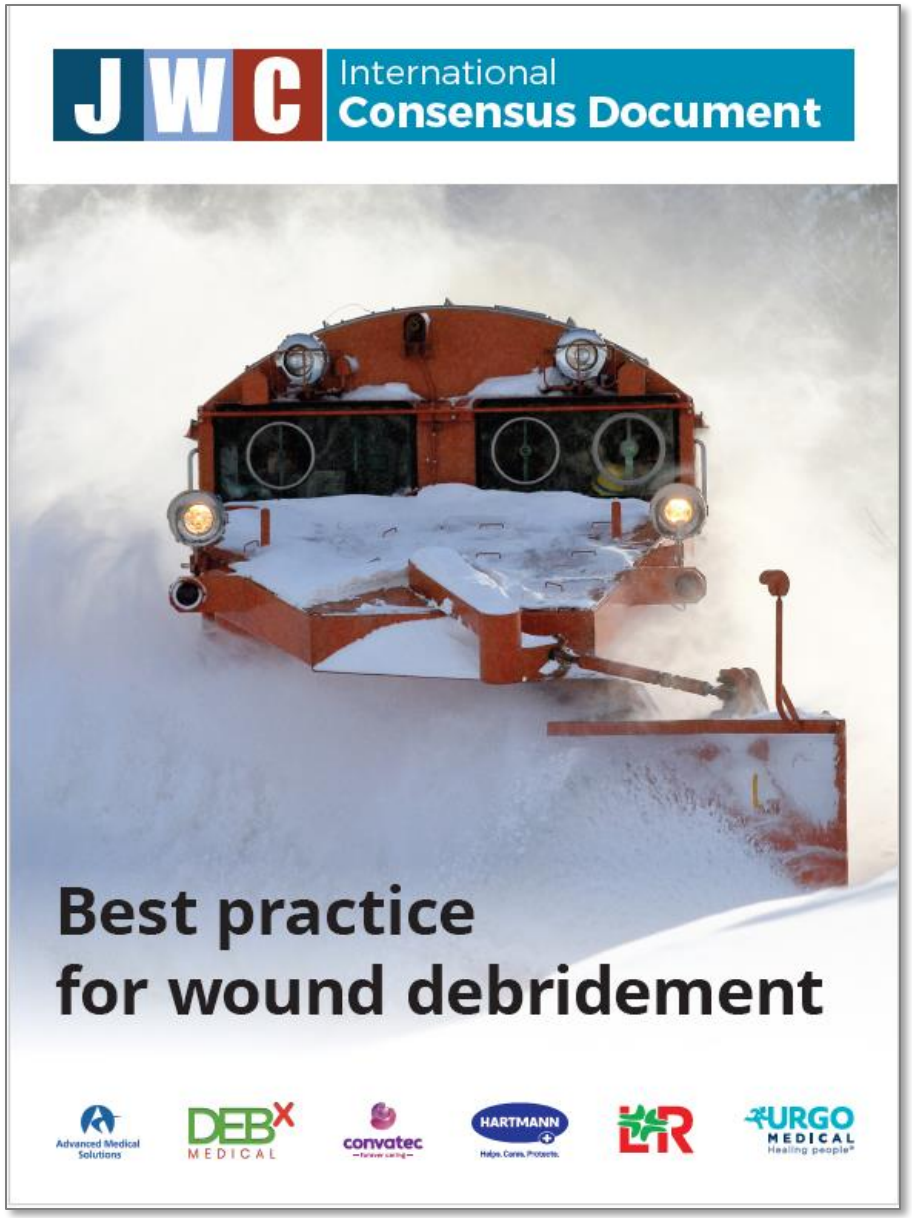
- DIFFERENT CARE SETTINGS MAY REQUIRE DIFFERENT APPROACHES
- Health professional's level of training may limit their scope of practice

- CONSIDER 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

J Wound Care. 2024;33(6):SUP C. Accessed March 11, 2025. https://www.journalofwoundcare.com/docs/debridementConsensus.pdf

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 the removal of germs and debris in a way that differentiates it from saline
- SYNERGISTIC technology with other forms of debridement



ROCF = reticulated open cell foam.

