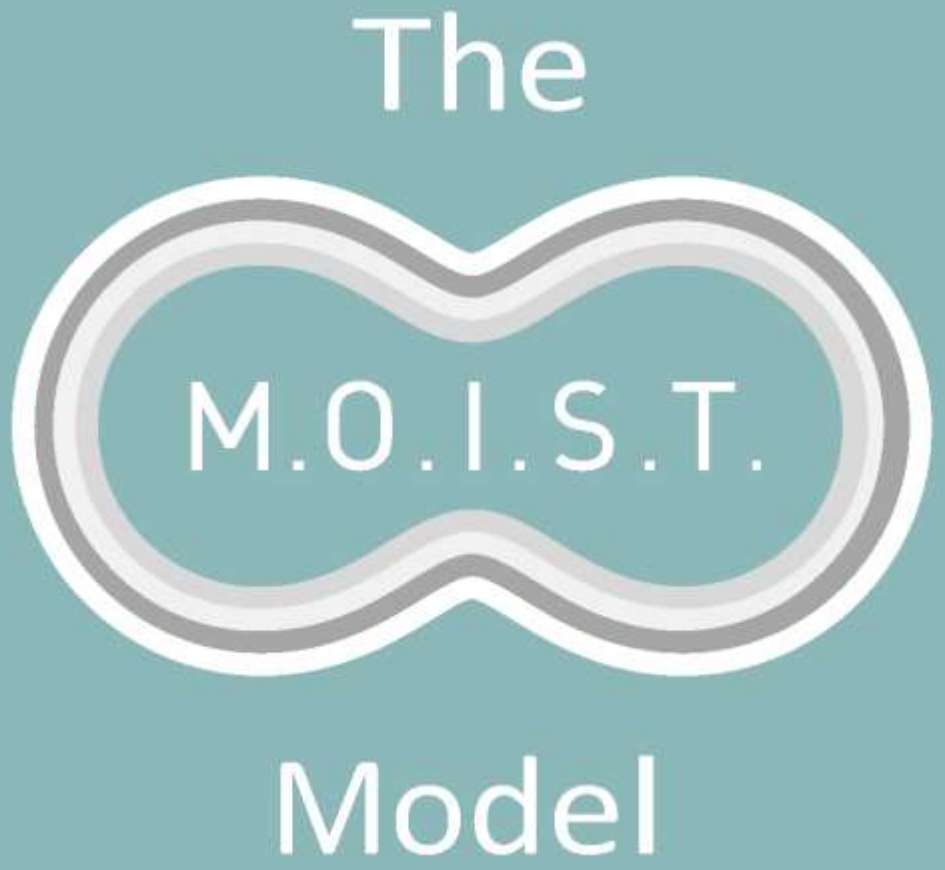
Optimizing Wound Management at the Point of Care



Presenter: Amy A. Armstrong MSN, RN, CWOCN, CNL

Disclosure

The presenter is an employee of Mölnlycke. The information presented herein is provided for educational and informational purposes. It is for the attendees' general knowledge and is not a substitute for medical advice. The material provided herein is not comprehensive for all medical developments and may contain errors or omissions. If you need advice regarding a specific medical situation, please consult a medical professional.

Upon completion of this educational offering attendees will be able to:

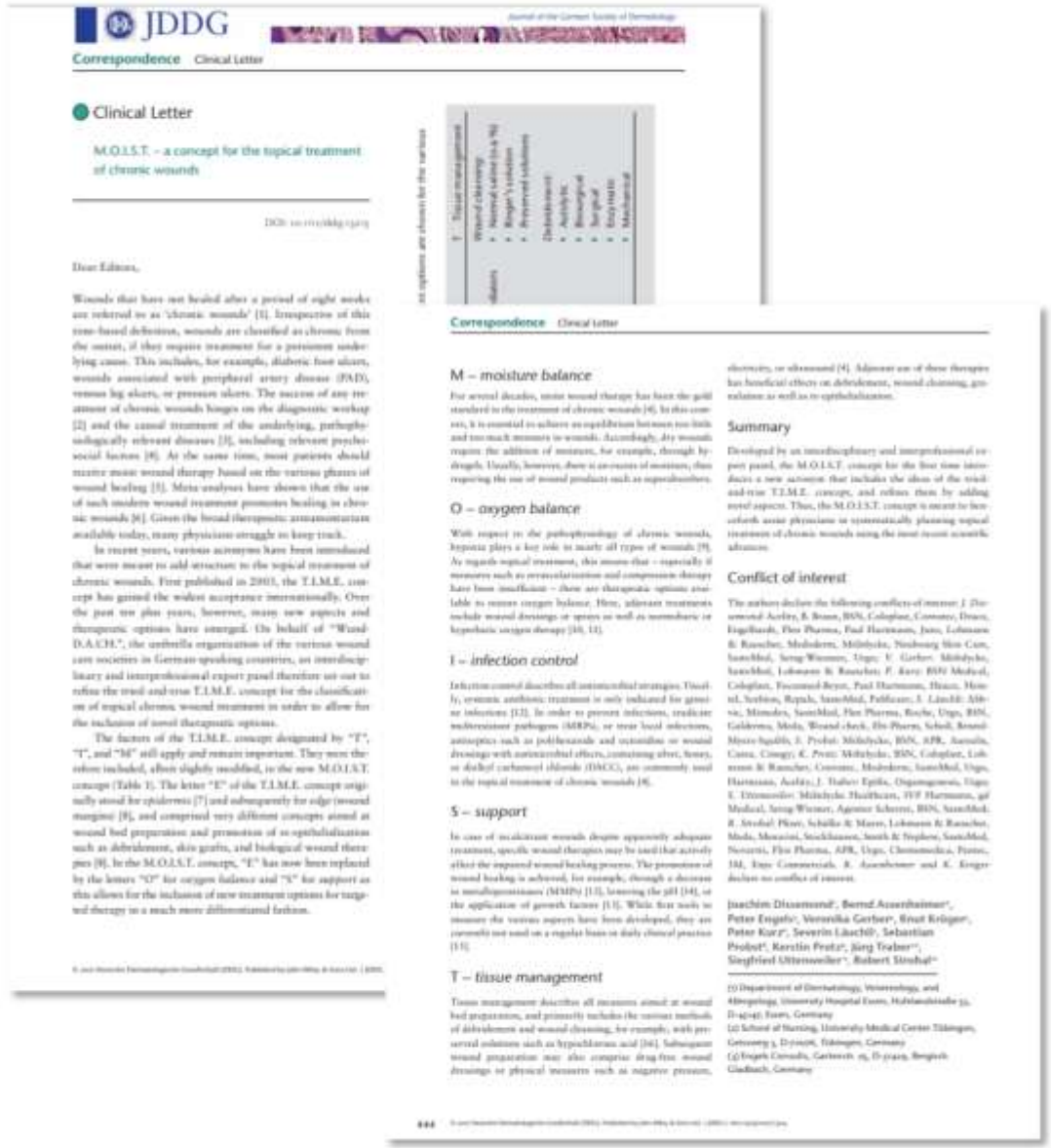
- Identify wound environment deficits and their effect on delayed healing
- Recall wound healing components associated with each letter of the M.O.I.S.T. acronym
- Use the M.O.I.S.T. model to determine what each wound needs to activate healing

Why the M.O.I.S.T. Model?

