

**INFECTION PREVENTION AND
CONTROL PRACTICES IN
RESIDENTS WITH CHRONIC
WOUNDS**

**PRESENTED BY: SARAH ROTAST
BSN, RN CWS**

PRESENTATION BY: PAMELA SCARBOROUGH
PT, DPT, MS, CDE, CWS, CEEAA
DIRECTOR OF PUBLIC POLICY & EDUCATION
AMERICAN MEDICAL TECHNOLOGIES



Speaker Contact Information for

Sarah Rotast

Sarah.Rotast@amtwoundcare.com



OBJECTIVES:

1. Discuss bioburden in chronic wounds (e.g. planktonic bacteria, biofilms).
2. Identify wound treatment considerations in the context of infection control practices (e.g. dressing changes, clean field).
3. Explain when and why antimicrobial interventions are a valid treatment choice rather than systemic antibiotics.
4. Determine best practice assessment parameters for identification of specific bacteria for antibiotic stewardship.



Welcome

Infection Prevention and Control Practices in Residents with Chronic Wounds

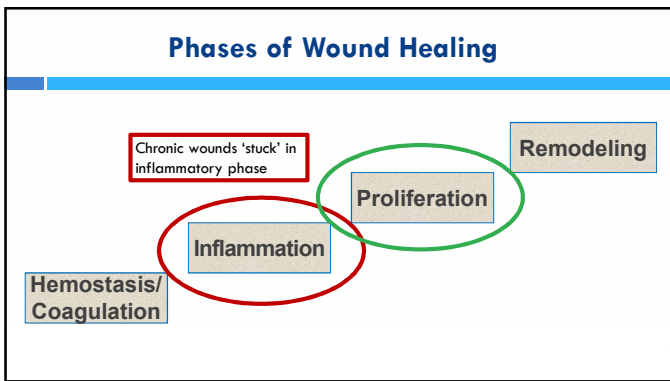
Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

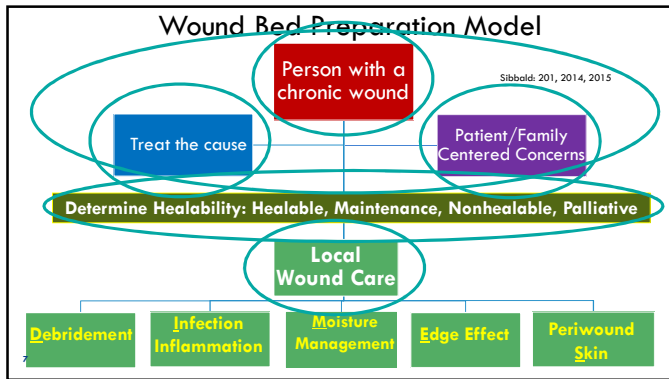
AMT Education Division

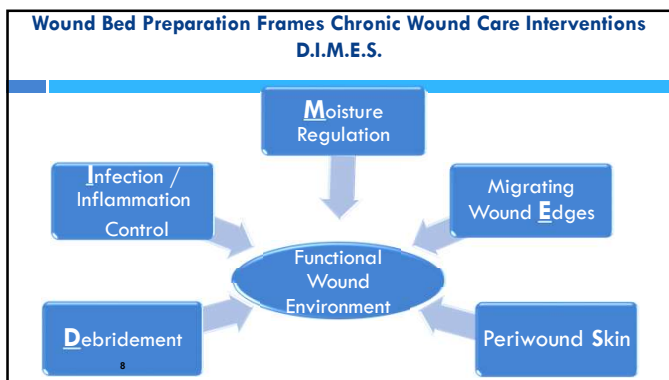
5 Wound Bed Preparation

All Chronic Wounds are Framed by the Treatment Processes Termed Wound Bed Preparation

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies. www.amtwoundcare.com







- ### Factors Contributing to Conversion to a Chronic Wound
- ▣ Increased bacterial load
 - ▣ Prolonged inflammatory processes (too many MMPs)
 - ▣ Excessive matrix metalloproteinases (MMPs)
 - Degrade growth factors
 - Degrade matrix proteins
 - Degrade cell surface structures (receptor sites)
 - ▣ Senescent cells
 - Non- or poorly responsive
- Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies. www.amtcare.com

MMPs made easy
Wounds International

Introduction
This article focuses on MMPs and the importance of their role in wound healing. It provides a comprehensive overview of the various types of MMPs and their functions in the wound healing process. The article is intended for healthcare professionals who are interested in understanding the molecular mechanisms of wound healing and how to optimize wound care.

