

# The Next Generation of Wound Care

A White Paper on  
SilvrSTAT® Antibacterial  
Wound Dressing Gel

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Wounds are a major threat to public health and the economy. The cost of wounds to the US healthcare system annually is measured in billions of dollars. According to the National Institutes of Health (NIH), the treatment of chronic wounds alone exceeds an estimated \$25 billion each year.<sup>1</sup> Acute and emergency wound care related to trauma, surgery and burns is required for millions of procedures. Skin scarring, an additional burden of wound healing, represents an annual cost of \$12 billion. Healthcare professionals, caregivers and patients are looking for improved treatment options and healing rates to minimize potential complications and shorten hospital stays. The pressure to reduce overall costs of wound care, to include nursing time and medical supplies, is greater than ever. Biotechnology-based pharmaceuticals and medical devices have become the focus of product innovation and are sure to impact the outcomes-oriented environment of emerging markets. The purpose of this white paper is to introduce a product manufactured with patented biotechnology that will lead the next generation of wound care treatment and healing. SilvrSTAT® Antibacterial Wound Dressing Gel is a molecular silver product nanoengineered to provide superior wound management more effectively than any other product on the market.

## PRODUCT DESCRIPTION

SilvrSTAT® Antibacterial Wound Dressing Gel is a water based topical gel for use in the management of first and second degree burns, stasis ulcers, pressure ulcers, diabetic ulcers, lacerations, abrasions, skin tears, surgical incision sites, device insertion sites, graft sites and donor sites. Laboratory testing has demonstrated that SilvrSTAT® inhibits the growth of a wide spectrum of microorganisms to include bacteria, viruses, yeast and mold without any known toxic side effects.<sup>2</sup> SilvrSTAT® contains 32ppm Proprietary Silver (purified water, nano-silver at .01 micron), Propylene Glycol, Triethanolamine and Carbomer. SilvrSTAT® is odorless, nonirritating and transparent, allowing good visualization of the wound bed and margins. SilvrSTAT® is easily applied directly to the wound and covered with a conventional or specialized dressing. The gel should normally be reapplied with a dressing change every 24 hours, but the frequency will depend on the type and condition of the wound. In kill time studies (antimicrobial effectiveness), SilvrSTAT® has been shown to maintain broad spectrum antibacterial control with greater than 99.9% reduction in bacteria counts at one hour and twenty-four hours, and greater than 3-4 log reductions from original bacterial counts at seven, fourteen and twenty-eight days.<sup>3</sup> (See Figures 1 and 2). When

applied directly to the wound 1/8" thick and covered with a dressing, it would be expected to maintain antibacterial effectiveness for at least 3 days. For 1st and 2nd degree burns: SilvrSTAT® Antibacterial Wound Dressing Gel should be applied to 1st degree burns and allowed to dry. Second degree burns may require an application which is allowed to dry followed by a loose dressing to protect blistered areas. If the integrity of the skin is compromised, burn unit or burn treatment protocols<sup>4</sup> to include the use of SilvrSTAT®, non-adhesive dressings and a secondary protective layer should be considered. SilvrSTAT® is intended for external use only and should be stored at room temperature. SilvrSTAT® contains no sulfa components or alcohol and is non-flammable. It will not stain or discolor tissue. There are no known or reasonably suspected adverse reactions associated with the use of SilvrSTAT® Antibacterial Wound Dressing Gel, as stated in the United States package insert.

## LEADING TECHNOLOGY UNMATCHED BY OTHERS

SilvrSTAT® was officially launched into the US market by ABL Medical in the fourth quarter of 2012 as the first of a new class of bioengineered products based on the company's patented technology. SilvrSTAT® is FDA cleared as a 510(k) medical device with FDA approved

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indications as listed under the product description. The introduction of SilvrSTAT® marks the start of a new era for topical wound therapies and technology available to the biomedical industry. As a respected provider of innovative medical products to healthcare professionals globally since 2011, ABL Medical's MAgNET (Multivalent Silver Nano Engineered Technology) manufacturing process is unique and differentiates their product line from competitors in the wound care market. SilvrSTAT® was formulated to provide the most stable and effective topical antibacterial available and is composed of particles with optimal size and properties for killing bacteria and allowing prompt wound healing. SilvrSTAT® is manufactured with great accuracy using ten thousand five hundred volts of alternating current for electrophoresis. The end products generated by ABL's patented technology contain precisely engineered multivalent silver nanoparticles with an atomic structure that is radically different than the monovalent ionic silvers in current use. SilvrSTAT® is composed of stable molecules of metal + oxide, which is one of the keys to its remarkable properties. A metallic core of elemental silver coated with a tetrahedral structure of silver oxide ( $\text{Ag}_4\text{O}_4$ ) produces the bio-activity necessary to continuously kill microbes in a wound. The size of the nanoparticles is also essential to understanding the properties of SilvrSTAT® and what sets it apart from other medical forms of silver. There is an optimal particle size for achieving the maximal effectiveness of silver nano-particles. If the particle size becomes too small, the product becomes unstable and loses its effectiveness. In demonstrating the knowledge of just how significant this physical property is to nanoparticles, ABL Medical holds a patent for what the company deems the most bio-active and medically effective particle size. Further study of these particles by leading experts revealed that within the molecules of metallic silver oxide previously described, each silver particle is able to act independently when mobilized within a water base.<sup>5</sup> Because of the way they are engineered, the silver particles have a very unique charge barrier which pulls them together in clusters but holds them to within 2-3 nanometers of each other. This supports their magnetic 'super charge' while allowing maximal surface interface with the microorganisms to

