



WOUND CARE ESSENTIALS: SCIENCE, STRATEGY, AND SOLUTIONS

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HOLLAND, MICHIGAN

DISCLOSURES

- Speaker/Consultant:
 - Urgo Medical North America,
 - Solventum
 - Molnlycke
 - LifeNet Health
 - Convatec
 - Smith & Nephew
 - Organogenesis
 - Lynch Regenerative Medicine



OBJECTIVES

1. Examine key concepts in wound healing, factors that promote or inhibit wound healing, and prevention of wound complications.
2. Describe the cost benefits of early intervention with chronic or non-healing wounds to prevent complications and support the healing trajectory.
3. Explore emerging interventions and best practices to treat complex wounds through illustrative case studies.

SOME HARSH FACTS

- Chronic nonhealing wounds impact nearly 15% of Medicare beneficiaries (8.2 million) - far more than suggested by previous studies
- A conservative estimate of the annual cost is \$28 billion when the wound is the primary diagnosis on the claim. When the analysis included wounds as a secondary diagnosis, the cost for wounds is conservatively estimated at \$31.7 billion
- The highest cost estimates related to site of service were for hospital outpatients (\$9.9-\$11.4 billion) – demonstrating a major shift in costs from hospital inpatient to outpatient settings
- What types of wounds?
 - Surgical wounds \$11.7 to \$13 billion (total US)
 - Diabetic foot ulcers \$6.2 to \$6.9 billion (total US)
 - Arterial ulcers \$9,105 to \$9,418 per patient
 - Pressure ulcers \$3,696 to \$4,436 per patient
 - Venous ulcers \$10,000 to \$12,000 per patient

WHAT IS A CHRONIC WOUND?

A complex challenge that requires more than standard care.



CHRONIC WOUND

A wound that fails to proceed through an orderly and timely healing process and does not heal.

OTHER TERMS OFTEN USED



COMPLEX WOUND

A wound associated with multiple underlying factors that affect healing and require comprehensive, individualized management.



HARD TO HEAL WOUND

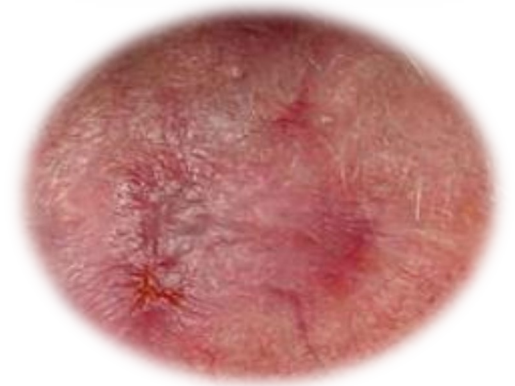
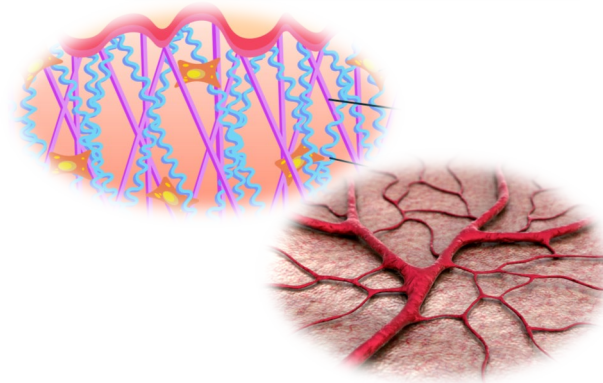
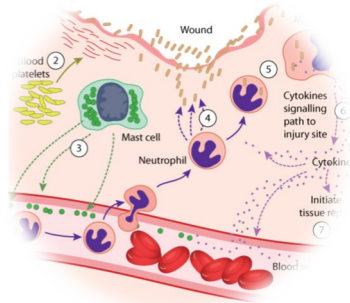
A wound that is stalled in the healing process due to persistent barriers and is unlikely to heal without advanced or specialized interventions.



THE GOAL

Treat the patient.
Identify the barriers.
Heal the wound.

WOUND HEALING PHASES



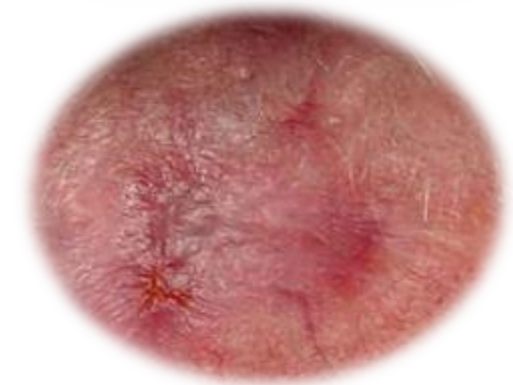
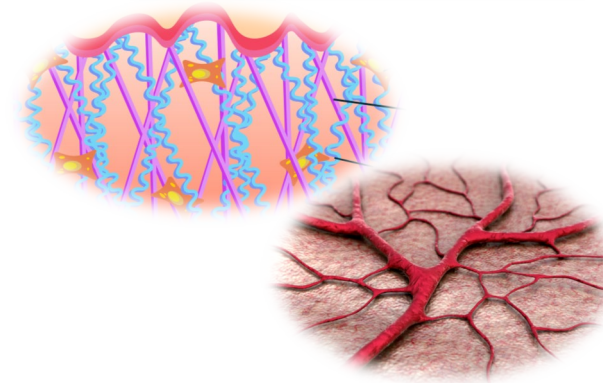
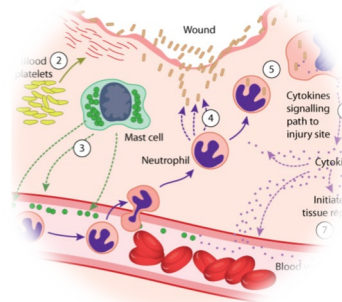
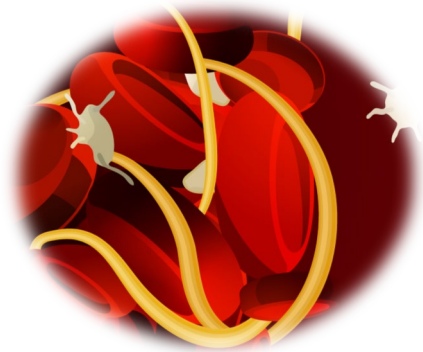
Hemostasis

Inflammation

Proliferation

Remodeling

"EXPECTED" WOUND HEALING



Hemostasis

Inflammation

Proliferation

Remodeling

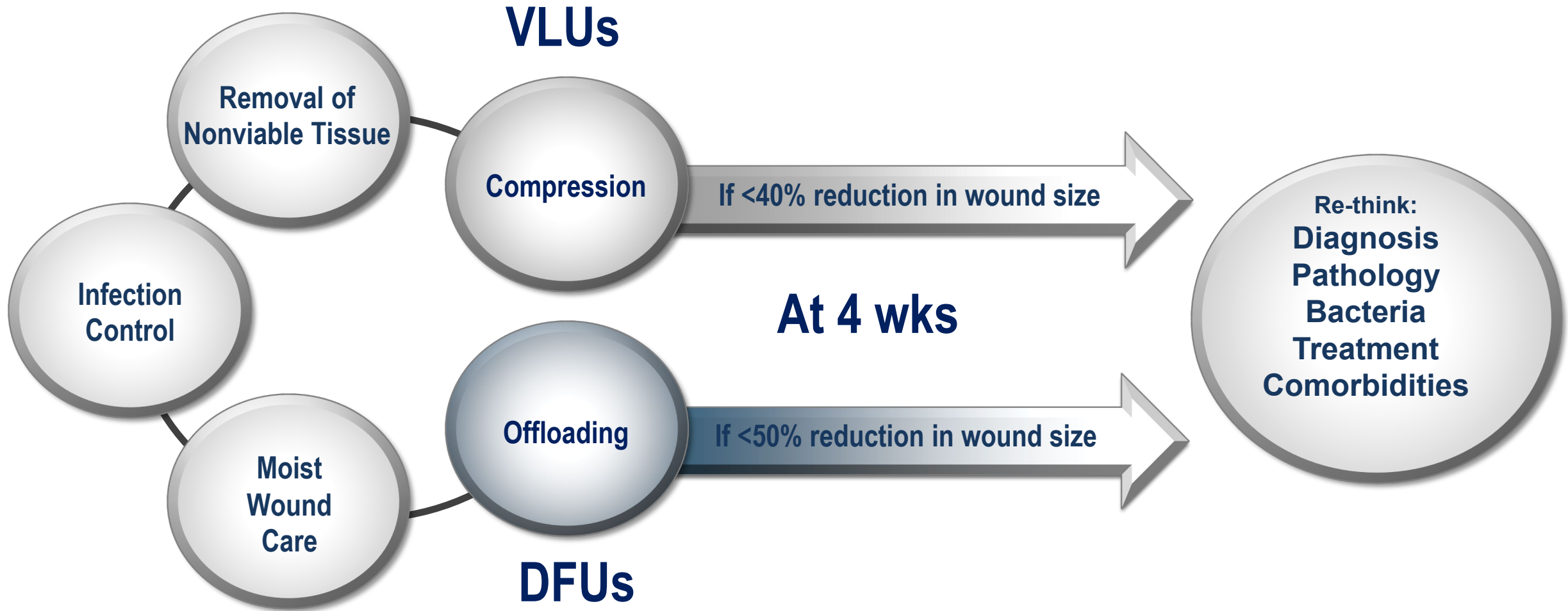
WE ALL GET THESE TEXTS....



THE *UNEXPECTED...*



PROGNOSTIC INDICATORS



HARD TO HEAL WOUNDS – WOUNDS WITH BARRIERS

- Patient barriers that can be managed or at least mitigated
 - Establish the right diagnosis
 - Access to the right specialized care
 - Improved nutrition
 - Improved glucose management
 - Improve perfusion
- Wound barriers are present that can be overcome
 - Uncontrolled or under-addressed etiology
 - Unhealthy tissue
 - Bacteria / biofilm
 - Proteases
 - Edema
 - pH



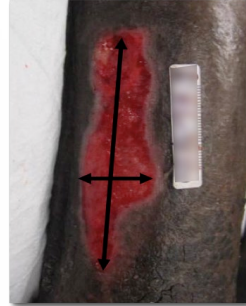
WOUND ASSESSMENT AND DOCUMENTATION CONSISTENCY

- Excellence in documentation begins with a comprehensive EHR
 - Use of standardized assessment tools (E.g., BWAT, PUSH, Braden)
 - Measurement
 - Tissue type
 - Exudate
 - Wound edges
 - Periwound condition
 - Pain – baseline and trajectory

A COMPLETE AND ACCURATE WOUND ASSESSMENT IS CRITICAL TO DEVELOPMENT OF AN EFFECTIVE TREATMENT PLAN



Degree of tissue injury



Measurements



Spaces
Undermining/tracts



Edges



Type and amount of
exudate



Tissue type, structures



Metabolic: Diabetes, obesity, malnutrition – chronic inflammation and poor protein synthesis

Cardiopulmonary & vascular: Peripheral arterial disease, CHF, COPD – impaired perfusion, chronic inflammation

Renal/hepatic/autoimmune/oncologic: Chronic inflammation and poor protein synthesis

Neurologic: CVA, spinal cord injury – denervation slows healing, lack of protective sensation

Medications: Steroids, chemo, immunosuppressants – impaired immune response

Lifestyle: Tobacco, alcohol, inactivity – contribute to chronic conditions

Cognitive/functional impairment – ability to participate in care

MANAGEMENT OF SYSTEMIC BARRIERS TO HEALING

HOW DO WE FIGURE OUT THE BARRIERS?



Is it always trial
and error?

The answer...

No

Maybe

Sometimes

WE HAVE INTERVENTIONS FOR THE KNOWN BARRIERS

- **ETIOLOGY:** Re-think, it could be that cancer masquerading as a venous ulcer
- **BACTERIAL LOAD:** Adequate cleansing with appropriate solutions and wound bed preparation (WBP), especially debridement
- **pH, PROTEASES:** Create a hostile wound environment; it goes back to WBP
- **EDEMA:** Will always delay healing
- **BUY-IN TO THE TREATMENT PLAN:** This is the patient's part!