Mayer DO, et al. *J Wound Care.* 2024;33(Sup6b):S1-S32. *J Wound Care*. 2024;33(6):SUP C. Accessed March 11, 2025. https://www.journalofwoundcare.com/docs/debridementConsensus.pdf

HOCl: Assister/Amplifier of 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	Examples	Mechanism of action	Key indications	WBP	Referral
Hypochlorous acid	Stabilised solutions or gels	Mechanical disturbing of devitalised 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					
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 weeks of treatment					

J Wound Care. 2024;33(6):SUP C. Accessed March 11, 2025. https://www.journalofwoundcare.com/docs/debridementConsensus.pdf

Polling Question

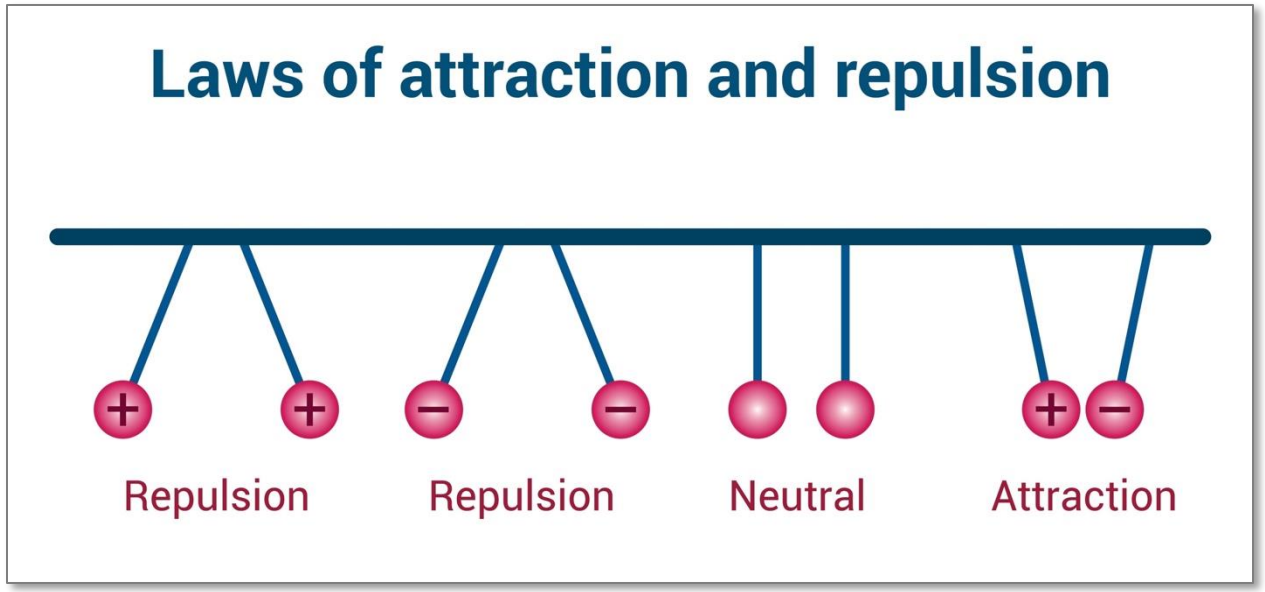
Integral debridement is a method of debridement that _____.

