The role of wound cleansing in the management of wounds

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Faculty

Speaker
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Moderator
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Agenda For Today

This 30-minute presentation will feature learning opportunities that will provide in-depth instruction and demonstration in wound care treatments. After this webinar, the learner will be able to:

- Identify the role of proper wound cleansing
- Discuss how to select and use non-toxic wound cleansers
- Describe advantages of collagen for managing a chronic wound

Objectives

At the end of this webinar, the learner will be able to:

- **Identify the role of proper wound cleansing**
- **Discuss how to select and use non-toxic wound cleansers**

A) The wound microenviroment

B) Is your wound cleansing practice up to date?

- Cleansing and its role
- Basic Cleansing Techniques
- When not to clean a wound

C) The ideal wound cleanser

D) The use of hypochlorous acid as a wound cleanser

E) Clinical Case studies

THE WOUND MICROENVIRONMENT

Wound microenvironment of chronic wounds represents a major therapeutic challenge[1]

The most relevant factors that influence the **healing process** are:

BACTERIA

Chronic wound provides an ideal environment for bacterial growth. Bacterial infection is one of the most prevalent causes for poor wound healing.

PROTEASES

Proteases (e.g. MMPs and elastase) play a key role in wound healing but excessive expression can lead to prolonged inflammation and delayed wound healing.[2]

BIOFILM

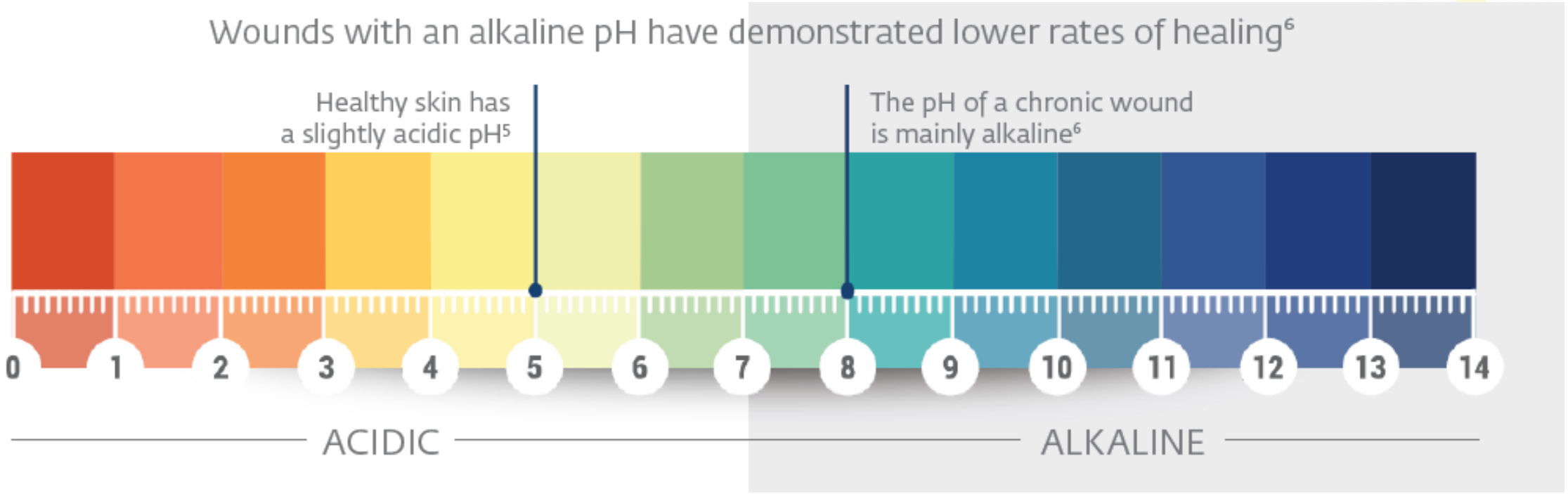
Bacterial biofilm plays an important role in maintaining a prolonged inflammation that ultimately can lead to the failure of wound healing.[3]

OXYGEN

In chronic wounds there is a substantial imbalance between the supply of oxygen and the high- engergy demand of the healing tissue. Inadequate oxygenation can slow down the wound healing process.[4]