MHC-2022-79912

Evolution of the M.O.I.S.T. Model

- Developed by Wund-D.A.CH
- Evolves T.I.M.E.
- Includes 2 important contributors
  - Oxygen balance
  - Supporting the wound bed



JDDG

Correspondence Clinical Letter

Clinical Letter

M.O.I.S.T. – a concept for the topical treatment of chronic wounds

Correspondence Clinical Letter

M – *moisture balance*

O – *oxygen balance*

I – *infection control*

S – *support*

T – *tissue management*

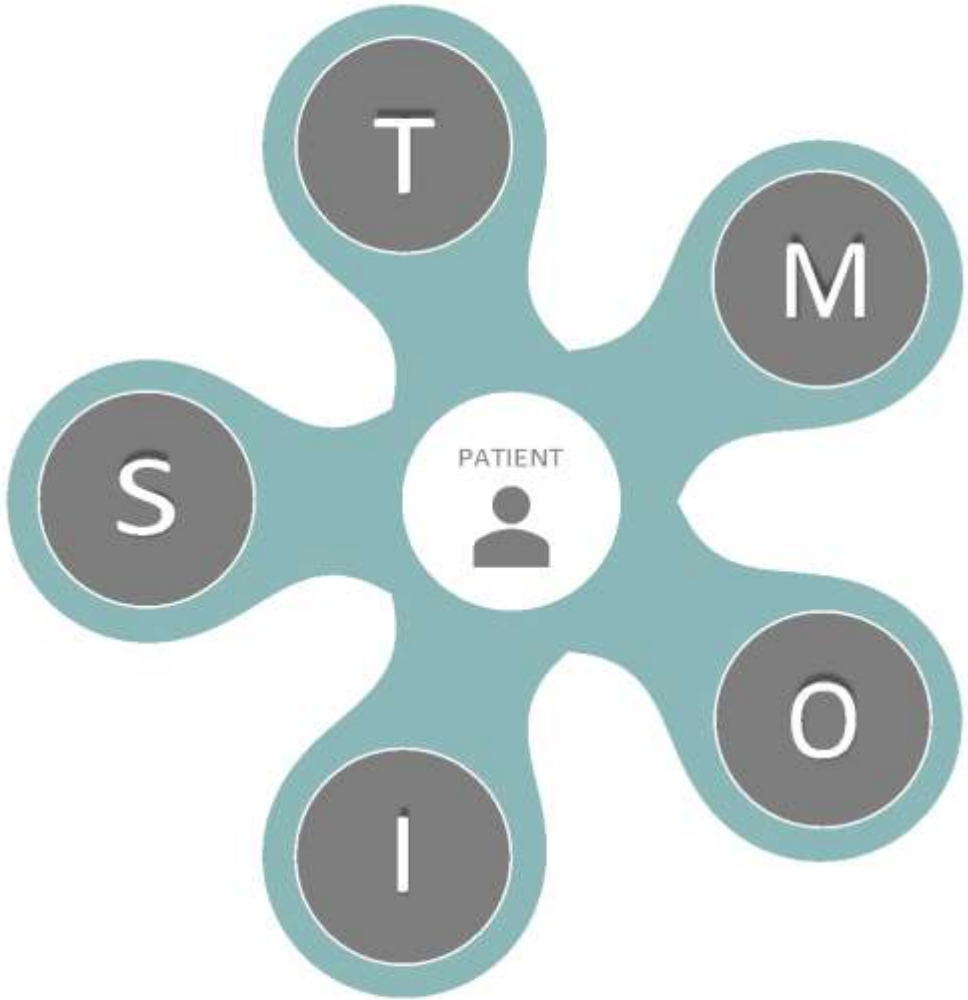
Summary

Conflict of interest

Dissemond, J et al. (2017). M.O.I.S.T. – a concept for the topical treatment of chronic wounds: Clinical Letter. Journal of the German Society of Dermatology. DOI: 10.1111/ddg.13215

The M.O.I.S.T. Model in Practice

- Applied following thorough wound assessment
- Does not need to be sequential



A Model for Optimizing Wound Management at the Point of Care

Dissemond, J et al. (2017). M.O.I.S.T. – a concept for the topical treatment of chronic wounds: Clinical Letter. Journal of the German Society of Dermatology. DOI: 10.1111/ddg.13215

M

Moisture Balance

Optimal Wound Healing Environment

- Moist but not wet
- Stable temperature
- Protection from cellular distortion

Moisture & Wound Healing

- Faster & better quality of healing

Autolytic debridement

Pain reduction

Reduced scarring

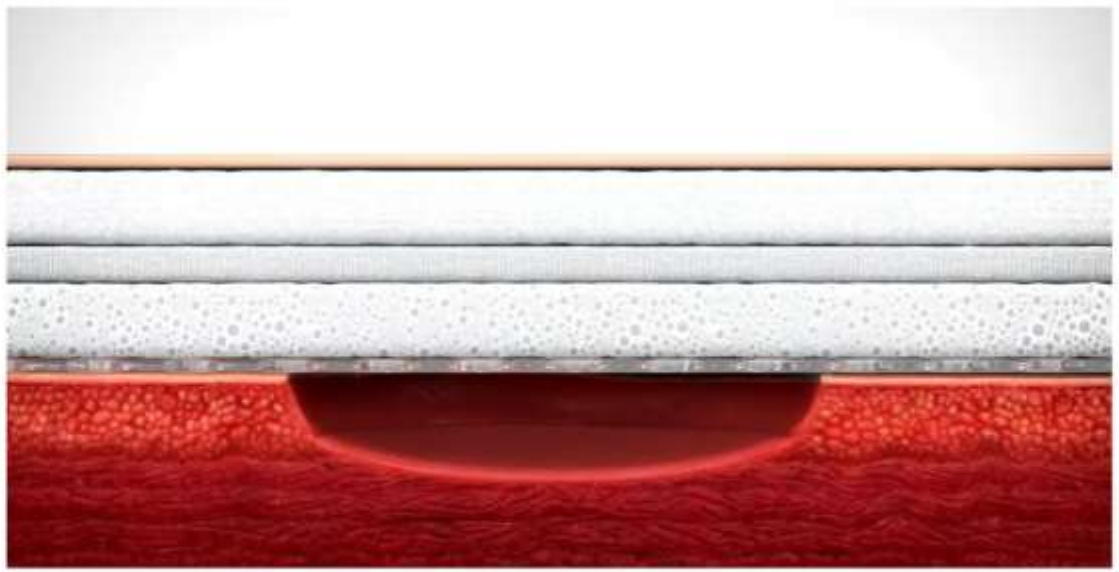
Collagen synthesis

Keratinocyte migration

1. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.
2. Nuutila, K., & Eriksson, E. (2020). Moist wound healing with commonly available dressings. *Advances In Wound Care*, 10(12), 685-698. DOI: 10.1089/wound.2020.1232

Undisturbed Wound Healing

Allowing the wound to “rest” by alleviating unnecessary dressing changes, which protects and supports the normal processes of skin and wound healing, including a moist wound environment & catalyzes faster wound closure.



Brindle, T., & Farmer, P. (2019). Undisturbed wound healing: a narrative review of the literature and clinical considerations. Wounds International. 10(2), 40-48.

Optimal Wound Dressing

Nuutila, K., & Eriksson, E. (2020). Moist wound healing with commonly available dressings. *Advances In Wound Care*, 10(12), 685-698. DOI: 10.1089/wound.2020.1232

Fluid Handling By Product Category

Product Category	Indication	WVTR	Absorptive Capacity	Wear Time
Film	Superficial low exuding	Moderate	None	Several days
Foam	Moderate to high exuding	Moderate	Moderate to high	A few days
NPWT	Acute & chronic wounds	Moderate	Moderate to high	Several days
Hydrogel	Full and partial thickness	High	None to low	A few days
Hydrocolloid	Shallow low exuding	Low	Moderate	Several days
Alginate, Gelling Fiber	High exuding	High	Moderate to high	A few days

Key: NPWT = negative pressure wound therapy; WVTR = water vapor transmission rate.