KNOW AND SUPPORT THE ETIOLOGY



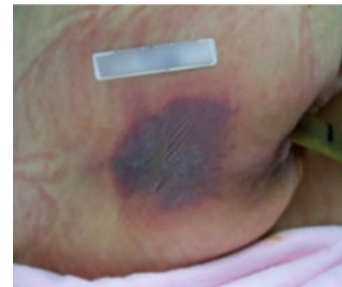
Venous Ulcers: Compression



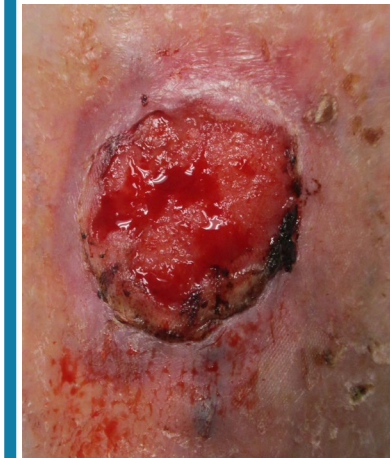
Arterial lesions: Revascularize and protect



Diabetic Foot Ulcers: Offload



Pressure Injuries: Offload



Atypical Wounds: Biopsy

IWII WOUND INFECTION CONTINUUM



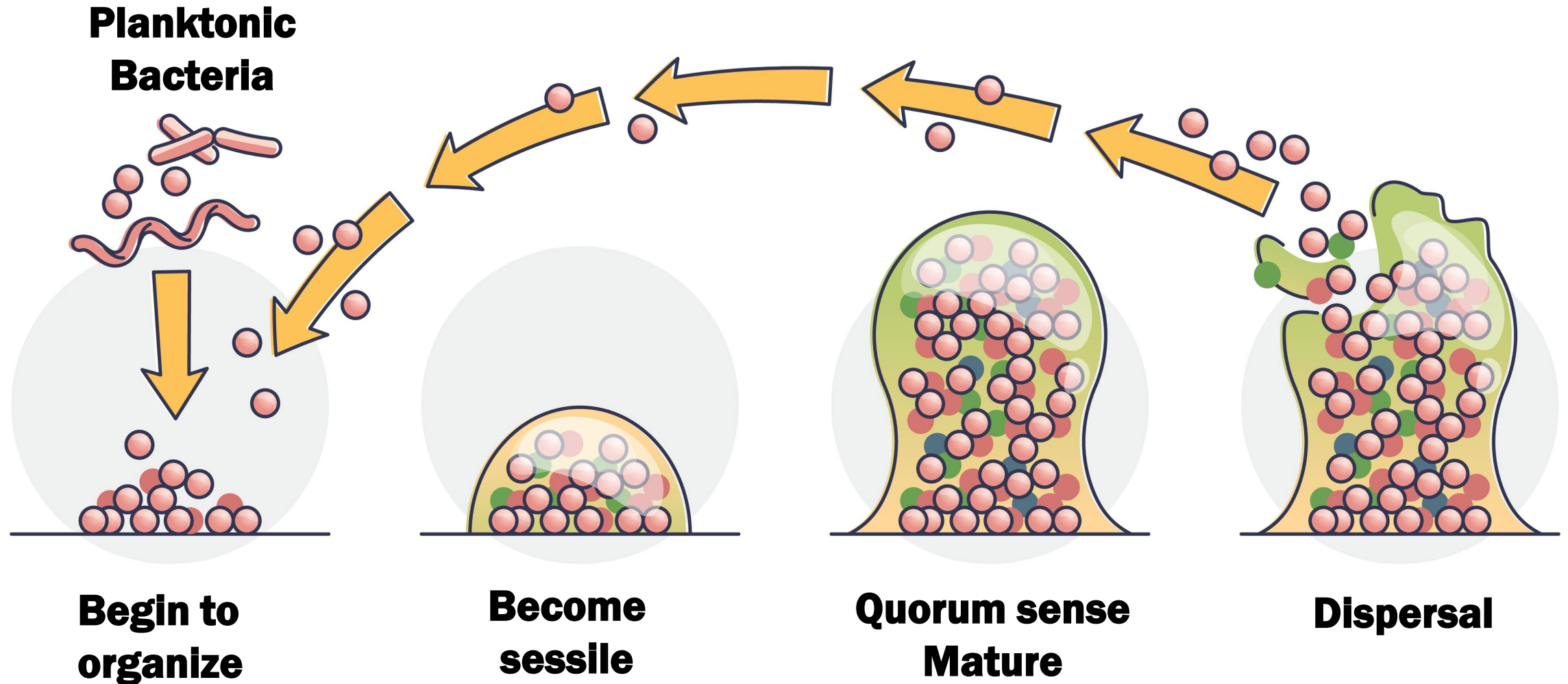
International Wound
Infection Institute

IWII WOUND INFECTION CONTINUUM AND MANAGEMENT GUIDE

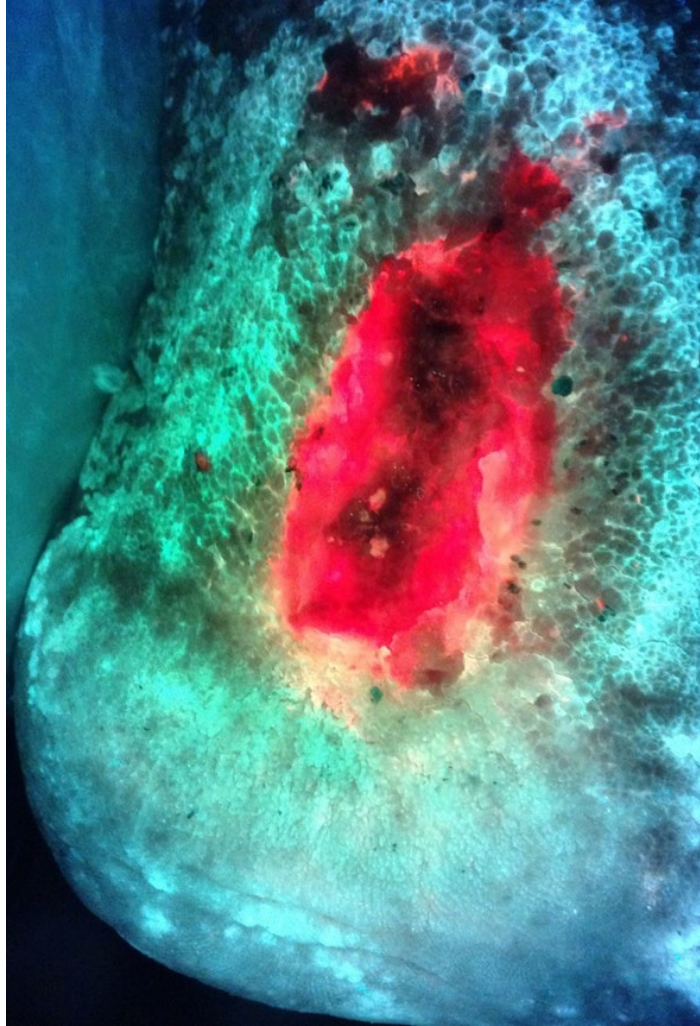


Increasing microbial burden in the wound					
As the continuum green shading darkens, microbial burden increases					
CONTAMINATION	COLONISATION	LOCAL WOUND INFECTION COVERT (subtle) OVERT (classic)		SPREADING INFECTION	SYSTEMIC INFECTION
Assess for wound infection					
• Microorganisms are present within the wound but are not proliferating • No significant host reaction is evoked • No delay in healing is clinically observed	• Microorganisms are present and undergoing limited proliferation • No significant host reaction is evoked • No delay in wound healing is clinically observed	• Hypergranulation • Bleeding, friable granulation • Epithelial bridging and pocketing in granulation tissue • Increasing exudate • Delayed wound healing beyond expectations	• Erythema • Local warmth • Swelling • Purulent discharge • Wound breakdown and enlargement • New or increasing pain • Increasing malodour	• Extending induration • Spreading erythema • Lymphangitis • Crepitus • Wound breakdown/dehiscence with or without satellite lesions • Inflammation, swelling of lymph glands	• Malaise • Lethargy or nonspecific general deterioration • Loss of appetite • Fever/pyrexia • Severe sepsis • Septic shock • Organ failure • Death

BIOFILM DEVELOPMENT

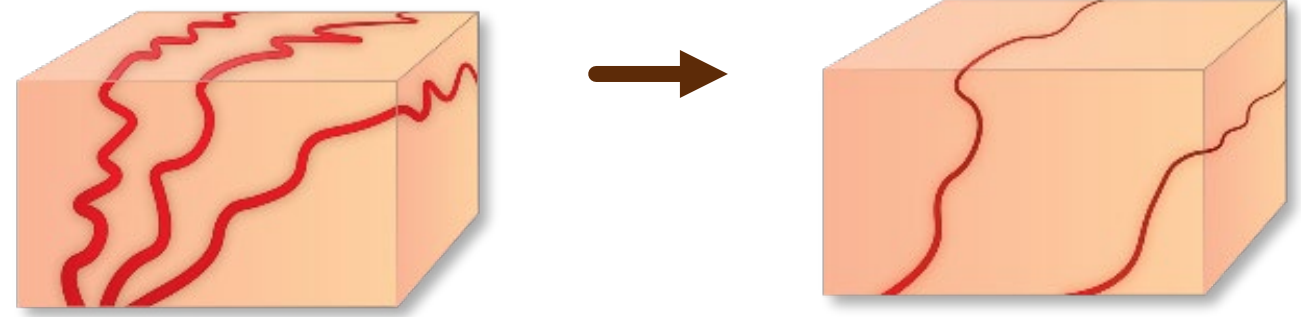
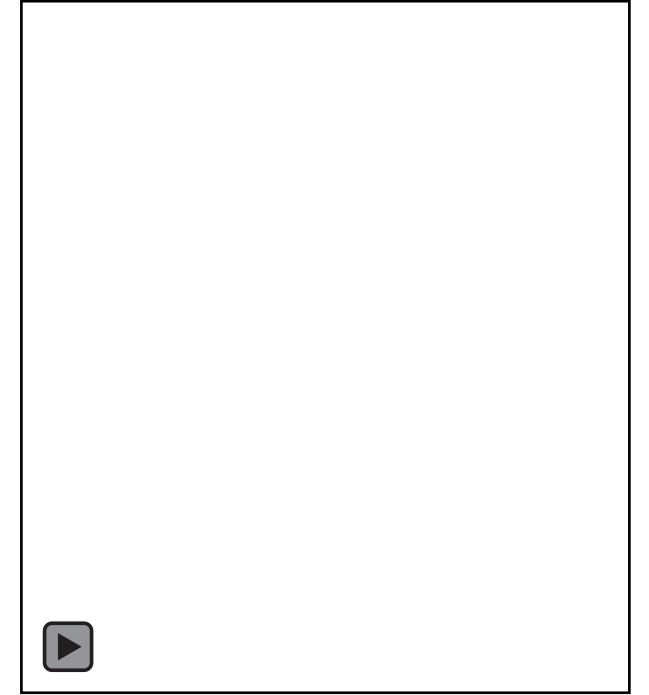


FLUORESCENCE IMAGING OF BACTERIAL PRESENCE



EDEMA: THE ROOT OF MANY EVILS

- Known challenges related to chronic venous and lymphedema patients
- Dependent edema often overlooked
- Issues with exudate management
 - Increased wound and periwound challenges
 - Soiling of clothing and bed linens
 - Source of odor and embarrassment
 - Social isolation and loss of workdays
- Issues with perfusion
 - Oxygen distance diffusion



TOOLS TO MANAGE EDEMA

- The list is short
- Choice is driven by the etiology / source of the edema
 - Negative Pressure Wound Therapy (NPWT)
 - Can be combined with compression
 - Compression wraps / Garments
 - Cyclic oxygen
 - Leg elevation
- Diuretics
 - *Rarely a good choice* unless edema is related to cardiovascular issues



“I CAN’T BE COMPRESSED”

- 69-year-old robust retired corrections officer, very active
- Chronic venous insufficiency only significant medical history
- Current clinic closed due to COVID-19
- Referring nurse warned us that he would refuse all compression
- Current regime:
 - 100 ABD pads/month
 - Zinc barrier to entire lower leg
 - Wrapping ankle to knee with Unna’s boot
 - Changing every day



INITIAL VISIT





- Three Days later... dramatically improved
- One area was adherent so changed to polyurethane foam
- 2 Layer Compression System and foam dressing



- Resumed treatment with better absorbency and secondary dressing
- Continued with 2-layer wrap