(1) Kruse CR et al (2015): *Wound Repair and Regeneration 23(4): 456–464* - **(2)** Caley MP et al (2015): *Advances in Wound Care 4(4): 225-234*
(3) Watters C et al (2015): *Chronic Wound Care Management and Research 2: 53–62* - **(4)** Castilla DM et al (2012): *Advances in Wound Care 1(6): 225-230*

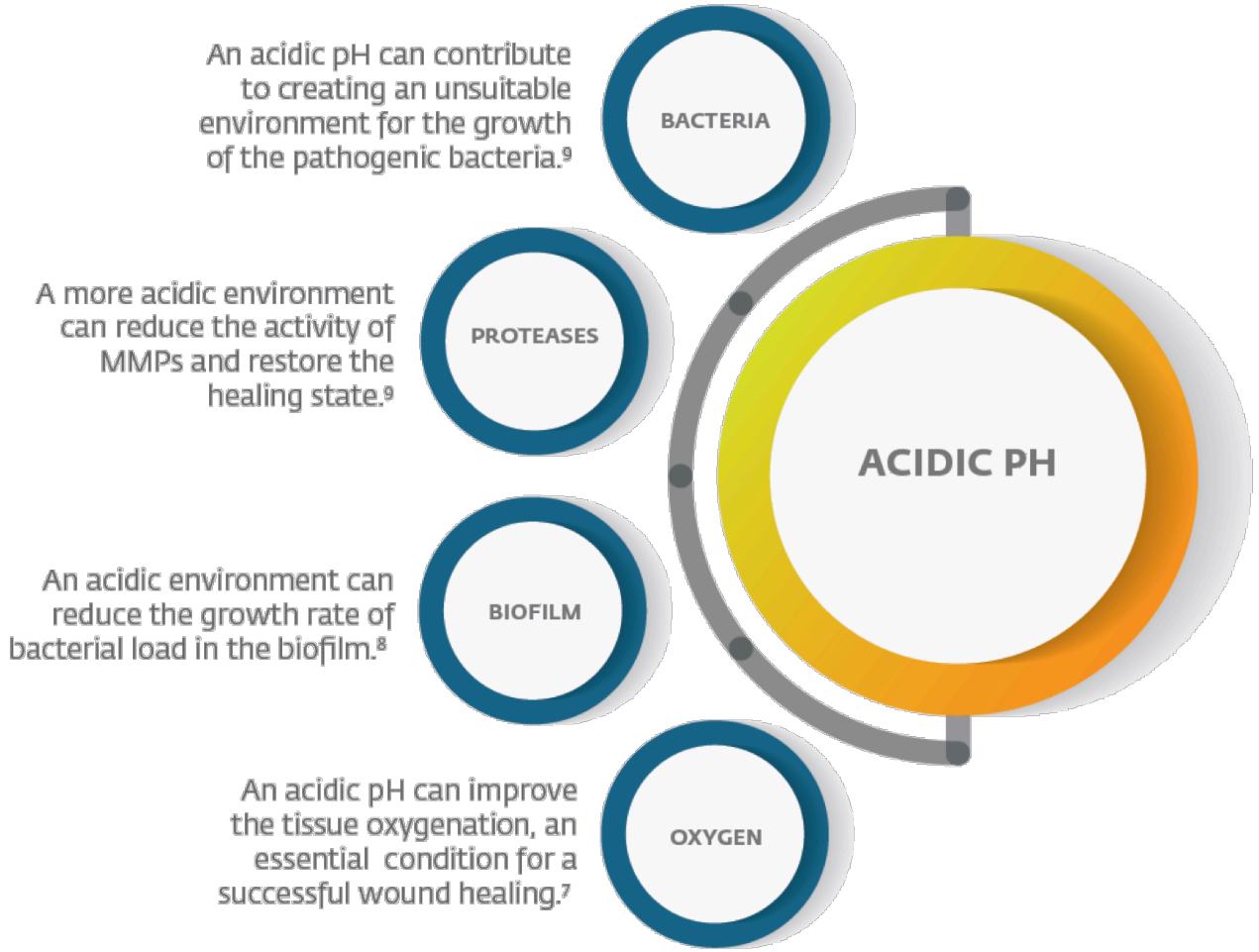
The importance of pH in wound healing



(5) Lambers H et al (2006): *J Cosmet Sci 2006; 28: 359–370* – **(6)** Gethin G (2007): *Wounds UK, 2007:3/3*

The importance of acidic pH

"An **acidic environment** in a wound bed is an additional benefit that can contribute to **reboot the wound** towards healing"



(7) Greener B et al (2005*): J Wound Care 14(2): 59–61* – **(8)** Hostacka´ A et al (2010): *Folia Microbiol. 55 (1): 75–78* - **(9)** Basavraj S et al (2015): *Wounds 27(1):5-11*

IS YOUR WOUND CLEANSING PRACTICE UP TO DATE?