A. occurs in a delayed fashion
B. always utilizes sharp instruments
C. is tailored to the patient's individual needs
D. uses cautery

Wounds with Slough

- Novel absorbent fiber dressing with TLC-Ag matrix (lipido-colloid technology with silver salts)
- Provides combined antimicrobial and complete cleaning action to fight against local infection
  - Steric exclusion
  - Hydrophobic interactions
  - Hydrogen bonds
  - Electrostatic interactions

Highly-Charged Fiber Dressing

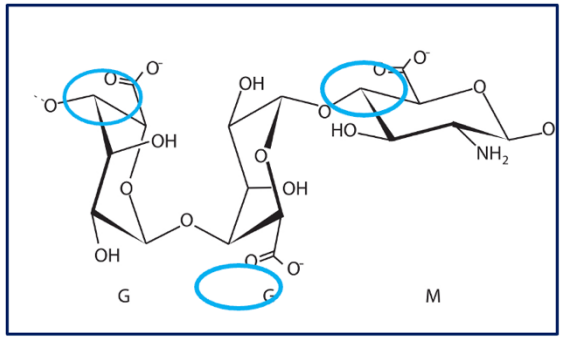


Works via electrostatic interactions

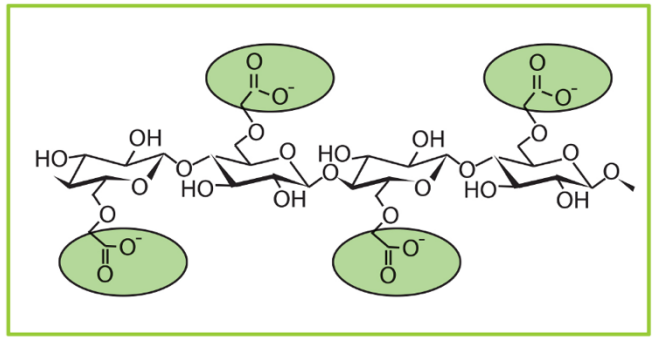
Many Absorbent Dressings Have Negative Charges

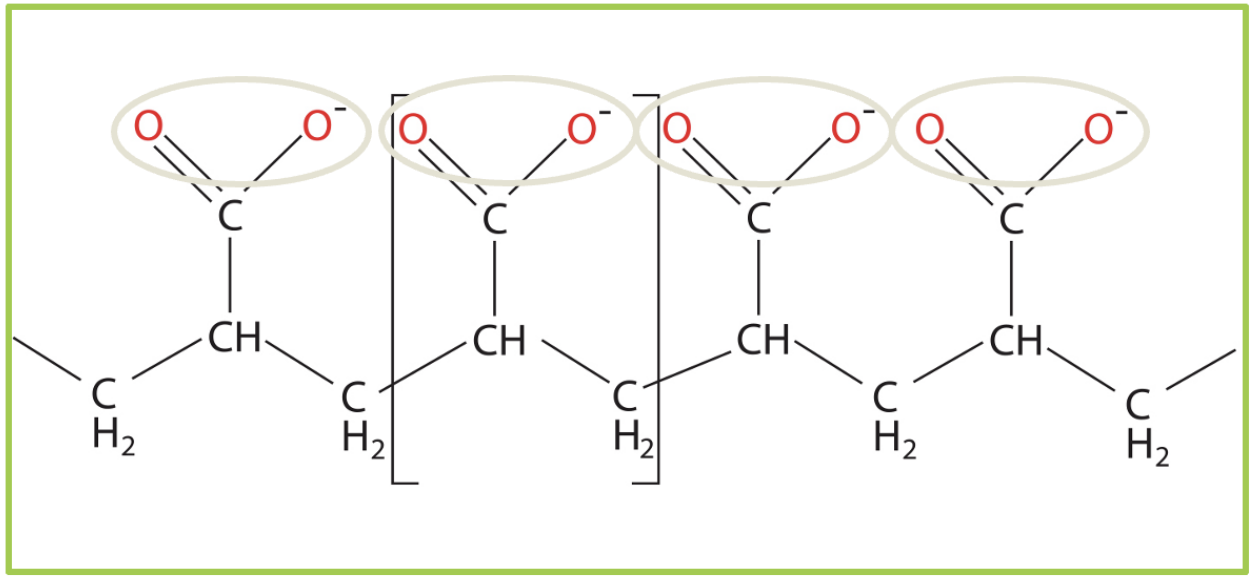
- Novel highly-charged fiber dressing has negative charges closer together/densely packed
- More negative charges per square inch of dressing