3 WEEKS



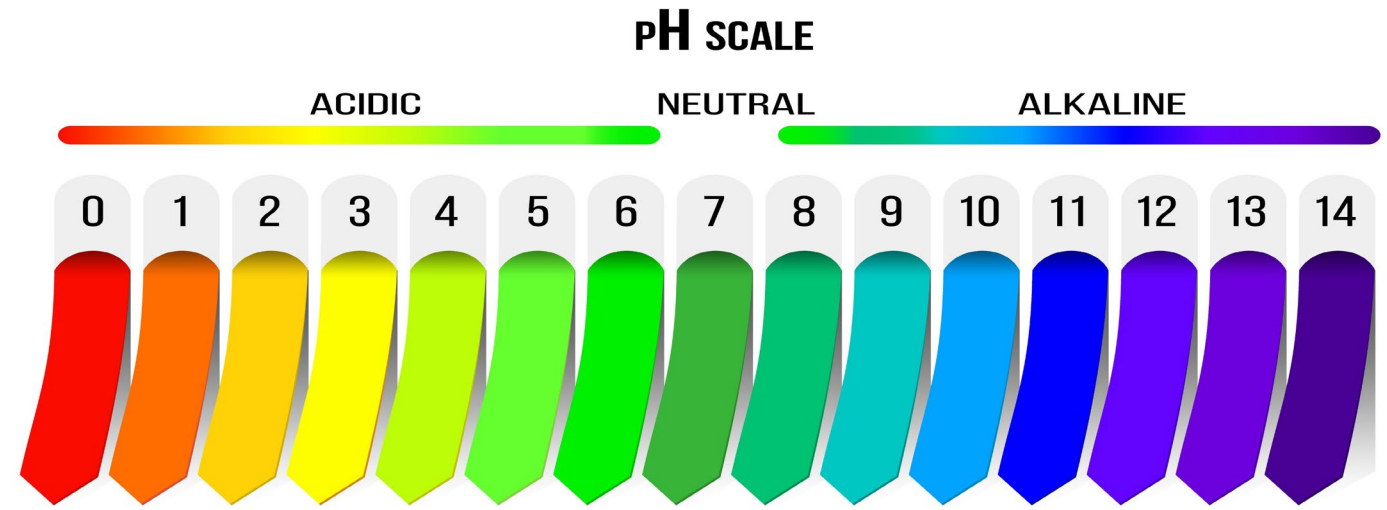


- Closed at 10 weeks
- Significant volume reduction

pH TO WOUND HEALING

The pH scale is logarithmic

- Each increase of 1 = 10x
- An increase of 5.5 to 8.5 = 1000x



Healthy, Intact Skin – pH 4.0-6.0 (Acidic environment)

- Higher antimicrobial properties
- Favorable to wound healing
- Preserves skin function
- Increased macrophage and fibroblast activity
- Ensures stratum corneum cohesion and barrier function

Vulnerable Skin – pH >7.5 (Alkaline environment)

- Allows pathogens to thrive
- Impedes the healing process
- Inflammation and irritation
- Same pH as Chronic wounds

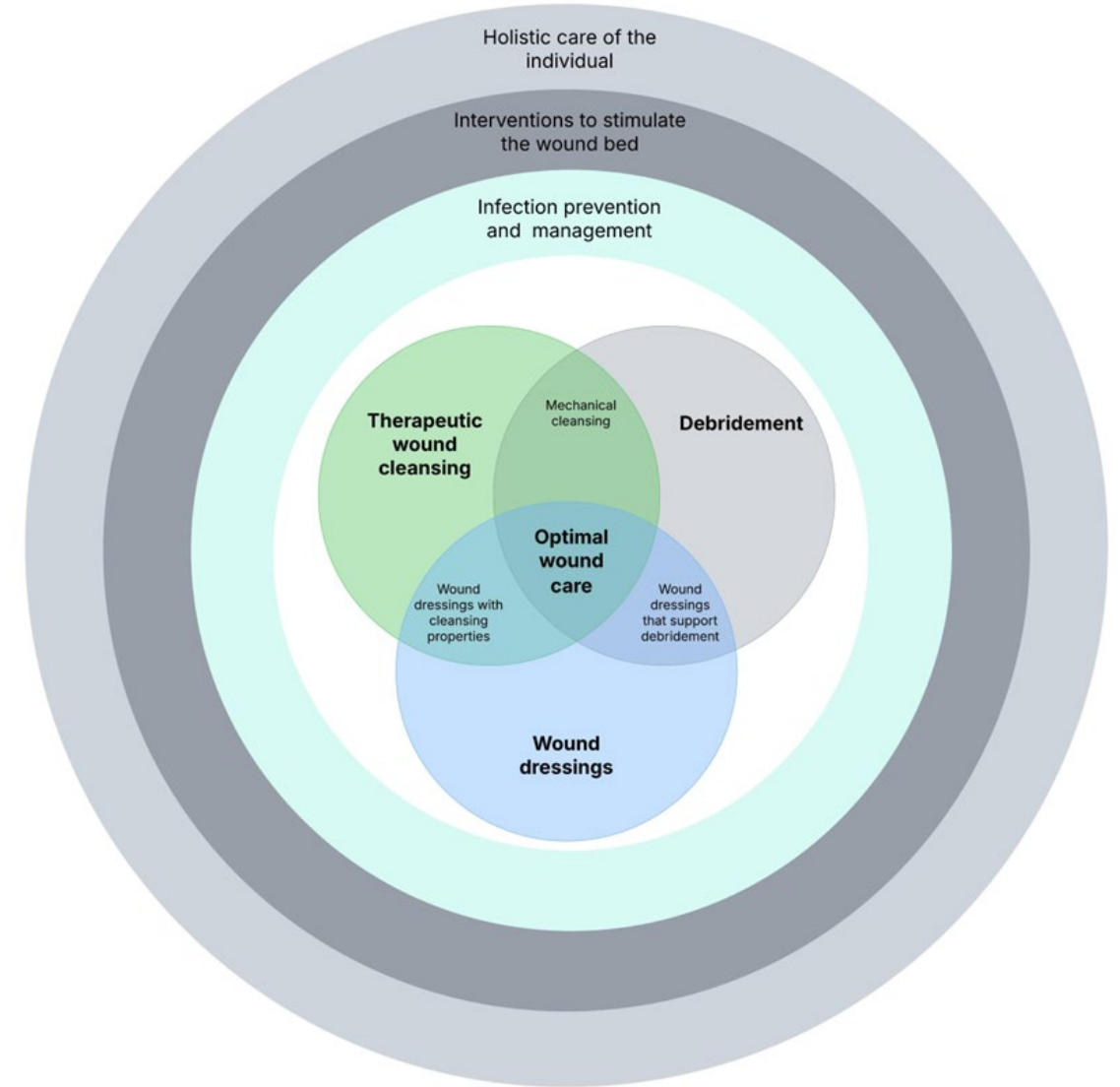
Healing Processes Affected by Changes in pH

Effects of lowering the pH to a more acidic environment

- Increased oxygen release into the wound
- Increased collagen formation
- Increased macrophage activity
- Increased fibroblast activity
- Increased graft take
- Control enzyme activity (ie, MMPs)
- Promotes angiogenesis
- Reduced toxicity of bacterial end products
- Reduced microbial proliferation and infection rates
- Reduced biofilm formation
- Reduced bacterial virulence
- Immunological responses

Optimal Wound Care

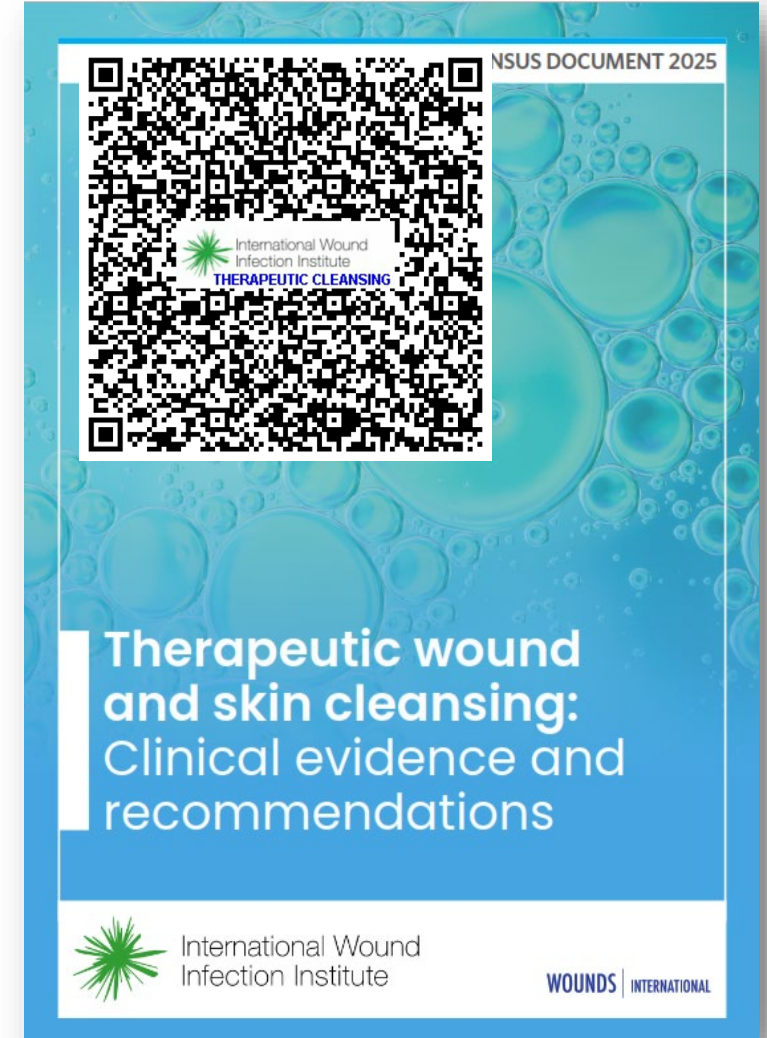
Goal is wound bed preparation



International Wound Infection Institute

Therapeutic wound and skin cleansing: **Clinical Evidence and Recommendations**

<https://www.woundinfection-institute.com>





Cleansing anything can be rewarding....

Wounds are no exception

However, it can become ritualistic and not therapeutic



THERAPEUTIC WOUND CLEANSING

Active removal of surface contaminants, loose debris, non-attached nonviable tissue, microorganisms, and/or remnants of previous dressings from the wound bed and periwound.

Recommendation 1

*Therapeutically cleanse all wounds
when the dressing is changed or removed.*

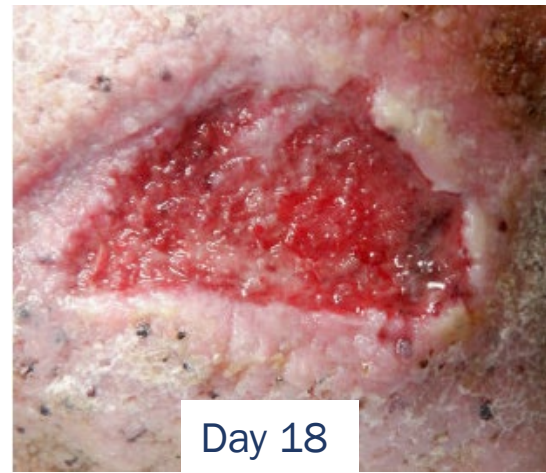
RECURRENT ULCER: CURRENT ULCER 2 YEARS



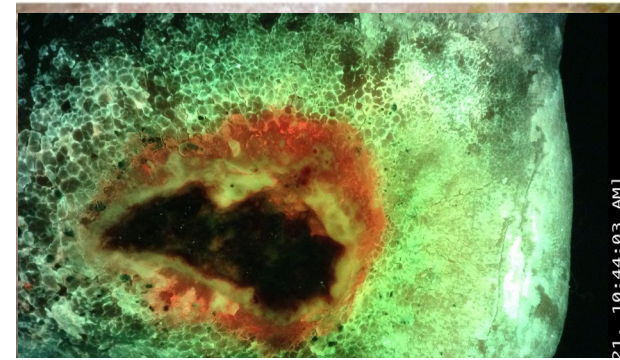
Day 0
Foam dressing, 2-layer wrap



Day 4; Pigmented foam



Day 18



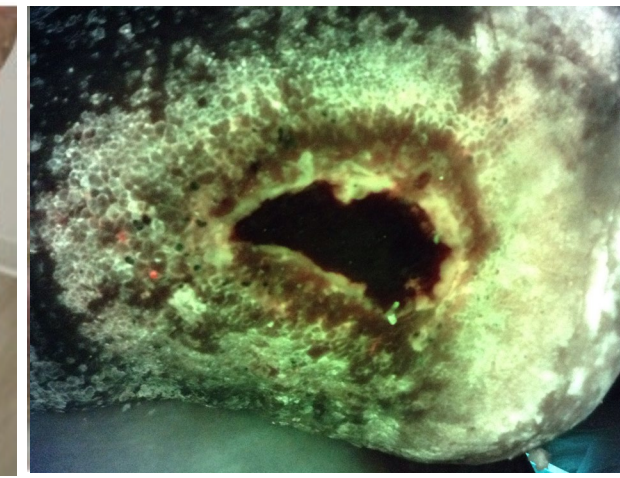
Day 32
Ultrasonic debridement with pHA,
AG dressing



