

## Introduction

Wound hygiene is a protocol of care that encourages a proactive and systematic approach to facilitate healing of chronic wounds, through consistent and repetitive cleansing and decontamination (Murphy et al, 2020). Referred to as the management of a wound to optimise healing, wound bed preparation (WBP) is a framework for assessment, diagnosis and treatment of wounds that can be implemented in combination with wound hygiene (Sibbald et al, 2011; Murphy et al, 2021; Shamsian, 2021). It is increasingly acknowledged that a back-to-basics approach is needed, including hand hygiene and decontamination, to protect the wound against persistent inflammation, infection and delayed healing (Wounds UK, 2020). Hydrocyn Aqua® (Bactiguard) is a versatile antimicrobial product range that is available as a solution and gel, and targets a broad range of microorganisms, reduces biofilm and improves wound healing.

### Focus on cleansing and debridement

With the objective of reducing microbial load, following a thorough holistic assessment, wound hygiene is initiated at the first referral and should be performed at every dressing change to kickstart the healing process and remove bacteria, biofilm, exudate, foreign debris and unhealthy/devitalised tissue (Wolcott and Fletcher, 2014; Murphy et al, 2022). The concept of wound hygiene has been described as a 4-step regimen, involving cleansing of both the wound and periwound skin, debridement to remove necrotic tissue, slough, debris and biofilm, refashioning of the wound edge to facilitate epithelial advancement, and application of dressings containing antibiofilm and/or antimicrobial agents (Murphy et al, 2020).

Wound cleansing is an integral part of wound care and refers to the active removal of devitalised tissues, wound debris and contaminants that are loosely adhered to the wound bed's surface. Goals of wound cleansing can be achieved using cleansing pads that are commercially available, antiseptic or antimicrobial wash, surfactant, medical skin cleansing wipes or forceps. While force should be applied gently, wound cleansing solution should be delivered with adequate vigour to disrupt surface debris without encouraging movement of bacteria into tissues.

Wound bed preparation (WBP) is a multifaceted approach involving cleansing and debriding to prepare the wound for healing and enhance effectiveness of therapeutic measures, including topical antimicrobials and other dressing types (Falanga, 2000; Schultz et al, 2003; Wounds UK, 2021). WBP involves creating an optimal wound healing environment by producing a well-vascularised stable wound bed to reduce bacterial load, decrease level of wound exudate and increase formation of healthy granulation tissue.

The dynamic and rapidly evolving concept of WBP was initially recognised by Schultz et al (2003), with Atkin et al (2019) developing the original TIME concept to TIMERS, comprising the six components that underpin WBP (Tissue, Inflammation/Infection, Moisture balance, Edge of wound/ Epithelisation, Repair and Regeneration, Social factors). The WBP model is reliant on effective, accurate and timely assessment to help clinicians identify patients with chronic wounds quickly, rather than failing to address problems and causing wounds to worsen for prolonged periods without treatment.

Delayed wound healing can be exacerbated by clinicians through poorly informed decisions regarding treatment and failure to identify signs of a complication, and/or seek timely advice (Nagle et al, 2022). These delays can have detrimental effects on an individual's quality of life and healthcare costs. Therefore, it is evident that a proactive and evidence-based approach is needed, to minimise the risk of wound complications and improve patient outcomes, through accurate and timely assessment and reassessment that includes determining the type/cause of the wound and identifying factors that may delay healing or increase risk of future wounds – e.g. infection, biofilm and further complications (Wounds UK, 2018).

### Importance of a biofilm-based intervention

Biofilms are aggregated and complex communities of slow-growing microorganisms that develop on or near wound surfaces and have high levels of intolerance to antibodies, antibiotics, disinfectants and phagocytic inflammatory cells (Kirketerp-Møller et al, 2020; Wounds UK, 2021). The role of biofilm in preventing, delaying and stalling wound healing is now widely accepted (Murphy et al, 2022). It has been estimated that biofilms are present in around 80% of chronic wounds, and there is increasing evidence to suggest that the majority of, if not all, chronic wounds have a biofilm associated with them (Malone et al, 2017). To avoid biofilm, wounds are often treated

with antiseptics; however, these can cause irritation and toxicity. A study by Ortega-Pena et al (2017) found that the effectiveness of a range of available antiseptics was associated with cytotoxicity; however, hypochlorous acid (HOCl) was found to prevent early biofilm formation without being cytotoxic to fibroblasts.