which they are exposed. In contrast, ionic silvers bind to biologically active chemical groups present in the cell membrane or other cellular components, proteins or nucleic acids. The killing of microbes by molecular silver occurs in the proximity of the infective agent as opposed to essentially direct contact required by ionic silver. Ionic silvers must come into close contact with the cell membrane of bacteria in order for the transfer of electrons to occur. This places ionic silver at a clinical disadvantage for killing bacteria where binding of the cell membrane consumes electrons from multiple silver ions leaving them incapable of further bactericidal activity. A much higher concentration of silver (i.e. silver ions) is required for ionic silvers to be effective. Therefore, it is essential to understand that there is a critical difference in the efficacy and toxicity of silver as an ion and silver as a metal due to both chemical binding properties and concentration levels.<sup>6,7</sup> Composed of neutrally charged molecules with multivalent silver oxide shells, the nanoparticles found in SilvrSTAT® pull electrons from multiple bacteria at the same time while in proximity to the bacteria causing continuous lysis at very low concentrations. Figures 4, 5 and 6 demonstrate the difference in the antibacterial efficacy of an ionic silver such as silver sulfadiazine versus a multivalent molecular silver such as SilvrSTAT®. SilvrSTAT® is distinctly different from other silvers in that electrophoresis produces complex, multivalent molecules of metallic silver + silver oxide versus soluble monovalent silver ions. As a broad spectrum antimicrobial, SilvrSTAT® is essentially equal and in many cases superior to traditional biochemical antibiotics with the distinct advantage that bacteria do not mutate to destroy its activity. Nano-engineered as an ultradilute water based silver gel, it acts as a powerful inorganic agent comparable to and synergistic with commercial antibiotics.<sup>5</sup>



## ATOMICALLY UNIQUE MECHANISMS OF ACTION

SilvrSTAT® contains technologically advanced metallic nanosilver with unique mechanisms of action that 1) promote rapid primary wound healing, 2) treat and prevent infection, 3) reduce pain and swelling, 4) stimulate stem cell release and activation of tissue factors and 5) promote chronic wound healing. The demonstrated ability of SilvrSTAT® to effect healing is the result of its unique characteristics that include, but may not be limited to:

- Multivalent silver oxide molecules surrounding a metallic silver core that continuously kills microorganisms ( $\text{Ag}_4\text{O}_4$ )
- Catalytic cycling capability due to rapid metallic bonding and repelling of outer electrons to microbial proteins versus one on one ionic bonding
- Higher bioavailability and reduction of bioburden at extremely low concentrations of silver
- Ability to reduce the inflammatory phase, increase the proliferative phase and increase the healing rate
- Generation of reactive oxygen species (oxygen radicals) which are lethal to microorganisms but do not harm normal cells and tissues
- Resonance phenomena generated by radiation frequencies (UVA wavelength range 890-910 THz) killing bacteria, viruses, molds and fungi by destroying proteins and resulting in reduction of pain and inflammation
- Stem cell activated angiogenesis and possibly growth factor mediated stimulation of pre-existing stem cells
- Particle size engineered to optimal stability and surface chemistry interaction
- Stability to light and temperature changes without the use of any additives
- Colorless composition comprising a transparent water-based gel for ease of application and visibility of wound bed and margins

The sum effects of these mechanisms of action and characteristics provide rapid antimicrobial activity at ultradilute concentrations of silver. (See figure 3)

## BIOLOGICALLY POTENT AND SAFE AT LOW CONCENTRATIONS

SilvrSTAT® has been subjected to meticulous laboratory testing and stringent safety testing by a variety of respected laboratories, researchers, universities and private institutions to generate independent data to demonstrate that this form of metallic silver is not toxic. ABL Medical Product Safety Studies include cytotoxicity studies, skin irritation and sensitivity studies, ingestion studies and injection studies.<sup>8</sup> SilvrSTAT® has met all standards for safe use and has been found to be non-irritating, non-sensitizing and non-cytotoxic. Antibacterial activity has been observed at low concentrations independent of the organisms tested. A comparison of both the minimum inhibitory concentrations (MICs) and minimum bactericidal concentrations (MBCs) of the nanoparticles found in SilvrSTAT® with the most prominent antibiotics used worldwide showed them to be essentially equal.<sup>9</sup> The majority of the strains tested exhibited MICs of 2.5ppm silver or less. The maximum concentration required was 5ppm. In addition, SilvrSTAT® nanoparticles have the unique advantage that pathogens do not mutate to destroy their activity. Rigorous analysis has demonstrated consistent and effective inhibition of the growth of *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Acinetobacter baumannii* and dozens of other strains of bacteria. In fact, it has been effective on all types and strains of pathogens it has been tested against. SilvrSTAT® has been used in a diverse range of settings and remains effective in the presence of antibiotic resistant strains including, but not limited to MRSA, VRE and CRE as well as *Candida albicans*. The nanosilver particles in SilvrSTAT® were found to emit resonance frequencies which are unique to their multivalent charges and in the same range as that part of the ultraviolet spectrum that kills bacteria and viral particles. The distinction between the effectiveness of SilvrSTAT® to improve wound healing and control bioburden in comparison to other medical silvers, hydrogels, enzymatic debriders and osmotic agents is currently of keen interest within the medical community. In head to head studies SilvrSTAT® has demonstrated superior kill times and outcomes versus topical treatments currently available for use in wound management. A key theory supporting improved healing