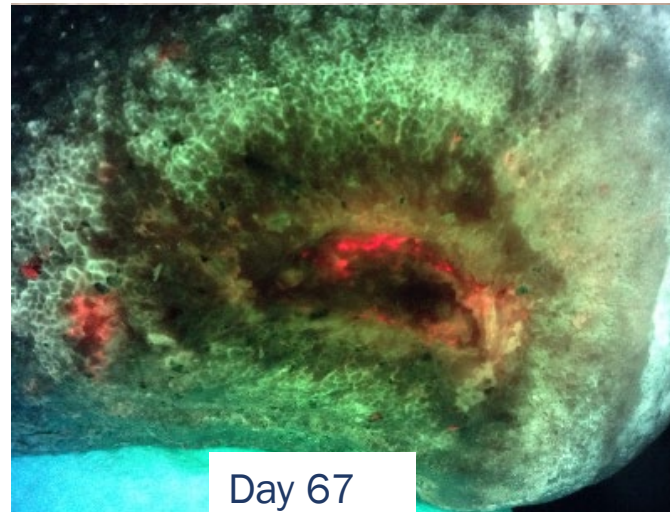
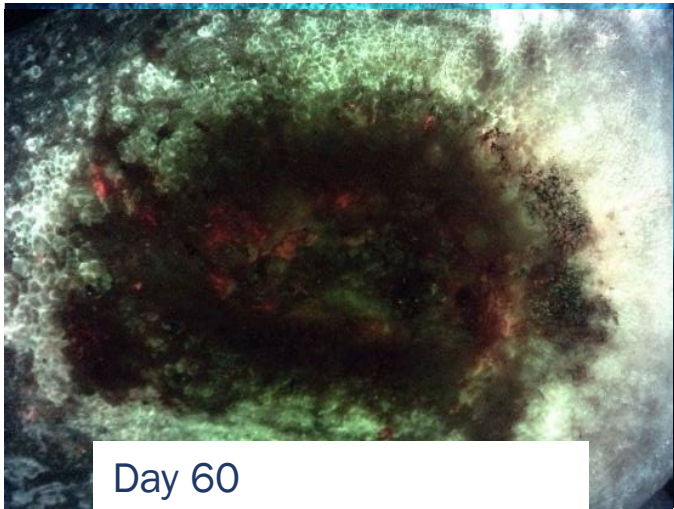
Day 11



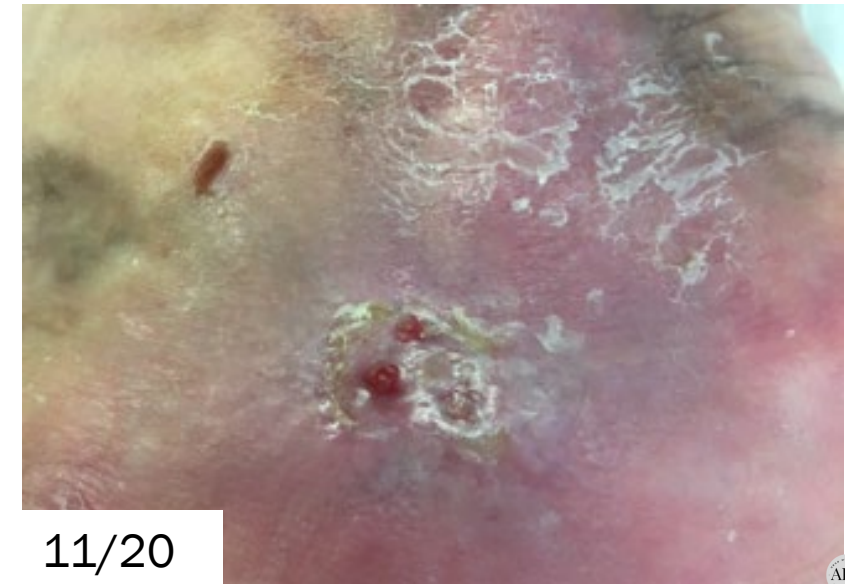
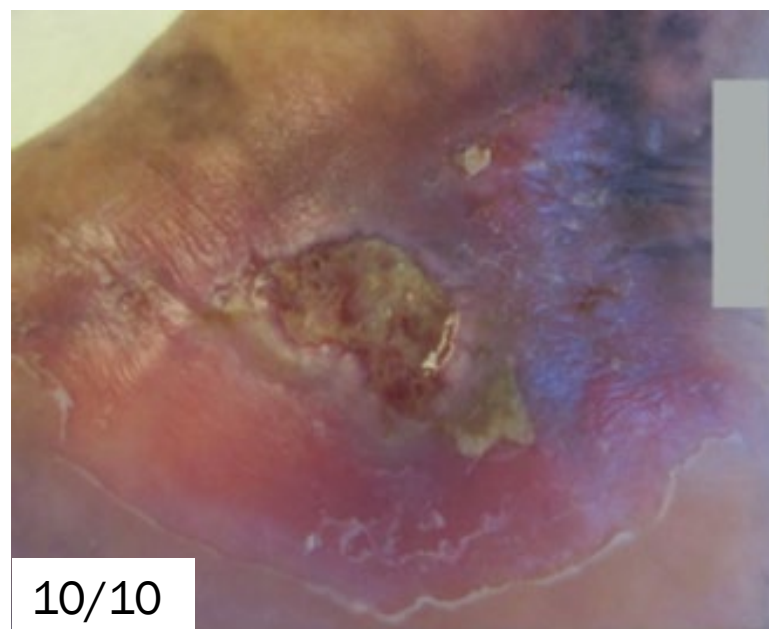
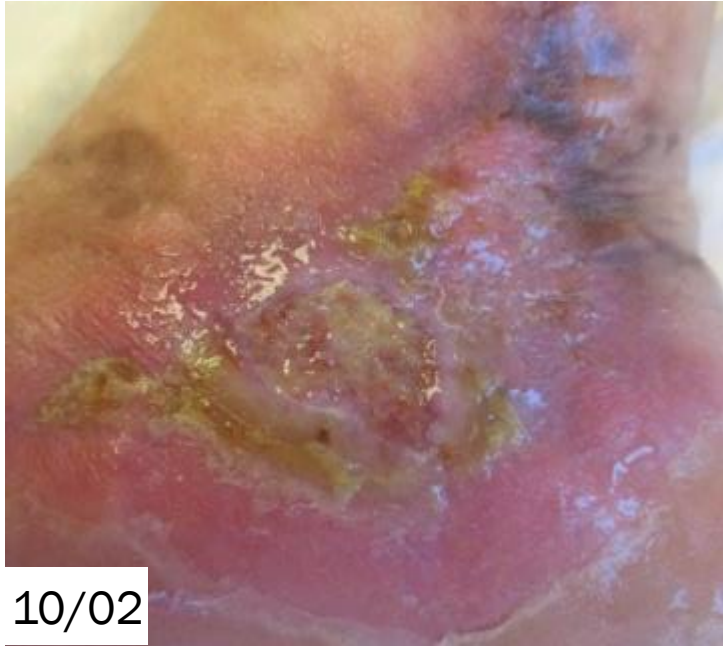
Day 25
Debrided