Is your wound cleansing practice up to date?

"Cleansing and its role"

> Wound cleansing is performed to remove surface contaminants, **bacteria**, **non-viable tissue** and excess **exudate** from the wound bed and surrounding skin [10]

> **Wound cleansing** can be an effective way to **remove inflammatory stimulants** and **local barriers from the wound bed**[10]

An **ideal wound cleanser** should **modulate the wound microenvironment** balancing the management of key components with **preservation of tissue safety**[11]

(10) McLain N and Moore Z (2015): *Cochrane Database of Systematic Review, 4 (CD01167)* - **(11)** Main RC (2008): *J Wound Care 17(3): 112-114*

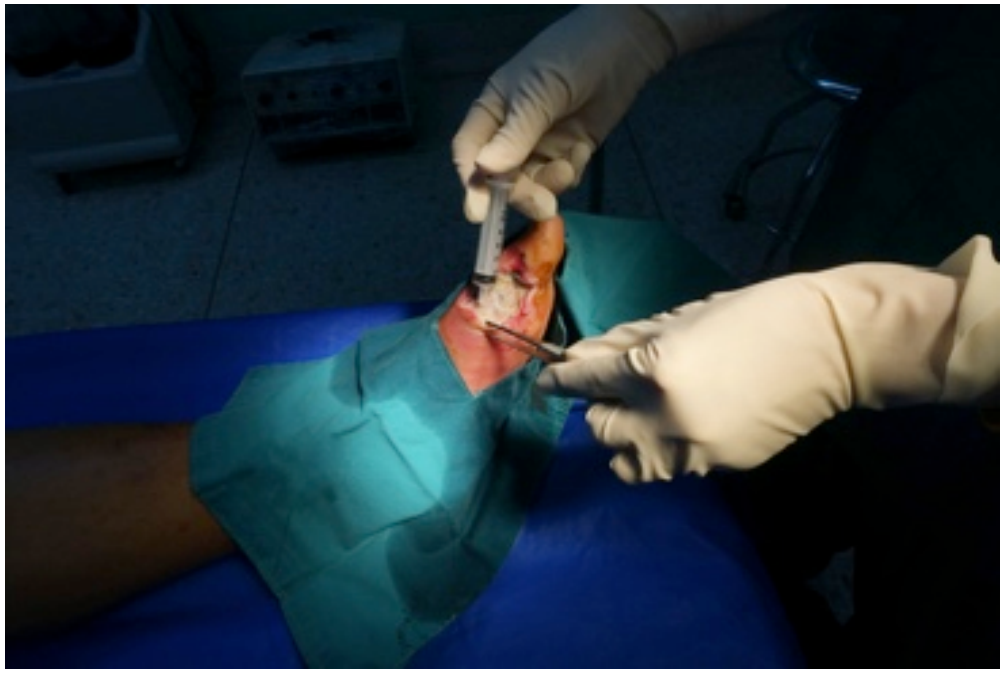
Is your wound cleansing practice up to date?

“Basing cleansing techniques”

Swabbing

(use items that don’t leave debris in wound bed)

Irrigation



Is your wound cleansing practice up to date?

“When not to clean a wound ”

Dry gangrenous wounds
(want to keep dry)

Fragile granulation tissue
(may be traumatic)

THE IDEAL WOUND CLEANSER

The ideal wound cleanser

When you ask your patient
about their basic wound care at home….
what is the usual (and unfortunate) answer?

