NPWT Demystified:

A Case-Based Journey Through NPWT Modalities and Best Practices

Supported by an educational grant from Solventum, Medical Surgical Business

Faculty

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Faculty Disclosures

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  Advisory Board: Urgo Medical NA; Consultant, Speakers Bureau: Solventum, Medical Surgical Business; Urgo Medical NA
- **Emily Greenstein, APRN, CNP, CWON-AP, FACCWS**
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Please submit your questions at any time via the Question Box

We look forward to hearing from you!

Learning Objectives

- Describe the scientific principles and historical evolution of negative pressure wound therapy (NPWT)
- Compare traditional, portable, instillation-based NPWT systems and novel peel and place technology and select the appropriate modality based on wound characteristics, patient factors, and treatment goals
- Evaluate patient scenarios to determine optimal NPWT use, including initiation timing, dressing selection, and transition to other wound care modalities

NPWT = negative pressure wound therapy.

The Negative Pressure Wound Therapy Journey

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Vibra Hospital
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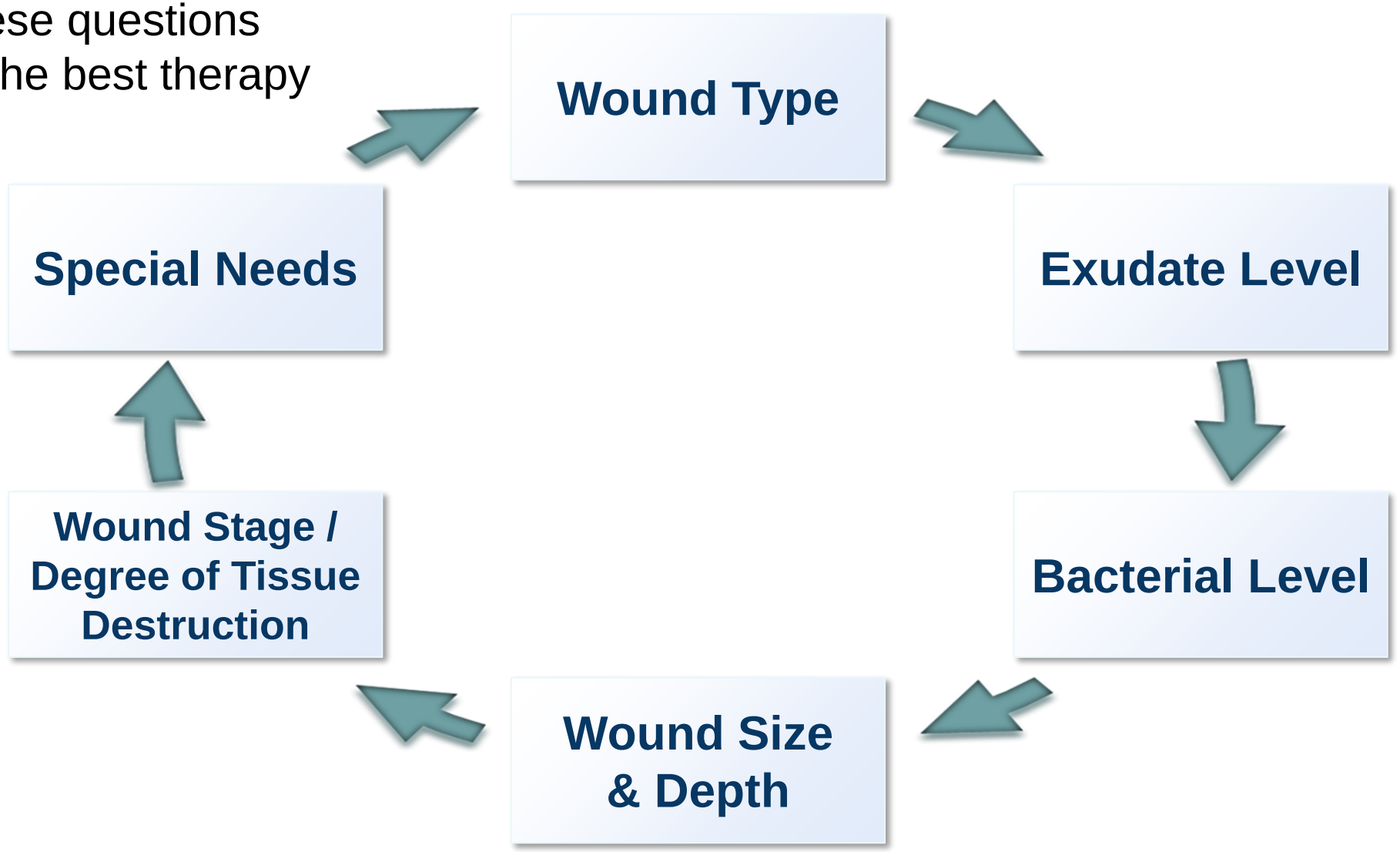
Problems We Face

- Complex patients
- Understaffing
- Lack of training/education
- Access to supplies/appointments

Get to Know the Patient FIRST, and Then the Wound

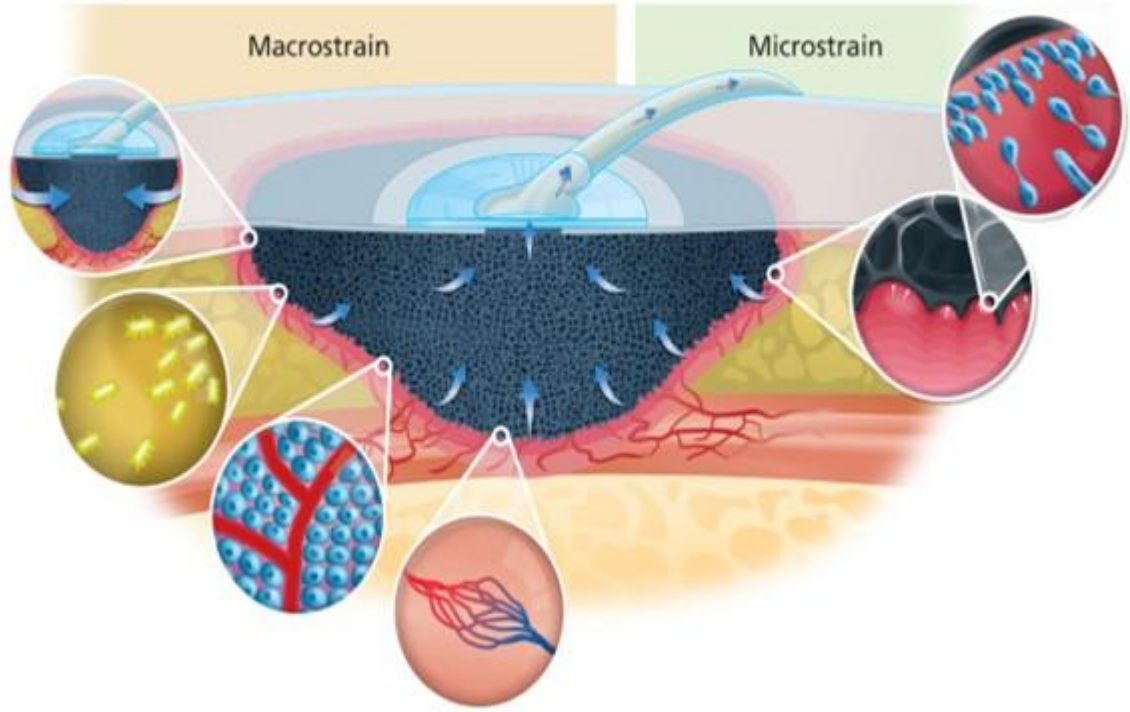
Answer these questions
to identify the best therapy



Utilizing Negative Pressure Wound Therapy

NPWT Mechanism of Action

- Macrostrain
  - Draws wound edges together
  - Direct (complete) wound bed contact
  - Evenly distributes negative pressure
  - Removes exudate/infectious materials
  - Reduces edema and promotes perfusion
- Microstrain
  - Promotes granulation tissue by cell migration and proliferation



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NPWT Indication

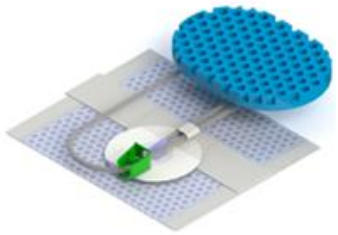
- Chronic wounds
- Acute/traumatic wounds
- Partial-thickness burns
- Wound dehiscence
- Flaps and grafts

Inpatient: Technology that Integrates Dressing and Wound Management

- 3M™ V.A.C.® Therapy (NPWT)
- 3M™ Veraflo™ Therapy (NPWTi-d)
- 3M™ Prevena™ Therapy (Disposable NPWT)
- 3M™ AbThera™ Therapy (Open Abdomen Dressing)

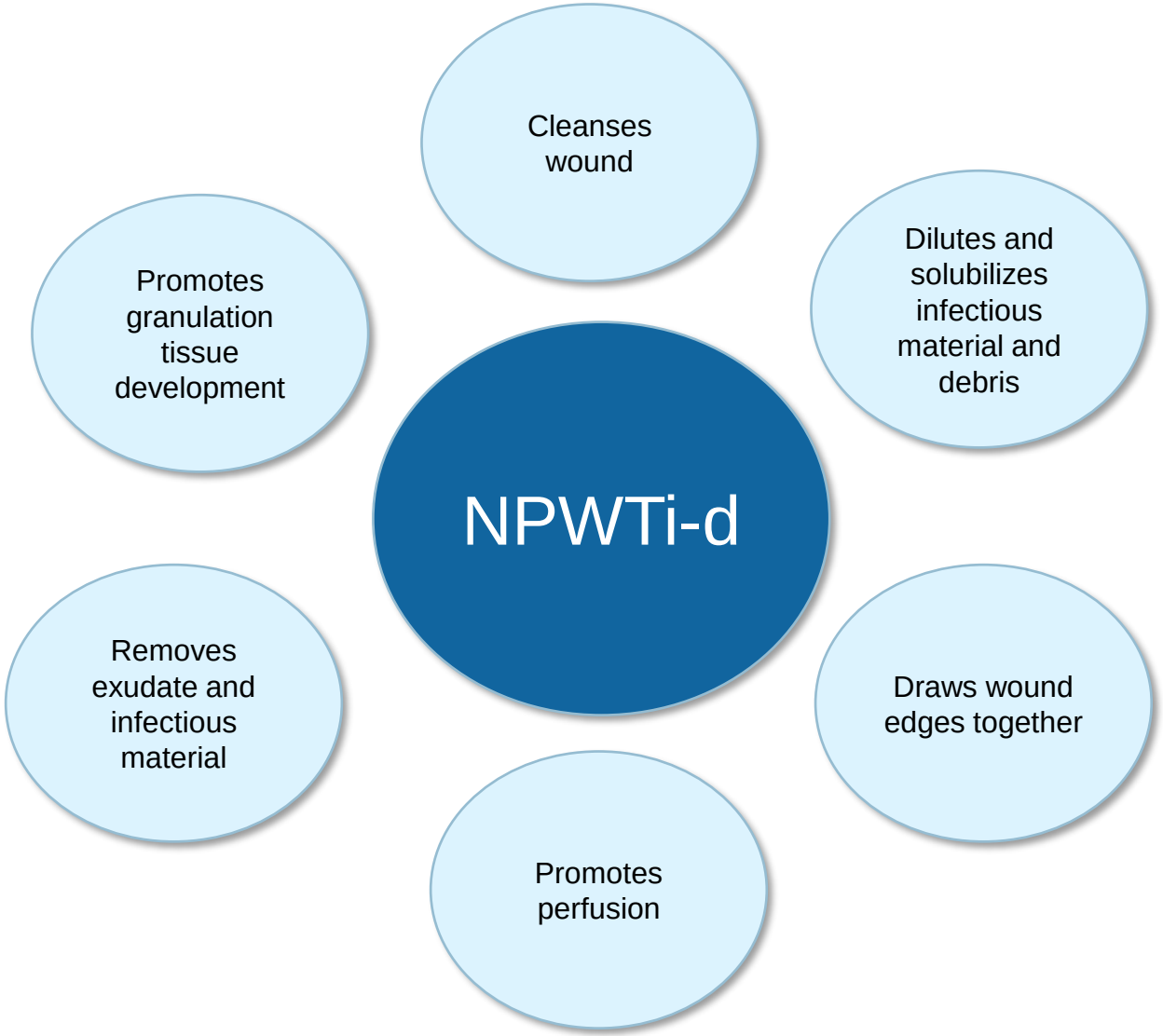
History of Negative Pressure Wound Therapy

1994 2004 2011 2015 2018 2022



Mechanism of Action

- A total of 1878 articles published



Automatic Instillation

- Automatically determines volume to instill
- Automatically instills topical solution after clinician confirmation
- Helps prevent or reduce over/under filling of dressing
- Default therapy cycle recommended by global advisory panel
- Choice of automatic or manual instillation

Goals of Therapy

- Clinical goals of therapy can include
  - Preparation for reconstructive surgery
  - Stabilization of the wound bed
  - Successful wound bed decontamination
  - Restoration of wound bed integrity
  - Stimulation of granulation tissue

★ Goals of therapy should be reassessed at each dressing change. Device and dressings can be adjusted as needed.

