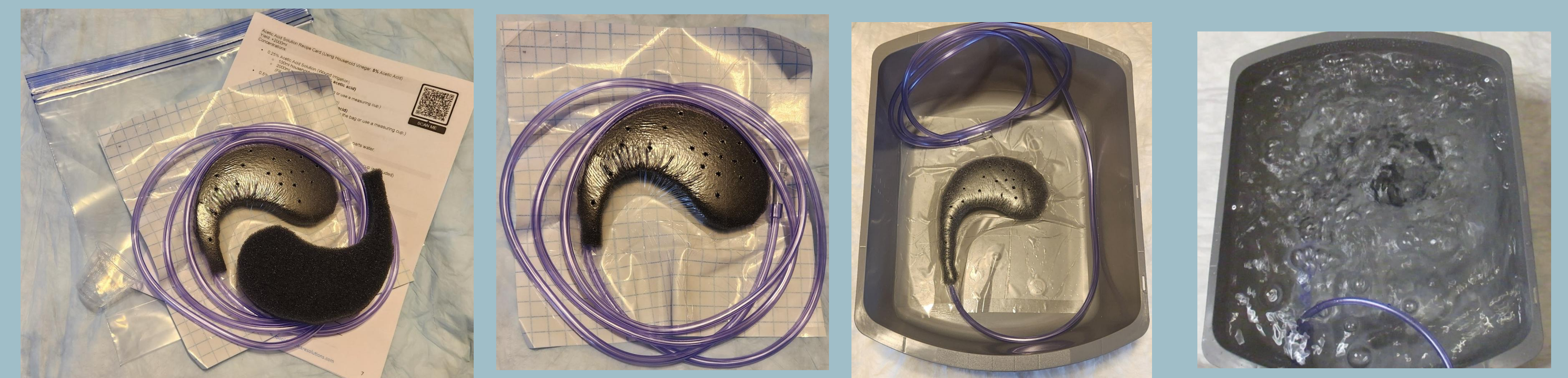


# Improving Wound Debridement and Oxygenation Using a Novel Hydrotherapy Method Powered By and Combined with Oxygen Therapy

Authors Jason Ayers, RN WCC; Dr David Haverly MPD; Josie Smith RN, BSN



## Abstract

**Introduction** We developed a new process of using hydrotherapy powered by oxygen, that can cleanse and debride wounds in a disposable, affordable and time-saving method. Cleansing/debridement of diabetic foot ulcers, pressure injuries, PAD ulcers and stasis dermatitis can present difficulties. Risks included while removing slough and biofilm are infection, decreased blood flow, and pain. This method brings the benefits of hydrotherapy; without the past issues of time-consuming and costly set-up and breakdown and reduces the risk of cross contamination.

**Methods** We combined hydrotherapy with oxygen supply to power a disposable bubbler device. We created a new hydrotherapy kit that contains an oxygen bubbler, a mixing kit for solutions and a cleansing foam pad. This novel approach uses oxygen bubbles that pass over wound tissues with slight hydrostatic water pressure. Oxygen bubbles in a warm antiseptic solution passing over the wound tissue would provide a cleansing effect. While increasing oxygen to surface wound tissues. This soothes and hydrates while providing improved cleansing with the foam debridement pad. Our procedures were done at bedside with our patients simply soaking their wounds with oxygen bubbling over the wound bed. Each soak was about 10-15 minutes or until the solution started to cool. We then used a gentle foam pad to cleanse away the loosened material created from the hydrotherapy session. Photos were taken immediately before and after treatment to show the effects to wound base and tissue color.

**Results** Case studies, patient feedback and photos are presented with this presentation to demonstrate the positive outcomes of this novel treatment. The photographs show the quick and easy removal of crusting, biofilm, slough and eschar. This has been shown to greatly increase healing times in an easy, time saving, disposable, and single patient use method. After a clean wound is a healing wound.

**Discussion** Utilizing oxygen/air powered hydrotherapy to remove slough and biofilm in a pain-relieving method while increasing warmth, hydration and oxygenation presents a great improvement in patient care. This would demonstrate improved outcomes over that of standard treatments of sharp debridement, autolytic, or enzymatic. Other treatments could cost more in treatment times, heal times and increase hospital stays which can lead to significantly increased costs, and reduced quality of life.

## Case Studies: Stasis dermatitis

This study includes before and after photos of two patients, pre and post oxygenating hydrotherapy powered by oxygen. These are very similar pts both in their 60's, chronic stasis dermatitis, cellulitis, CHF, diabetic, non-compliance and poor self-care r/t living conditions(homeless). Both of these pts had legs covered in scaly skin with heavy crusting, areas of eschar covering small ulcers, edema, and discolored skin. Both patients were treated with warm hydrotherapy in a betadine solution using our oxygen bubble device. The oxygen bubble device was attached to the bottom of 2 clean 5-gal buckets with plastic liners. This was used to enable the hydrotherapy water depth to reach further up the legs. Treatment lasted about 15-20 minutes; patients voiced enjoyment of the therapy. After soaks were completed, excess water was poured down the toilet and liners and devices were disposed of in the trash. The legs were cleansed with the foam pad from our kits, and dried. After the soak the scaly/crusty skin was softened, easily able to

## Case Studies: Stasis dermatitis (cont.)

be removed. Legs after treatment were then applied with antifungal ointment and light compression wraps. Photos below show before and after 15-20 minute oxygenating hydrotherapy treatment. Both pts expressed excitement over the improvement to their legs. One pt stated, "My legs haven't looked this good in years".