What are MMPs?
MMPs are a group of enzymes that are involved in the breakdown of the extracellular matrix. They are produced by various cells in the body, including fibroblasts, macrophages, and neutrophils. MMPs are essential for many biological processes, including tissue remodeling, cell migration, and wound healing.

Why are they called MMPs?
The name MMP stands for Matrix Metalloproteinase. These enzymes are capable of breaking down all three major components of the extracellular matrix: collagen, elastin, and proteoglycans. This makes them powerful tools for tissue remodeling and repair.

Free download from Wounds International

D. Gibson, B. Cullen, R. Legerstee, K.G. Harding, G. Schultz. MMPs Made Easy. *Wounds International*, 1(1): 1-6, 2010.

Bacteria in Wound Bed and Chronic Inflammation

11

- Bacteria in wound often at greater levels than host's ability to control
- Produce proteases (eg matrix metalloproteinases [MMPs]) - destructive to new tissue
- MMPs being released from inflammatory cells that digest normal collagen scaffold in wound bed
- Bacteria and chronic inflammation damage cells needed for wound healing
- Interfere and delay chemical reactions needed for wound closure

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

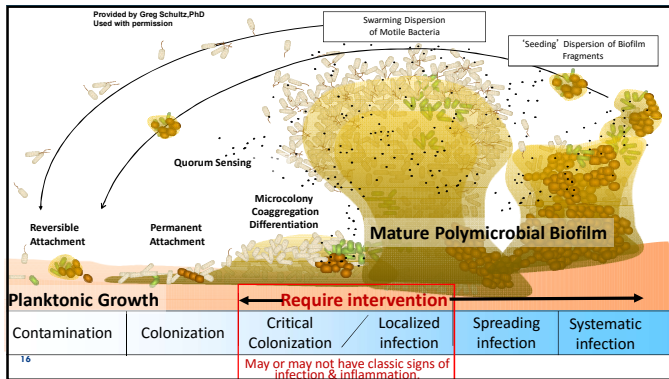
Bacteria and Biofilms

12

- Bacteria grow in 2 primary forms:
 - 1. Planktonic**
 - Free floating
 - Antibiotics destroy fairly easily
 - Most antibiotic testing is on planktonic
 - 2. Biofilms**
 - Complex communities of bacteria, yeast, fungi, virus (microbial cities)
 - Adhere to solid surfaces
 - Create and embed themselves in self-generated extracellular polysaccharide matrix