Nuutila, K., & Eriksson, E. (2020). Moist wound healing with commonly available dressings. *Advances In Wound Care*, 10(12), 685-698. DOI: 10.1089/wound.2020.1232

Problems with Inadequate Exudate

- Delayed autolytic debridement
- Delayed healing
- Dressing adherence
- Pain or tissue damage

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Moisture Balance Basics: Dry Wounds

Wound Condition	**TOO DRY**
Clinical Signs	• Scab or fibrin • No drainage • Pain
Goal	• Donate Moisture
Dressing Types	• Hydrogels

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2. Nuutila, K., & Eriksson, E. (2020). Moist wound healing with commonly available dressings. *Advances In Wound Care*, 10(12), 685-698. DOI: 10.1089/wound.2020.1232

Problems with Excessive Exudate

- Discomfort/pain
- Protein loss and fluid/electrolyte imbalance
- Peri-wound skin damage
- Wound expansion
- Psychosocial effects

1. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.
2. Nuutila, K., & Eriksson, E. (2020). Moist wound healing with commonly available dressings. *Advances In Wound Care*, 10(12), 685-698. DOI: 10.1089/wound.2020.1232

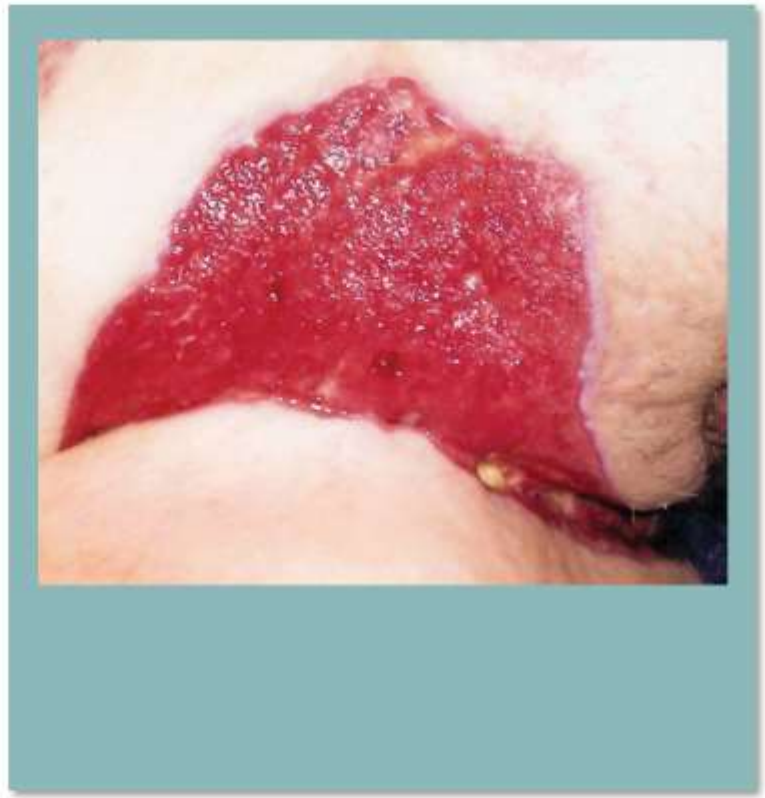
Moisture Balance Basics: Wet Wounds

Wound Condition	**TOO WET**
Clinical Signs	• Maceration • Hypergranulation
Goal	Absorb Moisture
Dressing Types	• Alginates • Hydrofibers • Foams • Superabsorbers

1. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.
2. Nuutila, K., & Eriksson, E. (2020). Moist wound healing with commonly available dressings. *Advances In Wound Care*, 10(12), 685-698. DOI: 10.1089/wound.2020.1232

Moisture Balance Basics: Moist Wounds

Wound Condition	**MOIST WOUNDS**
Goal	• Maintain Moisture
Dressing Types	• Foams • Films • Hydrocolloids



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O

Oxygen Balance

Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com

Hypoxia & Wound Healing

- Initial signal for wound healing[1-2]
- Detrimental, if prolonged[1-2]
  - Inhibits angiogenesis
  - Interrupts re-epithelialization
  - Slows extracellular matrix (ECM) synthesis

1. Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com
2. Guan, Y. et al. (2021). Sustained oxygenation accelerates diabetic wound healing by promoting epithelialization and angiogenesis and decreasing inflammation. Science Advances. 7(35), 1-14. DOI: 10.1126/sciadv.abj0153

Tissue Oxygenation Delivery

- Local oxygen supply
- Supplemental oxygen
- Hemoglobin enhancement

Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com

Accessing Perfusion

- Capillary refill >3 seconds
- Palpation of peripheral pulses
- Ankle-brachial pressure index (ABPI)
- Toe-brachial index (TBI)
- Temperature difference between the feet
- Transcutaneous oxygen measurement

1. Wound, Ostomy and Continence Nurses Society. (2017). Venous, arterial, and neuropathic lower-extremity wounds: Clinical resource guide. Mt. Laurel, NJ: Author
2. Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com

Oxygen Therapies

- Hyperbaric oxygen therapy (HBOT)
- Topical oxygen therapy (TOT)
- Other:
  - Vascular interventions
  - Skin transplantation
  - Fullerenes

Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com

Oxygen Balance: TOT

Topical oxygen therapy (TOT)

- Continuous delivery of non-pressurized oxygen (CDO)
- Low constant pressure oxygen in a contained chamber
- Higher cyclical pressure oxygen
- Oxygen release through dressing or gel
- Oxygen transfer
- Application of oxygen species

Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com

Oxygen Balance: HBOT

- Restores oxygen levels
- Anti-infective effect on aerobes and anaerobes
- Reduces inflammation & edema
- Stimulates angiogenesis, vasculogenesis, stem cells
- Improves healing

Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com

HBOT Best Practice

- Part of a multidisciplinary treatment plan
- Ongoing wound care
- Wound care 4 weeks prior to HBOT
  - Debridement
  - Vascular screening
  - Offloading
  - Infection therapy

- Monitor efficacy with TCO2
- Discontinue if HBOT not effective

Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com

Oxygen Balance: Vascular Interventions

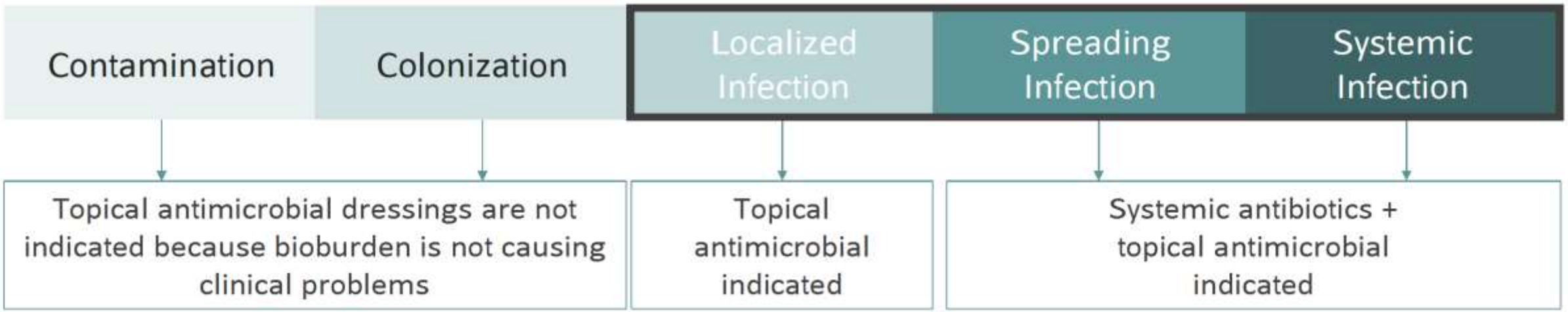
- Smoking cessation
- Cardiovascular exercise
- Medication management
- Reperfusion therapies
  - Coronary angioplasty
  - Coronary artery bypass surgery
  - Catheter-assisted thrombus removal

1. Gottrup, F. (2017). Oxygen therapies for wound healing: EWMA findings and recommendations. Wounds International, 8(4), 18-22. Available on www.woundsinternational.com
2. Cleveland Clinic. (2021). Poor Circulation. Accessed on https://my.clevelandclinic.org/health/diseases/21882-poor-circulation