Alginates



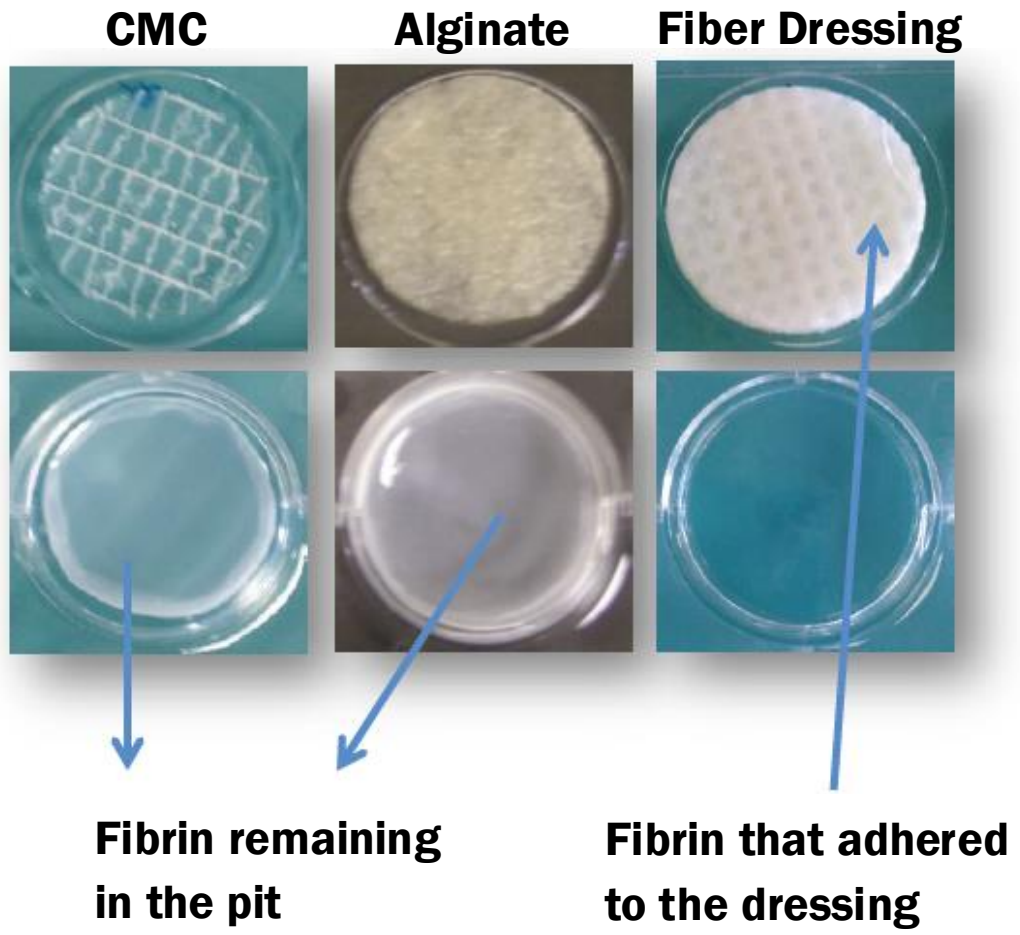
CMC Gelling Fiber



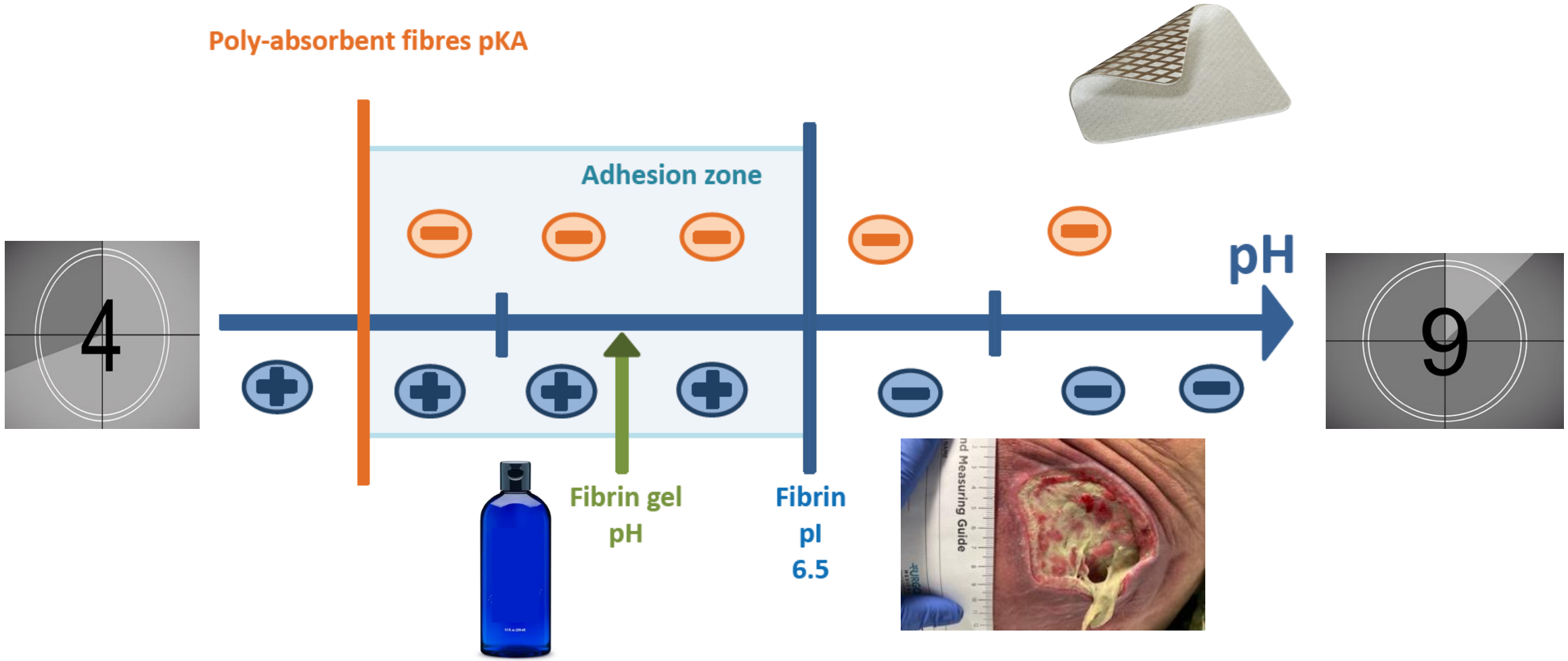


Fibrin Attraction

- Positively charged fibrin gel in petri dish
- Charged fiber technology



Synergy Between HOCl and Negative Fibers



Case Studies

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

MedlinePlus. National Library of Medicine (U.S.) Updated June 2024. medlineplus.gov.