Don’t Shy Away from Complex Wounds

Challenging applications may include

- Wound location (ie, close to the rectum, groin, or perineum)
- Large wounds
- Wounds with multiple contours
- Wounds with less than favorable periwound skin condition

Faust McElroy E. Clinical Recommendations for Application of 3M™ Veraflo™ Therapy on Wounds with Complex Geometries. Current Dialogues in Wound Management. 2019 July; 5(S2):11-13.

Polling Question

How do I know when to stop NPWTi-d therapy?

A. The goal of therapy has been met
B. The patient is discharged home
C. The wound is not progressing after 2 wks
D. All of the above

Case: Fournier's Gangrene

Patient/Diagnosis

- 51y Female
  - Type 2 DM
  - Fournier's gangrene
  - Smoker

Day 0: 20cm, width: 27cm and depth: 3.5cm
Pocket up to 6cm to medial wound margin

Wound Treatment/Procedure

- Underwent surgical debridement of the area, NPWT with instillation applied. 0.25% acetic acid soak time 10min q3hrs
- Dressing changes 3x/wk

Case: Fournier's Gangrene

Day 7: 20cm, width: 27cm and depth: 3.cm
Pocket up to 6cm to medial wound margin

*Note: *Days 9-14*, 3M™ V.A.C. Veraflo Cleanse Choice™ NPWTi-d dressing was not used due to supply access issue

Day 14: 19cm, width: 26cm and depth: 2.5cm
Pocket along medial margin, 10cm in length with max depth of 9cm

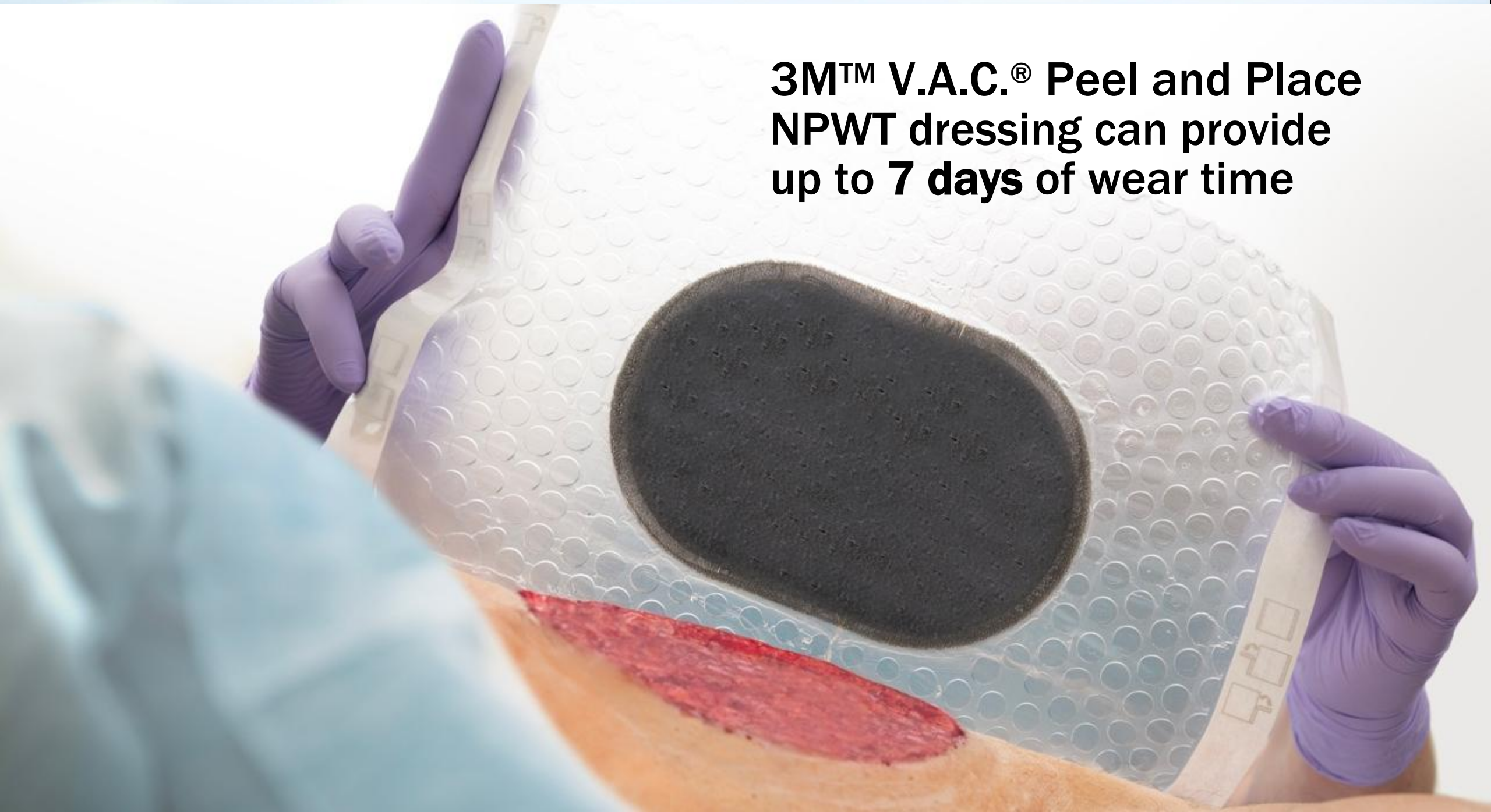
Case: Fournier's Gangrene

Day 21: 19.5cm, width: 24cm and depth: 2cm
Pocket along medial margin, 7cm in length with max depth of 9cm

3mos post surgical debridement:
1wk post split-thickness skin graft (STSG)

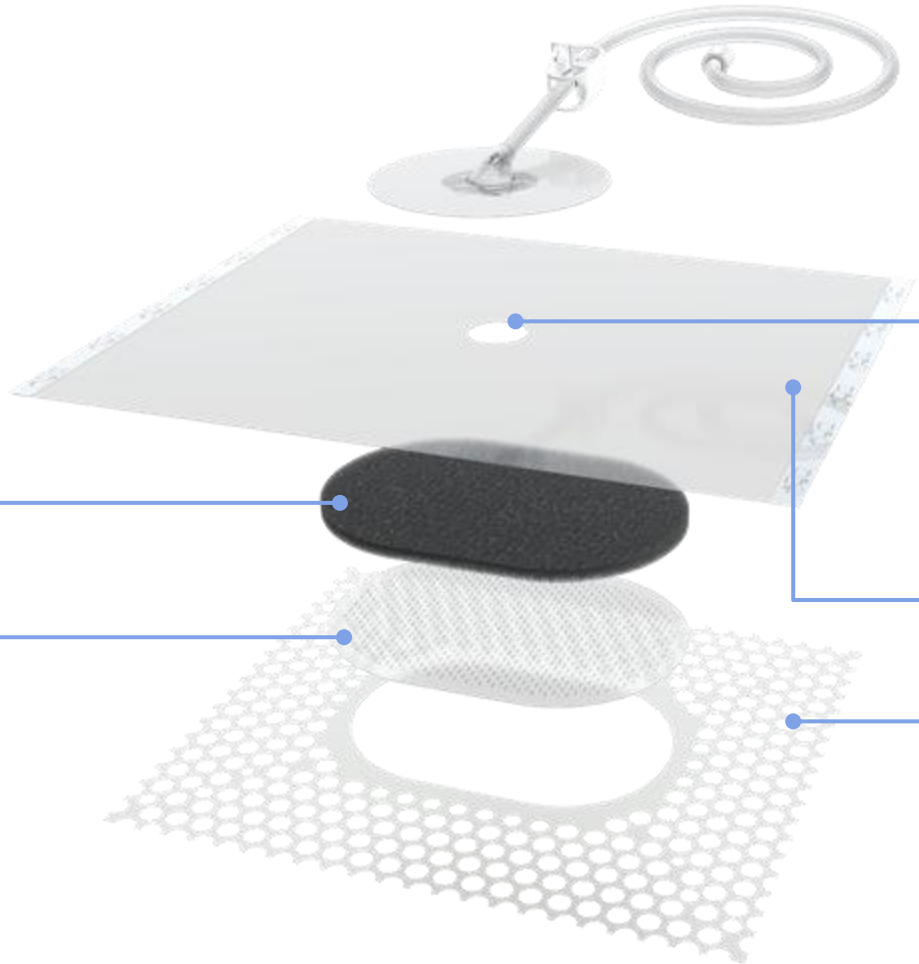
Day 28:
13cm x 22cm x 2cm with tunneled area of 7.5cm
Discharged to SNF

STSG = split-thickness skin graft.


3M™ V.A.C.® Peel and Place
NPWT dressing can provide
up to 7 days of wear time

All-in-One Dressing

Integration for ease of use



3M™ SensaT.R.A.C.™ Pad Hole
(pre-cut pad)

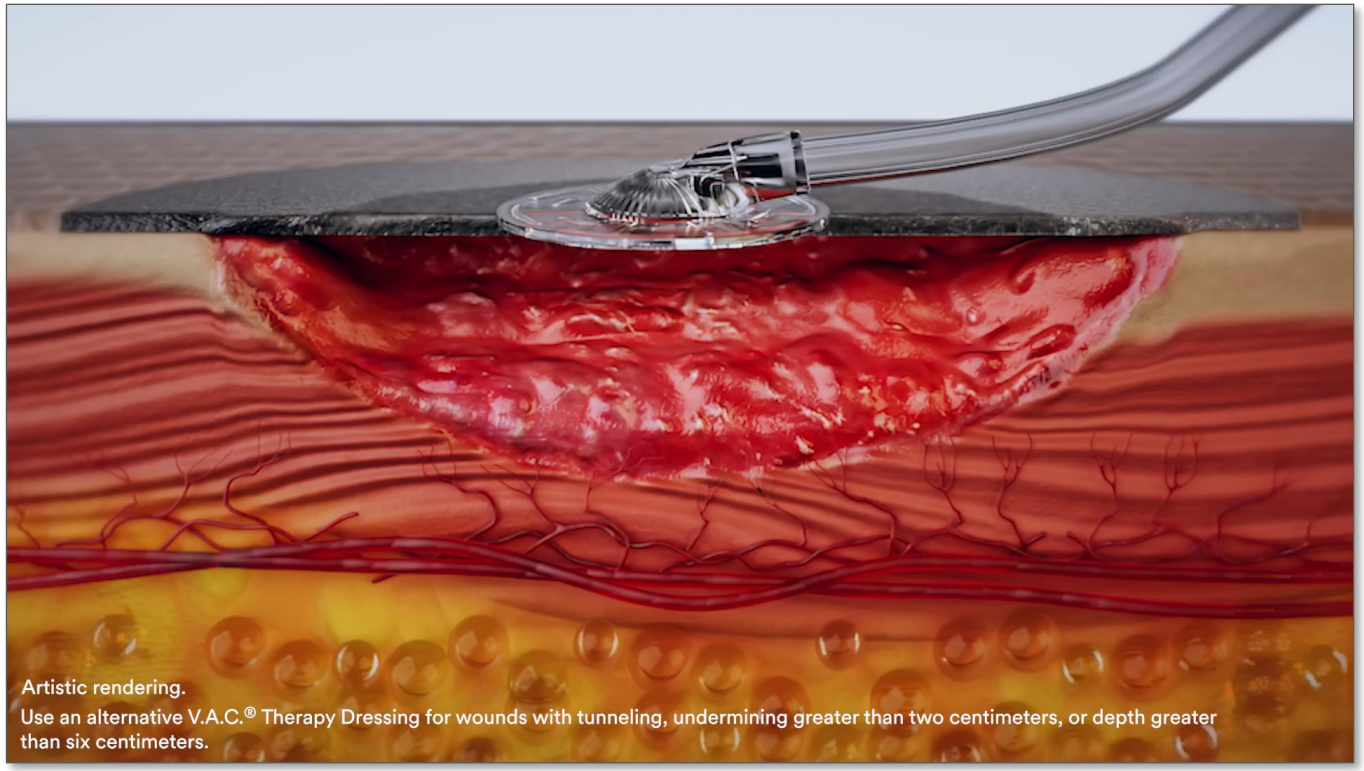
3M™ V.A.C.® Granufoam
Dressing (black foam)