The prevalence of multi-drug resistant bacteria is escalating, and chronic wound patients receive significantly more antibiotics (both systemic and topical) than any other patient group (Tzaneva et al, 2016; World Health Organization [WHO], 2020). Therefore, action needs to be taken to promote routine cleansing of wounds and establish early biofilm-based interventions as the optimal wound care strategy to help reduce bioburden, minimise overuse and misuse of antibiotics, improve patient outcomes and create cost savings for healthcare systems (Atkin et al, 2018; Edwards-Jones and Spruce, 2019; Murphy et al, 2020).

### Selecting the appropriate wound cleansing solution

Essentially, wound cleansing helps achieve goals of WBP by creating optimal conditions for wound healing. Selection of a wound care product should reflect the treatment requirements as identified following a thorough assessment of the patient and their wound. Choice should ultimately be influenced by the wound type, any underlying condition, comorbidities, personal circumstances, and preferences and expectations of both the patient and clinician.

The ideal antimicrobial agent sustains release at concentrations that are sufficiently low to minimise toxicity but still able to destroy or inhibit microorganism growth (International Wound Infection Institute [IWII], 2022). Topical antimicrobial agents or wound dressings are not required where there are no signs and symptoms of infection; therefore, an in-depth wound assessment should be conducted to identify if a wound is infected, whether locally or systemically, and antimicrobials should only be used in these wounds (Roberts et al, 2017). The ideal antimicrobial agent has not been established conclusively, and selection of a solution is based on a number of factors (Box 1).

It should be stressed that engaging in judicious use of antibiotics in wound care will contribute significantly to a reduction in antimicrobial resistance (AMR). Moreover, alignment of wound infection prevention with the goals and principles of antimicrobial stewardship (AMS) is essential to address the growing burden of AMR.

#### Box 1. Factors to be considered in selection of an ideal antimicrobial agent (IWII, 2022; Kramer et al, 2018; Kramer, 2020)

- Assessment of the wound (e.g. aetiology, anatomical location and visible structures)
- The person's risk of wound infection
- Signs and symptoms indicative of local wound infection or spreading infection
- Colonisation with multi-drug resistant organisms
- Efficacy and organism sensitivities of solution
- Goals of care
- Local policies and resources

### Introducing Hydrocyn Aqua®

Hydrocyn Aqua® is a non-toxic and environmentally friendly wound care product range that is available as a wound wash, debridement agent and cleansing solution for several tissue and wound types. Its active component is HOCl, which is non-toxic, when used in low concentrations, and exhibits potent and rapid antimicrobial activity to accelerate wound healing (Wolcott and Fletcher, 2014).

As HOCl is naturally occurring and is produced by the body's own neutrophils, Hydrocyn Aqua® mimics the immune system to kill bacteria, fungi and viruses (Box 2). Its antimicrobial effect is rapid, and a close to 100% reduction in the number of microbial species is observed within 60 seconds (Bactiguard, 2023a). Sakarya et al (2014) concluded that in comparison to iodine, HOCl had favourable effects on fibroblast and keratinocyte migration, and that HOCl is therefore an ideal wound care agent for improved wound healing.

#### Box 2. How HOCl-containing Hydrocyn Aqua® mimics the immune system (Sakarya et al, 2014; Bongiovanni, 2016; Kiamco et al, 2019)

- Facilitates biofilm degradation, fibroblast activation and keratinocyte migration
- Elicits its effects through hypertonicity and liquid peroxidation
- Inhibits protein and DNA synthesis
- Promotes DNA breakage and impairs ATP production
- Improves oxygen perfusion to the wound.

### The Hydrocyn Aqua® range

The Hydrocyn Aqua® product range is made up of various solutions, gels and sprays that, when used in combination, provide the ideal product for effective wound healing (Figure 1):

- **Hydrocyn Aqua® solution:** A solution that is indicated as a debridement agent and cleanses the wound, to remove bacteria and biofilm (Nair et al, 2019) and accelerate wound



**Figure 1: Hydrocyn Aqua® product range**

Table 1a: Hydrocyn Aqua® solution		
Product Code Hydrocyn Aqua®	Type	Volume
<b>Solution</b>		
HW3CE700	Spray	100 ml
HW34E100	Bottle Cap Closure	250 ml
HW34E700	Spray	250 ml
HW35D100	Bottle Cap Closure	500 ml
HW36D100	Bottle Cap Closure	1000 ml
HW35C102	Irrigation Bag	500 ml
HW36C102	Irrigation Bag	1000 ml
HW3H103	Gauze	10x10 cm

Table 1b: Hydrocyn Aqua® gel and gel spray		
Product Code Hydrocyn Aqua®	Type	Volume
<b>Gel</b>		
HW40F900	Gel tube	15 g
HW41F900	Gel tube	30 g
HW42C900	Gel tube	50 g
HW4CB900	Gel tube	100 g
<b>Gel spray</b>		
HW42E800	Gel spray	50 g
HW4CG800	Gel spray	100 g

healing (Bactiguard, 2023b). Hydrocyn Aqua® solution contains the naturally produced HOCl that possesses antimicrobial capability to reduce microbial load and biofilm in the wound (Table 1a; Nair et al, 2019; Wounds International, 2019; Bactiguard, 2023a).