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times and outcomes noted lies in the ability of SilvrSTAT® to impact the tissue-specific progenitor and pluripotent stem cells that contribute to wound repair. If and how silver stimulates stem cell proliferation is a highly debated topic. It has been postulated for more than a decade that some silver preparations enhance wound healing beyond what is attributed to infection control alone.<sup>10</sup> There is no universally accepted mechanism of action to explain the growth stimulation properties of silver and most topical silvers are antimicrobial barriers used when a hydrogel is indicated to keep a wound moist and allow for natural healing to occur. Normally, the growth of granulation tissue in open wounds begins at the periphery and progresses towards the center of the wound. When SilvrSTAT® is applied to open wounds and burns, deep pink coloration of the wound bed and margins accompanied by rapid ingrowth of healthy granulation tissue occurs. Smooth margins, islands of epithelialization and significant reduction in pain and swelling is observed. This suggests rapid removal of infective agents, stem cell activated angiogenesis and possibly growth factor mediated stimulation of pre-existing stem cells within the wounded tissue.<sup>11</sup> Regardless of the mechanisms involved, the overall effect is a rapid change in the wound healing cascade from the inflammatory phase to the reepithelialization phase resulting in improved healing times and outcomes with no evidence of toxic effects. Furthermore, the observed reduction in scarring is thought to be secondary to a cascade of events initiated by the enhanced healing properties of SilvrSTAT® and persisting thru the proliferative and remodeling phases to cause improved collagen filling within the matrix of the wound producing less tension, better bridging of tissue components and less fibrotic constriction. SilvrSTAT® is non-toxic and cost effective, in part, due to the low 32ppm concentration of atomically unique nanosilver. It has no known or expected adverse effects.

## **IMMEDIATE IMPACT ON THE MANAGEMENT OF WOUNDS**

SilvrSTAT® is formulated as a 32ppm antibacterial wound dressing gel that provides quick and continuous antibacterial activity. The improved healing outcomes observed when SilvrSTAT® is applied to wounds is most importantly due to its potent antibacterial properties resulting in reduction and control of biofilm and bioburden. This critical benefit is applicable to a broad range of clinical challenges such as rapid healing, treatment and prevention of infection, facilitated graft uptake or donor site healing and resolution and prevention of chronic wounds.<sup>12</sup> Feedback and preliminary data from healthcare professionals throughout the US and Canada supports in vivo testing that SilvrSTAT® has a positive impact on the inflammatory, proliferative and remodeling phases of wound healing. SilvrSTAT® rapidly reduces the bioburden, effectively killing common and resistant strains of bacteria following application. SilvrSTAT® stimulates the production of stem cells effectively shortening the inflammatory phase and accelerating the proliferative phase to improve healing times. It is postulated that SilvrSTAT® reduces wound related pain by disrupting the conduction of electrical impulses at the nerve endings. The precisely engineered particles have a high electrical conductivity while bearing the chemical inertness of the silver itself. Clinical data suggests that it is superior in performance when compared with the leading prescribed topical wound preparations. Evidence based clinical practice has also proven SilvrSTAT® to be a preferred treatment for wounds when compared to current topical therapies.

MRSA and VRE, two of the most epidemiologically significant pathogens that cause hospital acquired infections, are associated with high morbidity and mortality rates.<sup>13</sup> Increases in hospital costs combined with loss of revenue associated with hospital acquired infections are a major concern in the clinical management of wounds. In 2005, the annual cost in the US to treat hospitalized patients with MRSA infections alone was estimated to be between \$3.2 and \$4.2 billion as reported by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR).<sup>14</sup> By 2011, fewer

cases of MRSA infections were occurring in the US compared to 2005, according to a study conducted by the Centers for Disease Control and Prevention (CDC). Despite the decreases, MRSA infections remain problematic. The majority of infections have their onset in the community or outpatient settings.<sup>15</sup> The economic impact of community acquired MRSA has been assessed using economic simulation models to estimate costs and differentiate them between payer perspectives. Cost varies depending on patient age and co-morbidities but in the US, community acquired MRSA imposes an estimated annual burden of \$478 million to \$2.2 billion on third party payers and more than \$1.4 billion on society.<sup>16</sup> Colonized and infected patients are potential reservoirs for transmission to any setting. Regardless of the drug-resistant pathogen, increased costs are primarily driven by prolonged hospital stays and/or elevation of care.<sup>17,18</sup> Human case studies have shown SilvrSTAT® to eradicate resistant bacteria in wounds with or without antibiotics and with no reported toxicity. In an initial hospital study, the prototype of SilvrSTAT® significantly improved the treatment of wounds infected with MRSA. The average time to wound closure improved and patients reported a significant reduction in wound associated pain. Clinically significant reduction in healing times and improved outcomes have been observed in long term care facilities, podiatry clinics, wound clinics and burn units. It has been estimated that the nanosilver used to formulate SilvrSTAT® could potentially reduce the overall cost of treatment of a wound and reduce the average length of stay in a hospital.