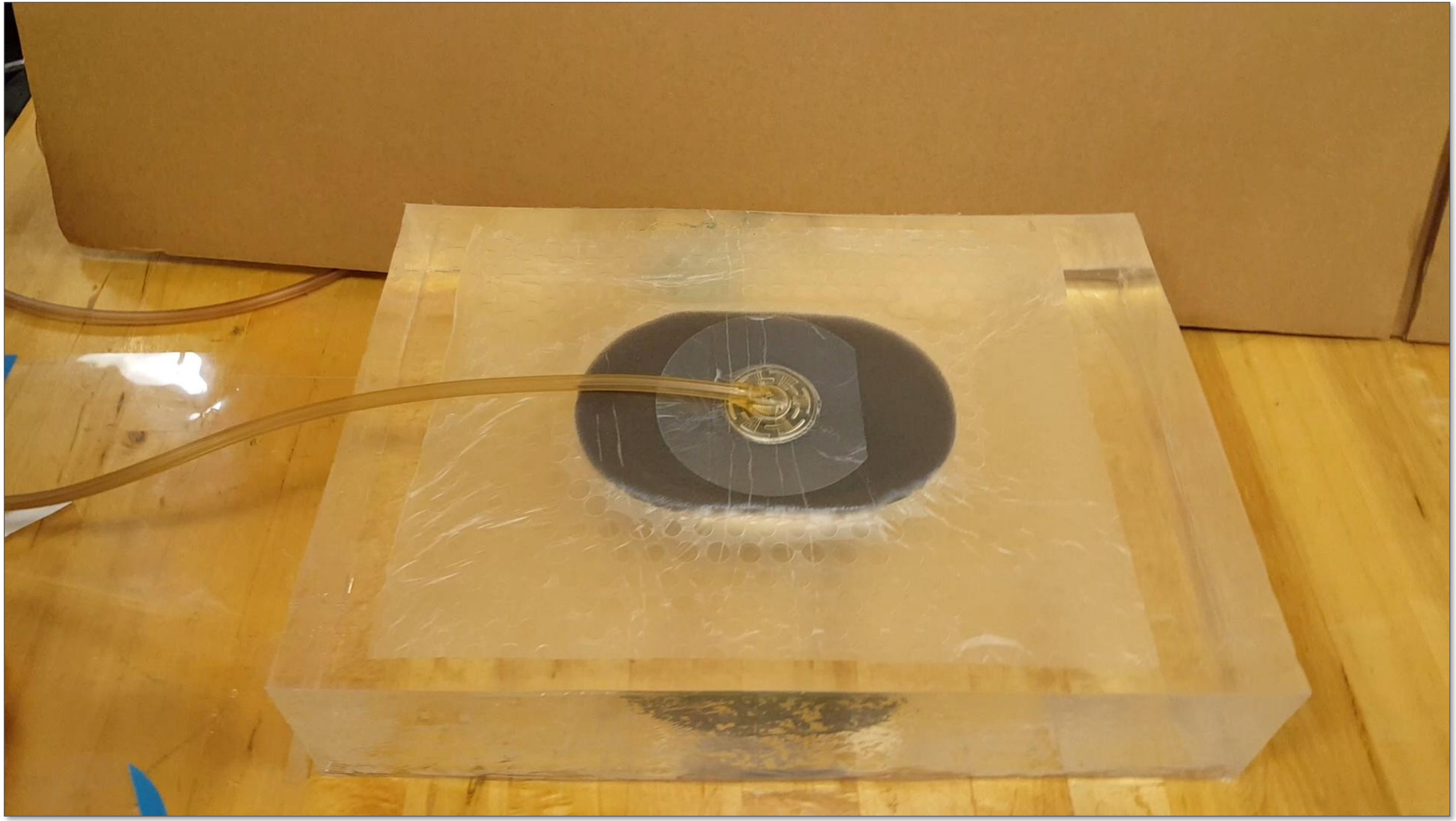
Perforated non-adherent layer

3M™ Dermatac™ Drape
(silicone-acrylic hybrid drape)

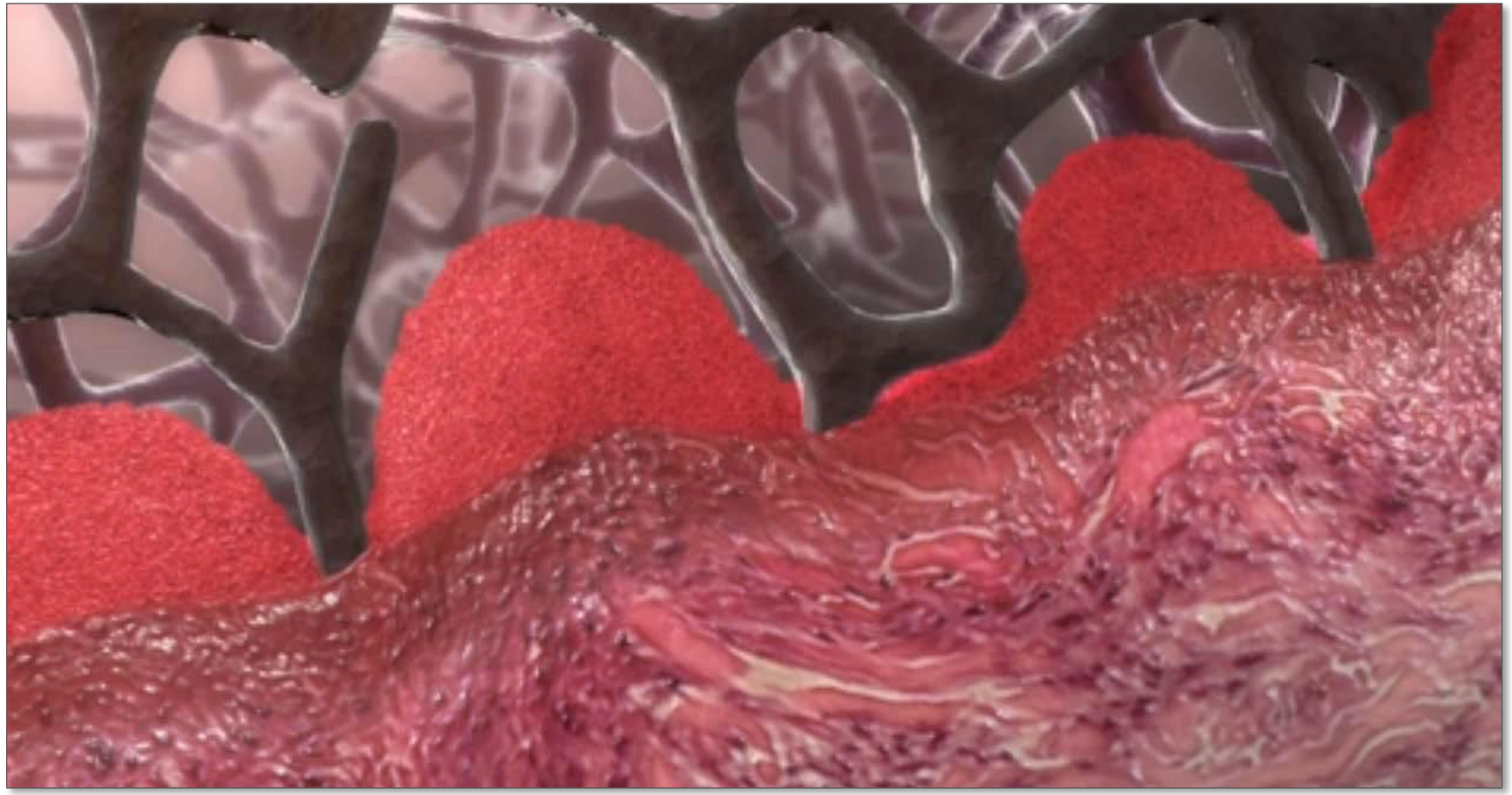
Mechanisms of Action

- NPWT peel and place dressing promotes wound healing by
  - Removing exudate and infectious materials
  - Reducing edema
  - Promoting granulation tissue formation and perfusion
  - Preparing the wound for closure





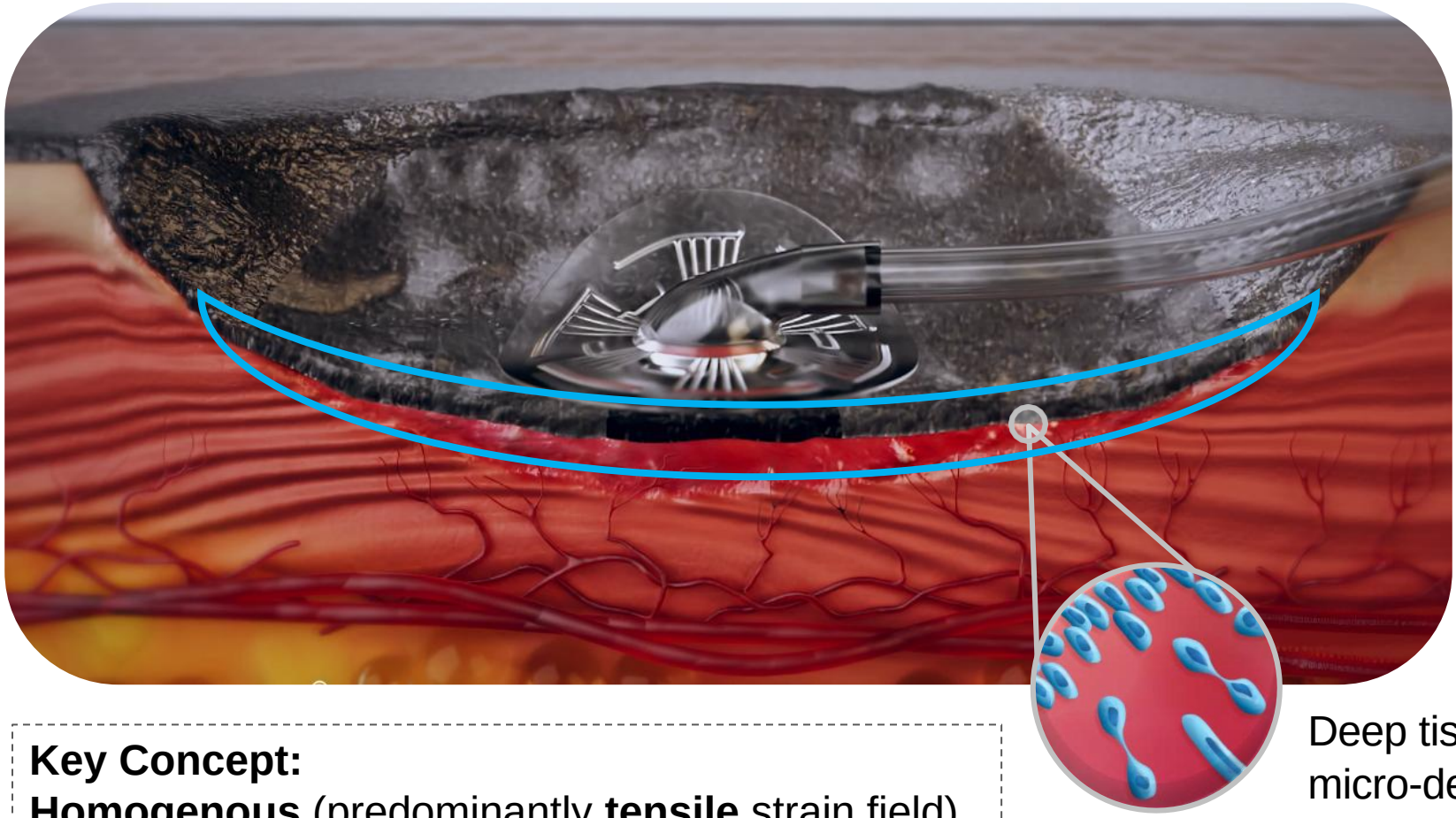
Tissue Micro-Deformation: NPWT with Black Foam Dressing