The ideal wound cleanser

"Antiseptic"

- Research has shown that **antiseptics** have a **negative impact on healing wounds** (Atiyeh, et.al. Int Wound J. 2009)
- Antiseptic categories include **alcohols**, **iodine**, **Chlorhexidine Gluconate** (CHG), **silver**, **hydrogen peroxide**
- Antiseptics can be used in the right situations, and durations

The ideal wound cleanser

There are **several broad categories** of solutions that can be used:

> Wound cleansing can help to achieve the goals of **wound bed preparation** by removing microorganism, biological and enviromental debris[12]

HYPOCHLOROUS ACID

Hypochlorous acid is produced by the body's immune cells in response to invading pathogens. When used as wound cleanser ingredient, it acts as a preservative by **inhibiting the growth of microorganisms** within the solution[12]

SALINE SOLUTION

Saline solution does not generally contain a preservative, so bacterial growth can occur once exposed to opportunistic microorganisms[12]

SODIUM HYPOCHLORITE

Sodium hypochlorite is familiar to HCPs as Dakin's solution (0.5% sodium hypochlorite). Dakin's solution can be **injurious to the wound tissue** and **can slow down wound healing**[12]

(12) Wolcott R et al (2014): *Wounds International (3): 25-31*

The ideal wound cleanser

The characteristics of an ideal wound cleanser

- The ideal wound cleanser should be **non-cytotoxic** to tissue

- The ideal wound cleanser should **decrease colonization of the wound bed**

- The ideal wound cleanser should be **cost-effective** and **stable**

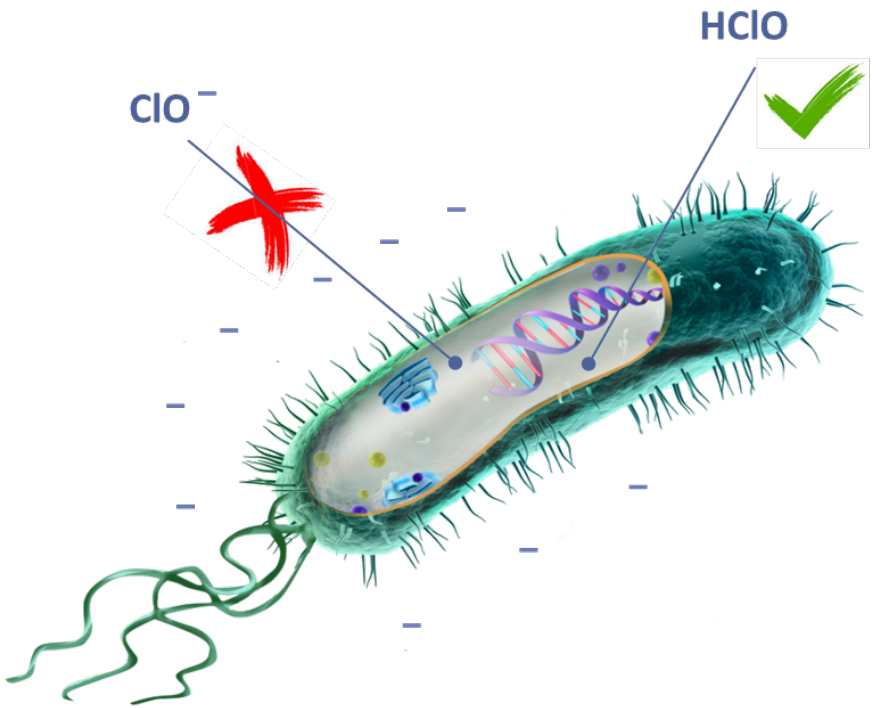
- The ideal wound cleanser should **not be an alkaline pH**

THE USE OF HYPOCHLOROUS ACID AS A WOUND CLEANSER

The use of hypochlorous acid as a wound cleanser

Hypochlorous acid is one of the major inorganic bactericidal compound
of **innate immunity** and it is **effective against a broad range of microorganisms**

Although they look similar, **hypochlorous acid** and **sodium hypochlorite** are still **very different**



The cell wall of pathogens is **negatively charged**

⇩

HClO can easily penetrate the cell wall and destroy the pathogens from the inner of the cell.