TKA Dehiscence Wound

- Day 6
- Novel dressing changed 3 times
- pHA soaks
- 0% reduction in slough

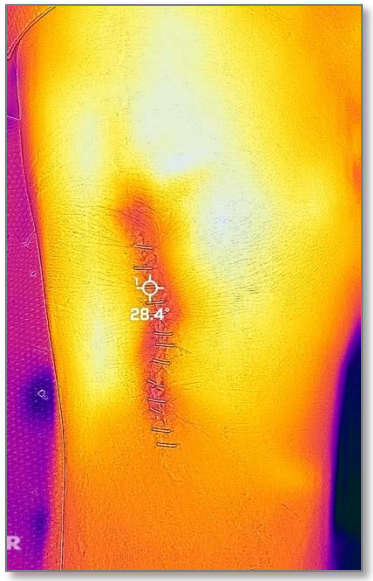
- Able to start in operating room with a much cleaner operative wound
  - Decreased slough = Decreased wound colonization

TKA Dehiscence Wound

- OR

- Excision of wound
- Irrigation with **pHA**

- Local tissue advancement closure
- Good perfusion of tissue
- Incisional NPWT (iNPWT)/ knee immobilizer



TKA Dehiscence Wound

- 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

TKA Dehiscence Wound

- **Healed at 2 wks**

Pyoderma Wound

- 68y Female
- Dermatology biopsied proven pyoderma gangrenosum to LLE

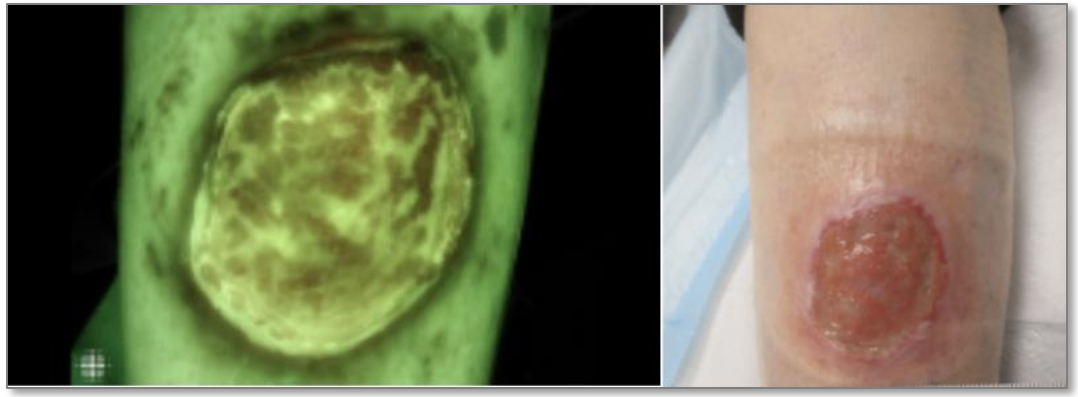
- Adherent slough

- Concern to avoid sharp debridement to not risk pathergy

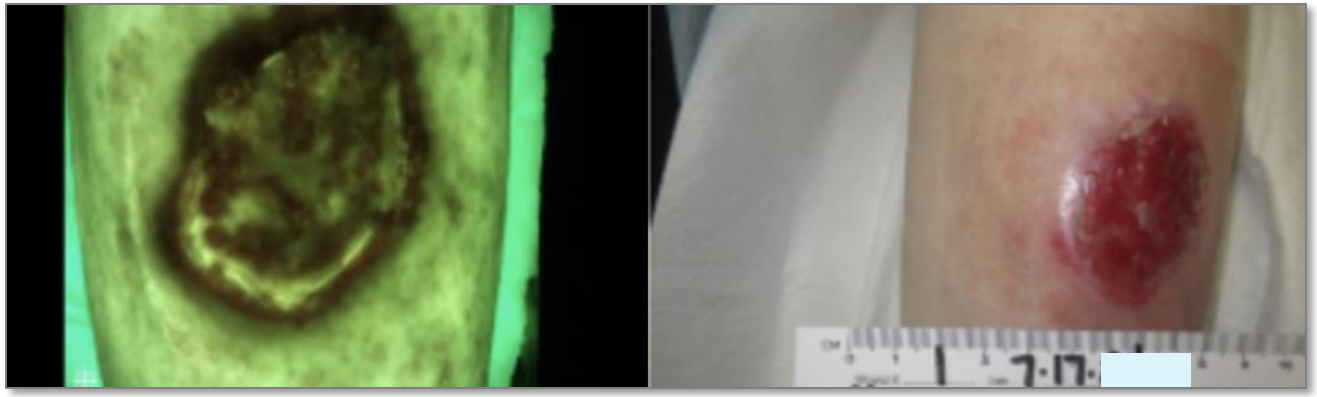