I

Infection Control

Implementing Topical Antimicrobial Dressings

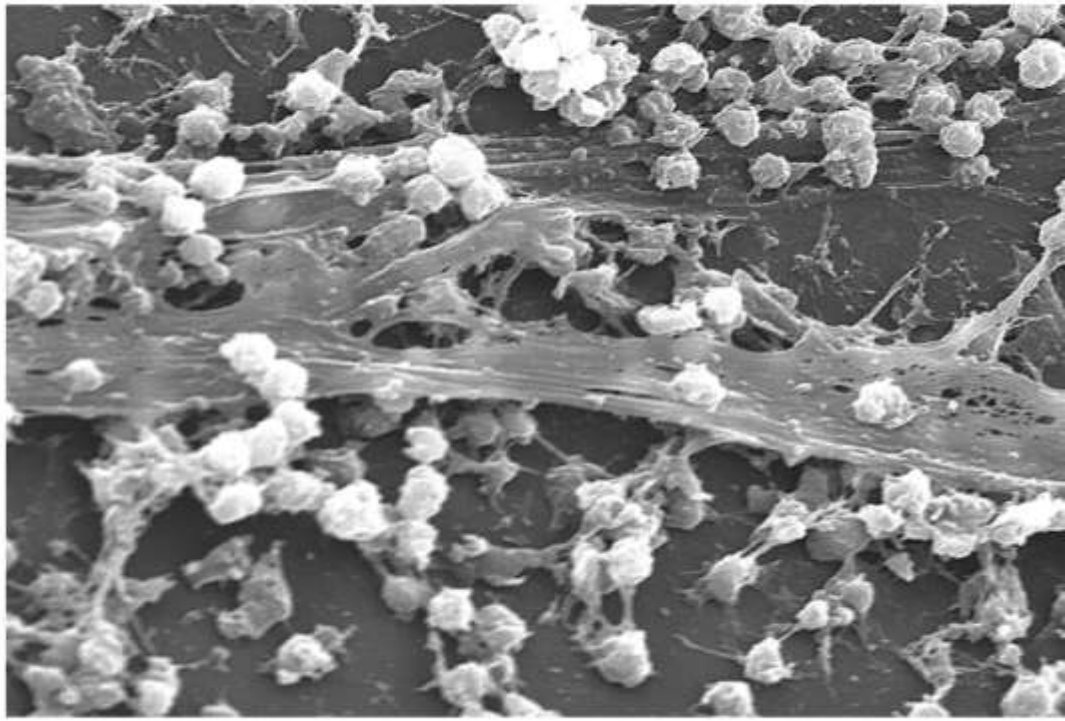


*Including critical colonization (also known as 'covert' or 'silent' infection or 'pre-infection'). Patients with chronic wounds often have comorbidities that suppress the signs of inflammation and make identification of infection difficult.

1. Winnipeg Regional Health Authority. (2018). Silver-based dressings: Evidence informed practice tools. Accessed on https://professionals.wrha.mb.ca/old/extranet/eipt/files/EIPT-013-016.pdf
2. Haesler, E., & Ousey, K. (2018). Evolution of the wound infection continuum. Wounds International. 9(4), 10-14

Biofilm & Delayed Healing

- Break up biofilm
- Remove slough: house of biofilm, comprising 90% of biofilm
- Reduce reformation with antimicrobials
- Protect from contamination



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Biofilm Assessment

- Not visible to the naked eye
- Indicated by other clinical signs
  - Increasing exudate & moisture
  - Inflammation & erythema
  - Poor granulation or friable hypergranulation
  - Recalcitrance to antimicrobial therapy

Haesler, E., & Ousey, K. (2018). Evolution of the wound infection continuum. Wounds International. 9(4), 10-14

Care During the Wound Infection Continuum

Identify & address risks

- Prevent cross-contamination
- Facilitate wound drainage
- Antimicrobial dressings
- Optimize wound environment
- Optimize healing

Haesler, E., & Ousey, K. (2018). Evolution of the wound infection continuum. Wounds International. 9(4), 10-14

Infection Control Strategies

Local and systemic options

- Antibiotics
- Antiseptics

- Antimicrobials
  - Silver
  - Copper
  - Honey
  - Dialkyl carbamoyl chloride.(DACC)

Dissemond, J et al. (2017). M.O.I.S.T. – a concept for the topical treatment of chronic wounds: Clinical Letter. Journal of the German Society of Dermatology. DOI: 10.1111/ddg.13215

Undisturbed Wound Healing

Using a dressing that supports increased wear time

AND

Leaving the dressing uninterrupted

Benefits

- Reduced contamination & infection risk
- Optimized healing
- Cost savings for alleviation of waste and clinician time
- Decreased patient's apprehension
- Increased patient satisfaction

Morgan-Jones et al. (2019). Incision care and dressing selection in surgical wounds: Findings from an international meeting of surgeons. Wounds International. Accessed on www.woundsinternatiolal.com

S

Support Wound

Address Underlying Cause

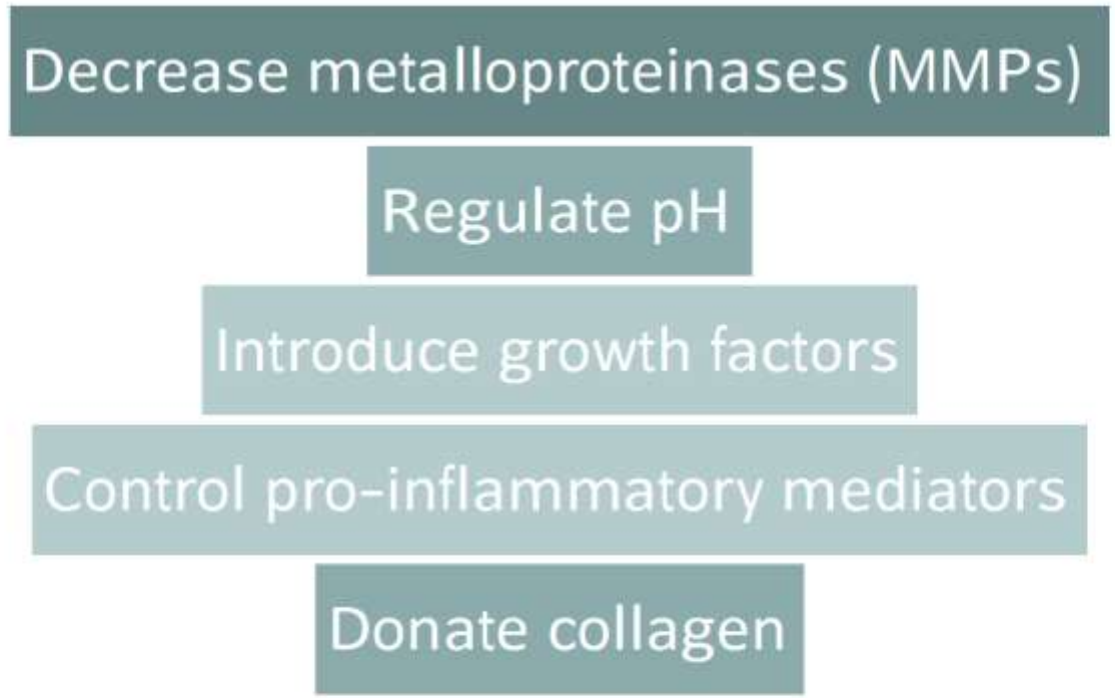
This approach may prevent an acute wound from progressing to a chronic state.