ClO^-/sodium hypochlorite can not easily penetrate the wall of pathogens

⇩

At the same concentration, the biocidal activity of
HClO is 80 times stronger than ClO^-

The use of hypochlorous acid as a wound cleanser

	HYPOCHLOROUS ACID HClO	SODIUM HYPOCHLORITE NaClO
SAFETY	✓ HClO is **naturally** found in our body[13]	✗ NaClO can be **injurious to the wound**[15]
	✓ It is produced by the **immune cells** (white blood cells) in response to invading pathogens[13]	✗ NaClO can be **cytotoxic**[15]
		✗ NaClO can **slow down wound healing**[15]
EFFICACY	✓ HClO is **80 times stronger** than NaClO[14]	✗ NaClO **does not easily penetrates** the bacteria[14]
pH	✓ **Acidic pH**	✗ **Alkaline pH**

(13) Armstrong DC et al (2015): *Ostomy Wound Manage 61(5):S2-S19* - **(14)** Rossi-Fedele G (2011): *J Int. Endod. J 44: 792-799* – **(15)** Hildago E et al (2002): *Chemico-Biological Interactions 139: 265-282*

CLINICAL CASE STUDIES: LEG ULCERS

Clinical cases (1/3)

- AGE, SEX: 48, male
- WOUND ONSET: 15 years before treatment with a **wound cleanser containing hypochlorous acid**
- COMORBIDITY: severe
  - Essential hypertension
  - Lymphoma: in 1999
  - Epilepsy
  - Valvular heart disease
  - Osteomyelitis of the knee in 2010
- CASE HISTORY BEFORE NEXODYN:
  - Traffic accident with left lower limb severe injury. Subsequent alteration of vascular architecture with the appearance of a large ulcer on the lower third of the left leg after chemotherapy, due to a car accident about 15 years ago
  - Large ulcer on the left leg (lower 1/3) treated with cycles of hyperbaric oxygen therapy. Since then, the lesion has never come to resolution.
  - From November 2011 to June 2013, the patient underwent 4 surgeries with engineered graft and skin graft without any benefit, with the exception of wound depth, becoming superficial.

Clinical cases (1/3)

Large ulcer on the left leg (lower 1/3)

From T0
to ≈ 10 months after

Time (days)	Tissues	Exudate	Depth	Area (cm^2)	VAS (pain)
0	Colonized	Hyperexudating	Superficial	250	7
12	Colonized	Average	Superficial	250	6
42 (≈1.5 m)	Cleansed	Controlled	Superficial	215	4
183 (≈6 m)	Re-epithelising	Controlled	Superficial	184	2
302 (≈10 m)	Re-epithelising	Controlled	Superficial	135	2
Result	**Improved**	**Improved**	**Unchanged**	**-46.0%**	**-71.4%**

Clinical cases (2/3)

- AGE: 31
- SEX: male
- WOUND ONSET: 2 years before treatment with a **wound cleanser containing hypochlorous acid**
- COMORBIDITY: severe
  - Young refractory severe obesity; sleeve gastrectomy in 2010 (pre-surgery weight 227 kg; 148 kg in 2011)
  - Psoriatic arthritis
  - Very large peripheral and lower edemas on a lymphostatic basis
- CASE HISTORY:
  - Stasis ulcer that does not tolerate the bandage
  - DE grafting with improvement on 06/2013
  - Very low compliance
  - Constant infections

Clinical cases (2/3)

Stasis ulcer that does not tolerate the bandage

From T0
to ≈ 9.5 months after

Time (days)	Tissues	Exudate	Depth	Area	VAS (pain)
0	Infected	Hyperexudating	Deep	300	8
22	Cleansed	Average	Superficial	250	5
155 (≈5 m)	Cleansed	Average	Superficial	180	2
236 (≈7.5 m)	Cleansed	Hyperexudating	Superficial	150	2
295 (≈9.5 m)	Cleansed	Poor	Superficial	118	2
Result	**Improved**	**Improved**	**Improved**	**-60.66%**	**-75%**

Clinical cases (3/3)