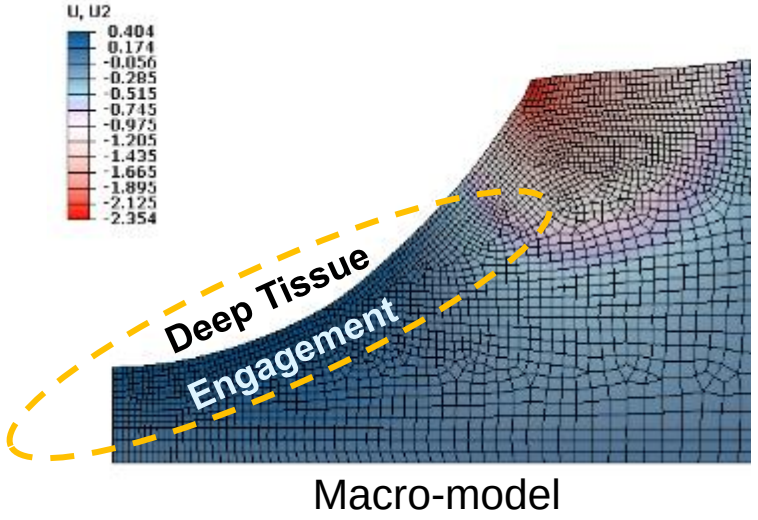


Visible buds of granulation tissue

Saxena SM, et al. *Plast Reconstr Surg*. 2004;114(5):1086-1095. McNulty: AK, et al. *Wound*. 2007;15:838-846. McNulty AK, et al. *Wound Repair Regen*. 2009;17(3):192-199.

Tissue Micro-Deformation:
NPWT Peel and Place Dressing





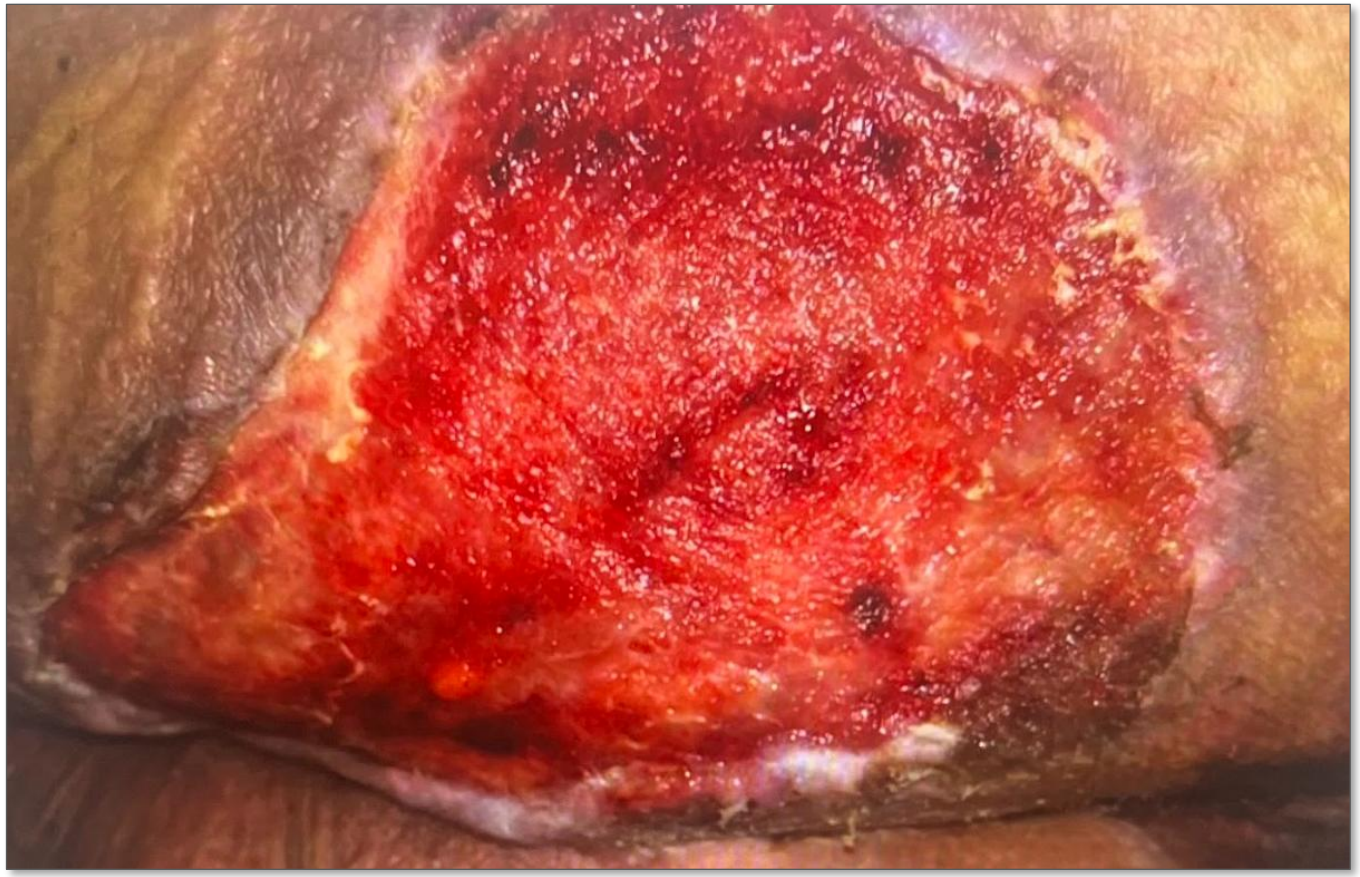
Macro-model

Deep tissue
micro-deformations

Key Concept:
Homogenous (predominantly **tensile** strain field)

What Would You Do?

- 63y Male
- Hx: Diabetes, dialysis, PAD/PVD, HTN
- Left buttocks stage 3 pressure injury (PI)



Day 0: 9.8cm x 10cm

PAD = peripheral artery disease; PVD = peripheral vascular disease; HTN = hypertension; PI = pressure injury.

Polling Question

What would you do?

A. Wet to dry dressings: Change daily
B. A “butt paste” of some type
C. NPWT with instillation
D. NPWT peel and place dressing

Day 14: 10cm x 6.4cm x superficial

Day 21: 7cm x 3.5cm x superficial

Day 35: 5 cm x 1.5 cm x superficial

Clinical Pearls

- NPWT can be utilized in a variety of settings
- NPWT has evolved over the past 25 yrs
- Don’t shy away from complex wounds

Thank you!

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Selecting Which NPWT System to Use Based on Wound, Patient, and Treatment Goals

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Associate Professor of Surgery, University of South Carolina
School of Medicine, Greenville
Adjunct Associate Professor, Clemson University
Department of Bioengineering

About me...

- 33 yrs practicing podiatry, wound care, and amputation prevention
- Multidisciplinary wound center
- Work in acute and post-acute settings
- Interests in diabetic foot ulcer (DFU), surgical wounds, and hard-to-heal wounds (HTHW)
- Board-certified in foot surgery and wound care

DFU = diabetic foot ulcer; HTHW = hard-to-heal wounds.

Prisma Health Fast Facts

- In SC, Prisma Health has 18 acute care and specialty hospitals in a 21-county service area
- Recent expansion into TN with the acquisition of Blount Memorial Hospital
- 25,944 inpatient and 75,507 outpatient surgeries

Types of Wounds I Treat

- Diabetic foot wounds
- Surgical wounds
- Wound dehiscence
- Trauma
- Pressure ulcerations

Wound Care Toolkit

Negative Pressure Wound Therapy (NPWT)

- NPWT has been studied across multiple care settings and wound types
- NPWT is in its 3rd decade of use
- Many types of NPWT are available
  - **Electrical**
  - **Battery-powered**
  - **Mechanical**
    - Constant force spring; no electrical or battery power required
- Similar mechanisms of action; significant differences in use and instructions

Indications for NPWT

- Chronic wounds
- Acute wounds
- Traumatic wounds
- Partial-thickness burns
- Dehisced wounds
- Ulcers
  - Diabetic
  - Venous
  - Pressure
- Flaps
- Grafts

Polling Question

Portable NPWT may not be used in the treatment of partial-thickness burns.

A. True
B. False

NPWT Across the Continuum

Case: Portable NPWT Device

- 51y Male s/p hallux amputation, chronic wound since Dec. 2021
- Past medical history:
  - Poorly controlled DM, HTN, OM, BKA right leg

OM = osteomyelitis; BKA = below-knee amputation.

Case: Portable NPWT Device

- 3 days postop excision of ulcer and partial 1st ray resection with 3M™ ActiV.A.C.™ (portable NPWT system)

Case: Portable NPWT Device

- 3 wks postop with portable NPWT system

Case: Portable NPWT Device

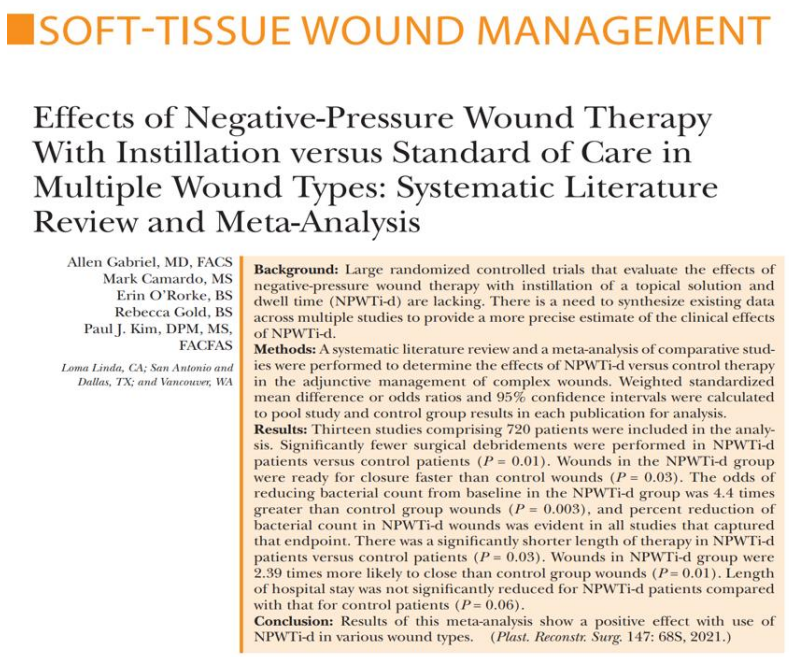
- 6 wks postop
  - 4 wks with portable NPWT system
  - 2 additional wks of 3M™ Promogran Prisma™ Matrix Wound Dressing (ORC, collagen, Ag matrix)

ORC = oxidized regenerated cellulose.