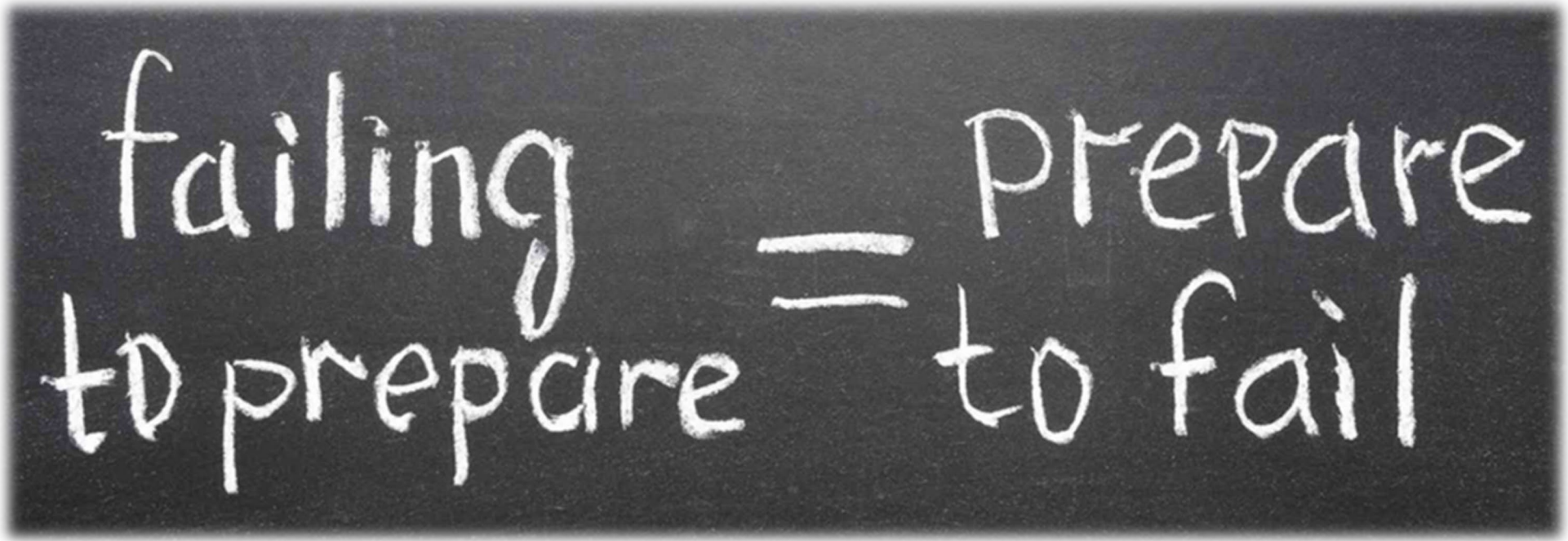
2 YEARS  **10.5 WEEKS**



CHANGED JUST ONE THING....AFTER 6 MONTHS



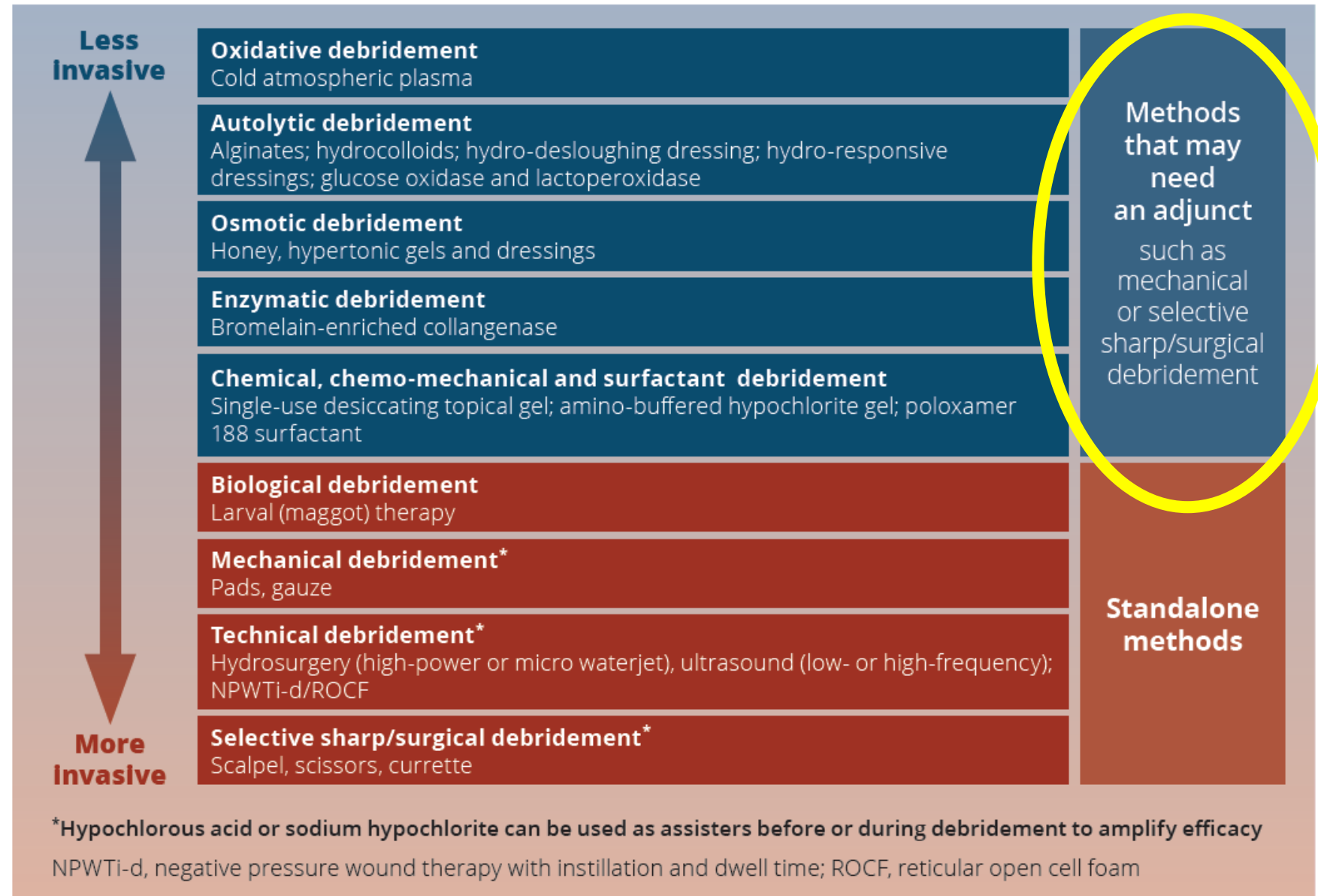
WOUND BED PREPARATION



failing
to prepare = prepare
to fail

MORE THAN ONE WAY TO APPROACH DEBRIDEMENT

Figure 8. Debridement methods by invasiveness and need for an adjunct



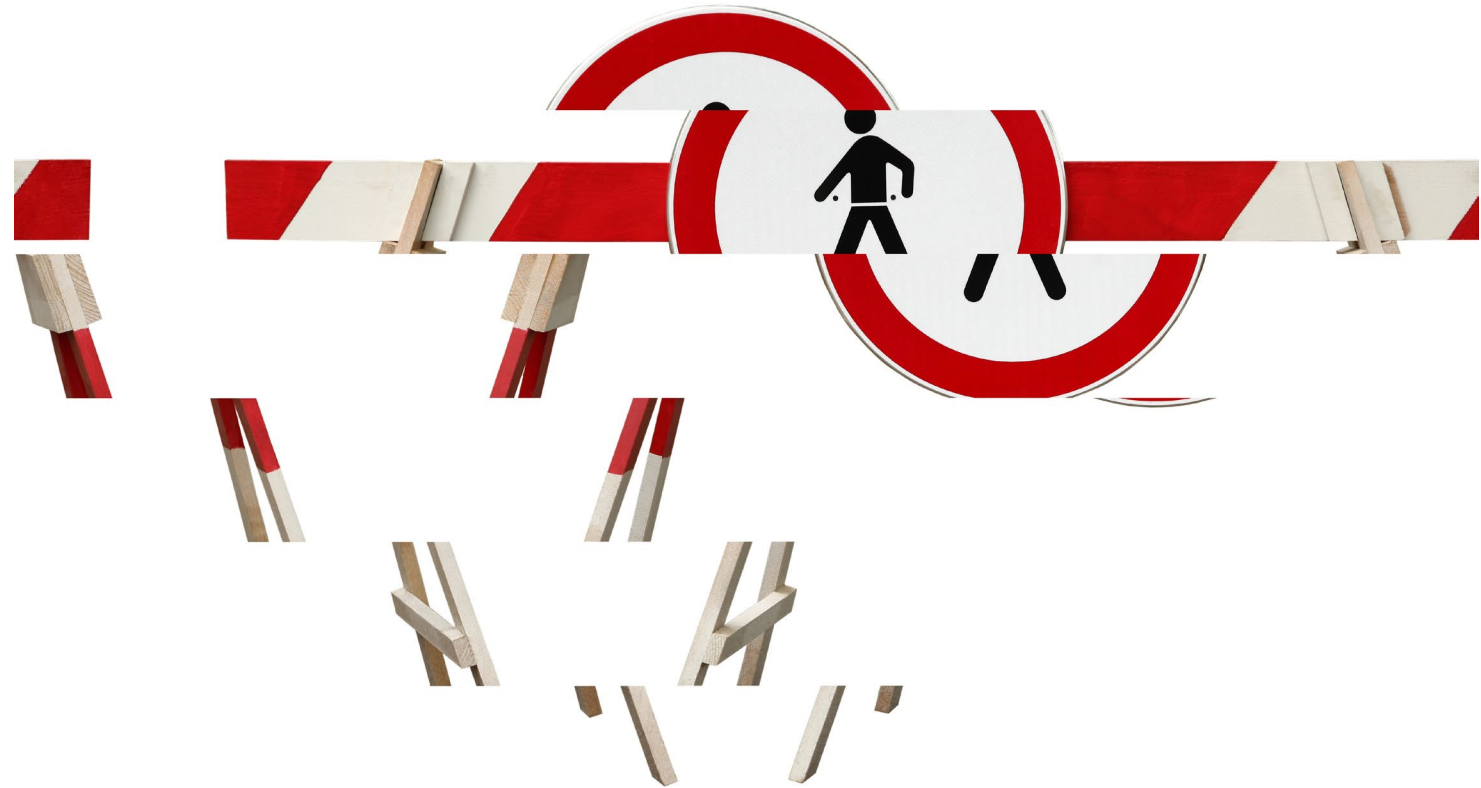
SEVERAL OPTIONS, MOST HAVE LIMITS



- Sharp debridement – The Gold Standard
 - Painful, may require anesthesia
 - No tissue selectivity & cannot remove everything
 - Limited in scope & not all wounds qualify
 - Stops at the scalpel
- Traditional Autolytic Debridement
 - Slow-acting, requires frequent changing
 - Depends on healthy immune system and moisture balance
 - Increased risk of infection and/or maceration
- Mechanical Debridement
 - Non-selective (i.e., wet to dry dressings)
 - Can be painful
- Enzymatic Debridement
 - Requires daily application
 - May be costly
 - Doesn't debride *all* debris

BARRIERS AND LIMITATIONS TO STAND ALONE METHODS

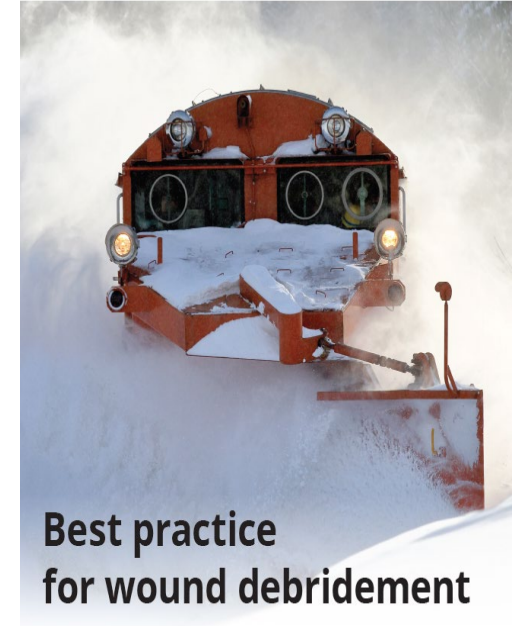
- Access to tools
- Site of Care
- Limits of skill sets
- Pain



INTEGRAL DEBRIDEMENT

1. It takes a **holistic** and **complete** approach
2. It also allows for a **tailored** and **patient centric** approach to wound care that highlights the need to **consider patient's comfort** and preferences when selecting a debridement method.
3. This (new concept) can **help bridge limitations** in an individual's **health professional's scope of practice** and knowledge base, potentially enabling **more effective outcome**.

Consensus statement: This consensus document proposes a new approach referred to as integral debridement, which the authors define as 'the combined use of different but complementary methods of debridement on the same wound'.



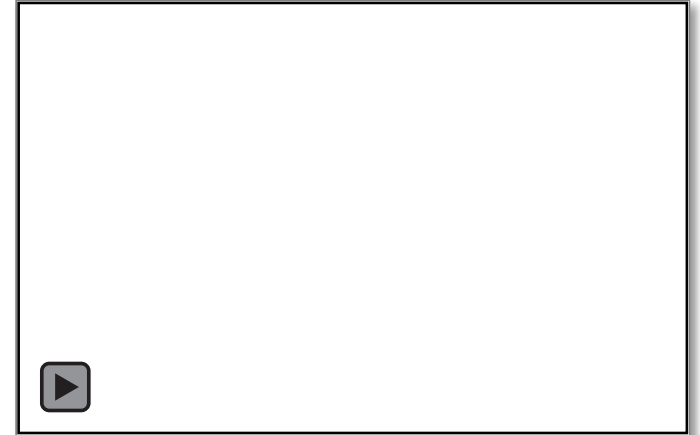
WOUND CARE IS PATIENT FOCUSED VS PRODUCT FOCUSED

THAT'S THE DIFFERENCE BETWEEN WOUND CARE AND WOUND HEALING



RISK-BASED ESCALATION

- When standard care is no longer sufficient or risk of delayed healing warrants advanced measures AND...
- Fundamental barriers (infection, perfusion, offloading, nutrition) are being addressed
- But this **does not** always mean waiting 4 weeks
- At-risk wounds:
 - Exposed tendon/bone
 - Radiation injury
 - Ischemic or neuropathic ulcers
 - Post-surgical dehiscence
- Early identification of stalled wounds prevents chronicity and cost escalation



TREATMENT PLANNING AND ESCALATION: PRINCIPLES BEFORE MODALITIES

- It's always about the patient and the wound
- Importance of sequencing, reassessment intervals, and stop/continue rules
- Emphasis on integration—not replacement—of standard wound care

CONSIDERATIONS FOR THERAPIES USED OUTSIDE THE CLINIC OR HOSPITAL

- Appropriateness of modality for patient/wound
- Cost effectiveness
- Ease of use
- Monitoring and reassessment cadence
- Documentation requirements for continuity and coverage

PATIENT AND ENVIRONMENTAL CONSIDERATIONS

Environmental

- Transportation
- Home environment
- Caregiver support
- Time availability
- Work restrictions
- Insurance coverage

Patient

- Compliance
- Functional ability
- Beliefs/cultural considerations (porcine restrictions, etc.)

LET'S TALK ABOUT OXYGEN

Adequate oxygen supply
is necessary for all
cellular functions



HYPERBARIC OXYGEN THERAPY

- Microbial defense
- Angiogenesis
- Collagen synthesis
- Risk of barotrauma, seizures
- Limited by vascular supply
- Only covered for ischemic DFU (Wagner grade 3), refractory osteomyelitis, radiation necrosis, compromised grafts/flaps
- Costly



PRESENTLY APPROVED INDICATIONS FOR HB02

- Wagner 3 and higher DFU
- Failing/compromised flaps/grafts
- Delayed radiation soft-tissue injury
- Bony osteoradionecrosis
- Decompression sickness (Bends)
- Acute arterial thrombosis/embolism
- Carbon Monoxide poisoning
- Necrotizing soft-tissue infections; gas gangrene and necrotizing fasciitis
- Chronic refractory osteomyelitis
- Central retinal artery occlusion
- Sudden sensorineural hearing loss
- Crush injuries/compartment syndrome

TOPICAL OXYGEN

- Microbial defense
- Angiogenesis
- Improved granulation tissue quality
- Stronger, more organized collagen deposition
- Faster wound contraction and epithelialization
- Applied directly to the wound bed – not limited by vascular supply
- Can be used on any full-thickness wound
- Covered nationwide in the VA, by Medicaid in certain states, and by private insurers and Workers' Comp with prior authorization

Differences Between Systemic & Topical Mechanisms of Oxygen Delivery



- **HBO is the systemic delivery of O₂** to area of pathology
- **HBO hyper-saturates the blood** by dissolving O₂ in the plasma – can't supersaturate Hgb
- 1200mmHg in the blood results in **300-400mmHg in tissue**
- As arterial blood circulates, oxygenation at the site of a wound relies on intact vasculature to allow diffusion of O₂ to the location and for the growth of new blood vessels.



- Topical Oxygen is immediately available to the wound bed **without the need to remove gas permeable dressings**
- Cyclical Pressurized Topical Oxygen – **Therapy provides the highest topical penetration** of oxygen into the wounded tissue.
- The immediate availability of oxygen at a **partial pressure of approximately 800 mmHg**

MULTI-MODALITY ITOT

Topical Oxygen Therapy + Cyclical Compression

- Concurrently addresses hypoxia, edema, and inflammation
- Cyclical pressures increase pO₂ available to tissues (~800 mmHg), while decreasing O₂ diffusion distance
- Potentiates complimentary inflammation resolution, tissue perfusion, and wound repair pathways
- Can be used over gas-permeable dressings, does not require additional dressing changes
- Can be applied by patients or non-clinical caregivers

Clinical findings

- Higher incidence of healing
- Reduced time to healing
- Reduced infection
- Improved granulation tissue formation
- Pain reduction
- Improved quality-of-life scores
- Reduced scarring
- Lower recurrence rates
- Decreased hospitalizations
- Decreased amputations

INDEPENDENT SYSTEMATIC REVIEWS & META-ANALYSES

All 5 confirm that DFUs treated with SOC + TOT are approximately **2X** more likely to heal than SOC alone

137% increased likelihood of ulcer healing

Enhanced healing of hard-to-heal DFUs

Improved number of completely healed ulcers, reduced ulcer area, and improved durability and quality of life

12-week complete wound healing; nearly 60% improvement over standard care

Significantly improved wound healing; 60% higher likelihood of healing at 12 weeks

Complete Healing at 12 Weeks

Thanigaimani et al, 2021

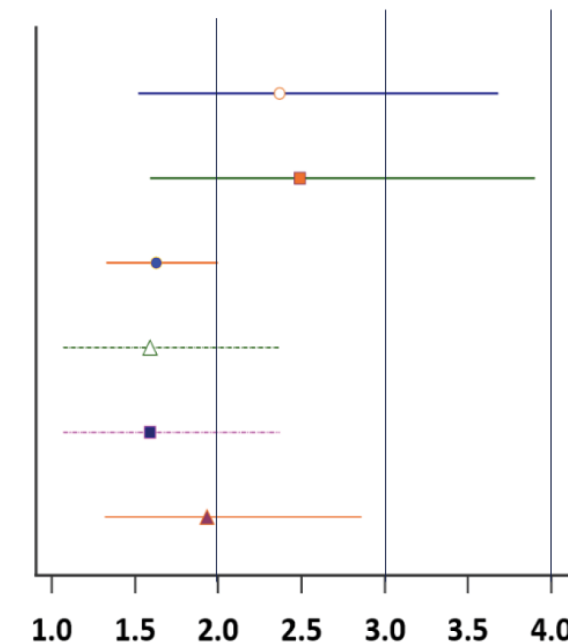
Connaghan et al, 2021

Sun et al, 2022

Carter et al, 2022

Sethi et al, 2022

AVERAGE



RR

2.37 [1.52-3.68]