Synergistic Debridement

- pHA soaks
- Highly-charged fiber dressing

Reduction in Bacterial Fluorescence



4 wks



7 wks

5 Months: Healed

Infected Calciphylaxis

- 71y Female
- End stage renal disease (ESRD) and 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.


Smart Instill Feature
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

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

Venous Gangrene

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

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

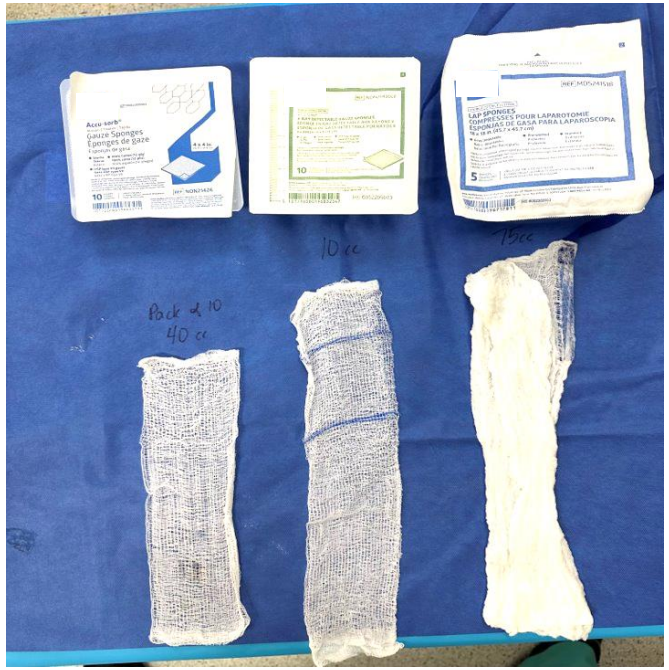
Venous Gangrene

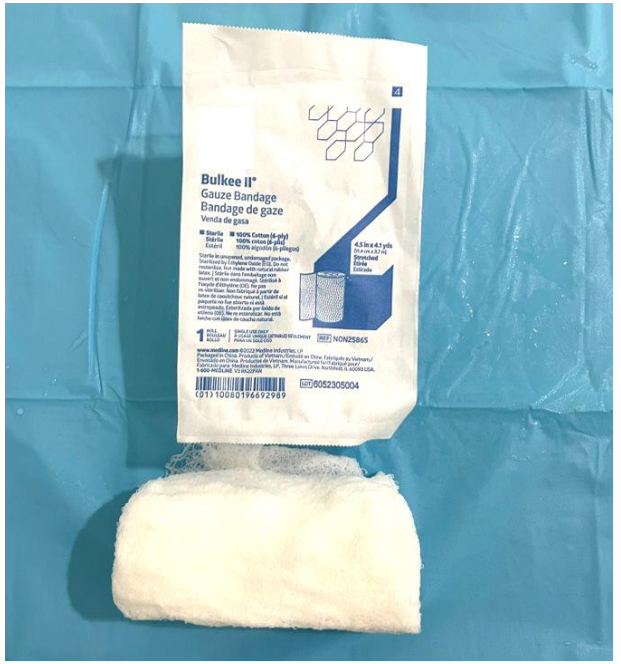
Groin Abscess Wound

- 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 Sponges (1)	Rolled Gauze Bandage (1)
Amount of pHA to saturate	10cc	40cc	75cc	124cc
Cost	$0.63	$2.52	$4.75	$7.81