In differentiating between a chronic wound and an acute wound it is noted that while chronic wound healing does not follow the same patterns of acute wound healing,<sup>19,20</sup> SilvrSTAT® is effective on both. In contrast to acute wounds, chronic wounds have different molecular and biochemical changes resulting in impaired inflammatory responses, decreased cellular function, an increased proportion of senescent cells and poor re-epithelialization.<sup>21</sup> Chronic and non-healing wounds are prevalent in older patients, accompanied by comorbidities and healing rates reduced by the aging process. Multi-drug resistance and colonization with

more than one type of bacterial strain are common in chronic wounds. SilvrSTAT® has proven to be effective in the treatment of chronic wounds by resolving clinical or subclinical infection, relieving persistent pain, improving the appearance of unhealthy tissue, promoting healthy granulation tissue and decreasing recurrent wound breakdown. Early Long Term Care facility wound data showing a significant reduction in MRSA infected wounds treated with SilvrSTAT® and successful treatment and prevention of chronic ulcerative wounds has been reported and is pending publication.

## SUMMARY

There are dozens of silver products on the market today. Most are ionic preparations which work by chemical action that requires them to have direct contact with microbes to have any positive effect. SilvrSTAT® Wound Dressing Gel represents the next generation of technology for wound care and is unequalled by its competitors. In comparison to current therapies, it represents a novel approach to killing or disabling pathogens and resolving acute and chronic wounds, burns and disruption or irritation of the skin. It is atomically unique and produced using the MAGNET (Multivalent Silver Nano Engineered Technology) manufacturing process for higher bioavailability and effectiveness. It is likely that the unusual effectiveness is due to the relationship between the surface chemistry and inner properties of the oxide + metal and the size and distribution of the particles. The multivalent, catalytic nano-molecular technology of SilvrSTAT® provides rapid antibacterial activity, reducing and controlling biofilm and bioburden at extremely low concentrations of silver. These properties are the result of patented technology and precise manufacturing conditions. SilvrSTAT® has been tested extensively and found to be bactericidal for all organisms tested, to include all resistant strains. In other studies, the nanoparticles comprising SilvrSTAT® were compared to other commercially available silver products and found to have superior activity to all other preparations tested. The data suggest because of the high safety profile and broad spectrum of antimicrobial activity, SilvrSTAT® can effectively be used in conjunction with or as an alternative

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to antibiotics. The laboratory kill rates on bacteria and other pathogens cannot be matched by other topical wound products. It has a remarkable impact on the healing process, disinfecting the wound and preventing further infection while reducing inflammation and stimulating stem cells and angiogenesis for improved outcomes and reduced scarring. Chronic wounds require their own unique approach independent from protocols established for acute injury. Due to its low concentration and high safety profile, SilvrSTAT® is appropriate for both chronic and acute wounds unbound by efficacy, tolerability, cost, toxicity, sensitivity or adverse effects. In addition to its superior healing and antimicrobial properties, other great appeals for SilvrSTAT® are its cost effectiveness, lack of local or systemic toxicity and simplicity of administration. It is safe and non-toxic and there are no known or expected adverse reactions associated with its use. SilvrSTAT® is water based with no alcohol, alginate or sulfa components. SilvrSTAT® provides a significant advance in the promotion of a pathogen-free healing environment and is the first of several products expected to be introduced by ABL Medical. SilvrSTAT® should be considered for any of the FDA approved indications listed and prioritized to patients with wounds complicated by resistant organisms or where exposure to resistant organisms is anticipated. SilvrSTAT® should be included in any strategy to reduce costs related to wound management in hospitals, long terms care facilities, outpatient clinics and even in the community. SilvrSTAT® is stocked by major wholesalers and DME suppliers with third party reimbursement channels established in most market segments.

### **NEWLY RELEASED ANTIMICROBIAL DATA**

Head-to-head clinical testing of topical wound treatments against common or resistant wound pathogens is a powerful and compelling way to compare products against each other. It may potentially present unique challenges and cause great debate as to whether the results definitively determine the best course of treatment. While each patient's wound(s) and co-morbidities are unique and variable, the fundamental characteristics of head-to-head in-vitro studies have the potential to address

critical outcome issues. These issues include reduction in bioburden, broad spectrum antimicrobial activity, and no increased risk to the patient or wound due to adverse effect on healthy tissue. Secondary issues may sometimes be extrapolated from such testing and prove helpful in determining minimum and maximum dosing intervals, onset of bactericidal activity and cost effectiveness. ABL Medical and Analytical Resource Laboratory, Lindon, UT, designed a head-to-head test to evaluate SilvrSTAT® against five commonly prescribed types of topical wound products currently on the market:

**Medical Grade Honey** - Manuka honey from New Zealand lists effectiveness on wounds by osmotic activity, lowering wound pH, and autolytic debridement for promotion of wound healing.