Planktonic Bacteria

Mature Biofilm



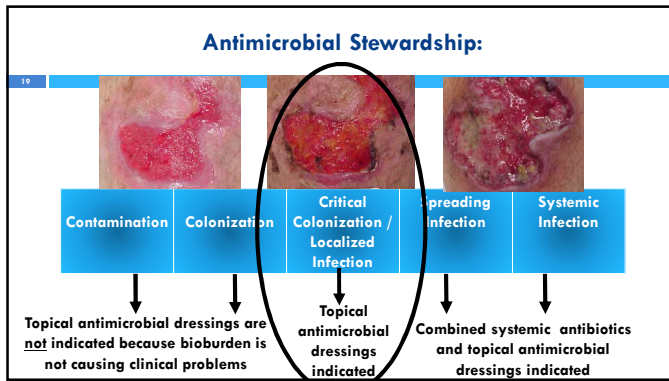
Signs of Critical Colonization

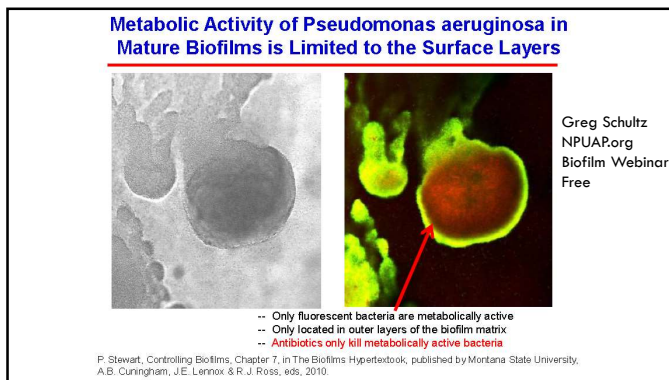
- Progression towards closure stalls
- Granulation tissue
 - Absent or abnormal
 - Color-red/purple
 - Friability
- Odor – subtle or dramatic change
- Increased/high exudate levels in presence of granulation tissue
 - Wounds attempt to “flush out” foreign particles, bacteria

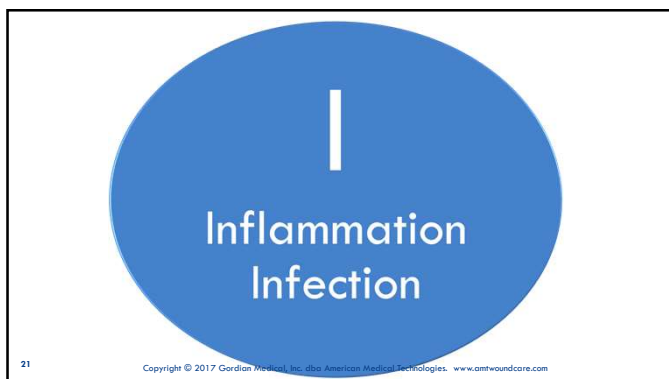
Bacteria Housed in Biofilm Difficult to Kill

- Bacteria live comfortably in dormant or semi-dormant state within biofilm
 - Antibiotics cannot penetrate biofilm
 - Antibiotics not effective against bacteria in dormant/semi-dormant state
 - After antibiotic use, where some bacteria may be killed on periphery of biofilm, dormant bacteria begin to proliferate more aggressively to rebuild and grow bacteria community
 - Bacterial biofilms break off and invade adjacent tissues, spreading the infection

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.







Infection Definition

- Invasion by and multiplication of pathogenic microorganisms in a bodily part or tissue, which may produce subsequent tissue injury and progress to overt disease through a variety of cellular or toxic mechanisms

http://medical-dictionary.thefreedictionary.com/infection. Accessed 4/26/2017

Types of Infection Disease

- Most infections caused by one of four types of organisms
- **Bacteria** – single-celled organisms that reproduce themselves, by themselves.
- **Virus** – microorganisms that cannot reproduce themselves; they take over the cells they infect in order to reproduce and spread.
- **Fungi** – look like plants, but live off of animals, people and plants (examples are mushrooms and yeast).
- **Protozoa** – small parasites that live in the water and live off of other organisms, such as humans (examples include malaria and giardia).

Infection: Clinical Picture

- Swelling
- Induration
- Erythema >3cm beyond wound edge
- Warmth
- Pain
- Odor



Amputation Great Toe
Signs and Symptoms of Infection

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Infected Wounds

25



Superficial pseudomonas infection



Deeply infected diabetic foot

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Cellulitis

- Common, potentially serious bacterial skin infection
- Dermis and subcutaneous tissues affected
- S&S erythema, edema, pain
- More commonly seen on feet and hands; can occur anywhere on body
- Most often has a pre-existing lesion or ulcer
- Break in the skin barrier and a portal of entry for infection



Cellulitis-Bacterial Load Diving Deep and Spreading Out into Soft Tissues



We must learn to control:

- 1. Bacterial load**
- 2. Excessive MMPs**

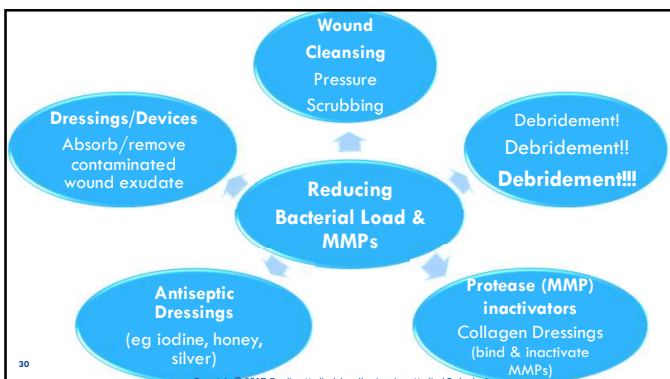
What to Do?