2.49 [1.59-3.90]

1.63 [1.33-2.00]

1.59 [1.07-2.37]

1.59 [1.07-2.37]

1.93 [1.32-2.86]

Positive Treatment Effect

BOOT VERSUS MULTI-PATCH SYSTEM



Multi-Patch System
for wounds on the body



WE RARELY NEED TO CHANGE OUR TREATMENT CHOICE

DRESSING PERMEABILITY COLOR CODE*		EXCELLENT	GOOD	FAIR	FAIL
	Dressing Type	Dry/Scant Exudate	Light Exudate	Moderate Exudate	Heavy/Copious Exudate
Calcium Alginate			All single component alginates (i.e. Kaltostat, Maxorb, Melgisorb, etc.)		
	Medihoney alginate				
Hydrofiber			All single component hydrofibers (i.e. Aquacel, Durafiber, Exufiber, Kerracel, etc.)		
Collagen			All single component collagens (i.e. Promogran Prisma, Promogran Ag, Puracol, Fibracol, Endoform, etc.)		
Polymer			Phoenix, Altrazeal, Microlyte AG		
Super Absorber			All single component super absorbers (i.e. Sorbion, Kerramax, etc.)		
Gels		Tegaderm Hydrogel, Iodoflex, Iodosorb GelSurg-X/Blast-X, Medihoney Gel Tube			
Ointments/Creams		Santyl, Silvadene (petrolatum-based ointments are not recommended)			
Contact Layer (single layer only)		Mepitel, Mepitel One, Adaptic Touch, Restore Silver Contact, McKesson Contact Silicone, Adaptic (single layer)			
		Xeroform, Vaseline gauze, petrolatum gauze (petrolatum-based contact layers are not recommended)			
Foams		All foams that do not have a film backing, such as Hydrofera Blue Classic and Polymem WIC, Hydrofera Blue Ready, Aquacel Pro Foam Border, Aquacel Foam Adhesive, Allevyn Life, Allevyn Gentle Border, Mepilex Border, Tegaderm HP Border, Permafoam, Mepilex Border Flex, Tielle, Kendall Hydrophilic Foam			
		Mepilex AG Border, Medifoam Ag Border, Optifoam Border, Biatain Silicone, Optifoam Gentle, Kliniderm Foam Silicone Border, Suprasorb			
		Allevyn Classic, Allevyn Classic Gentle Border, Allevyn Ag Border, Urgotul Foam Border, Polymem Border, Kerrafoam Gentle Border, Polymem Ag Border			
		Lyof foam Extra			
Hydrocolloids		Hydrocolloids are not recommended (i.e. Kendall Alginate Hydrocolloid, Medihoney Hydrogel Colloidal, DuoDerm, etc.)			
Skin Substitutes (Cellular and Tissue Based Products and scaffolds)		All products without a silicone or acrylic backing (i.e. Matristem Wound Matrix, Kerecis, Oasis, BTM, etc.)			
Multi-Layer Compression System		Coban-2, Profore, UrgoK2, UrgoK2 Lite			
UNNA Boot					
Total Contact Cast		TCC, TCC EZ, Other			
*Based on internal bench testing and published permeability/moisture vapor transmission rate (MVTR) data					

*Based on internal bench testing and published permeability/moisture vapor transmission rate (MVTR) data

PATIENT #1

- 69-year-old male in fairly good health other than significant peripheral vascular disease
- Wound present for 3 years after patient states he underwent vascular surgery with wound infection.
- Had been offered an amputation
- Imaging negative
- Visible tendon and muscle, no S/S of infection





January



Month 3
Began ITOT



Month 10

PATIENT #2

- 57-year-old female – Raynaud's with gangrene
- Multi-year history of scleroderma with some ortho surgical interventions
- Multiple attempts at topical management: Santyl, honey, settled on hydrogel because of the pain



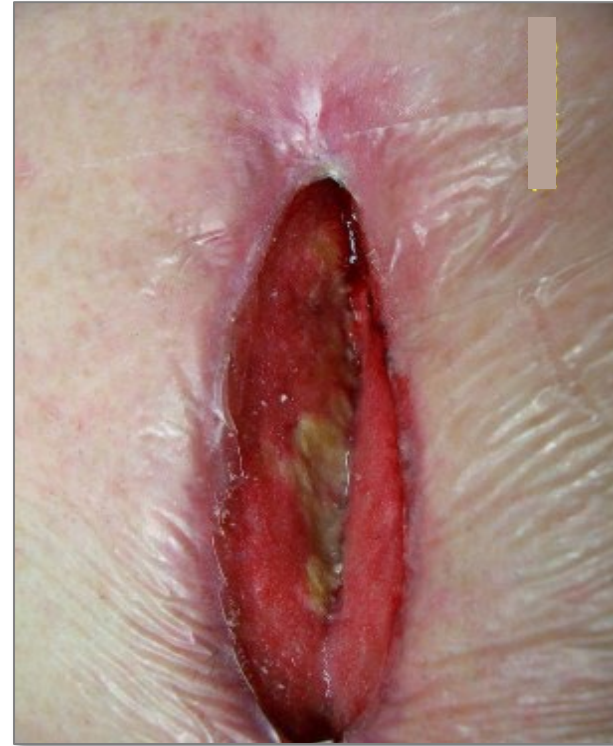


Began ITOT



NEGATIVE PRESSURE WOUND THERAPY (NPWT)

- Systems that continuously or intermittently apply sub-atmospheric pressure to the surface of a wound to assist healing
- Most use reticulated open cell foam (ROCF) directly on wound surface
- Sealed with an acrylic drape
- Attached by a tube to the mechanical pump
- In its third decade of use



NPWT INDICATIONS

- Chronic wounds
- Acute wounds
- Traumatic wounds
- Sub-acute wounds
- Partial-thickness burns
- Dehisced wounds
- Closed surgical incisions that continue to drain following sutured or stapled closure
- Ulcers, such as
 - Diabetic
 - Venous insufficiency
 - Pressure
- Flaps
- Grafts

CLINICAL BENEFITS OF NPWT

- Increases local blood flow
- Reduces edema
- Stimulates granulation tissue formation
- Stimulates cell proliferation
- Removes soluble healing inhibitors from the wound
- Reduces bacterial load
- Draws the wound edges closer together
- Controls exudate, odor; ↓ clothes soiling, ↑ patient comfort
- Reduces dressing changes
- Reduces treatment costs

**WHAT SHOULD WE
SEE?**



2 wks



NEGATIVE PRESSURE DEVICES



SINGLE-USE NPWT/EXTENDED WEAR DRESSINGS

- Closed surgical incisions
- Small, low exudating wounds
- Ambulatory/Working patients
- Compromised patients





HIGH AMPUTATION

- 53-year-old female, heavy long time smoking history, still ½ PPD smoker
- CV disease, PAD, hypertension, pulmonary issues
- High AKA after 2-3 previous failed BKAs
- 4 months post op with most recent surgery
- Exquisitely painful, 10/10 with dressing changes
- Came to us already using portable NPWT system
 - Added oil emulsion dressing with promise of one piece dressing as soon as her wound size was appropriate



JULY 5TH ONE PIECE DRESSING ORDERED

- When dressings arrived at home patient had transportation issue
- Home care nurse applied first two dressings 7/10 and 7/15
- Our last visit (6/12) she measured 13 x 17.3 x 0.5 cm (225 cm²)