Instillation-Based NPWT

- Cleans wound through instillation of topical wound cleansers
  - Softens and loosen wound debris (instill)
- Delivers topical antiseptic/antimicrobial wound solutions (dwell)
  - Helps manage bacterial population
- Removes solubilized wound debris and infectious materials (NPWT)
- Promotes granulation tissue formation and perfusion (NPWT)
  - Prepares wound for closure
- Contained, controlled wound irrigation

Clinical and Economic Benefits of Instillation-Based NPWT (NPWTi-d)



SOFT-TISSUE WOUND MANAGEMENT

Effects of Negative-Pressure Wound Therapy With Instillation versus Standard of Care in Multiple Wound Types: Systematic Literature Review and Meta-Analysis

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Mark Camardo, MS
Erin O'Rorke, BS
Rebecca Gold, BS
Paul J. Kim, DPM, MS, FACFAS

Loma Linda, CA; San Antonio and Dallas, TX; and Vancouver, WA

Background: Large randomized controlled trials that evaluate the effects of negative-pressure wound therapy with instillation of a topical solution and dwell time (NPWTi-d) are lacking. There is a need to synthesize existing data across multiple studies to provide a more precise estimate of the clinical effects of NPWTi-d.
Methods: A systematic literature review and a meta-analysis of comparative studies were performed to determine the effects of NPWTi-d versus control therapy in the adjunctive management of complex wounds. Weighted standardized mean difference or odds ratios and 95% confidence intervals were calculated to pool study and control group results in each publication for analysis.
Results: Thirteen studies comprising 720 patients were included in the analysis. Significantly fewer surgical debridements were performed in NPWTi-d patients versus control patients ($P = 0.01$). Wounds in the NPWTi-d group were ready for closure faster than control wounds ($P = 0.03$). The odds of reducing bacterial count from baseline in the NPWTi-d group was 4.4 times greater than control group wounds ($P = 0.003$), and percent reduction of bacterial count in NPWTi-d wounds was evident in all studies that captured that endpoint. There was a significantly shorter length of therapy in NPWTi-d patients versus control patients ($P = 0.03$). Wounds in NPWTi-d group were 2.39 times more likely to close than control group wounds ($P = 0.01$). Length of hospital stay was not significantly reduced for NPWTi-d patients compared with that for control patients ($P = 0.06$).
Conclusion: Results of this meta-analysis show a positive effect with use of NPWTi-d in various wound types. (*Plast. Reconstr. Surg.* 147: 68S, 2021.)

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ORIGINAL ARTICLE

IWJ WILEY

Economic model to estimate cost of negative pressure wound therapy with instillation vs control therapies for hospitalised patients in the United States, Germany, and United Kingdom

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Abstract
An economic model was developed to estimate the cost of negative pressure wound therapy with instillation and dwelling of a topical wound solution vs control therapies. Economic model inputs were means derived from the results of a recently published systematic review and meta-analysis of 13 comparative studies of negative pressure wound therapy with instillation. Means across studies comprising complex acute and chronic wounds for negative pressure wound therapy-instillation vs control (negative pressure wound therapy without instillation, gauze dressings, or gentamicin polymethylmethacrylate beads) groups were 1.77 vs 2.69 operating room visits ($P = .008$) and 9.88 vs 21.80 therapy days ($P = .02$), respectively. These inputs plus hospital cost data were used to model costs for the United States, Germany, and the United Kingdom. For the United States, Germany, and United Kingdom, respectively, economic model estimates of total potential per patient savings were $33 338, €8467, and £5626 for negative pressure wound therapy-instillation group vs control, based on assumed number of OR visits during therapy, cost of therapy system, and length of therapy. Model results showed an overall potential cost-savings with negative pressure wound therapy-instillation vs control, based on fewer OR

- >50% reduction in LOS (9.88 days vs 21.80 days)
- >30% fewer surgical debridements (1.77 vs 2.69 debridements)
- Ready for closure almost twice as fast (7.88 days vs 14.36 days)
- Wounds were 2.39 times more likely to close

Gabriel A, et al. *Plast Reconstr Surg*. 2021;147(1S-1):68S-76S. Kim PJ, et al. *Int Wound J*. 2022;19(4):888-894.

Avoiding a Missed Opportunity

- 62y Male admitted to hospital for diabetic foot infection
  - PMHx: DM, HTN, sepsis, neuropathy
  - Initial surgery at community hospital; transferred to main campus for transmetatarsal amputation (TMA), discharged home postop day (POD) 3
  - New patient to wound care center (WCC) ≈4wks postop with necrotic tendon and exposed bone
  - Peer-to-peer and admitted to long-term acute care (LTAC) for instillation-based therapy

POD = postop day; WCC = wound care center; LTAC = long-term acute care.

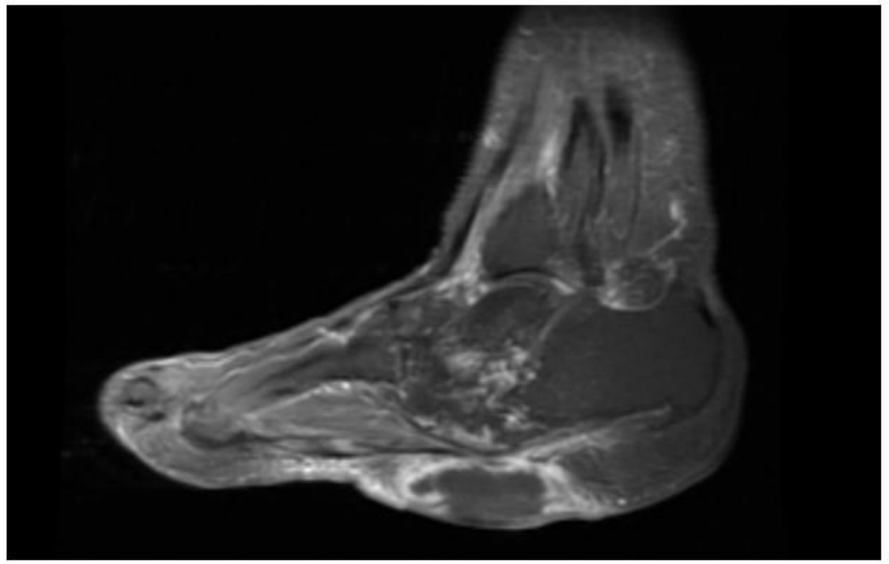
Avoiding a Missed Opportunity

Case: NPWT with Instillation

- 66y Female with chronic DFU >1yr, severe Charcot foot deformity, and previous 3rd ray amputation
  - DM, CKD, breast CA, diabetic neuropathy, dyslipidemia, GERD

CKD = chronic kidney disease; GERD = gastroesophageal reflux disease.

Case: NPWT with Instillation



FINDINGS:

Third digit amputation at the metatarsal neck. Valgus angulation and lateral subluxation of the first and second proximal phalanges at the MTP joints.

Large thick-walled fluid collection along the plantar aspect of the cuboid (axial STIR image 31) measuring approximately 5.3 x 1 x 5.8 cm, consistent with an adventitial bursa. The bursa indicating communication with the plantar mid foot ulcer (axial STIR image 29). Collection demonstrates peripheral enhancement. Mild soft tissue edema and enhancement surrounding the bursal collection consistent with cellulitis.

Small focus of edema and enhancement in the plantar aspect of the cuboid adjacent to the bursal collection (axial STIR image 30 and sagittal postcontrast image 15). The plantar cortex is mildly indistinct at this site (axial T1 image 30).

Advanced atrophy of the intrinsic musculature of the foot, consistent with denervation. Vertical orientation of the talus with dorsal dislocation of the medial and middle cuneiform at the navicular cuneiform joint. Chronic fragmentation of the cuboid and lateral cuneiform. Severe degenerative changes at the second through fifth TMT joints. Large ossific fragment along the distal tip of the lateral malleolus. Grade IV chondromalacia along the posterior aspect of the tibiotalar joint. Thickening of the medial cord of the plantar fascia.

IMPRESSION:

1. Large thick-walled fluid collection along the plantar aspect of the midfoot with surrounding inflammation. Collection likely communicates with a plantar ulcer. Findings are suggestive of an infected adventitial bursa. The bursal abuts the plantar surface of the cuboid. Mild signal changes in the cuboid are suggestive of early acute osteomyelitis.
2. Severe chronic Charcot arthropathy.

This study has been designated as a Call Report. Communication of the findings is pending and will be documented via an addendum when complete.

Case: NPWT with Instillation

- To OR for excision of ulcer and infected adventitial bursa. On POD 1, patient transferred to LTAC for IVABx and NPWT with instillation
  - ID recommended 28 days of ceftriaxone and metronidazole followed by an additional 28 days of oral cipro and metronidazole

Case: NPWT with Instillation

After 26 days of NPWTi-d

WCC: 1st application of cellular tissue product (CTP)

CTP = cellular tissue product.

Case: NPWT with Instillation

- After discharge from LTAC, care included
  - Hyperbaric oxygen therapy (HBOT)
  - Antibiotics
  - 5 applications of antimicrobial wound matrix
  - 3 applications of placental allograft
- Wound greater than 1yr closed 140 days after initial presentation

HBOT = hyperbaric oxygen therapy.

NPWT Peel and Place Dressing

Integrated design
Eliminates arts and crafts

Application time
On average, 2 min*[1]

Wear time
Up to 7 days

*In a simulated use test with 12 nurse and surgeon users. Average dressing application time of 01:48. SAT-MTF-05-995965 Marketing study for 3M V.A.C.® Peel and Place Dressing. 2023.

Dressing Specifically for NPWT System

- Acute, extended, or home care setting
- Intended to create an environment that promotes wound healing by secondary or tertiary (delayed primary) intention by
  - Preparing the wound bed for closure
  - Reducing edema
  - Promoting granulation tissue formation and perfusion
  - Removing exudate and infectious material
- Open wound types include
  - Chronic
  - Acute
  - Traumatic
  - Subacute
  - Dehisced wounds
  - Partial-thickness burns
  - Ulcers (such as diabetic, pressure, venous)
  - Flaps and grafts

Polling Question

The peel and place dressing system is to be used primarily in the _____ setting.

A. Acute care
B. Wound clinic
C. Home health
D. All of the above

Less than Ideal Wounds for Peel and Place

High exudate in dependent position

Why:

Exudate sometimes pools and may cause maceration on the skin

Skinny and deep

Why:

Dressing is unable to conform to the bottom of the wound bed and can result in exudate pooling

Active bleeding

Why:

All NPWT dressings require hemostasis to be achieved. And may cause blockage

DFU with inadequate offloading

Why:

Exudate is squeezed out of the tissue and may over-wet or macerate periwound skin (eg, bedrest, scooters, etc.)

PI with inadequate offloading

Why:

Source of the injury is not addressed, so wound is not likely to progress (eg, turning, positioning, padding, etc.)

Wounds receiving compression

Why:

Not indicated together. Compression may lead to reduced exudate removal and maceration or a pressure point

Peel and Place Dressing Change Frequency

- Wear time up to 7 days
- Healthcare provider may change more frequently based on
  - Wound condition concerns
  - Not yet comfortable with a 7-day wear dressing
  - Concerns over pressure/bony prominence and offloading

Case: Novel Peel and Place Dressing

- 83y Female s/p Moh's surgery for basal cell carcinoma (BCC)
  - Past medical history: DM, A-fib, fatty liver disease

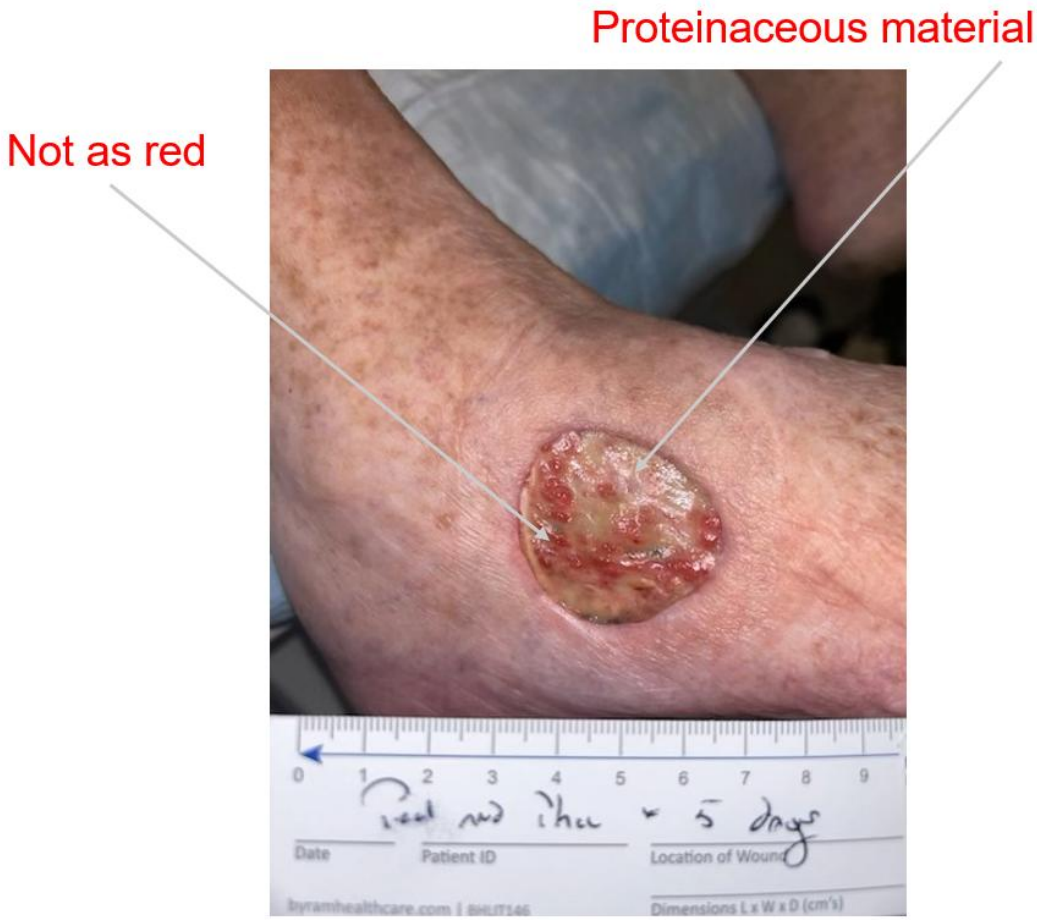
BCC = basal cell carcinoma.