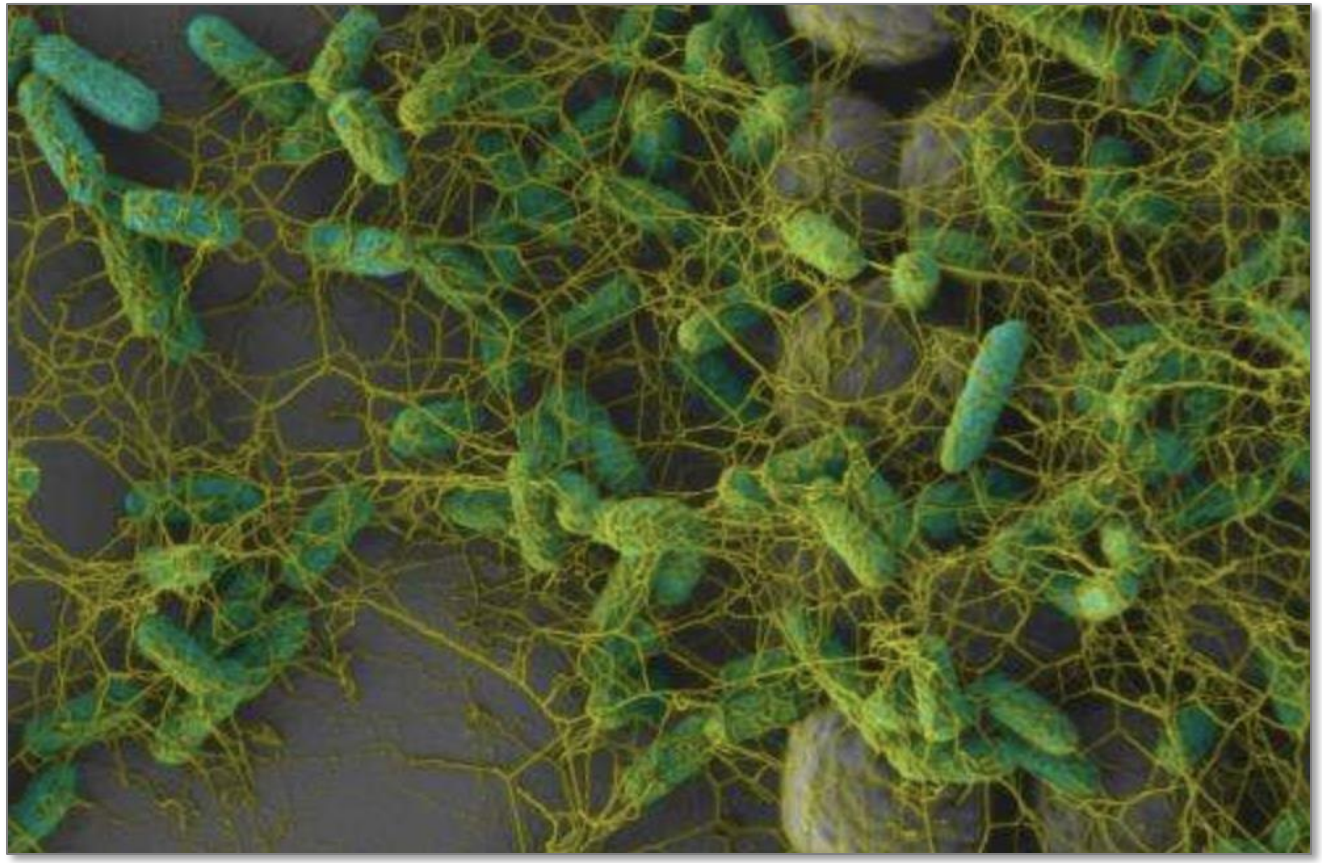




Groin Abscess Wound

Groin Abscess Wound

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



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

Thank you!

Please submit your questions via the question box