Wound Management Support Basics

Etiology	Presentation	Primary Support
All Wound Types	--	• Optimize nutrition • Encourage exercise • Promote smoking cessation
Pressure Injury		• Redistribute pressure & shear • Interface friction • Manage moisture
Diabetic Foot Ulcer		• Offload
Arterial Ulcer		• Address perfusion
Venous Leg Ulcer		• Compression
Other (Trauma, Surgical, Atypical, Unknown, etc.)	--	• Address underlying detriments

Stimulate Healing

Actively impact impaired wound healing processes



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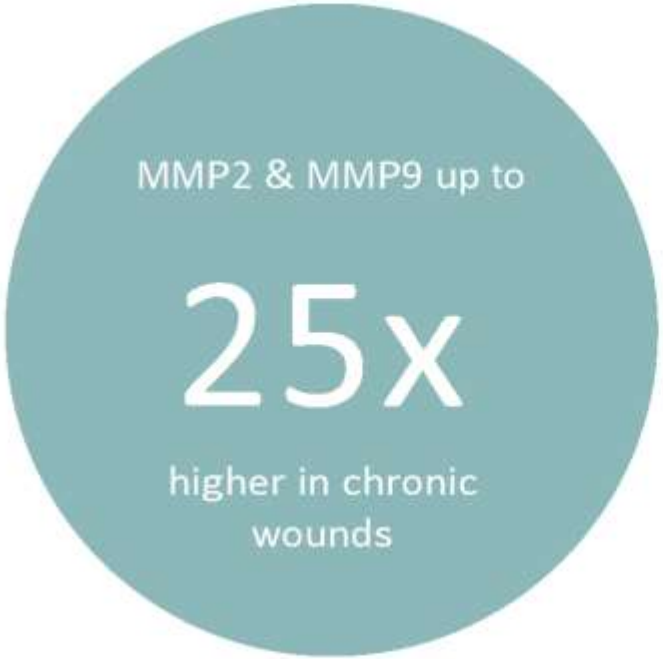
MMPs and Wound Healing

- Acute and chronic wounds
  - Regulate ECM degradation
  - Essential for re-epithelization
- Harmful in excess



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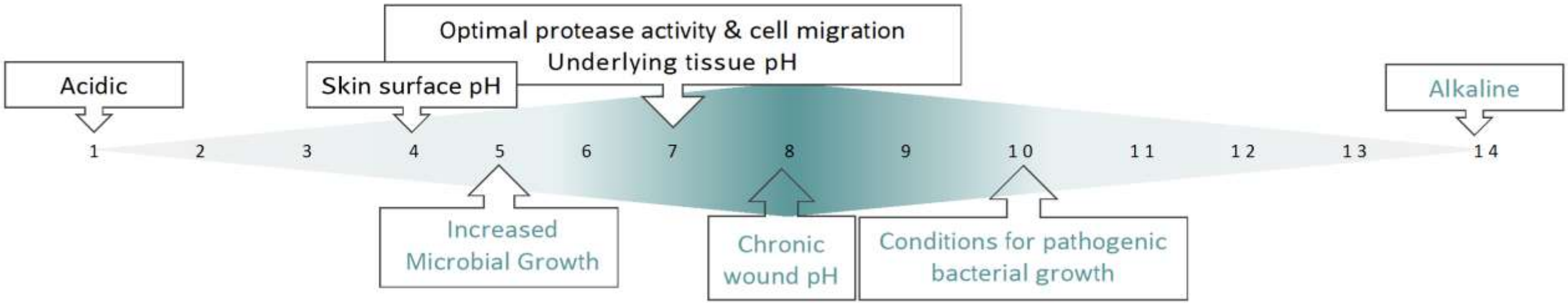
PH and Wound Healing



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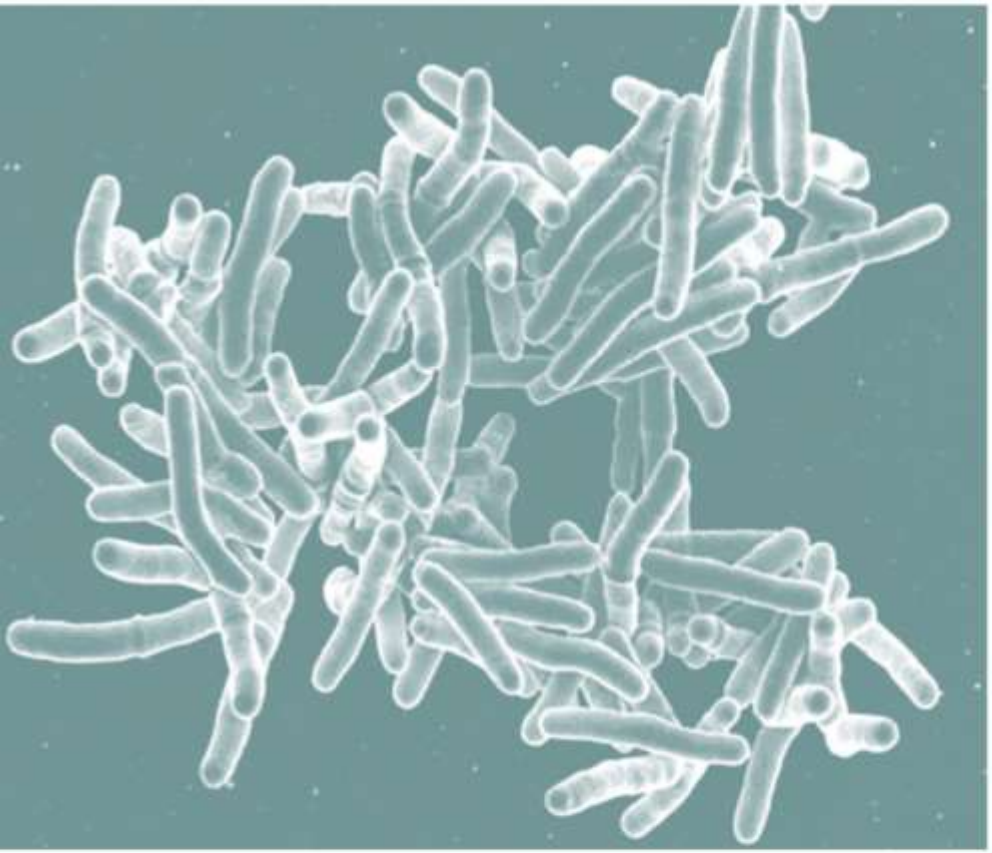
PH and Bacterial Growth



Wound-associated microorganisms	Optimum pH for growth
Staphylococcus aureus	7.0–7.5
Enterococcus faecalis	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

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Extracellular Matrix & Wound Healing

Highly complex noncellular component of all tissues within the body

- Essential support scaffold
- Initiates & directs tissue differentiation & homeostasis
- Disorganized in chronic wounds

ECM Proteins

- Collagen
- Elastin
- Fibronectin
- Glycosaminoglycans
- Tenascin-c
- Proteases

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Growth Factors & Wound Healing

- New blood vessel formation
- Epithelization
- Wound contraction
- Deposition of ECM

1. Xiao, T., Yan, Z., Xiao, S. *et al.* Proinflammatory cytokines regulate epidermal stem cells in wound epithelialization. *Stem Cell Res Ther* 11, 232 (2020). https://doi.org/10.1186/s13287-020-01755-y
2. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.

Pro-Inflammatory Mediators & Wound Healing

- Produced during inflammatory phase after injury
  - Activates downstream cascade
  - Regulates epithelization
- Detrimental in excess
- Higher in non-healing wounds

1. Xiao, T., Yan, Z., Xiao, S. *et al.* Proinflammatory cytokines regulate epidermal stem cells in wound epithelialization. *Stem Cell Res Ther* 11, 232 (2020). https://doi.org/10.1186/s13287-020-01755-y
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Collagen & Wound Healing

- Granulation formation
- Remodeling
- Scar reduction

1. Xiao, T., Yan, Z., Xiao, S. *et al.* Proinflammatory cytokines regulate epidermal stem cells in wound epithelialization. *Stem Cell Res Ther* 11, 232 (2020). https://doi.org/10.1186/s13287-020-01755-y
2. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.

T

Tissue Management

Wound Cleansing

- During each dressing change
- Wound and peri-wound

What makes a good wound cleanser?

