

## Integrating HOCl into Wound Care: A New Paradigm for Patient Management



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**P**re- and post-operative management of surgical wounds is important to prevent infection and dehiscence, minimize scar formation, and reduce the risk for other complications. Suboptimal wound healing can induce physical symptoms of itching, stiffness, scar contracture, tenderness, and pain, in addition to psychosocial effects caused by scarring, including diminished self-esteem, stigmatization, disruption of daily activities, anxiety, and depression.<sup>1</sup>

A consideration of current practices in wound healing suggests a need for new strategies for optimized pre- and post-procedural management.<sup>2-5</sup> There is growing evidence to suggest the utility of topically applied hypochlorous acid (HOCl). Naturally produced by the innate immune system, HOCl has known anti-microbial properties that also break down biofilm. It has also been shown to be anti-pruritic, anti-inflammatory, and increase oxygenation to wound sites.<sup>6,7,8</sup>

### PHYSIOLOGIC WOUND HEALING

While several systemic factors influence healing, the local skin environment is known to be critically important to wound closure and long-term cosmesis. Physiologic wound healing is characterized by a balance between new tissue biosynthesis and degradation of the existing extracellular matrix via apoptosis.<sup>9,10</sup> Scar formation may result when the

underlying regulatory mechanisms are impaired, often as a result of disruption of oxygenation and introduction of microbes.<sup>11</sup>

Topical preparations play a central role in pre- and post-operative wound management, to both facilitate wound cleansing and to reduce the risk of infections, and to support the natural healing process. Despite their popularity, use of topical antibiotic ointments remains controversial.<sup>12</sup> Studies suggest that between 1.5 and 9.1 percent of individuals are allergic to bacitracin and between 7.2 and 13.1 percent are allergic to neomycin.<sup>13,14</sup> Topical antiseptics may be detrimental to wound healing, especially if they are cytotoxic to keratinocytes and fibroblasts.<sup>15</sup> Chlorhexidine solution, specifically, has been found to be toxic to the middle ear and is associated with irreversible cornea damage with minimal exposure.<sup>16</sup>

### A NEW APPROACH

A new paradigm for periprocedural skin management is indicated—one based on HOCl-based formulations.

Available by prescription or for in-office dispensing, a line of products containing HOCl-based Microcyn Technology (IntraDerm Pharmaceuticals) may be used both as surgical prep and for postprocedural wound management: Alevicyn (prescription) and Lasercyn (office-dispensed) formulations are used to prepare skin for procedures; Celacyn Scar Gel (prescription) and Regenacyn Scar Gel (office-dispensed) are used immediately post-operatively to help reduce the risk of scar formation. Its unique antimicrobial, anti-inflammatory, and healing properties aid in scar management.

**Skin preparation.** HOCl damages the integrity of the bacterial cell membrane by increasing its permeability. As such, its potency is non-specific. HOCl is active against numerous bacterial, viral, and fungal pathogens, including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Candida albicans*.<sup>17</sup> Results from an in vivo study of skin inoculated with *S. aureus*, showed that topically applied hypochlorous acid gel reduced the bacterial count by  $\geq 99$  percent following a single application.

In one study to assess the antimicrobial effects of

	Prescription	Physician Dispensed	Uses
Skin preparation and healing	Alevicyan	Lasercyn	Intended for the cleansing, irrigation, moistening, debridement, and removal of foreign material including microorganisms and debris from exudating wounds, acute and chronic dermal lesions.
Post-procedure; scar management	Celacyn Scar Gel	Regenacyn Scar Gel	Intended for the management of old and new hypertrophic and keloid scars resulting from burns, general surgical procedures, and trauma wounds.

## Microcyn Technology (Stabilized HOCl)

- Eradicate microorganisms
- Reduce inflammation via inhibition of mast cell degranulation
- Reduce itch and pain
- Increase oxygenation of wound sites to improve healing
- Break down biofilms

Microcyn-based formulations for use as a pre-operative skin preparation, the product had similar antimicrobial activity as Hibiclens at all time points (30 seconds; 10 minutes; six hours).

**Supporting wound healing.** When a Microcyn technology (HOCl) plus antibiotics regimen was compared to Betadine plus antibiotics in the management of diabetic foot ulcers, Microcyn (HOCl) was associated with a statistically significantly greater reduction in microbial load. Average healing time for the Microcyn arm was 43 days, compared to 55 days for the Betadine arm. HOCl has also been shown to increase oxygenation at wound sites. Increases in TCPO<sub>2</sub> (transcutaneous pressure oxygen) play a role in regranulation, which may account for speedier healing.

**Managing symptoms.** HOCl also has significant anti-inflammatory activity via inhibition of nuclear factor κB kinase (NF-κB), which regulates activation of NF-κB, an activator of pro-inflammatory genes.<sup>18</sup> It appears likely that HOCl also functions to stabilize local mast cell activity. It also reduces the activity of histamine, leukotriene B<sub>4</sub> (LTB<sub>4</sub>), and interleukin-2 (IL-2), all of which are known mediators of itch.<sup>19</sup>

In one study of topically applied HOCl, a 28 percent reduction in investigator-assessed irritation was evident as early as day one, with a 46 percent reduction by day three. Fifty percent of subjects reported improvement in itching

at day one, and 85 percent had improvement at day three. Reducing the urge to itch abates a potential mechanism for mechanical disruption of the skin.

**Scar reduction.** A recent analysis determined the efficacy of topical HOCl in managing and treating hypertrophic and keloid scars and in relieving associated pruritus and pain. The inclusion of this modified silicone-based polymer to the formulation is believed to help support tissue remodeling. Unlike many silicone-based products, Celacyn Scar Gel and Regenacyn Scar Gel can be applied directly to the wound site in the immediate post-op period.

In a randomized, double-blind study comparing the efficacy, safety, and tolerability of Microcyn technology (HOCl)-based scar gel with a comparator device, trends suggested that Microcyn slightly outperformed the competitor and provided a statistically significant improvement in scars at day 112 compared to baseline.

**A new paradigm.** A recent analysis of the data regarding the use of HOCl for wound management concludes that the agent is safe and effective with minimal reported side effects. In fact, the authors urge that use of topical HOCl formulations be “strongly considered as a post-surgical/procedural wound healing agent.” ■

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