**Mupirocin Ointment** - An antibiotic derived from *Pseudomonas fluorescens* that is bacteriostatic at low concentrations and bactericidal at high concentrations. It is effective against gram positive bacteria, including MRSA and certain gram negative organisms. Resistance has been demonstrated from long term use.

**Ionic Silver Gel** - Ionic silver gels are formulated as amorphous hydrogel base that provides antimicrobial action while donating moisture.

**Silver sulfadiazene** - The most commonly used topical antibacterial agent for the treatment of burn wounds. It has a broad spectrum of antimicrobial activity but may cause pain, burning or itching of the treated skin. It is contraindicated in patients that are allergic to sulfa.

**Botanical Extract Gel** - A topical preparation formulated with naturally produced botanical extract. The botanical extracts are readily absorbed into the wound and act as astringents to exert anti-inflammatory and bactericidal properties.

All six products were tested against six common and problematic organisms to include:

MRSA, VRE, *P. aeruginosa*, *E. coli*, *C. albicans* and *S. agalactiae*. Samples for Time-Kill analysis of the bacteria and fungi were drawn at 10 minutes, 1 hour, 4 hours and 24 hours. The Table shown in Figure 7 reflects the comparison of SilvrSTAT® to existing treatments. The results strongly

support that SilvrSTAT® provides the best broad spectrum coverage for bacteria and fungi of the six tested products. In this study, only SilvrSTAT® attained reduction of pathogen counts to <10 CFU/ml for all tested pathogens. Hard

evidence as to whether SilvrSTAT® demonstrates the best clinical based outcomes for wound healing will come from evidence based practice and well-designed clinical studies.

## FIGURES

**Figure 1 - Bacteria Kill Time Study with SilvrSTAT® at 1hr and 24hrs**

KILL TIME STUDY WITH 32 PPM GEL				
ORGANISM	EXPOSURE INTERVAL	AVG. CONTROL TITER (CFU/ML)	PERCENT REDUCTION	LOG REDUCTION
MRSA	1 HR	$1.9 \times 10^6$	>99.99	>4.98
	24 HR	$1.9 \times 10^6$	>99.99	>4.98
P. aeruginosa	1 HR	$2.1 \times 10^6$	>99.99905	>5.02
	24 HR	$2.1 \times 10^6$	>99.99905	>5.02
VRE	1 HR	$1.9 \times 10^6$	>99.56	2.35
	24 HR	$1.9 \times 10^6$	>99.99	>5.38
BACTERIA	FDA Requirements for bacteria indication: Not less than 1.0 log reduction from the initial calculated count at 7 days, not less than 3.0 log reduction from the initial count at 14 days, and no increase from the 14 days count at 28 days.			

ABL Medical Data on File- FDA Required Time Study: Nelson Laboratories (#474527, #474527A, #474527C, #474527B, #474527D, #474527E)

**Figure 2 - Bacterial Kill Time Study For SilvrSTAT® Expressed as Log Reduction @ 7, 14, and 28 days**

ORGANISM	DAY 7	DAY 14	DAY 28
S. aureus	>4.72	>4.72	>4.72
P. aeruginosa	>4.31	>4.31	>4.31
E. coli	>4.56	>4.56	>4.56
C. albicans	>4.73	>4.73	>4.73
A. niger	>3.59	>3.59	>3.59

ABL Medical Data on File- Nelson Laboratories (#429606)

**Figure 3 - Disinfectant Efficacy Results at 5 and 10 Minutes**

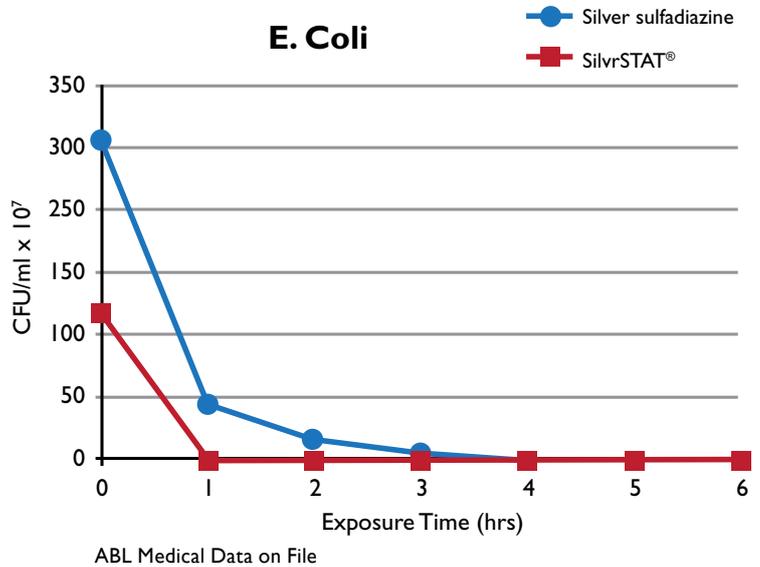
60 Different Tests per Bacteria to Evaluate How Quickly Bacteria Are Killed By SilvrSTAT®