## Case Study: Surgical wound dehiscence and infection of great toe amputation

78-yr old male with a history of osteomyelitis of the great toe status post amputation a week prior. Home health RN told him to come to ER due to incision being open and infected. C/o pain in foot area, great toe amputation site dehiscence, purulent drainage, edema. Discussion with the primary wound care reported he comes into clinic with pet hair in wound. Pt has Type 2 diabetes, Osteomyelitis, Hypertension, and PAD.

**Assessment:** Left great toe amputation site open with loose sutures holding onto clumps of eschar. Strong foul odor from the wound. Dark skin and dusty wound bed color.

**Treatment:** Administered oxygenating hydrotherapy treatment using an oxygen bubbling device, with a warm Dakin's 1/4 strength solution, for about 15 minutes in a bath pan. Then I used the provided foam pad to scrub/cleanse area with gentle circular motions. A large "clump" of necrotic tissue came off on pad. The matured dead skin and slough softened with warm solution, enabled it to be cleansed away. Exposed bone visible after necrotic tissue was debrided. Dressing applied was Dakin's 1/2 strength wet to dry, wrapping the foot to slow cooling after warm soak. Pt voiced hydrotherapy treatment felt good.

**Post treatment:** The significant color changes were, peri-wound skin color improved to pink and wound bed improved dusky to red. There was no odor after cleansing. Pt sent for surgical resection of bone and closure. Vascular studies showed severe occlusions and PAD, pt referred to vascular surgeon.

## Case Study: Surgical wound dehiscence and infection of great toe amputation(cont.)



## Case Study: Index Finger Injury

Working age male pt in the ER 10 days earlier with a finger amputation, through the IP joint. Pt had been working on a running car engine when he reached into the engine. His finger was then pulled into the belt and pulley system both crushing/ cutting the end and ripping tissue off the anterior finger. Imaging shown traumatic amputation with 90% loss of the distal phalanx and only a few small bony fragments remaining. The open wound extended down the anterior of the finger. MRI showed no osteomyelitis, that infection was limited to soft tissue. Wound presented black dried eschar/ crusting, with draining puss. Pt reported he had continued to work construction. Pt reported he had not followed up since ER, states no money to pay, had to work. Pt had thought best to leave wound open to the air. Possible sand, dirt and grease noted in the wound.

Pt was ordered NPO for possible I/D with ortho. Day 1 finger was treated with an oxygenating hydrotherapy treatment in hypochlorous acid solution for about 15-20 minutes. First session removed about 80% of eschar. He reported very little discomfort, even found bubbling soothing. On exam by ortho, surgery was cancelled due to successful debriding hydrotherapy.

Day 2 finger was treated a second time with a oxygenating hydrotherapy treatment in hypochlorous acid solution for about 15-20 minutes. Second treatment removed about 50-80% of remaining eschar. Pt was then able to be discharged with wound care education and supplies to treat at home.

Wound photos represent x2 treatments and results within about 24 hours. **Day 1 pre and post first treatment:**



## Case Study: Index Finger Injury(cont.)

Day 2 pre and post treatment:



## Conclusion and Recommendations

A clean wound is a wound that is healing. Hydrotherapy with topical oxygen therapy works collaboratively to produce optimal results. Healing times are faster with a less painful debridement compared to traditional methods due to the wounds being cleansed and infused with oxygen simultaneously. Our new approach to these two therapies will make effective and time efficient therapy accessible to all patients whether they are receiving care in the hospital, nursing facility, or their own homes; this makes the benefits achievable across the entire spectrum of care. Hydrotherapy has been unavailable to patients that are outside of the clinical setting due to the cumbersome and expensive equipment that was required prior to the availability of this new innovation. Previously this equipment was difficult to set up and came with an increased risk of infection.

Home healthcare staff will be able to administer treatments that will cleanse, debride wounds, and promote tissue growth. Nursing facilities will be able to perform hydrotherapy both quickly and with ease even in their busy setting with high patient loads. The setup of our oxygenating hydrotherapy unit takes only a few minutes. The process is streamlined and clear directions are provided within the kit for easy reference. The clean-up process is as simple as folding all components up into the drape and dropping them into the trash leaving nothing to clean or sanitize. Due to the simple nature of this innovation nursing staff will be more likely to incorporate oxygenating hydrotherapy into their patient's treatment regimen.

In conclusion, the presented case studies make it clear that healing times will be reduced in wounds with the use of these combined therapies. Patients are more cooperative during the debridement process due to the less painful nature making it a more pleasant experience all thanks to the utilization of oxygenating hydrotherapy! When the results of treatment are immediate, nurses feel encouraged, patients feel more hopeful, physicians are happier, and the hospitals will ultimately see these results reflected in their bottom line.

References  
 1. JAMA Dermatol. 2013;149(9):1050-1058. doi:10.1001/jamadermatol.2013.4960  
 2. Burke D.T., Ho C.H., Saucier M.A., Stewart G. Effects of hydrotherapy on pressure ulcer healing. Am J Phys Med Rehabil. 1998;77(5):394-398.

For more information contact Jason Ayers RN at [jayers@swirlcaresolutions.com](mailto:jayers@swirlcaresolutions.com)