Case: Novel Peel and Place Dressing

Case: Novel Peel and Place Dressing

Case: Novel Peel and Place Dressing

- Redefining expectations
  - Granulation tissue
    - Color not as red, texture will be smoother
  - Proteinaceous material on wound surface
  - Odor
    - Dressing may exhibit moderate odor after longer wear time



Case: Novel Peel and Place Dressing

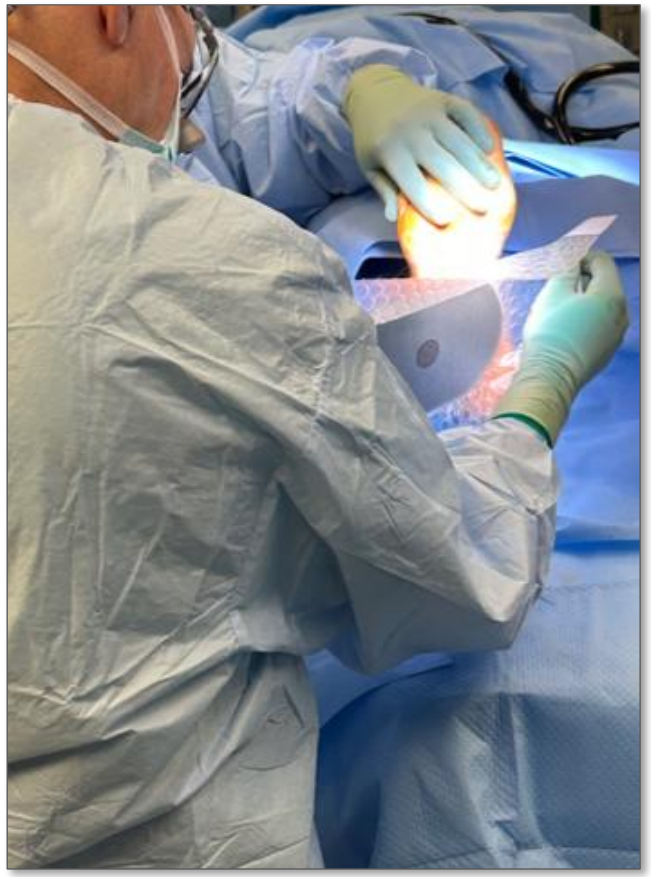
- Peel and place dressing x40 days with most dressing changes at 7 days wear time
  - Wound ready for STSG

Case: Novel Peel and Place Dressing

Case: Novel Peel and Place Dressing

Peel and Place Value in Acute Care

- Up to 7 days of wear time allows critical staffing and resource flexibility while effectively maintaining NPWT
- All-in-one design streamlines application and reduces staff training; staff across skill levels can perform dressing changes
- Covers entire wound and surrounding tissue for <2-min application on average, saving time in the OR
- Faster dressing application may reduce costs for procedures in OR



Peel and Place Value in Wound Clinics

- Up to 7 days of wear time provides WCC patients who are not eligible for home health the opportunity to benefit from NPWT
- Nurses who were surveyed rated the dressing easy to use
- <2-min application time is significantly faster
- Available at no additional cost for at-home patients; billed to patient's insurance under same code as other NPWT dressings

Peel and Place Value in Home Health Setting

- 3x the wear time; 1/3 of the nursing visits
- Can reduce number of nursing visits
- Fewer dressing changes mean home health agencies could manage more patients per month that require NPWT
- Easier application for clinicians who may not have experience or confidence applying NPWT on more complex wounds
- Available at no additional cost for at-home patients; billed to patient's insurance under same code as other NPWT dressings

Clinical Pearls

Avoid missed opportunities. Understand that:

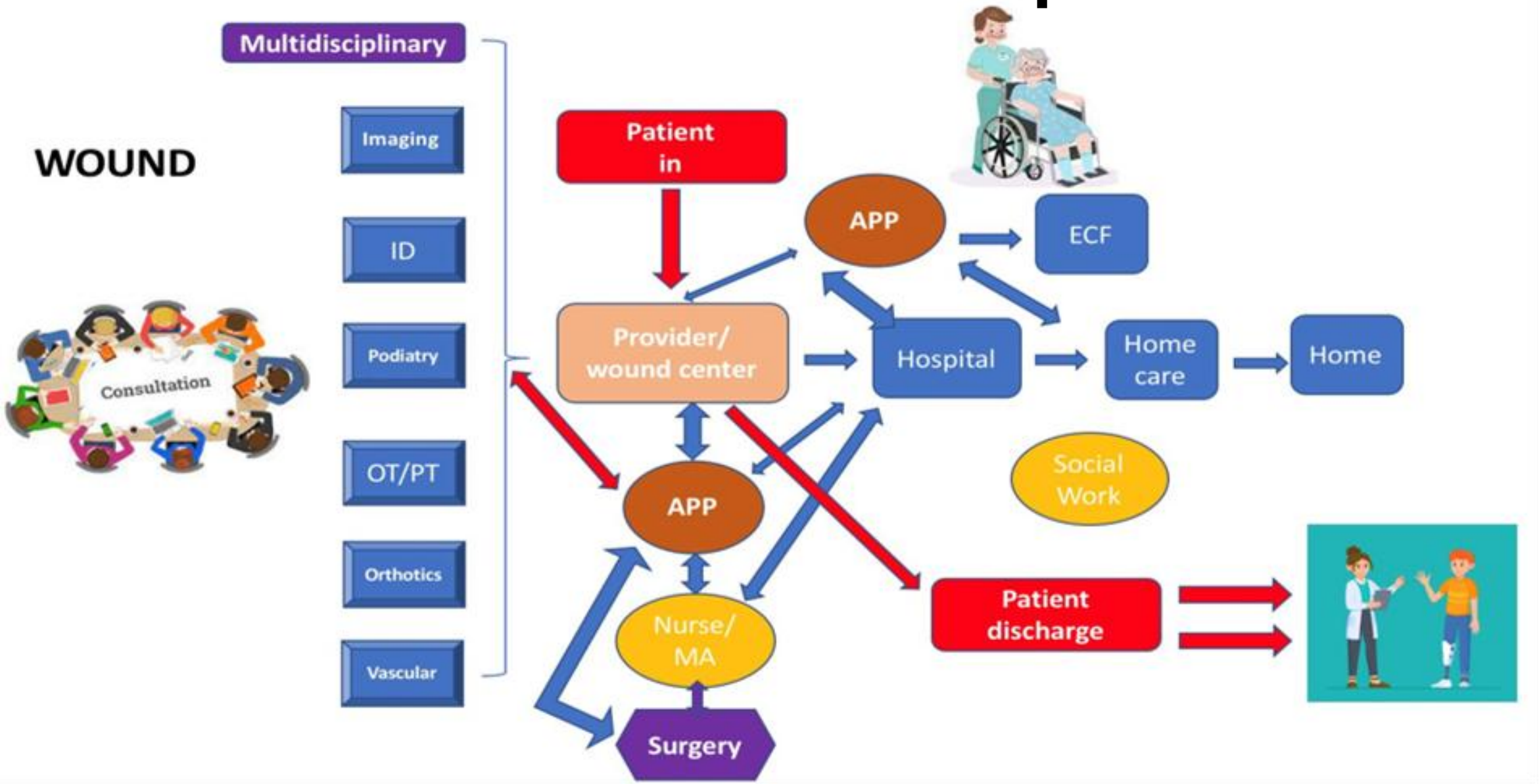
- NPWT is not only for large wounds
  — it works great for smaller wounds, too
- Common myth: NPWT should be used when other modalities fail
  — consider using NPWT early on for wound bed preparation
- Wound care, including NPWT, is a “team sport”
  — communication amongst team members and appreciation of what everyone brings to the team can improve care and outcomes

Real-World Examples:

Navigating a Complex Road

Karen Bauer, DNP, CNP-FNP, CWS, FAAWC
Emory Heart and Vascular
Immediate Past President, Society for Vascular Nursing
Board Member, Association for the Advancement of Wound Care
Atlanta, GA

A Not-So-Linear Trip



Paving the Path: Tools for the Road

- Collaborative Care: Clear communication – written and verbal
- Patient-Centered: Assess individual needs, involve patients/families in planning and decision making
- Comprehensive Training: Lunch & Learn, shared clinic visits, virtual sessions
- Standardized Protocols
- Access to Resources: Smart sets, consignment programs, know who has what
- Consider the use of sNPWT to assist in transition

sNPWT = single-use NPWT.

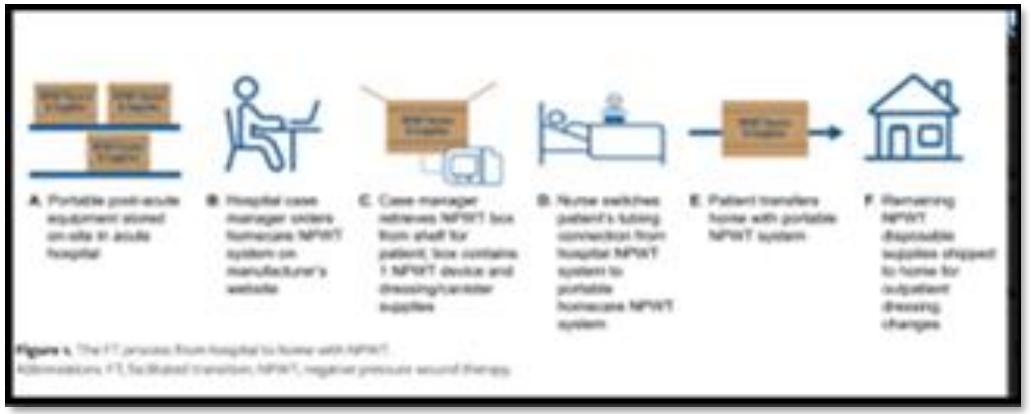
Lumbers M. *Br J Community Nurs.* 2024;29(Sup12):S36-S38.

Roadblocks and Detours

- Training: NPWT, proper wound care techniques, troubleshooting
- Logistics: Access to supplies, equipment, timely communication
- Patient Education: Benefits, complications, maintenance
- Patient Adherence: NPWT protocols
- Wound Complexity: Careful assessment and planning

Consignment at Discharge

- Discharge processes are complicated and involve many cross-institutional complexities
- Delays in hospital patient discharge are associated with increased cost and risk of infection, lower patient satisfaction, and even mortality
- Study looked at hospitals with NPWT facilitated transition programs vs standard
- ciNPT patient LOT was 1.8 days shorter for FT vs non-FT facilities (9.0 vs 10.8 days) – potential per patient hospital savings of $5071
- Consignment programs also limit the need for same-day deliveries, which reduces service burden and overall healthcare system costs
- Over 5000 hospitals included, 82,543 billable orders



ciNPT = closed incision negative pressure therapy.
Boli L, et al. *Wounds.* 2022;34(12):E118-E120.

Polling Question

You are discharging a patient from the acute care setting to a skilled rehab facility. The patient is currently using traditional NPWT. He will need physical therapy upon admission to the skilled center and has a large sacral pressure ulcer with subcutaneous involvement. What therapy is best?