- **Hydrocyn Aqua® gel and gel spray:** A hydrogel and spray that both moisturise the wound to ensure optimal wound healing and have a continuous bacteriostatic effect (Bactiguard, 2023b). Hydrocyn Aqua® gel and gel spray contain hypochlorous acid that acts as an antimicrobial agent. When used in combination, they facilitate debridement more easily, as well as keep the wound protected against infection during dressing change, soften

the area, prevent necrotic tissue and quicken healing rates (Bactiguard, 2023c; Table 1b).

### Hydrocyn Aqua®'s mode of action

Hydrocyn Aqua® combats bacteria, viruses and fungi by a process called osmotic shock. HOCl is electrically neutral, while the cell walls of pathogenic microorganisms are negatively charged. When Hydrocyn Aqua® is applied, HOCl penetrates the pathogen cell wall and slime layer, destroying vital cell components and ensuring that water flows into cells to equalise the osmotic gradient. As a result, osmotic shock occurs, where the rise in internal pressure causes pathogens to burst (Andrés et al, 2022).

As HOCl is a naturally occurring oxidant produced by neutrophils, Hydrocyn Aqua® kills bacteria through hypertonicity and hydroxyl radical generation. Hydrocyn Aqua® is biocompatible and tissue-friendly, and inhibits different cellular processes within bacterial species to reduce biofilm and increase oxygen perfusion, which is important for collagen formation and wound healing (Figure 2; Nair et al, 2019; Bactiguard, 2023c; 2023d).

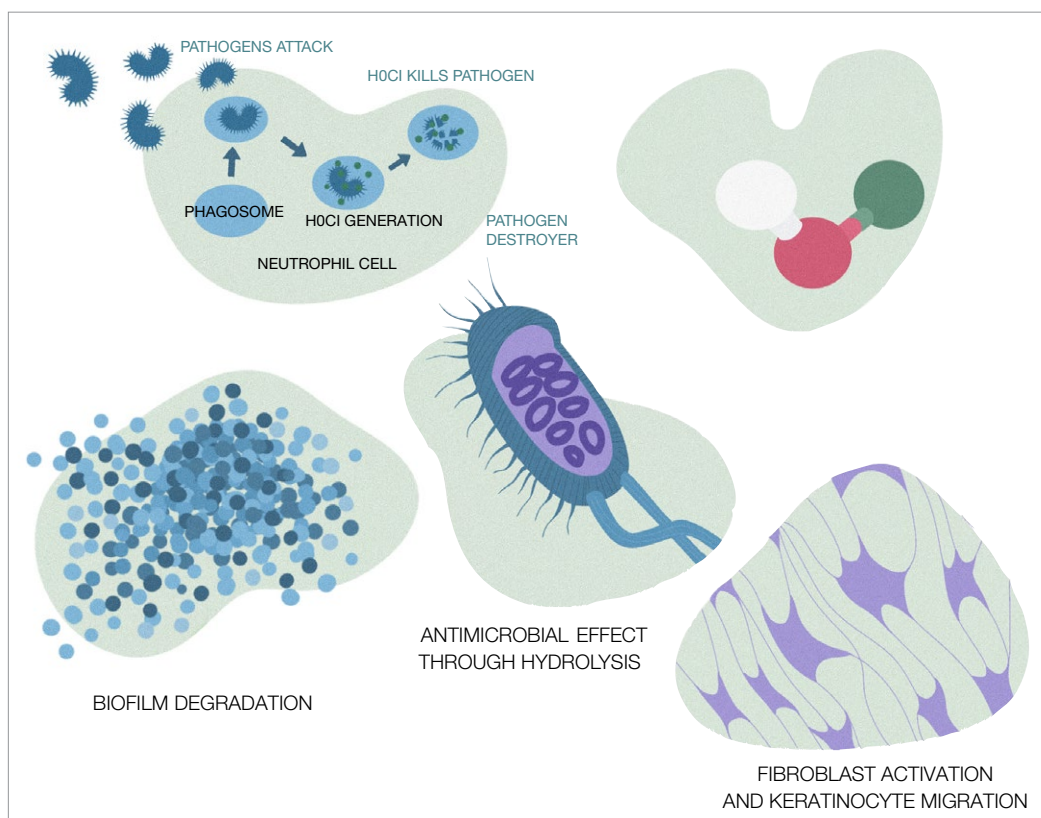
HOCl has emerged as the most potent and environmentally safe disinfectant, that is effective against a wide range of pathogens (WHO, 2020), making it an ideal alternative to standard antibiotic therapy. Currently, acute and chronic wounds are treated with costly antibiotics in ways that inevitably lead to multi-drug resistant strains (Tzaneva et al, 2016); however, in line with AMS strategies, HOCl can ease the burden on healthcare systems as an infection control measure in the face of evolved resistance to conventional antiseptics, and meet the growing demand for broad-spectrum antimicrobial agents that do not contribute to resistance traits (Bongiovanni, 2016; WHO, 2020).

