8.25"

11.5"

Launching for the

1st time in India

multident™

Nano-Silver hydrogel for ORAL HEALING & PROTECTION

HARNESS THE POWER OF

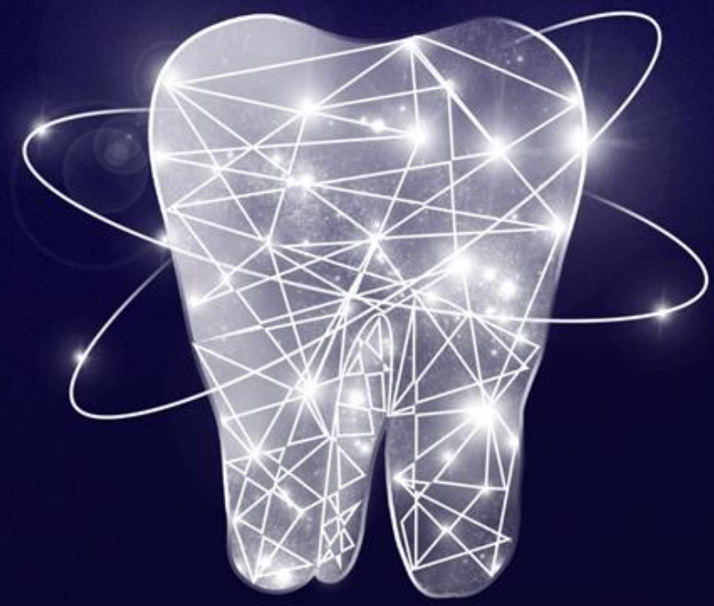
NANO-SILVER

WITH

SILVERSOL

TECHNOLOGY

Monograph



multident™

Nano-Silver hydrogel for ORAL HEALING & PROTECTION

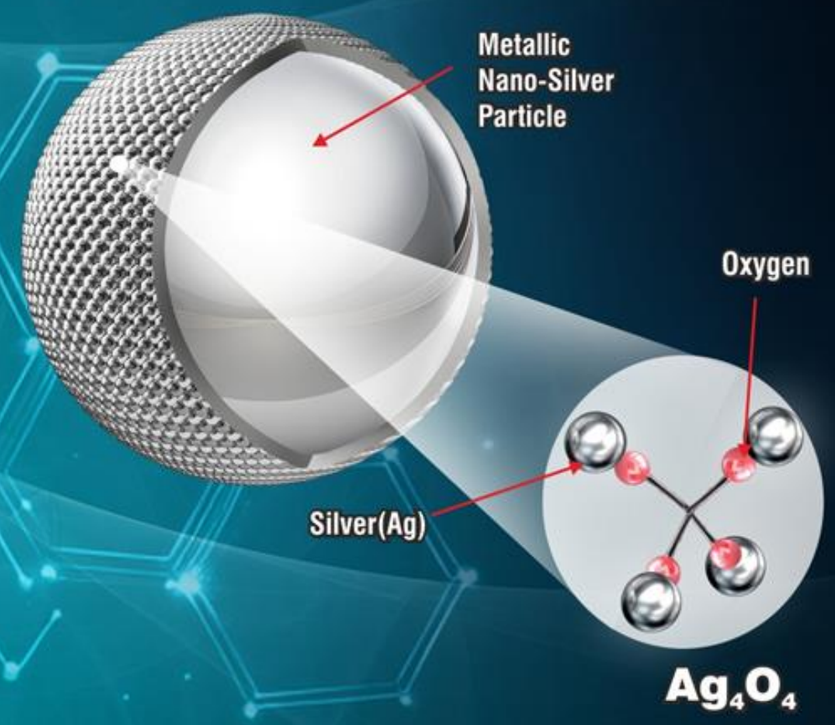
8.25"

11.5"