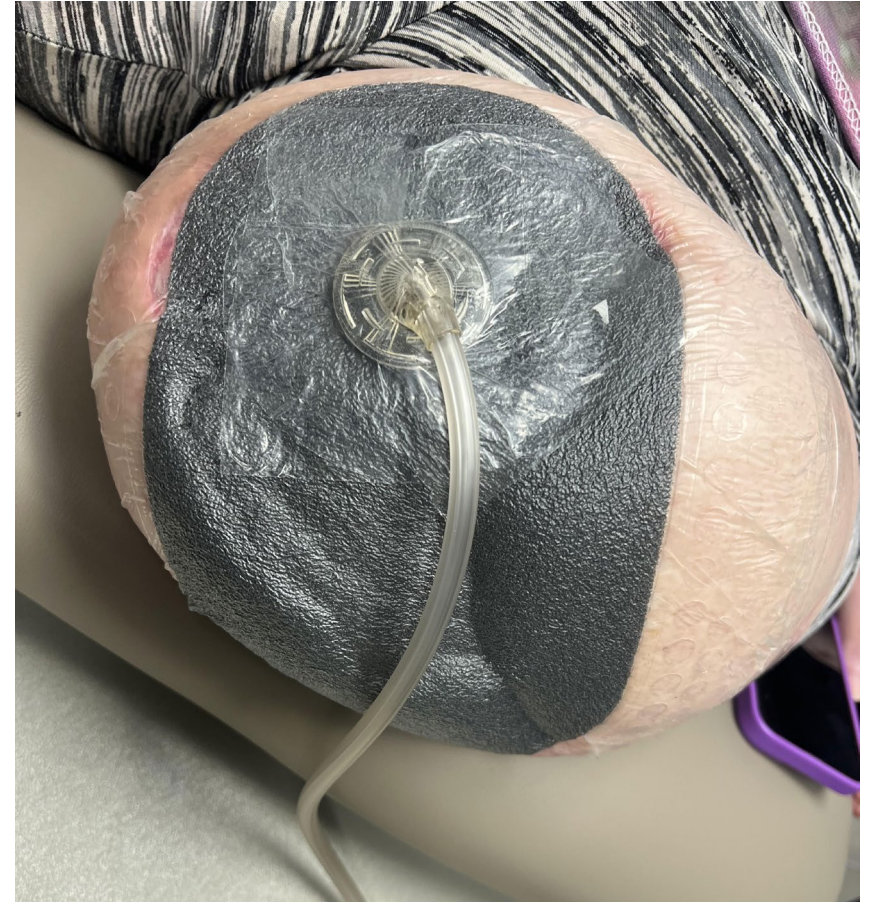
1 week prior to placement

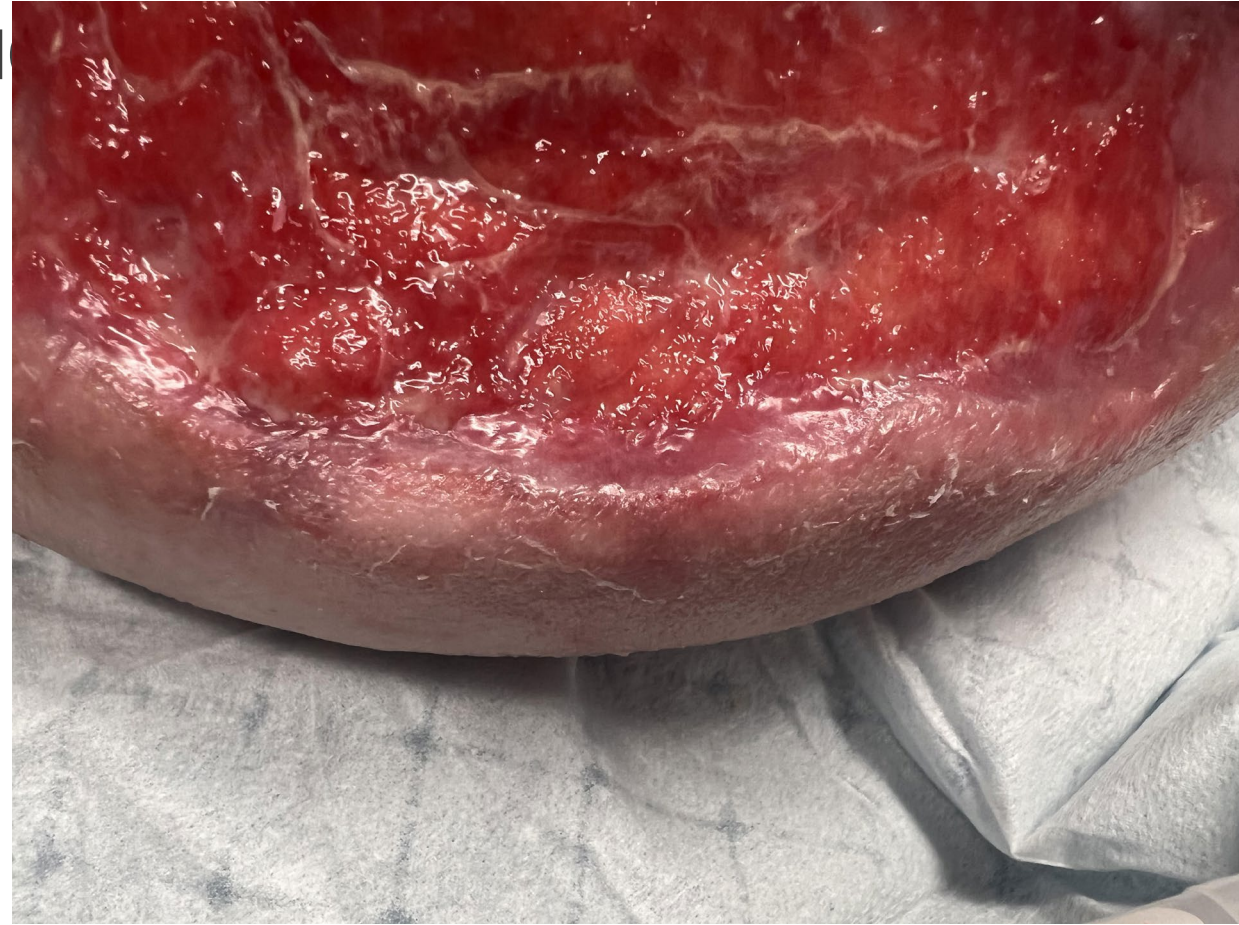
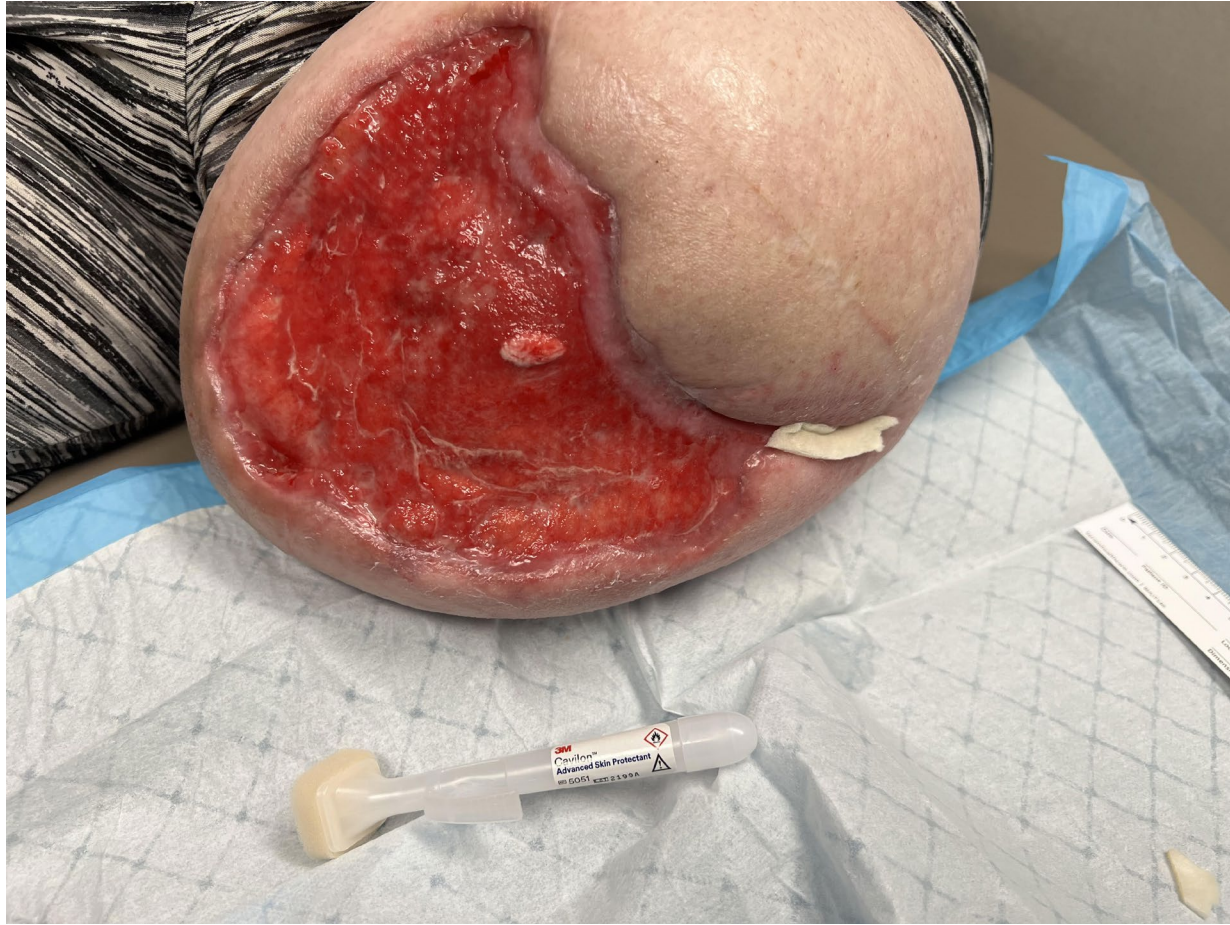


7/18: 13 x 14x 0.1 cm
182 cm²



ZERO PAIN ON REMOVAL, ZERO PAIN ON APPLICATION APPLIED AT -150 MMHG







26 days
10.5 x 9.4
182 down to 94 sq cm



34 days



42 days

9 x 10 cm

Took 1 day break to treat skin



43 days



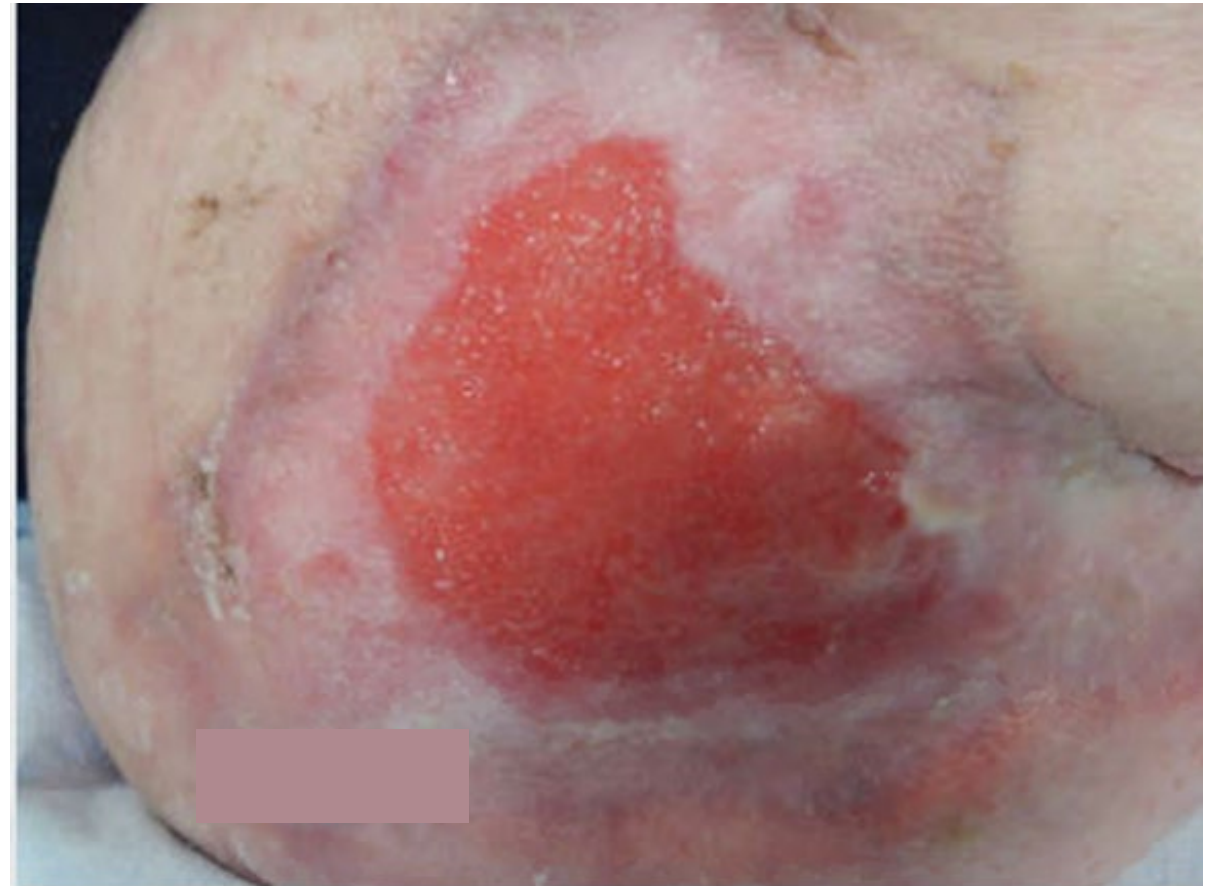
49 days
9.6 x 9.5 cm



55 days
8.0 x 9.0 cm
72 sq cm

FINAL

- 100 days
- Moved to collagen alone changed 2 times a week
- Reduction in PAIN
- Granulation/ Contraction as traditional foam
- EPITHELIALIZATION!
- Weekly dressings
- Reduced clinic visit time
- Discontinued home care



CELLULAR AND TISSUE-BASED PRODUCTS

- Also referred to as “CAMPs” (cellular, acellular and matrix like products)
- Cellular (i.e., containing living cells) or acellular (i.e., biologically inert)
- Primarily sourced from biologic tissue
 - Animal (e.g., equine/bovine/porcine/ovine)
 - Human (e.g., cadaveric skin, placenta, neonatal foreskin [keratinocytes and fibroblasts], umbilical cord)
 - Fish
- Include synthetic materials or biosynthetic matrices
- CTPs don’t “take”
 - They are not skin grafts
 - There is no vascularization
 - There is no integration

■ CTP = cellular and tissue-based product; CAMPs = cellular, acellular and matrix-like product.

Liu Y, et al. Current Available Cellular and Tissue-Based Products for Treatment of Skin Defects. *Adv Skin Wound Care*. 2019;32(1):19-25. Abdo J, Ortman H. Biologic and Synthetic Cellular and/or Tissue-Based Products and Smart Wound Dressings/Coverings. *Surg Clin North Am*. 2020;100(4):741-756.

CELLULAR DEVICES

- Manufactured to preserve cells and cellular activity
- Living cells interact with wound environment
 - Secrete extracellular matrix (collagen)
 - Produce growth factors needed by the wound at the needed time and needed amounts
 - Provide temporary wound coverage
 - Some placental products have mesenchymal stem cells; depending on processing

ACELLULAR DEVICES

- Human and animal-derived products are processed to remove cells, leaving the collagen matrix and destroying pathogens
- Provides scaffold
 - For matrix metalloproteinases (MMPs) to bind to and break down collagen in the product
 - To support cell ingrowth and granulation tissue formation
 - For epithelial cells, fibroblasts, and endothelial cells to migrate into and proliferate
 - To contain/protect growth factors

CELLULAR AND TISSUE-BASED PRODUCTS

- Tissue scaffold
- Immunomodulation
- Growth factor and cytokine signaling
- Granulation tissue formation
- *Wound bed must be clean, granulating, and well perfused*
- Not indicated for use over necrotic or infected tissue

PATIENT SELECTION: THOUGHT PROCESSES

- Type, history, and duration of wound
 - Consider atypicals with other underlying factors
- Wound bed preparation: Is it ready?
 - Debridement
 - Bioburden management
- Ability to address underlying pathology
 - Offload, compress, revascularize
- Insurance coverage

JUST ONE THING....

- 74-year-old gentleman, referred for care while on winter visit to Florida
- PMH: HTN, RA, type 2 Diabetes, Hx. of DVT
- Medications: Plavix, Lasix, Prednisone, Methotrexate, Atenolol, Lisinopril, Pravastatin
- Previous history of diabetic foot ulcers; resolved
- PSH: Hip replacement right, Lumbar spine surgery , CABG/Carotid surgery 2011
- Previous treatment: Various dressings, history of being unable to tolerate compression
- Treatment: Debridement with instrument followed by enzymatic agent, antimicrobial dressings and tubular bandage

VENOUS ULCERS X2 LEFT LEG

14 MONTHS: PROXIMAL



VENOUS ULCERS X2 LEFT LEG

14 MONTHS: DISTAL



1ST BLCT APPLICATION



2 WEEKS: 2ND APPLICATION



BLCT IN PLACE



WEEK 4: 3RD APPLICATION



WEEK 6: 4TH APPLICATION



8 WEEKS



**LEFT TO RETURN HOME..... SAW HIS PROVIDER A FEW WEEKS LATER
AT SAWC....**



SUMMARY

- Successful wound healing is not about using more products — it is about:
 - Identifying and correcting the underlying etiology
 - Addressing systemic barriers such as perfusion, infection, edema, and metabolic disease
 - Recognizing stalled wounds early
 - Escalating therapy based on patient risk, not just time
 - Coordinating care across settings
 - Advanced therapies should enhance standard care — not replace it.





SOME FINAL CONSIDERATIONS



PHOTOGRAPHS - THEY WILL MOST OFTEN HELP MORE THAN HURT

**One Look Is Worth
A Thousand Words--**

One look at our line of Republic, Firestone, Miller and United States tires can tell you more than a hundred personal letters or advertisements.