1. Peel and place dressing
2. NPWTi-d
3. Portable NPWT
4. This patient cannot have NPWT in his receiving environment

Answer

3

Rationale:

1. Peel and place is not available in the skilled rehab environment
2. NPWTi-d is also not available in his receiving facility
3. Portable NPWT allows him to utilize NPWT and remain active
4. NPWT is a great option in the skilled environment

Case 1: Care Transitions Family Help!

May: Initial Presentation DFI




IDSA Guidelines

2012	
Infection Severity	**Clinical Manifestations**
Mild	Localized to skin and subcutaneous tissue without systemic signs of infection. If erythematous, >0.5cm to ≤2cm around ulcer
Moderate	Local infection with >2cm or involving deeper infection (abscess, osteomyelitis, fasciitis) AND without systemic signs of infection
Severe	Local infection with SIRS (2 of the following): Temp >38C or <36C, HR >90, RR >20, WBC >12K or <4K

2023	
Infection Severity	**Clinical Manifestations**
Mild **(At least 2+)**	Localized swelling or induration, erythema >0.5cm to ≤2cm around ulcer, localized tenderness/pain, localized warmth, purulent discharge
Moderate	Local infection with >2cm from wound margin OR involving deeper infection (abscess, osteomyelitis, fasciitis) AND without systemic signs of infection
Severe	Local infection with SIRS (2 of the following): Temp >38C or <36C, HR >90, RR >20, WBC >12K or <4K

Slide used with permission: Matt Rico, PharmD, BIDCP

Senneville E, et al. *Diabetes Metab Res Rev.* 2024;40(3):e3687.

Take Home: IDSA Guidelines

UTMC *Pseudomonas aeruginosa* Susceptibility Trends

	AMK	TOB	GEN	TZP	MEM	FEP	CIP
2018	100	94	96	80	87	84	71
2019	100	92	93	85	85	93	84
2020	100	95	99	75	83	86	68
2021	100	96	99	79	85	90	87
2022	100	99	97	73	84	86	73

University of Toledo Medical Center
Diabetic Foot Infections Pocket Guide

Diagnosis and Criteria	Recommended Therapies

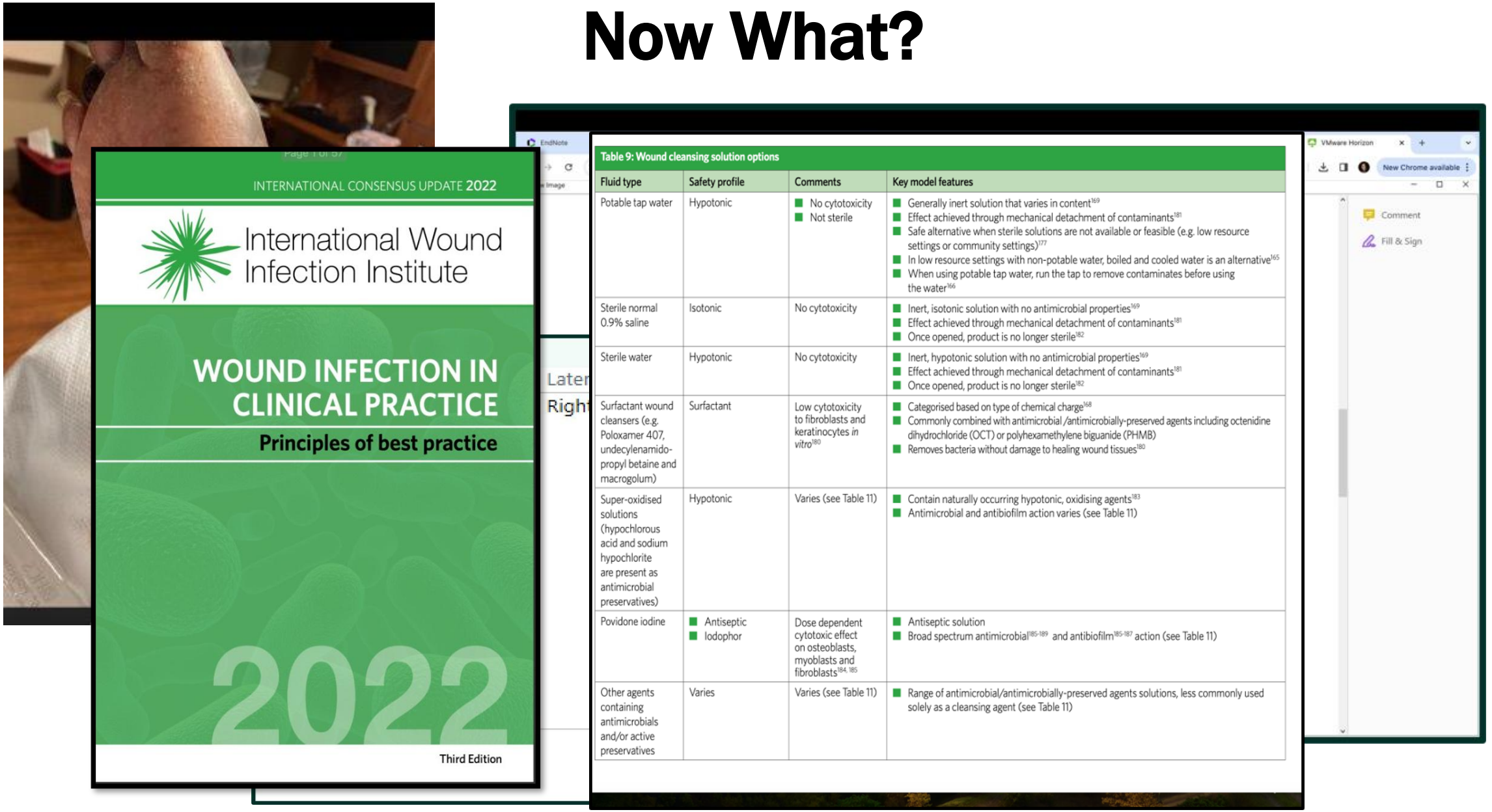
Mild DFI
• At least <u>two</u> of the following:
  ○ Localized swelling or induration
  ○ Erythema > 0.5 cm to ≤ 2 cm around ulcer
  ○ Localized tenderness/pain
  ○ Localized warmth
  ○ Purulent Discharge
• Usually treated with PO therapy
	Probable Pathogen(s)*: MSSA, *Streptococcus* spp, or MRSA (if prior isolation or risk factors for MRSA)
	
	Preferred Agents^: Cephalexin 500mg q6h, Amoxicillin-clavulanate 875mg-125mg q12h, Doxycycline 100mg q12h, Trimethoprim-sulfamethoxazole 800mg-160mg q12h
	
	Duration of Therapy: 1-2 weeks OR 10 days following surgical debridement

Moderate DFI
• Local infection with > 2 cm from wound margin OR involving deeper infection (abscess, osteomyelitis, fasciitis) AND <u>**without systemic signs of infection**</u>
	Probable Pathogen(s)*: MSSA, *Streptococcus* spp, Enterobacterales, MRSA (if prior isolation or risk factors for MRSA), ± anaerobes
	Antimicrobial Guidance Based on Presentation^
	1. No complicating features (foreign body, puncture wound, deep abscess, arterial/venous insufficiency, lymphedema, immunosuppression, AKI)
	  • Amoxicillin-clavulanate, ampicillin-sulbactam, cefuroxime, ceftriaxone, cefazolin ± metronidazole
	2. Recent antibiotics (within last 30 days) / Abscess / Bone & Joint
	  • Ceftriaxone + vancomycin ± metronidazole
	3. Macerated ulcer
	  • Piperacillin-tazobactam OR cefepime + vancomycin ± metronidazole
	4. Ischemic limb/necrosis/gas forming
	  • Ceftriaxone + vancomycin + metronidazole/clindamycin

Severe DFI
• Local infection AND <u>**at least two**</u> of the following:
  ○ Temperature > 38˚C or < 36˚C
  ○ HR > 90
  ○ RR > 20
  ○ WBC > 12K or < 4K
 	
Do NOT empirically target *Pseudomonas aeruginosa* in temperate climates unless it has been isolated from cultures of the affected site within the previous few weeks
	Duration of Therapy:
	○ Moderate/severe WITHOUT bone/joint involvement: 2-4 weeks
	○ Moderate/severe WITH bone/joint involvement
	  • Resected: 2-5 days
	  • Debrided (soft tissue): 1-2 weeks
	  • Positive culture of bone margins AFTER resection: 3 weeks
	  • No surgery/dead bone: 6 weeks
	○ Tailor antimicrobial therapy based on culture results and consider transitioning to oral therapy after patients have appropriate source control procedures and are clinically stable

*MRSA risk factors: prolonged hospitalization, ICU admission, recent hospitalization, recent antibiotic use, invasive procedures, admission to nursing home, open wounds, hemodialysis, immunocompromised status, long-term CVC
^May require renal dose adjustment

Now What?


INTERNATIONAL CONSENSUS UPDATE 2022
International Wound Infection Institute
WOUND INFECTION IN CLINICAL PRACTICE
Principles of best practice
2022
Third Edition
Table 9: Wound cleansing solution options
Fluid type | Safety profile | Comments | Key model features
Potable tap water | Hypotonic | No cytotoxicity; Not sterile | Generally inert solution that varies in content[169]; Effect achieved through mechanical detachment of contaminants[181]; Safe alternative when sterile solutions are not available or feasible (e.g. low resource settings or community settings)[177]; In low resource settings with non-potable water, boiled and cooled water is an alternative[165]; When using potable tap water, run the tap to remove contaminates before using the water[166]
Sterile normal 0.9% saline | Isotonic | No cytotoxicity | Inert, isotonic solution with no antimicrobial properties[169]; Effect achieved through mechanical detachment of contaminants[181]; Once opened, product is no longer sterile[182]
Sterile water | Hypotonic | No cytotoxicity | Inert, hypotonic solution with no antimicrobial properties[169]; Effect achieved through mechanical detachment of contaminants[181]; Once opened, product is no longer sterile[182]
Surfactant wound cleansers (e.g. Poloxamer 407, undecylenamido-propyl betaine and macrogolum) | Surfactant | Low cytotoxicity to fibroblasts and keratinocytes in vitro[180] | Categorised based on type of chemical charge[168]; Commonly combined with antimicrobial /antimicrobially-preserved agents including octenidine dihydrochloride (OCT) or polyhexamethylene biguanide (PHMB); Removes bacteria without damage to healing wound tissues[180]
Super-oxidised solutions (hypochlorous acid and sodium hypochlorite are present as antimicrobial preservatives) | Hypotonic | Varies (see Table 11) | Contain naturally occurring hypotonic, oxidising agents[183]; Antimicrobial and antibiofilm action varies (see Table 11)
Povidone iodine | Antiseptic; Iodophor | Dose dependent cytotoxic effect on osteoblasts, myoblasts and fibroblasts[184, 185] | Antiseptic solution; Broad spectrum antimicrobial[185-189] and antibiofilm[185-187] action (see Table 11)
Other agents containing antimicrobials and/or active preservatives | Varies | Varies (see Table 11) | Range of antimicrobial/antimicrobially-preserved agents solutions, less commonly used solely as a cleansing agent (see Table 11)
VMware Horizon
New Chrome available
Comment
Fill & Sign