The power of Nano-Silver

multident™

Nano-Silver hydrogel for ORAL HEALING & PROTECTION



POWERED BY SILVERSOL TECHNOLOGY

PATENDED
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ARISTO | ARISTO PHARMACEUTICALS PRIVATE LIMITED

In collaboration with

American Biotech Labs

Introducing

multident™

Nano-Silver hydrogel for ORAL HEALING & PROTECTION

PATENT NO
WO 06 74117
US 6 214 229
US 6 743 348
AMERICAN BIOTECH LABS, USA

8.25"

11.5"

CONTENTS

8.25"

11.5"

Introduction:

Oral health is a good predictor of overall health. The link between oral and general health has only recently been established. Oral health represents a major concern for general health, while general health is a key determinant of overall quality of life. Oral health is a main part of general health since it has various effects on the entire human body. This can be explained by periodontitis contributing to the systemic inflammatory burden. There is a possible interaction between periodontitis with the complex pathogenesis of diabetes mellitus and cardiovascular disease as well as endocarditis and recurrent pneumonia in older age. Good oral health may therefore contribute to the general health and the prevention of pathologies and may thus also affect overall quality of life.

(Ref: Block, C., König, HH. & Hajek. BMC Oral Health 22, 606 (2022)).

Oro-dental diseases present a significant global health challenge, affecting nearly half of the world's population. It is estimated that oral diseases affect nearly 3.7 billion people. In India the incidence of mild and moderate periodontal conditions was nearly 25%, while about 19% of the adults experience severe periodontitis.

(Ref: Journal of Multidisciplinary Healthcare 2022:15 1547–1557)

These oro-dental diseases, including dental caries, gingivitis, periodontitis, and tooth loss, can lead to pain, disfigurement, and systemic health complications. While largely preventable, they disproportionately affect vulnerable populations, including children, the elderly, and those with limited access to dental care.

(Ref: WHO.2025)

The consequences of widespread poor oral health can be seen on the personal, population, and health systems level, as caries and periodontal disease deteriorates the individual health and well-being, decrease economic productivity, and act as significant risk factors for other systemic health ailments. In most of the developing countries including India, there is a limited access to oral health care services, as a result teeth are often left untreated or are extracted because of pain or discomfort. The growing incidence of some chronic diseases like diabetes can further have a negative impact on oral health.

(Ref: Gambhir R and Gupta T. Annals of Medical and Health Sciences Research. 2016. 6(1):50).

multident™

Tooth Gel

Colloidal Nano Silver and Xylitol

Oral Gel for Teeth and Gums

First Time in India

Ingredients:

Silver Sol Solution (Deionized water and 22 ppm Colloidal Nano Silver), Xylitol, Carbomer, Triethanolamine, Peppermint Oil, Permitted Colour.

Net Weight: 35 g

Nanotechnology

Nanotechnology involves the design, production, and application of materials and devices on a nanometric scale, typically less than 100 nanometers.

Nanoparticles

- The prefix "nano" is a Greek word for "dwarf".

SILVERSOL®: A Unique Nanotechnology

- A novel formulation based on patented technology.
- Formulated to 22ppm nano colloidal silver or metallic nano silver aqueous gel form along with Xylitol and peppermint oil (used in food industry).

American Biotech Labs: Pioneers of SilverSol® Technology

- ABL is a globally recognized innovator in nano-silver research and development.
- The company has developed and patented SilverSol® Technology.

8.25"

11.5"

Colloidal Nano-Silver:

A Unique Bio-disruptive Nanotechnology

Colloidal Nano Silver is also known as Nano silver hydrogel or Metallic Nano-Silver. It is also termed as "Nano Metallic Silver Tetrahedral Tetraoxide" (NMSTTO) based on its structure. It is a preparation consisting of silver particles suspended in liquid.

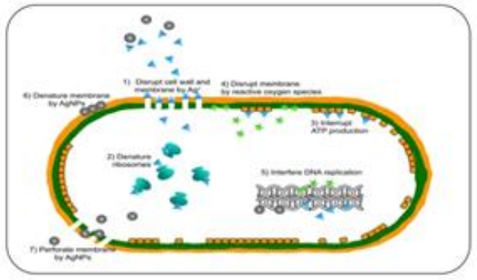
SilverSol contains nanoparticles of size 5-7 nm which comprise an interior of metallic silver and an exterior of silver oxide including multivalent silver (I, III) oxide, Ag_4O_4. Research has uncovered multiple modes of action by which the Metallic Nano-silver Particle functions.