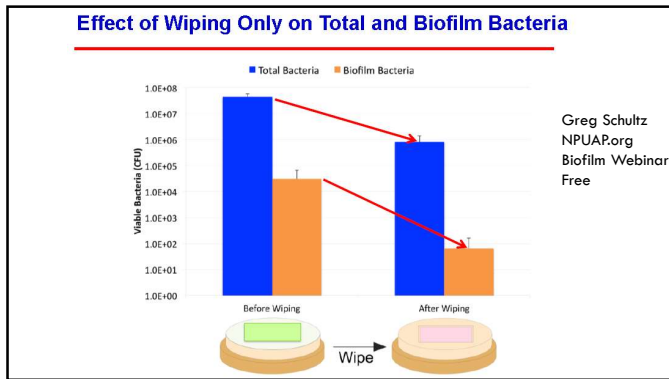
39

1. Stalled wound with excessive MMPs - treat persistent inflammation
2. Superficial local wound infection-topical antiseptics
3. Deep local wound infection – topical antiseptics, systemic antibiotics
4. Systemic infection-systemic antibiotics and local antiseptics

NOTE: Continue debridement and excellent local wound care

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.






How Quickly Can Planktonic Bacterial Reform Protective Biofilms After Wound Debridement?

3 days

Greg Schultz
NPUAP.org
Biofilm Webinar
Free


- ### Not Introducing Additional Microbes From Outside Environment
- Clean work area
 - Clean hands before and after **each task** during dressing changes
 - Clean/sterile gloves
 - Sterile instrument (ex. debridement)
 - Appropriate handling and disposal of soiled dressings, instruments, supplies
 - Appropriate isolation technique when highly infectious organism identified (PPE, private rooms, visitation control with education for family regarding isolation rules)
- Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

ASSESSMENT OF BACTERIAL BURDEN



Methods of Wound Culture




- Biopsy
- Levine's Swab Culture Technique




Lab assessing culture growth

Quantitative Tissue Biopsy

- Historically "gold standard" - at least best practice
- Painful (may need anesthetic)
- Skill Intensive
 - Unavailable in many settings
- Used more in research than clinical practice
- Greater than 10^5 (100,000) colony-forming units (CFU) per gram of tissue considered to be infected




3mm Punch Specimen



Know the lab's preference/requirements for transport of specimen

Improve Swab Technique

- ❑ Thoroughly cleanse wound surface with non-preserved saline/wound cleanser
- ❑ **Do not cleanse with antimicrobial wash-alters culture results**
- ❑ Don't swab:
 - ❑ Through dressing residue
 - ❑ Old exudate
 - ❑ Necrotic tissue
 - ❑ Blood
- ❑ i.e. SWAB **VIALE TISSUE ONLY!!!**
- ❑ Don't bother with dry surfaces
- ❑ **Place in carrier, transport ASAP**




Do **NOT** swab this stump in this uncleaned condition!!!

Photo Courtesy: Dot Weir, RN, CWON...

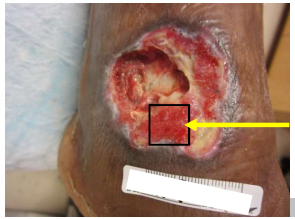
Levine's Technique

- ❑ Surface swab of a one cm² area of **healthy tissue** in the wound
- ❑ Press & roll swab into wound bed to obtain culture fluid
- ❑ Cultures and biopsies tell which drugs to use for which bacteria



Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Location, Location, Location....