NPWTi – LTACH to Hospital Transitions

Dec. 29

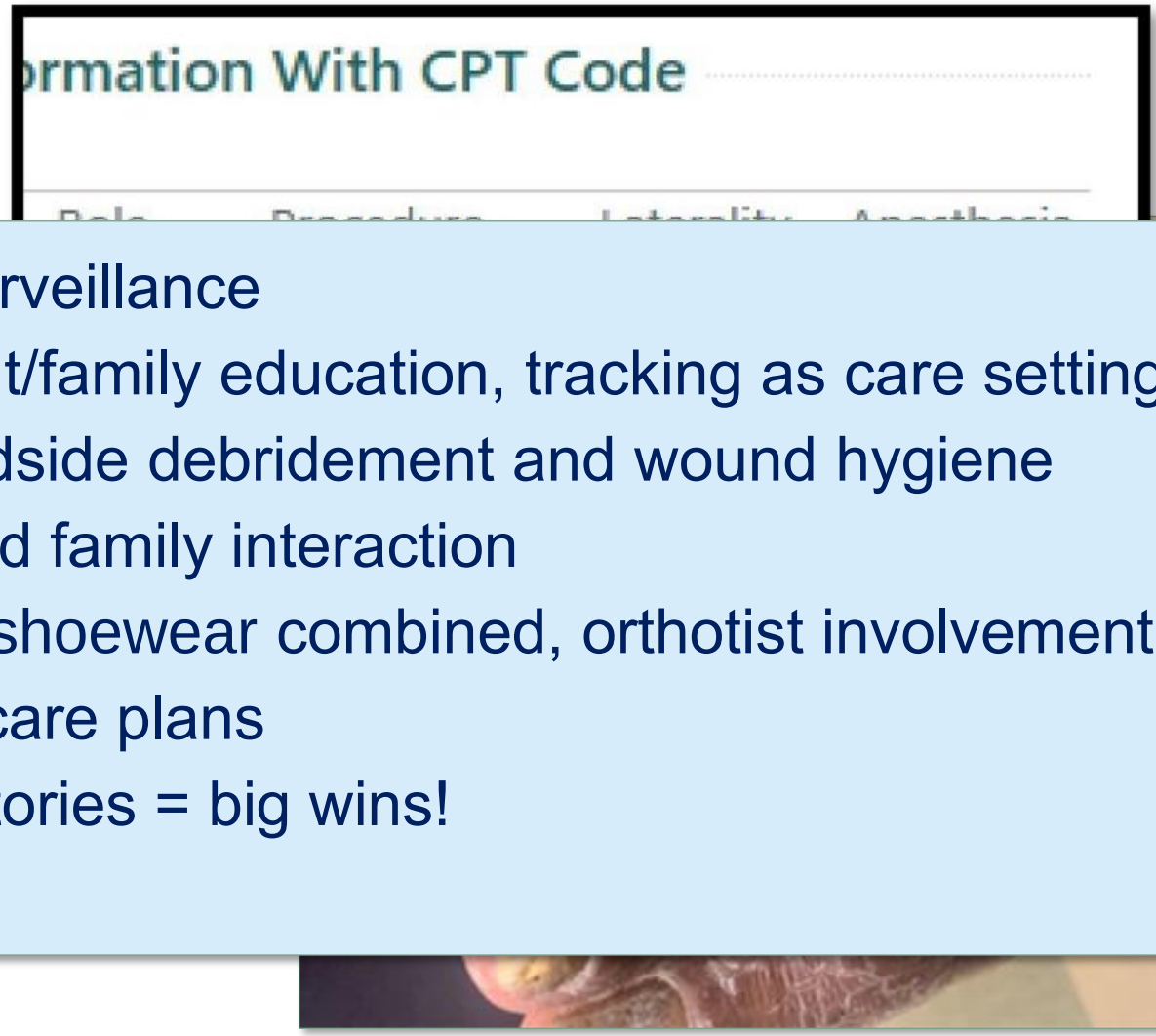
Jan. 9

Feb. 21

NPWTi

- 2021 Meta-analysis
- 13 studies, 720 patients
- Significantly fewer OR debridements done in NPWTi-d patients vs control patients (*P*=0.01)
- NPWTi-d group showed reduced bacterial count 4.4x greater than control group wounds (*P*=0.003)
- Significantly shorter time treated in NPWTi-d patients vs control patients (*P*=0.03)
- Wounds in NPWTi-d group were 2.39x more likely to close than control group wounds (*P*=0.01)
- LOS not significantly reduced for NPWTi-d patients compared to control patients (*P*=0.06)

Gabriel A, et al. *Plast Reconstr Surg.* 2021;147(1A-1):68S-76S. Kim PJ, et al. *Int J Wound.* 2020;17(5):1194-1208.



1. Frequent arterial surveillance
2. RFM/GDMT: Patient/family education, tracking as care setting changed
3. Aggressive with bedside debridement and wound hygiene
4. Frequent patient and family interaction
5. Offloading devices/shoewear combined, orthotist involvement
6. Coordination of ID care plans
7. Celebrate small victories = big wins!
8. Beg, barter, steal

- Transition to collagen
- Edges monitored/managed
- Add moisture
- Host factor management and patient/family involvement
- Pay attention to details – flexibility

01/12/2023	01/12/2023	XR foot 3+ views right

Case 2: Meet Your Patient Where They Are!

Large Abdominal Wound Post Renal Transplant

- 65y Female, Type 2 DM with diabetic retinopathy and h/o DFUs
- HTN, CAD s/p old MI (2016), CABG x2 (9/21/2021, LIMA to LAD and reverse SVG to OM)
- HFpEF, h/o paroxysmal atrial fibrillation
- Carotid artery stenosis s/p right carotid endarterectomy (12/13/2018)
- Secondary hyperparathyroidism and anemia of CKD
- Stage 4 oropharyngeal cancer (left tonsil)
- COPD, HPL, GERD, gout, hypothyroidism, skin melanoma s/p excision
- Osteoarthritis s/p right knee replacement (2017)
- h/o right rotator cuff tear
- Anxiety, obesity, OSA (on CPAP), h/o colon polyps, diverticulosis, h/o MRSA infection, hearing loss (left ear)
- Anesthesia problems, difficult IV access
- Dermatitis, chronic sinusitis, headaches, dental disease, h/o fecal incontinence

Surgical Progression

NPWT: The Power of Wound Specialist Persuasion (Getting other services to buy in)

Deceased Donor Kidney Transplant: June 28

Incisional Infection Washout: July 9, July 25

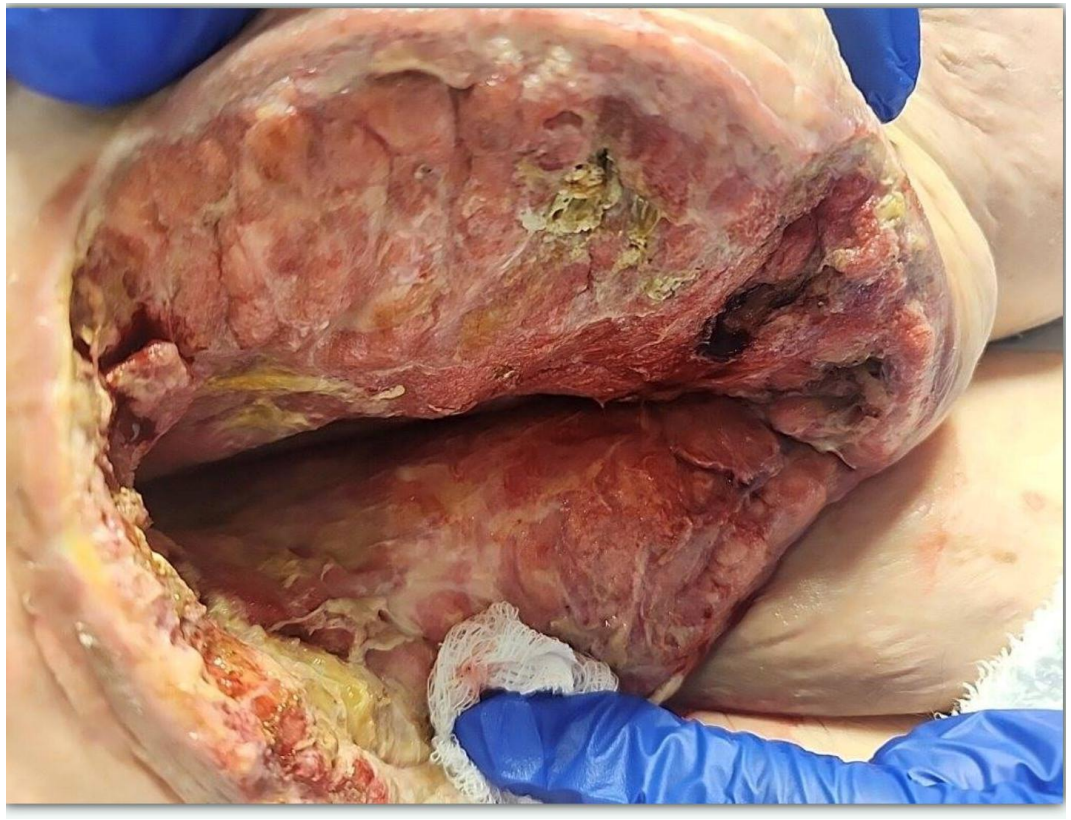
Consulted July 10

July 10

July 18

Postoperative

- S/P 7/25 wash-out
- NPWTi initiated: NPWTi-d dressing, 10min dwell time q2hrs with hypochlorous acid (HOCl), -125 mm Hg
- Multidisciplinary Care: ID, Transplant APP, Wound/Vascular, Patient and Family



POD 1: 2nd I&D

NPWTi = negative pressure wound therapy with instillation; I&D = incision and drainage.

Kim PJ, et al. *Int Wound J*. 2020;17(1):174-186.

ECF Transition

Discharge to SNF: Aug. 4

Portable NPWT, black foam,
-125 mm Hg

Clinic follow-up Aug. 14

Keys: Multi-morbid, immunosuppressed
Goal: Meticulous wound hygiene, HOCl, nutrition

Clinic follow-up Aug. 30

Pain at wound edge
Intervention: Hydrocolloid

SNF = skilled nursing facility.

Transition Home

- Discharged home with Home Health
- Clinic follow-up Sept. 2
- Still having pain at edges; improved
- Portable NPWT continued
- Focused on diet
- **Patient frustrated: Goal is to swim**

Multiple conversations with home health nurses

Normandin S, et al. *Plast Surg*. 2021;35(3):164-170.

Novel NPWT

- Oct. clinic follow-up
  - Started peel and place dressing
  - HOCl, collagen

Reminders for 3M™ V.A.C.® Therapy with 3M™ V.A.C.® Peel and Place Dressing

Indications

V.A.C.® Peel and Place Dressing can be used on:

- Chronic wounds
- Acute wounds
- Traumatic wounds
- Subacute wounds
- Dehisced wounds
- Partial-thickness burns
- Ulcers (such as diabetic, pressure or venous insufficiency)
- Flaps
- Grafts

Warnings

Do not use on wounds with:

- Undermining greater than 2 cm
- Tunneling
- Depth greater than 6 cm

Dressing should cover the entire wound bed and extend onto intact skin.

Find the right size

Small - EZ5SML	Medium - EZ5MED	Large - EZ5LRG
Max wound size: 6.1 cm x 8.6 cm **Max Depth:** 2 cm	**Max wound size:** 11.1 cm x 16.6 cm **Max Depth:** 4 cm	**Max wound size:** 13.6 cm x 24.2 cm **Max Depth:** 6 cm

Always read and follow the detailed Instructions for Use along with important safety information provided in the packaging.

Application tips for 3M™ V.A.C.® Therapy with 3M™ V.A.C.® Peel and Place Dressing

Wear time

Dressing can remain in place for **up to 7 days**.[1]

Device settings

Set the device to **-75 to -150 mmHg** on **continuous mode**.

Do not	Drape Tips
• Cut foam. • If skin barrier/protectant is used under the adhesive portion of the dressing, do not reposition the dressing as adhesive properties may be reduced. • Use with other V.A.C.® Therapy Dressing Kits or foams, as they have a shorter wear time. • Push foam portion of the dressing down. Allow the dressing to draw down and conform the wound bed as negative pressure is applied. • Stretch dressing.	• Apply loosely over the wound area. • Leave at least a 5 cm border of drape wherever possible. • Can reposition within 20 minutes of initial application. • For curved anatomy, slits may be cut in the drape portion of the dressing to help reduce overlap, drape folds or remove wrinkles.

Watch how-to-apply video →

Customer service: 800-275-4524

Clinical support: 800-275-4524 x 56650

Technical support: 800-275-4524 x 3

NOTE: Specific indications, contraindications, warnings, precautions, and safety information exist for these products and therapies. Please consult a clinician and product Instructions for Use prior to application. Rx only.

[1] SAT-BSER-05-869347 VAC Peel and Place (Ganymede) BSER. 510(k) K222859.

Coordination

Nov: Peel and place dressing

Dec: Collagen

Ulcer reportedly closed → pt contracted COVID → Collagen re-initiated via telemed

Closed

Jan 29, 2025

Take Home

- Clinical algorithm useful
- Need for flexibility
- Care setting
- Skill, training, comfort level of teams
- Insurance
- Patient tolerance and needs
- Step-down consideration with subsequent monitoring; can backtrack, if needed
- Safety first
- Shared decision making!

Thank You

Please submit your questions via the Question Box