- Hypoallergenic
- Nontoxic To Viable Tissue
- Readily Available
- Cost-effective
- Stable

Smith, K. (2017). Top Tips for Best Wound Cleansing Practices. Wound Care Education Institute. Accessed on https://blog.wcei.net/top-tips-for-wound-cleansing#:~:text=A%20good%20wound%20cleanser%20should,15%20pounds%20per%20square%20inch.

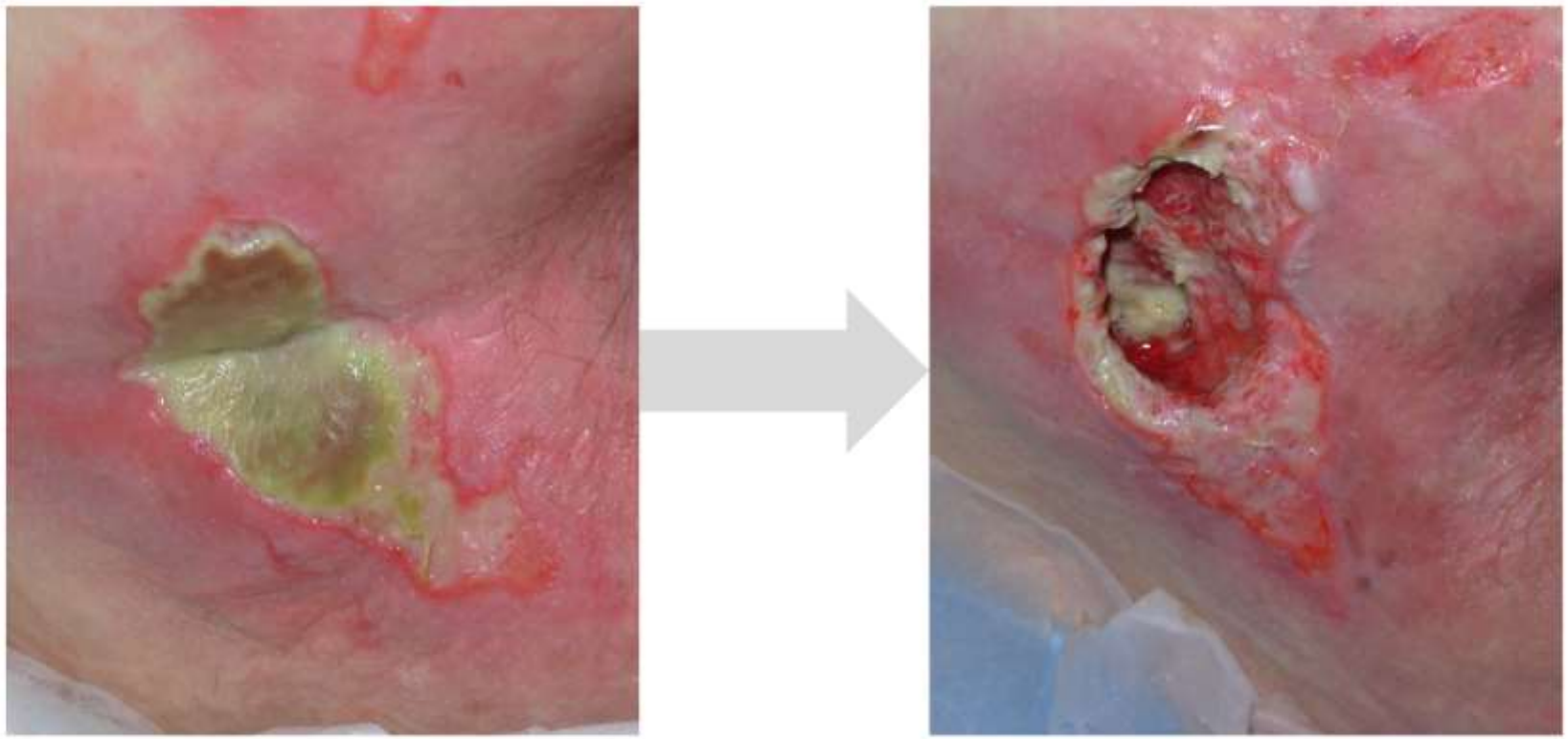
Common Wound Cleansers

- Normal Saline optimal
- Commercial cleansers
- Skin cleansers
- Lactated Ringers
- Potable (drinkable) tap water

Smith, K. (2017). Top Tips for Best Wound Cleansing Practices. Wound Care Education Institute. Accessed on https://blog.wcei.net/top-tips-cleansing#:~:text=A%20good%20wound%20cleanser%20should,15%20pounds%20per%20square%20inch.

Wound Debridement

The removal of necrotic (dead) or infected tissue to activate the healing process.



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Wound Debridement Types

- Autolytic
- Bio-surgical
- Surgical
- Enzymatic
- Mechanical
- Medicinal or topical therapies

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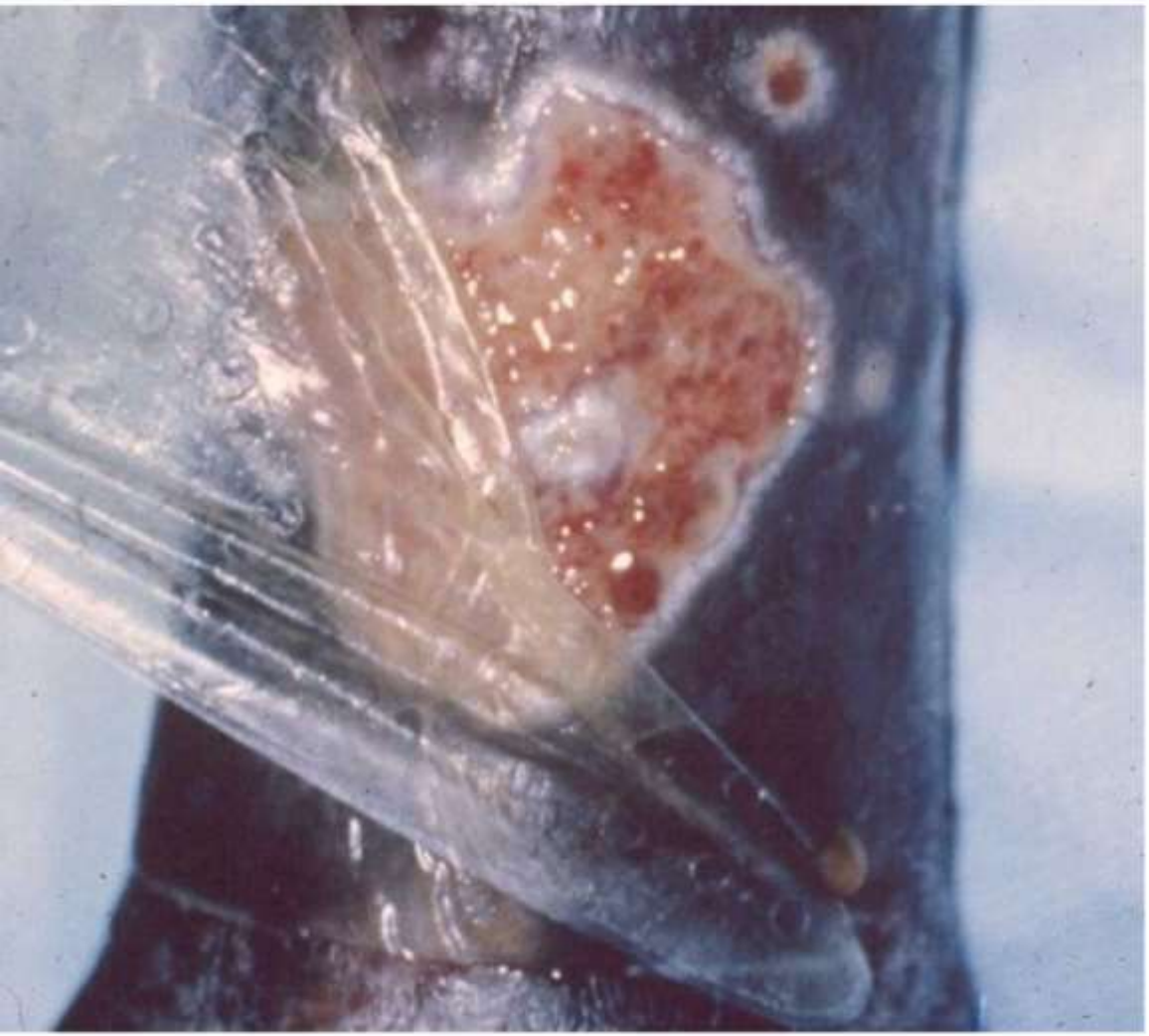
Autolytic