**WE WILL PROVE THEIR VALUE
BEFORE YOU INVEST ONE DOLLAR
IN THEM.**

Ever consider buying Supplies from a catalog?

What's the use! Call and see what you are buying. One look at our display of automobile and motorcycle accessories will convince you of the fact.

**THAT WE HAVE EVERYTHING FOR
THE AUTO**

Piqua Auto Supply House
133 N. Main St.—Piqua, O.



WHEN TO TAKE PICTURES

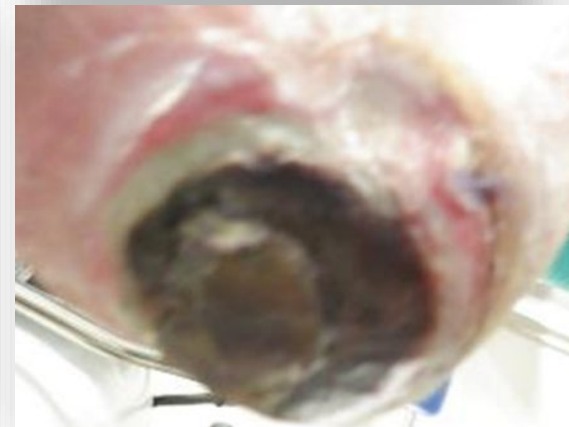
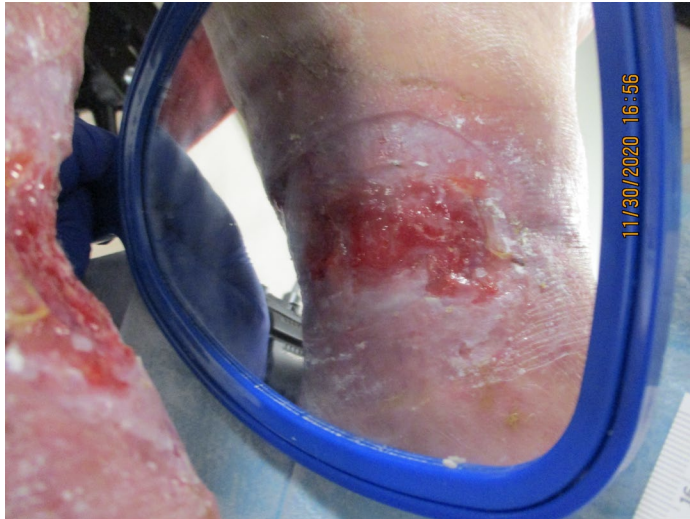
- Anything that is present on admission
- If you are unsure how to describe something
- Any new skin issue
- All of the above at discharge



PHOTOGRAPHS – LOCATION



PHOTOGRAPHS – TAKE TIME AND CHECK!!



What if these
were selfies to
post on social
media?

IT'S A MYTH...



CONSIDERING THE TOTAL COST OF CARE

A retrospective analysis conducted on a national insurance provider's medical claims data examined 6,181 acute and 1,480 chronic wound patients that received NPWT from January 1, 2009 to June 30, 2011 showed that **early initiation of NPWT resulted in lower estimated total and wound-related costs than late use of NPWT.**⁷



Wound related costs were:

41% lower for chronic wounds treated Early vs. Late

(\$23,950 vs \$40,579, $p < 0.001$)

30% lower for acute wounds treated Early vs. Late

(\$13,416 vs. \$19,112, $p < 0.001$)

Total estimated costs were:

Patients with **chronic wounds treated early had 25% lower total estimated costs**

(\$70,016 vs. \$93,289, $p < 0.001$)

Total estimated costs were:

Patients with **acute wounds treated early had 17.7% lower total estimated costs**

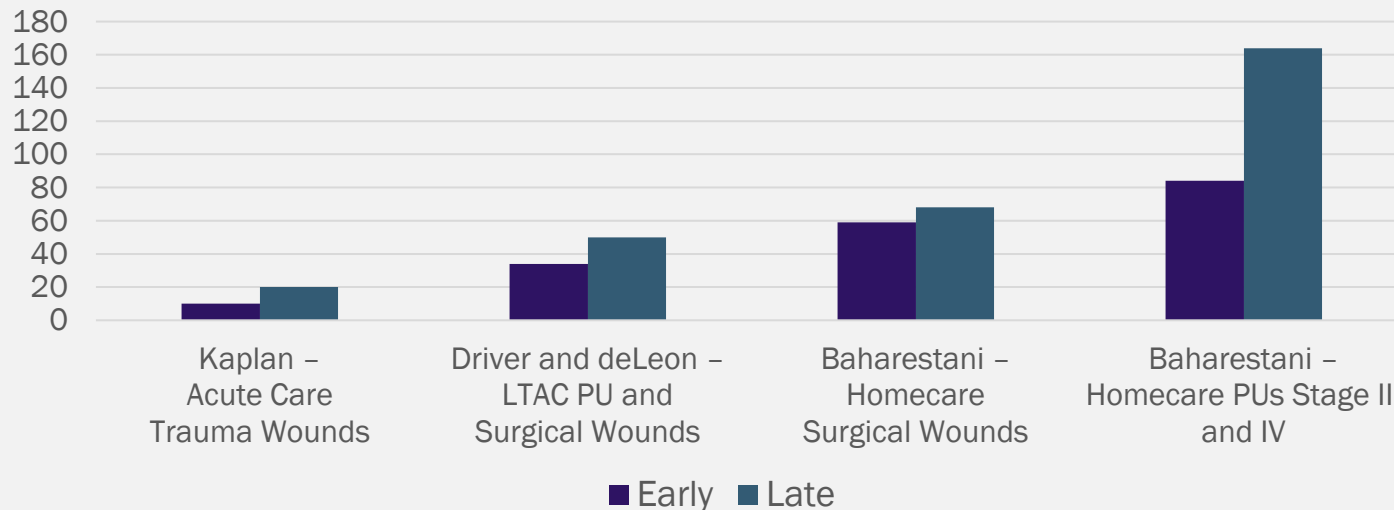
(\$54,999 vs \$66,865, $p < 0.001$)

EARLY INITIATION HAS SHOWN PROVEN BENEFITS OF NPWT ACROSS MANY CARE SETTINGS

NPWT has been shown to be a successful way to manage wounds for the past 31 years.²

Benefits of early initiation of NPWT on acute and chronic wounds have been demonstrated in acute care, long-term acute care, and home health care.^{3-5*}

Early Initiation of NPWT Has Been Shown to Reduce Length of Stay^{3,5,6}



*Footnote: Early NPWT was defined for acute wounds as treatment initiated within the first 7 days from the first wound treatment date and within 30 days for chronic wounds; late NPWT initiation occurred after this time. A secondary analysis was conducted on a sub-set of patients where Charlson Co-morbidity Index Scores ≤ 5 , to assess Early vs. Late cost differences by wound type, excluding the sickest patients with significant non-wound long-term care costs; this cohort represented 80% of the wounds.

Early Vs. Late Initiation Of V.A.C.® Therapy:

- Reduced inpatient days in acute and intensive care unit by at least 50%⁶
- Reduced inpatient days in long term acute care by 30%⁵
- Reduced homecare length of stay by 34% for surgical wounds³
- Reduced homecare length of stay by 49% for pressure injuries³

WHAT WAS THE DEFINITION OF EARLY VS. LATE USE OF NPWT?

Acute Wounds:

- **Early Use:**
- NPWT was instituted within **7 days** of first WCC visit.
- **Late Use:**
- NPWT was instituted after **7 days** post admission to WCC.

Chronic Wounds:

- **Early Use:**
- NPWT was instituted within **30 days** of first WCC visit.
- **Late Use:**
- NPWT was instituted after **30 days** post admission to WCC.

WOUND TYPES FROM DATA BASE

- Traumatic
- Surgical Dehisced
- Amputations
- Pressure Ulcers (heels and not on heels)
- Venous Ulcers
- Diabetic Foot Ulcers
- Chronic (Miscellaneous)

WOUND CARE CENTER “REAL WORLD” USE OF NPWT

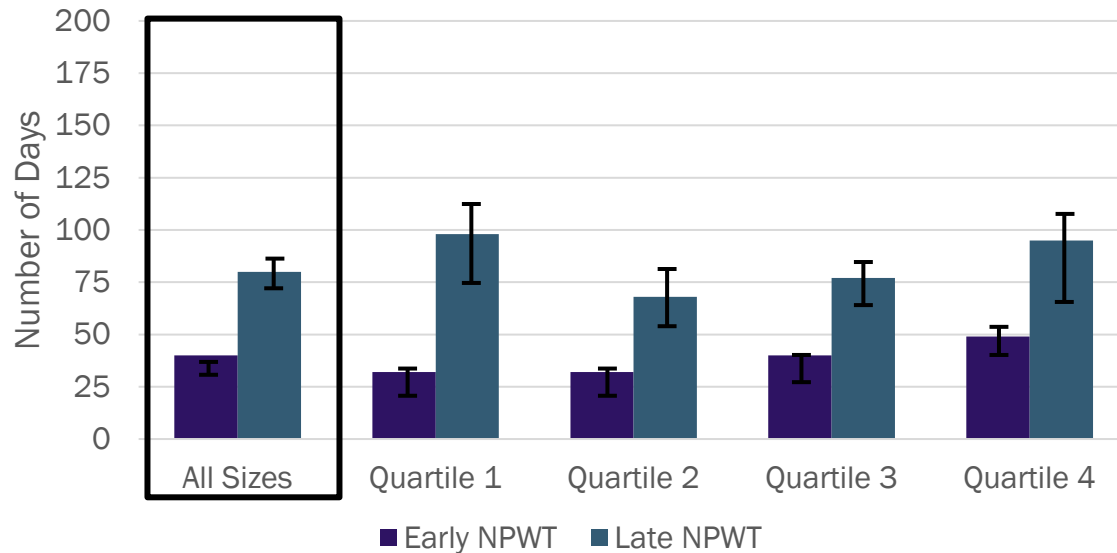
ACUTE Wound Surface Area (WSAs),
median days from first visit to 75% WSA reduction was

40.4 vs. **81.6**

(37.4, 41.6)
for the early group

(76.4, 90.5)
for the late group

($p < 0.0001$)



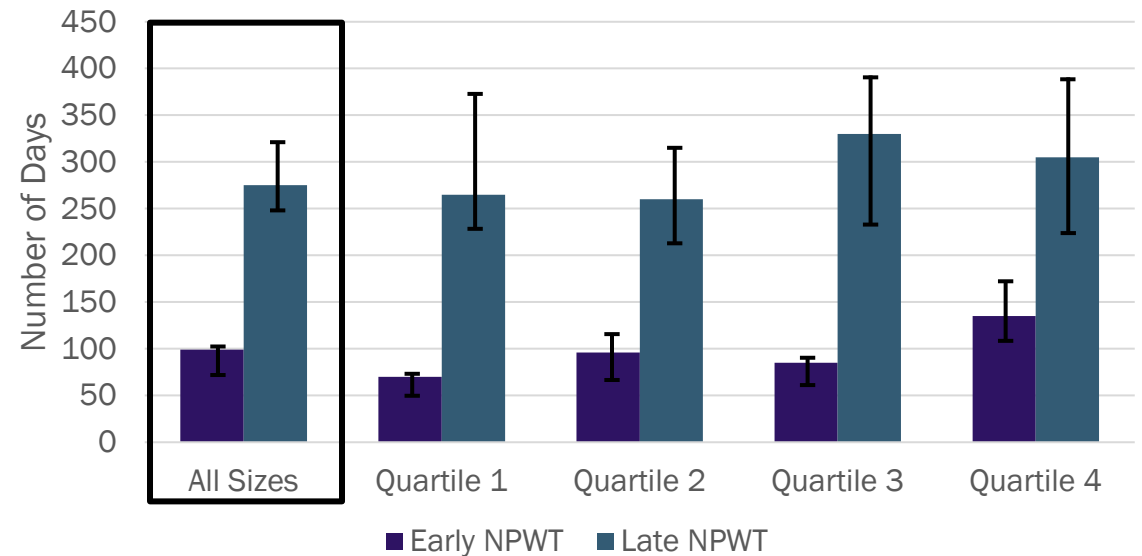
CHRONIC Wound Surface Area (WSAs),
median days from first visit to 75% WSA reduction was

96.4 vs. **274.6**

(88.5, 111.4)
for the early group

(251.5, 321.5)
for the late group

($p < 0.0001$)



RESULTS OF EARLY INITIATION OF NPWT

- When NPWT was initiated early in the WCC treatment time period compared to late initiation, the days to reach significant closure (75% WSA reduction) were:¹

1/2
THE TIME
FOR ACUTE
WOUNDS

1/3
THE TIME
FOR CHRONIC
WOUNDS

In addition, improved wound surface area reduction was observed for **ALL SIZES** of acute and chronic wounds with early treatment.

THANK YOU FOR LISTENING, QUESTIONS?