ORGANISM	TIME POINT (MIN)	CARRIER TITER (CFU/CARRIER)	NUMBER OF CARRIERS TESTED	NUMBER SHOWING GROWTH	NUMBER SHOWING NO GROWTH
P. aeruginosa	5	$5.5 \times 10^4$	60	0	60
	10	$5.5 \times 10^4$	60	1	59
S. aureus	5	$5.5 \times 10^6$	60	6	54
	10	$5.5 \times 10^6$	60	1	59
S. choleraesuis	5	$5.5 \times 10^6$	60	1	59
	10	$5.5 \times 10^6$	60	0	60

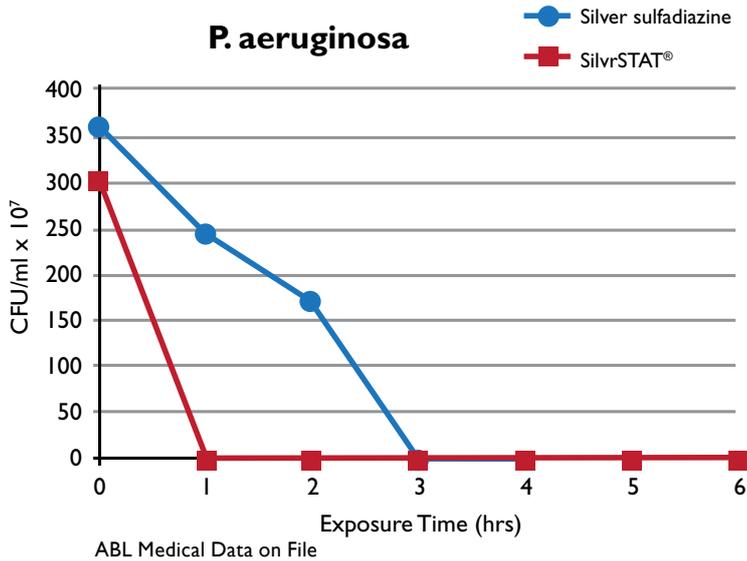
ABL Medical Data on File-Nelson Laboratories #217898

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**Figure 4 - SilvrSTAT® vs. Silver Sulfadiazine Bacterial Kill Time Data For E.Coli**