- Uses the body's enzymes and natural fluids
- Softens necrosis
- Moisture retaining dressing once daily

Ideal Patient:

- Non-infected wounds
- Pressure injuries

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2. Nunez, K. (2019). What Is Wound Debridement and When Is It Necessary? Medically reviewed by Shilpa Amin, MD, CAQ, FAAFP. Accessed on Healthline Media.

Biological Debridement

- Also known as larval therapy
  - Consume necrosis
  - Release antibacterial substances
  - Eat harmful bacteria
- Applied 24–72 hours & replaced twice weekly

1. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.
2. Nunez, K. (2019). What Is Wound Debridement and When Is It Necessary? Medically reviewed by Shilpa Amin, MD, CAQ, FAAFP. Accessed on Healthline Media.

Biological Debridement

Ideal Patient:

- Large, infected wounds
- Wounds with antibiotic resistant bacteria
- Poor surgical candidates

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2. Nunez, K. (2019). What Is Wound Debridement and When Is It Necessary? Medically reviewed by Shilpa Amin, MD, CAQ, FAAFP. Accessed on Healthline Media.

Surgical

- Removal of necrosis or infected tissue by cutting

Conservative Sharp

- Ideal when only minor debridement is needed

Surgical Sharp

- Ideal for large deep or very painful wounds

1. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.
2. Nunez, K. (2019). What Is Wound Debridement and When Is It Necessary? Medically reviewed by Shilpa Amin, MD, CAQ, FAAFP. Accessed on Healthline Media.

Enzymatic

- Uses enzymes in the topical ointment or gel to soften necrosis
- Applied 1–2 times per day

Ideal Patient:

- Bleeding problems
- High risk for surgical complications

⊗ Not Recommended for large or severely infected wounds

1. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.
2. Nunez, K. (2019). What Is Wound Debridement and When Is It Necessary? Medically reviewed by Shilpa Amin, MD, CAQ, FAAFP. Accessed on Healthline Media.

Mechanical

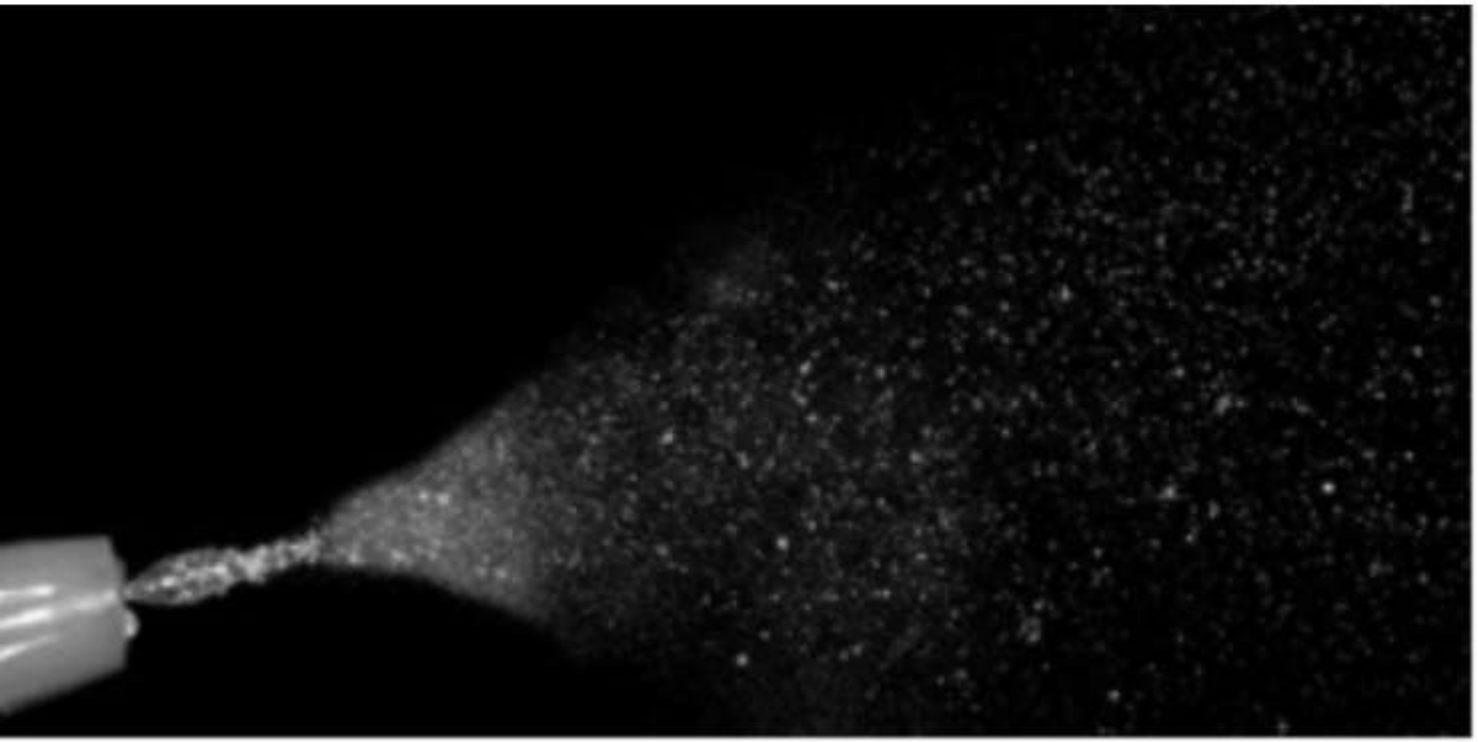
- Most common type of debridement
- Removes unhealthy tissue by force

Types

- Hydrotherapy
- Wet-to-dry
- Monofilament debridement pads

1. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.
2. Nunez, K. (2019). What Is Wound Debridement and When Is It Necessary? Medically reviewed by Shilpa Amin, MD, CAQ, FAAFP. Accessed on Healthline Media.