### Suitable wounds for use

Hydrocyn Aqua® can be used throughout several stages of wound healing, including granulation, epithelialisation, and management of exudate, necrosis, infection and slough. The product range is suitable in a wide range of wounds including acute and chronic wounds, cuts and lacerations/abrasions, critically colonised wounds, stage 1–4 pressure injuries, venous stasis and diabetic ulcerations, surgical wounds (intraoperative and postoperative) and burns (1st–2nd degree; Nair et al, 2013; Abdul-Aziz, 2016; Wongkietkachorn et al, 2020; Soon et al, 2021; Bactiguard, 2023e). Hydrocyn Aqua® is also indicated for a broad range of tissue types, including joints, tendons, cartilage, bones and ligaments as well as sensitive areas – e.g. ears, eyes, nose and mouth, skin, mucosa and the peritoneal cavity (Park et al, 2002; Kim et al, 2008; Garg et al, 2013; Castillo et al, 2015; Stroman et al, 2017; Kramer et al, 2018).

### Guide for use in practice

The combination therapy of solution and hydrogel in a range of sizes makes Hydrocyn Aqua® a versatile system for the effective management of acute and chronic with a local or systemic infection.

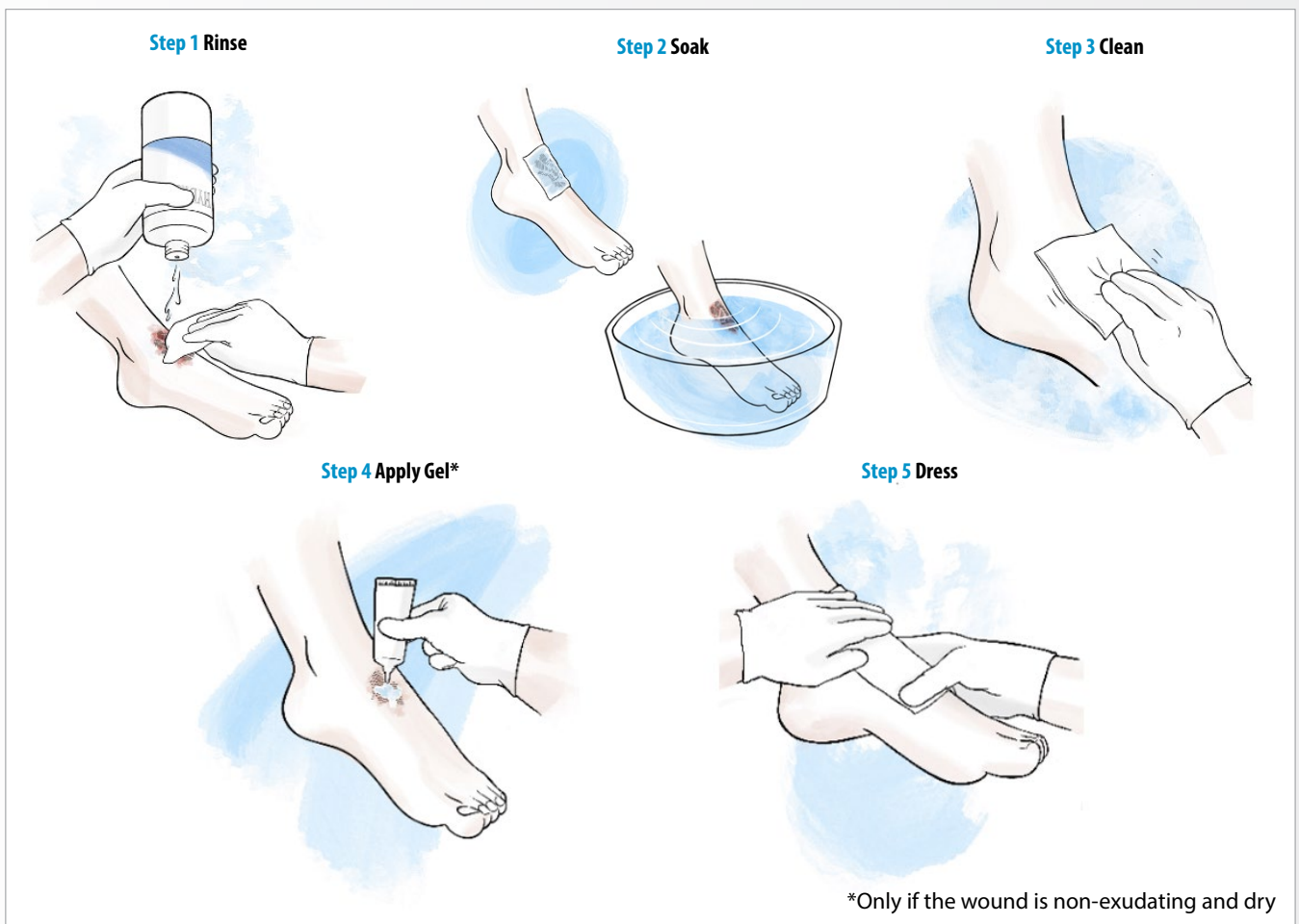


**Figure 2: Hydrocyn Aqua® mimics the body's own immune system**



# Hydrocyn Aqua®

# made easy



**Figure 3: General directions for use**

Instructions for use in practice (Figure 3):

1. Thoroughly rinse and clean the infected wound area with Hydrocyn Aqua® solution
2. Soak gauze or cotton balls with Hydrocyn Aqua® solution and place on the wound bed for 10–15 minutes. Alternatively, soak and rinse the wound meticulously in Hydrocyn Aqua® solution entirely for 10–15 minutes
3. Clean the wound with Hydrocyn Aqua® solution
4. Apply Hydrocyn Aqua® gel or gel spray to the entire wound site to increase moisture
5. Dress the wound and, depending on the wound requirement, repeat the procedure and change dressings every 1 to 3 days, and leave for longer periods throughout the healing process.