Swab viable, clean tissue ONLY

Swab here after thorough cleansing

Photo Courtesy: Dot Weir, RN, CWON

Repeated Sharp/Surgical/Mechanical Debridement

- > Very few products penetrate biofilms
- > Critically important to perform adequate debridement to remove necrotic tissue and biofilm
- > Necrotic tissue feeds bacteria and contributes to biofilm formation
- > Sharp/surgical debridement and maggots remove biofilm
- > Have 3-day window to treat with antimicrobials before biofilm reforms

Polymerase Chain Reaction (PCR)

- Molecular technique targeting and amplifying bacterial DNA to allow them to be detected
- Relies on thermal cycling, repeated heating and cooling for DNA melting and then enzymatic replication of the DNA
- Requires only tiny sample, not necessary to "grow" cultures
- Sensitive specific can be done in a few hours
- Likely will begin to identify new patterns of bacteria species that correlate and predict poor wound healing.

Dowd SE, Wilson RD, Kennedy J, Jones C, Cox SE. Molecular diagnostics and personalized medicine in wound care: assessment of outcomes. J Wound Care. 2011;20(5):234-239.

43

Treating Chronic Wounds with Infections

It's ALL about the biofilm!!!

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

44

Mechanically Removing the Biofilm

- Debridement-sharp/surgical-BEST (not readily available in all care settings)
- Low frequency non-contact ultrasound-Q 3 days-BEST-penetrates biofilm
- Low frequency contact ultrasound-BEST-(not available in all care settings)
- Wipe daily + surfactant (surfactant + antibiotic)-GOOD – not readily available in LTC
- Maggot debridement therapy - BEST
- Autolytic-Poor- particularly in older population
- Enzymatic-Poor for removing biofilm-excellent for removing slough

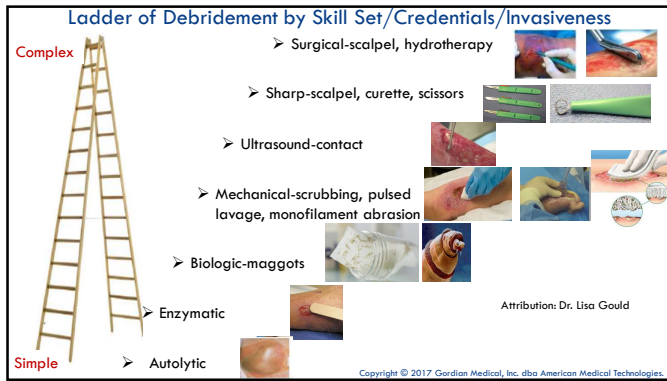
Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Larval Debridement Therapy

| Strain | Total bacterial | Autolytic | 1 day larval treatment | 2 day larval treatment |
|---------|-----------------|-----------|------------------------|------------------------|
| PA01 | ~1E+07 | ~1E+06 | ~1E+02 | ~1E+01 |
| SA35556 | ~1E+06 | ~1E+05 | ~1E+01 | ~1E+00 |

Greg Schultz
NPUAP.org
Biofilm Webinar
Free

L. Cowan, J. Steckmiller, P. Phillips, Q.P. Yang and G. Schultz. Chronic Wounds, Biofilms and Use of Medicinal Larvae. *Wounds*. Article ID 487024, 7 pages; <http://dx.doi.org/10.1159/0003987024>, 2013.



Nerds and Stones Mnemonic for treatment of bacterial burden

| NERDS (3 or more, treat topically) | STONEES (3 or more, treat systemically) |
|--|---|
| <ul style="list-style-type: none"> ❖ Nonhealing wounds ❖ Exudative wounds ❖ Red and bleeding wound surface granulation tissue ❖ Debris (yellow or black necrotic tissue) on the wound surface ❖ Smell or unpleasant odor from wound | <ul style="list-style-type: none"> ❖ Size is bigger ❖ Temperature of 3°- F or more versus mirror image ❖ Os (probe to or exposed bone) ❖ New or satellite areas of breakdown ❖ Exudate, erythema, edema increased ❖ Smell increased |

Sibbald, 2008, 2011, 2014

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Antibiotics

- Antibiotics or antibacterials - type of antimicrobial used against bacteria for bacterial infections
- Potential for resistance
- Overgrowth of non-target bacteria
- Cultures and tissue biopsy** help identify which bacteria growing to target specifically with antibiotics
- Must be used with deep tissue and systemic infections
- Topical versions available for local superficial infections