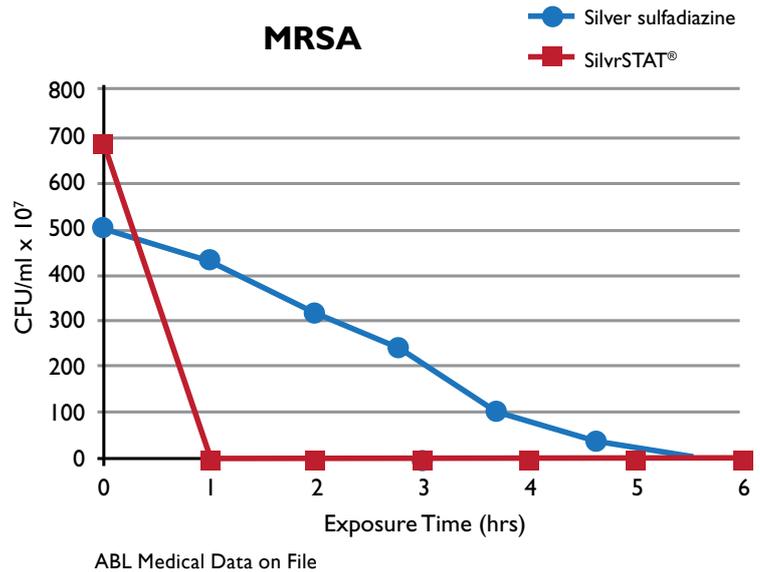


**P. aeruginosa**



**Figure 5 - SilvrSTAT® vs. Silver Sulfadiazine Bacterial Kill Time Data For P. aeruginosa**

**Figure 6 - SilvrSTAT® vs. Silver Sulfadiazine Bacterial Kill Time Data For MRSA**



**Figure 7 - Bacteria/Fungus Kill Time Study with SilvrSTAT and 5 Common Topical Antimicrobials**

PRODUCT	EXPOSURE INTERVAL	MRSA 3.8x10 <sup>5</sup> CFU/ml	VRE 7.2x10 <sup>5</sup> CFU/ml	P. aeruginosa 5.2x10 <sup>5</sup> CFU/ ml	E. Coli 8.1x10 <sup>5</sup> CFU/ml	C. albicans 6.8x10 <sup>5</sup> CFU/ml	S. agalactiae 4.3x10 <sup>5</sup> CFU/ ml
SilvrSTAT®	10 min	220000	500000	<10	8000	<10	250000
	1 hour	1200	10000	<10	<10	<10	15000
	4 hours	200	250	<10	<10	<10	<10
	24 hours	<10	<10	<10	<10	<10	<10
Medical Grade Honey	10 min	18000	450000	300	500000	700	8500
	1 hour	10000	180000	100	350000	<10	8000
	4 hours	20000	150000	<10	200000	<10	800
	24 hours	<100	600	<10	1300	<10	100
Mupirocin Ointment	10 min	<10	400000	65000	500000	150000	<10
	1 hour	<10	150000	700	80000	40000	<10
	4 hours	<10	150000	<10	16000	14000	<10
	24 hours	<10	180000	100	<10	12000	<10
Ionic Silver Gel	10 min	150000	350000	180000	450000	250000	280000
	1 hour	80000	35000	<10	75000	40000	3500
	4 hours	200	15000	<10	<10	35000	200
	24 hours	200	18000	<10	<10	800	<10
Silver Sulfadiazine Crème	10 min	120000	350000	1300	65000	7000	4000
	1 hour	2000	7000	100	300	100	100
	4 hours	300	<10	100	100	<10	<10
	24 hours	100	100	<10	<10	100	<10
Botanical Extract Gel	10 min	150000	420000	500	5500	14000	8000
	1 hour	75000	200000	100	200	300	3000
	4 hours	15000	200000	<10	<10	<10	100
	24 hours	<10	40000	<10	<10	100	200

ABL Medical Data on File -Analytical Resource Laboratory, Lindon, UT 03/14

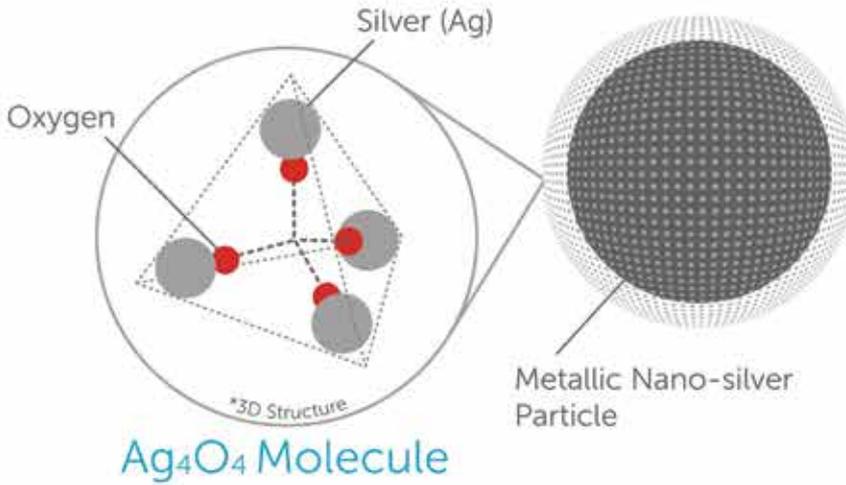
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## REFERENCES

1. Sen C K, Gordillo GM, Roy S, et al. Human Skin Wounds: A Major and Snowballing Threat to Public Health and the Economy. *Wound Repair and Regeneration* 2009 Nov-Dec; 17(6): 763-771.
2. Revelli D, Lydikson CG, Smith JD, et al. A unique Silver Sol with broad antimicrobial properties. *Antimicrobial* 2011; Apr, 3 (11): 5-16.
3. Holladay RJ, et al. Treatment of humans with colloidal silver composition. U.S. Patent 7,135,195, November 14, 2006.
4. Sterling JP, Heimbach DM, Gibran NS. Management of the Burn Wound. *ACS Surgery: Principles and Practice* (2010), doi:10.2310/7800.S07C15.
5. Roy R, Hoover MR, Bhalla AS, et al. Ultradilute Ag-aquasols with extraordinary bactericidal properties: role of the system Ag-O-H<sub>2</sub>O. *Materials Research Innovations* 2007; 11 (1): 3-18.
6. Chaloupka K, Yogeshkumar M, Seifalian AM. Nanosilver as a new generation of nano-product in biomedical applications. *Trends in Biotechnology* 2010; Nov, 28 (11): 580-88.
7. Arora S, Rajwade JM, Paknikar KM. Nanotoxicology and in vitro studies: The need of the hour. *Toxicology and Applied Pharmacology* 258 (2012) 151-165.
8. Munger MA, Radwanski P, Hadlock GC, et al. In vivo human time-exposure study of orally dosed commercial silver nanoparticles. *Nanomedicine: Nanotechnology, Biology and Medicine* (2013), doi:10.1016/j.nano.2013.06.010
9. De Souza A, Mehta D, Leavitt RW. Bactericidal activity of combinations of Silver-Water Dispersion with 19 antibiotics against seven microbial strains. *Current Science* 2006; Oct 91 (7): 926-929.
10. Becker R. Effects of Electrically Generated Silver Ions on Human Cells and Wound Healing. *Electro- and Magnetobiology* 2007; 19 (1): 1-19.
11. Neuss S, Becher E, Woltje M, et al. Functional expression of HGF and HGF receptor/c-met in adult human mesenchymal stem cells suggests a role in cell mobilization, tissue repair, and wound healing. *Stem Cells* 2004; 22 (3): 405-14.
12. Falanga V. The chronic wound: impaired healing and solutions in the context of wound bed preparation. *Blood Cells, Molecules, and Diseases*; 32 (1): 88-94.
13. Cooper BS, Medley GF, Stone SP, et al. Methicillin-resistant *Staphylococcus aureus* in hospitals and the community: Stealth dynamics and control catastrophes. *Proc Natl Acad Sci USA* 2004; July 6; 101 (27): 10223-28.
14. US Outcomes Research Group of Pfizer Inc, et al. ISPOR meeting poster session I (Abstract ID# 9489). New Research Estimates MRSA Infections Cost US Hospitals \$3.2 Billion to \$4.2 Billion Annually. <http://www.infection-controltoday.com>; Posted on: 05/16/2005; Copyright 2010 by Virgo Publishing.
15. Lee B, Singh A, David MZ, et al. The economic burden of community-associated methicillin resistant *Staphylococcus aureus* (CA-MRSA). *Clin Microbiol Infect* 2013; Jun, 19 (6): 528-36.
16. Dantes R, Mu Y, Belflower R, et al. National Burden of Invasive Methicillin-Resistant *Staphylococcus aureus* Infections, United States, 2011. *JAMA Intern Med*. Published online Sep 16, 2013 doi:10.1001/jamainternmed.2013.10423.
17. Klein E, Smith DL, Laxminarayan R. Hospitalizations and Deaths Caused by Methicillin-Resistant *Staphylococcus aureus*, United States, 1999-2005. *Emerg Infect Dis* 2007; 13 (12): 1840-46.
18. Noskin GA, Rubin RJ, Schentag JJ, et al. The Burden of *Staphylococcus aureus* Infections on Hospitals in the United States: An Analysis of the 2000 and 2001 Nationwide Inpatient Sample Database. *Arch Intern Med* 2005; 165 (15): 1756-61
19. Werdin F, Tennenhaus M, Schaller HE, et al. Evidence-based Management Strategies for Treatment of Chronic Wounds. *ePlasty*, 2009; 9: e 19.
20. Diegelmann RF, Evans MC. Wound Healing: An Overview of Acute, Fibrotic and Delayed Healing. *Frontiers in Bioscience* 2004; Jan, (9): 283-289.
21. Enoch S, Price P. Cellular, molecular and biochemical differences in the pathophysiology of healing between acute wounds, chronic wounds and wounds in the aged. *World Wide Wounds* Aug 2004. **W**