### Benefits of Hydrocyn Aqua®

Hydrocyn Aqua® meets the requirements of an ideal antimicrobial solution, as it is biocompatible with no contraindications, does not cause pain and is non-toxic/cytotoxic/sensitising/flammable/irritating to human cells or granulation tissue (Nair et al, 2019; Bactiguard, 2023d; 2023f). The solution and gel are effective against a broad spectrum of microbes, safe in a variety of wound aetiologies and effectively remove loose tissue in the wound without causing harm. In addition, Hydrocyn Aqua® is an environmentally friendly product range that uses recyclable plastics, and its leftover solution can be poured down the sink.

The active substance, HOCl, has broad-spectrum antimicrobial activity to effectively reduce microbial load and biofilm in the wound, protect against infection during dressing change and provide moisture (Sakarya et al, 2014;

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Kiamco et al, 2019; Burian et al, 2022). Hydrocyn Aqua® has also been shown to reduce microbes as compared to sodium chloride saline solution, which has limited or almost negligible antimicrobial effects (Davis et al, 2021; Bactiguard, 2023g). **Box 3** summarises the advantages of the Hydrocyn Aqua® product range.

## Summary

**Hydrocyn Aqua® is a biocompatible, gentle and safe wound care product range that is suitable for washing, debriding and irrigating wounds, and encourages wound hygiene, preparation of the wound bed and removal of biofilm. Consisting of various solutions and hydrogels, Hydrocyn Aqua® effectively cleanses and can be used on a variety of acute and chronic wounds. In doing so, Hydrocyn Aqua® accelerates the wound healing process, provides moisture, controls malodour and reduces bioburden, by protecting the wound from a multitude of bacteria, fungi and viruses.**

### Box 3. Advantages of Hydrocyn Aqua® (Bactiguard, 2023c; 2023f; 2023h)

- Multiple products to choose from, for superficial to deep wounds (aqua/gel/spray/gauze impregnated form)
- Moistening and soothing effect
- Helps maintain an optimal wound healing environment
- Bacteriostatic and bactericidal; reduces, prevents and kills bacterial growth
- Assists in rapid wound healing
- Ready to use; no mixing or dilution required
- Broad-spectrum efficacy
- Neutral pH levels
- Colourless and odourless
- Does not hamper the wound healing process
- Contains no drugs or steroids
- Non-toxic, non-cytotoxic and non-irritant
- Reduces malodour and pain
- Comfortable for the patient.

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