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

How to Treat Local Infections and Biofilms

- 49
- > Potential Treatment Interventions
 - > Vashe wound wash-good
 - > Cadexomer iodine-best
 - > Contact Low Frequency Ultrasound-best
 - > Non-contact low frequency ultrasound-best with iodine solution
 - > Pulsed Lavage with antimicrobial solution-good
 - > Sharp debridement-best
 - > Wound scrubbing-good NOTE...should be done frequently to prevent biofilm reforming
 - > CAUTION with new granulation or epithelial tissue
 - > Negative pressure with antimicrobial instillation-good
 - > Maggots-best

Adapted from
 Greg Schultz's-NPUAP Biofilm Webinar
 NPUAP.org

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Antibiotic Use



- 50
- General **overuse of antibiotics** has created super bugs which have mutated causing common antibiotics to become ineffective
 - Growth of resistant strains (MRSA, VRE)
 - Morbidity associated with overuse of antibiotics

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Topical Antimicrobials

- 51
- Include both antiseptics and antibiotics
 - Antibiotics should be used with caution
 - Culture/biopsy for specificity for growing organisms whenever possible
 - In the absence of advancing cellulitis, bacteremia fever or pain, **topical treatment** may provide best first-line therapy

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Modified Sodium Hypochlorite Hydrogel

- 52
- ❑ NOT Dakin's
- ❑ Dakin's cytotoxic to wound healing cells
- ❑ Broad-spectrum, safe & effective, topical antimicrobial
- ❑ Effective against antibiotic resistant strains CRE, MRSA & VRE, fungicidal, virucidal and sporicidal properties
- ❑ NOT harmful to wound cells needed for healing
- ❑ Formats:
 - ❑ Solution
 - ❑ Hydrogel
- ❑ Antibiofilm activity and actively penetrated through biofilm & killed microorganisms within biofilm



Hypochlorous Acid: An Ideal Wound Care Agent With Powerful Microbicidal, Antibiofilm, and Wound Healing Potency
 Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies. www.amtwoundcare.com

Dakin's Does NOT Penetrate Biofilm

- 53
- 60 minutes of exposure to Dakin's solution (bleach and water)
- Many bacteria in this biofilm dying (green cells)
- Many cells in interior of biofilm still alive (orange cells)
- Costerton, SciAm, 2001



Courtesy: Greg Schultz

Cadexomer Iodine

- 54
- ❑ Cadexomer starch as a carrier of 0.9% iodine
- ❑ 1 gram absorbs up to 6 ml of fluid
- ❑ Slow release of iodine during uptake of fluid
- ❑ No evidence of resistance
- ❑ **Penetrates biofilm-eliminates/kills 99.99999% of biofilm bacteria**
- ❑ Active against MRSA, *S. aureus*, *P. aeruginosa*, and other relevant pathogens
- ❑ Changed every 1-3 days



Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Silver

55




Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Antimicrobial Action of Ag⁺

56

- ❑ Broad spectrum of antimicrobial action
 - ❑ Gram Positives
 - ❑ Gram Negatives
 - ❑ Aerobes / Anaerobes
- ❑ Ag⁺ can kill antibiotic- resistant bacteria
 - ❑ MRSA, VRE
- ❑ Effective against fungi
- ❑ Anti-inflammatory
 - ❑ Loss of rubor/redness
- ❑ Has an effect on biofilms...different silver dressings have different biofilm interruption outcomes due to type of silver species and base materials comprising dressings

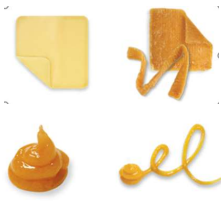


Impact of Silver-Containing Wound Dressings on Bacterial Biofilm Viability and Susceptibility to Antibiotics during Prolonged Treatment. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2981228/> Accessed 4/26/17

Medical Grade Honey

57

- ❑ Specific plants from New Zealand, Australia
- ❑ From Manuka plant – Tea Tree
- ❑ Studies show honey from New Zealand and Australia most effective in penetrating biofilms
- ❑ Grocery store honey ineffective...more like using high fructose corn syrup



Merckoll P¹, Jonassen TG, Vad ME, Jeansson SI, Melby KK. Bacteria, biofilm and honey: a study of the effects of honey on 'planktonic' and biofilm-embedded chronic wound bacteria. *Scand J Infect Dis.* 2009;41(5):341-7

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Question: What effects do microbicidal wound dressings have on mature biofilms grown on pig skin explants?