- AGE: 83
- SEX: male
- WOUND ONSET: 2.5 years before treatment with a **wound cleanser containing hypochlorous acid**
- COMORBIDITY: severe
  - Benign prostatic hyperplasia with previous TURP (Transurethral resection of the prostate)
  - Hypertension
  - Post-thrombotic syndrome on the right leg
  - Lipotimic episodes
  - Paroxysmal atrial fibrillation
  - Chronic carential anaemia
- CASE HISTORY:
  - April 2012: hospitalization with a diagnosis of bilateral ulcers of the lower limbs by pyoderma gangrenosus and polimicromic super-infection, with severe sepsis, eurhythmic paroxysmal atrial fibrillation by wandering pacemaker at heparin in coagulant dosage, mild heart failure, anasarcatic condition in severe protein-caloric malnutrition, psychomotor agitation with delirium perhaps iatrogenic in nature (carbapenem and opiates), suspected sleep apnea syndrome.
  - April 2013: new hospitalization for re-grafting

Clinical cases (3/3)

Bilateral ulcers of the lower limbs

From T0
to ≈ 9 months after

Time (days)	Tissues	Exudate	Depth	Area (cm^2)	VAS (pain)
-455 (≈15 m)	Slough	Hyperexudating	Superficial	160	6
-70 (≈2 m)	Slough	Hyperexudating	Superficial	140	6
0	Slough	Hyperexudating	Superficial	120	5
Result	**Unchanged**	**Unchanged**	**Unchanged**	**-25%**	**-17%**
START OF TREATMENT WITH NEXODYN					
0	Slough	Hyperexudating	Superficial	120	5
190 (≈6 m)	Slough	Average	Superficial	70	2
275 (≈9 m)	Slough	Poor	Superficial	38	1
Result	**Improved**	**Improved**	**Unchanged**	**-68.33%**	**-80%**

Thank you to Angelini for sponsoring this webinar

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We will take a few minutes to review……

NEXODYN
Nexodyn™ Antimicrobial Wound Care Solution

Product features

NEXODYN® can support **the physiological healing process**

NEXODYN® is a FDA-cleared **hypochlorous acid-based wound cleanser**, developed for topical treatment in the field of **acute** and **chronic wound management**

MAIN PRODUCT FEATURES

- ✓ **Acidic pH (2.5 – 3.0)**
- ✓ **High purity** (>95% of free chlorine species derived from **HClO**)
- ✓ **Free Chlorine species: 40-70 ppm**
- ✓ Long stability: 30 days from first opening

The mechanical action of the fluid flowing across the lesion can help to **remove biologic** and **inert materials** such as **microorganisms**, **biological debris** and **environmental dirt**

NEXODYN
Nexodyn™ Antimicrobial Wound Care Solution

Bacterial activity tests

The **antimicrobial** preservative effectiveness of HClO has been demonstrated against the **organisms** in the table below in *in vitro* testing (Time Kill Assay):

Pathogenic Bacteria	Log Reduction / Exposure Time
Staphylococcus aureus	**99.9992%** (5.11 Log_{10}) after 15 sec
Staphylococcus pyogenes	**99.9958%** (4.38 Log_{10}) after 15 sec
Staphylococcus epidermidis	**99.9499%** (3.30 Log_{10}) after 15 sec
Pseudomonas aeruginosa	**>99.9999%** (> 6.11 Log_{10}) after 15 sec
Escherichia coli	**>99.999%** (> 5.55 Log_{10}) after 15 sec
Multi-drug resistant (MDR) Staphylococcus aureus	**>99.999%** (> 5.44 Log_{10}) after 15 sec
Extended-spectrum beta-lactamase (ESBL) producing Enterobacteriaciae	**>99.9999%** (> 6.23 Log_{10}) after 15 sec
Vancomycin intermediate resistant Staphylococcus aureus (VISA)	**>99.999%** (>5.84 Log_{10}) after 15 sec
Multi-drug resistant (MDR) and OXA-48 producing Klebsiella pneumoniae	**>99.999%** (> 5.32 Log_{10}) after 15 sec
Extended-spectrum beta-lactamase (ESBL) producing Proteus mirabilis	**>99.999%** (>5.99 Log_{10}) after 15 sec
Multi-drug resistant (MDR) Escherichia coli	**>99.999%** (>5.92 Log_{10}) after 15 sec
Candida albicans	**>99.999%** (>5.01 Log_{10}) after 15 sec

How to use NEXODYN®

Applying NEXODYN® on wounds is **fast** and **simple**

Contraindications: Do not use in case of hypersensitivity to any component of the product (hypochlorous acid, chlorine and hypochlorite ion)

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References

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QUESTION?