Ultrasonic Debridement



- Breaks up devitalized tissue
- Quick
- Requires specialized training

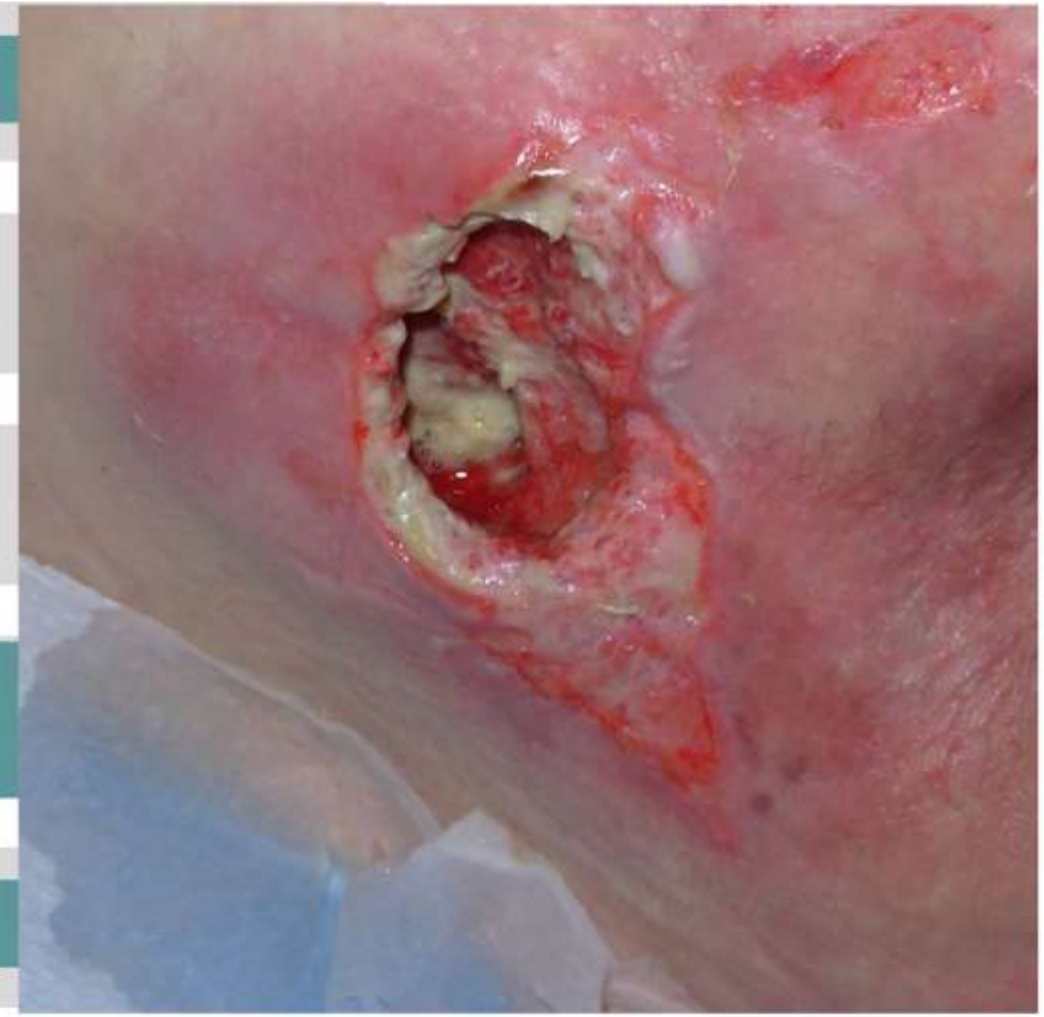
1. World Union of Wound Healing Societies (WUWHS). (2019). Consensus Document. Wound exudate: effective assessment and management. Wounds International.
2. Nunez, K. (2019). What Is Wound Debridement and When Is It Necessary? Medically reviewed by Shilpa Amin, MD, CAQ, FAAFP. Accessed on Healthline Media.

Check Yourself

Taking the M.O.I.S.T. Model to the Point of Care

The M.O.I.S.T. Model

- **M** Moisture Balance — Wet: Absorb
- **O** Oxygen Balance
- **I** Infection Control
- **S** Support Wound — Pressure/Shear Redistribution
- **T** Tissue Management — Necrotic: Debride



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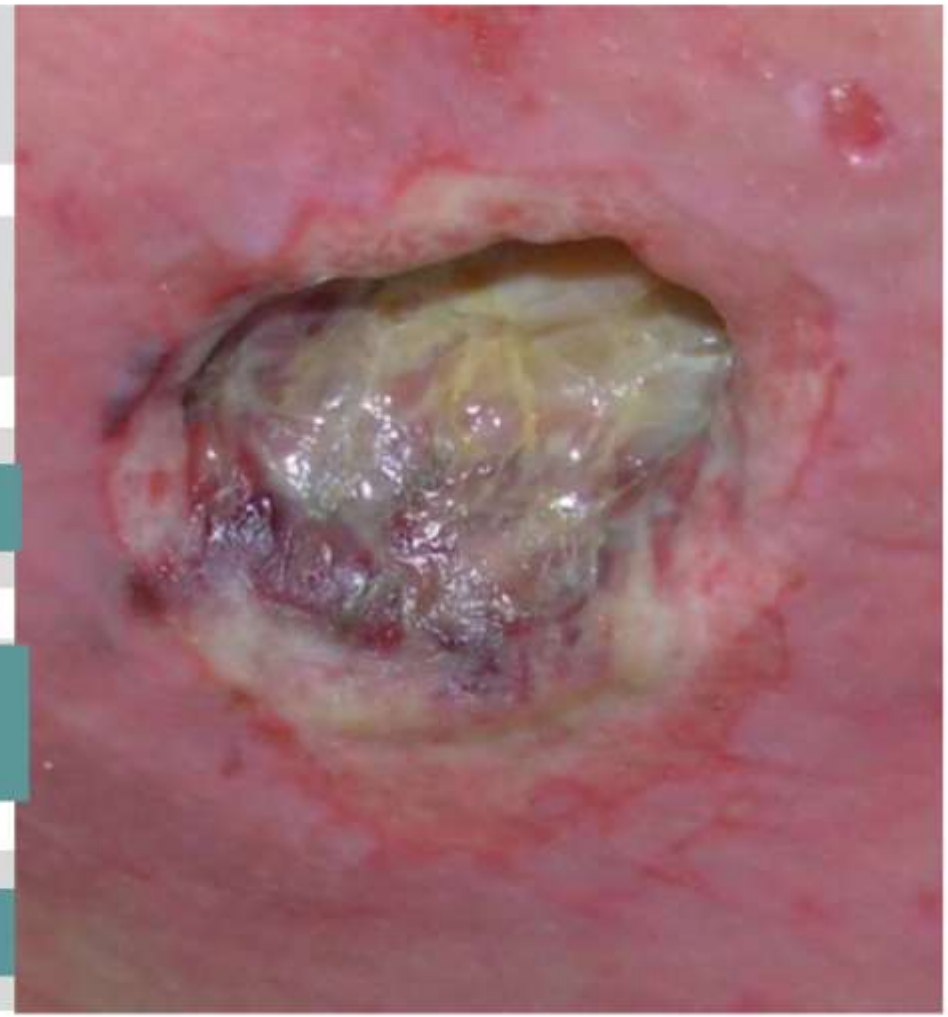
The M.O.I.S.T. Model

- **M** Moisture Balance
- **O** Oxygen Balance
- **I** Infection Control — Infected: Antimicrobial
- **S** Support Wound — Pressure/Shear Redistribution
- **T** Tissue Management — Necrotic: Debride



The M.O.I.S.T. Model

- **M** Moisture Balance — Moist: Keep Moist
- **O** Oxygen Balance
- **I** Infection Control
- **S** Support Wound — Pressure & Shear Redistribution
- **T** Tissue Management

The M.O.I.S.T. Model

M	Moisture Balance	High Exudate: Absorb
O	Oxygen Balance	
I	Infection Control	Infected: Antimicrobial
S	Support Wound	Edema: Compression
T	Tissue Management	Necrotic: Debride

The M.O.I.S.T. Model

- **M** Moisture Balance
- **O** Oxygen Balance — Ischemic: Oxygen Therapy
- **I** Infection Control — Infection: Antiseptic
- **S** Support Wound — ABI 0.4: Vascular Intervention
- **T** Tissue Management

The M.O.I.S.T. Model

- **M** Moisture Balance — Moist: Keep Moist
- **O** Oxygen Balance
- **I** Infection Control
- **S** Support Wound
- **T** Tissue Management

The M.O.I.S.T. Model

- **M** Moisture Balance
- **O** Oxygen Balance
- **I** Infection Control
- **S** Support Wound — Stagnant: NPWT
- **T** Tissue Management — Necrosis: Debride

MHC-2022-79912

Key Take-Aways

The M.O.I.S.T. Model:

- Clinical-decision making tool
- Guide product/intervention along the wound healing continuum
- Individualize care through bundled best practices

Wounds speak...Are you listening?

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Thank you!