Answer: Most microbicidal wound dressings can reduce mature biofilms by 1-log (90%) to 2-logs (99%) except cadexomer iodine dressing that eliminated 7-logs (99.99999%) of biofilm bacteria

Greg Schultz
NPUA.org
Biofilm Webinar
Free

59

CMS Infection Control Pilot

Wound Management Tracer

Important you use this document to help you get ready for survey around wounds in 2018.

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

This complete document is provided as a download.

Wound Management Tracer-Surveyor Checklist-1

60

- Hand hygiene is performed before a wound procedure.
- Gloves are worn during the dressing procedure.
- A gown is worn if healthcare personnel contamination is anticipated during the dressing procedure (e.g. excessively draining wounds).
- Reusable dressing care equipment (e.g., bandage scissors) must be cleaned and reprocessed (i.e., disinfected or sterilized according to manufacturer's instructions) if shared between residents.
- Refer to current CDC guidelines
 - CDC Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008
 - https://www.cdc.gov/hicpac/Disinfection_Sterilization/6_Disinfection.html

Wound Management Tracer-Surveyor Checklist-2

- 61 Clean wound dressing supplies are handled in a way to prevent cross contamination between residents (e.g. wound care supply cart remains outside of resident care areas; unused supplies are discarded or remain dedicated to resident).
- Dressing change conducted per physician/practitioner orders.
- Multi-dose wound care medications (e.g., ointments, creams) should be dedicated to one resident whenever possible.
- NOTE: If multi-dose wound care medications (e.g., ointments, creams) are used for more than one resident, then the medications should be stored in a central medication area and should not enter the resident treatment area. For example, a small aliquot of medication should be dispensed into a clean container for single-resident use.**

Wound Management Tracer-Surveyor Checklist-3

- 62 Wound care documentation in resident's medical record reflects the condition of the wound and includes the following:
 - a. Type of dressing
 - b. Frequency of dressing change
 - c. Wound description (e.g., measurement, characteristics)
- NOTE: F314 has many more parameters listed for complete wound care documentation. **Take your guidance from F314.**
- Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

Summary

- It's all about the biofilms**
- Present in >80% chronic wounds
- Impair healing
- Stimulate ongoing chronic inflammation causing elevated levels of MMPs that degrade proteins and cells receptors essential for healing
- Complex communities of microbes encased in self-produced polysacchride matrix with high tolerance of innate antibodies, antibiotics, and antiseptics
- Topical dressings do not reduce biofilm-except sustained release cadexomer iodine dressings-penetrates and kills biofilm

References

64

- Sibbald G, Woo KY, Ayello E. Wound bed preparation: DIM before DIME. *Wound Healing Southern Africa*. 2008, 1:29-34.
- Sibbald GR, Goodman L, Krasner DL, Smart H, et al. Special Considerations in Wound Bed Preparation 2011: An Update. *Advances in Skin & Wound Care* 2011; 24: 415-36.
- Sibbald RG, Ovington LG, Ayello EA, Goodman L, Elliott, JA. Wound bed preparation 2014 update: Management of critical colonization with gentian violet and methylene blue absorbent antibacterial dressing and elevated levels of matrix metalloproteases with an ovine collagen extracellular matrix dressing. *Advances in Skin & Wound Care*; 2014 Mar;27(3 Suppl 1): 1-6.

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.

References

65

De la Torre, J. Chronic Wounds. (2015) Available at:
<http://emedicine.medscape.com/article/1298452-overview#a3>

Tatum OL, Dowd SE. Wound Healing Finally Enters the Age of Molecular Diagnostic Medicine. *Advances in Wound Care*. 2012;1(3):115-119.
 doi:10.1089/wound.2011.0303.

- NPUAP.org
 - Battling Biofilms: Winning the War Against Pressure Injuries
 - November 17, 2016
 - Presenter: Gregory Schultz, PhD

Copyright © 2017 Gordian Medical, Inc. dba American Medical Technologies.