# THE NEXT GENERATION IN WOUND THERAPY

## Unique Molecular Silver Technology



### Multivalent

The Ag<sub>4</sub>O<sub>4</sub> complex attracts electrons from the cell walls of multiple bacteria simultaneously.

### Catalytic

Bacteria are lysed when they lose electrons to the silver oxide, which passes these to the nano particle's metallic core. This transfer keeps the nanoparticle in a stable state, and it is thus able to provide ongoing bactericidal activity.

Our unique molecular technology allows for a lower concentration of silver, providing an option with no known or expected side effects. Our dressing is a smooth, transparent water-based gel that is HCP-friendly.

### Indications

- 1st and 2nd degree burns, and wounds such as:
- Pressure ulcers
- Stasis ulcers
- Diabetic ulcers
- Surgical incision sites
- Device insertion site wounds
- Graft sites and donor sites
- Lacerations, abrasions, and skin tears

### Advantages

- Rapid, continuous bactericidal activity for superior wound management
- Low 32ppm silver concentration
- No known or expected adverse events
- As a hydrogel, may facilitate autolytic debridement of necrotic tissue
- No Sulfa or alcohol and non-flammable

SilvrSTAT® Antibacterial Wound Dressing Gel contains 32ppm molecular silver that in lab tests has been shown to kill and inhibit the growth of microorganisms such as:

- *Staphylococcus aureus*
- *Pseudomonas aeruginosa*
- *Escherichia coli*
- antibiotic-resistant strains VRE and MRSA, as well as
- fungi such as *Candida albicans*

To request SilvrSTAT® samples, email [info@ablmedical.com](mailto:info@ablmedical.com) or call (801) 763-8000.

### KILL TIME STUDY WITH 32 PPM GEL

ORGANISM	EXPOSURE INTERVAL	AVG. CONTROL TITER (CFU/ML)	PERCENT REDUCTION	LOG REDUCTION
MRSA	1 HR	1.9 X 10 <sup>6</sup>	>99.99	>4.98
	24 HR	1.9 X 10 <sup>6</sup>	>99.99	>4.98
P. aeruginosa	1 HR	2.1 X 10 <sup>6</sup>	>99.99905	>5.02
	24 HR	2.1 X 10 <sup>6</sup>	>99.99905	>5.02
VRE	1 HR	1.9 X 10 <sup>6</sup>	>99.56	2.35
	24 HR	1.9 X 10 <sup>6</sup>	>99.99	>5.38
BACTERIA	Not less than 1.0 log reduction from the initial calculated count at 7 days, not less than 3.0 log reduction from the initial count at 14 days, and no increase from the 14 days count at 28 days.			

ABL Medical Data on File- FDA Required Time Study: Nelson Laboratories (#474527, #474527A, #474527C, #474527B, #474527D, #474527E)