Colloidal Nano-Silver:

Mechanism of Action

Ion Release:
- AgNPs continuously release silver ions (Ag^+), which exhibit antimicrobial activity.

Cell Wall Interaction:
- Ag^+ binds to cell walls and membranes due to electrostatic attraction and affinity to sulfur proteins.
- Binding increases membrane permeability, disrupting the bacterial envelope.



Intracellular Disruption:
- Internalized Ag^+ inactivates respiratory enzymes, generates reactive oxygen species (ROS), and interrupts ATP production.
- ROS damages DNA and membranes, leading to cell dysfunction.

Protein Synthesis Inhibition:
- Ag^+ can denature ribosomes, inhibiting protein synthesis.

DNA Interaction:
- Ag^+ interacts with sulfur and phosphorus in DNA, inhibiting replication and reproduction.

Structural Damage:
- AgNPs accumulate in pits on the cell surface, causing membrane denaturation.
- Due to nanoscale size, AgNPs penetrate cell walls, disrupting membrane integrity and causing lysis.

Signal Transduction Interference:
- AgNPs disrupt bacterial signaling by dephosphorylating tyrosine residues.
- Impaired signaling leads to apoptosis and halted cell division

Colloidal Nano-Silver:

Unique Mode of Action for Oral healing and Protection

1. Rapidly steals multiple electrons from bacterial cells (Electrocution)
2. Resonates & kills bacteria
3. Destroy bacterial cells (Bio-disruptive)
4. Inhibits bacterial biofilm formation
5. Wound healing: down regulates Matrix Metalloproteinase (MMPs)

SilverSol attacks microbes via a series of pathways. These various modes of action are referred to as "bio-disruptive" and "catalytic". Also, the inherent plasmonic resonance of the solid metallic nanoparticle can also be described as "catalytic".

Rapidly steals multiple electrons from bacterial cells (Electrocution)

Once the microbe is bound to the SilverSol particle, silver (I, III) oxide (Ag_4O_4) begins to exert its effect. The mechanism of Ag_4O_4 involves the acceptance of an electron by trivalent silver ions and ejection of an electron from monovalent silver ions through the aqueous media. The pathogen becomes "electrocuted" by electrons emanating from all Ag_4O_4 in the vicinity.

Resonates & kills bacteria

SilverSol resonates at 890-910 THz, i.e. 330-337 nm, which is in the UVA range. This frequency allows Silver Sol to kill bacteria and viruses by destroying proteins. UVA light is abundant in the environment. Resonance of Silver Sol facilitates absorption of an electron from a microbial protein. However, once the electron is accepted, a very high energy situation arises, and this energy is transferred to an electron which is fired at the microbe, causing electrocution in the presence of oxygen. In the sense that the resonance confers a vibrational effect to surrounding cells which affect only pathogens and not normal cells or cell function.

Destroys bacterial cells (Bio-disruptive)

Attacks microbes via a series of pathways including protein inactivation, DNA denaturation and disassociation, binding affinity and an oligodynamic effect.

Inhibits bacterial biofilm formation

Silver nanoparticles (AgNPs) inhibit biofilm formation by disrupting bacterial cell membranes, interfering with ribosome function, and generating reactive oxygen species (ROS). They also disrupt cell pathways, leading to cellular death. Furthermore, AgNPs can directly interfere with the adhesion and attachment of bacteria to surfaces, hindering biofilm development. (Ref: Swolana D, Kępa M, Kruszniewska-Rajs C, Wojtyczka RD. Int J Mol Sci. 2022 Aug 17;23(16):9257

Wound healing: down regulates Matrix Metalloproteinase (MMPs)

Rapid destruction of pathogens in wounds and around diseased and inflamed tissue leads to the down regulation of Matrix Metalloproteinase (MMPs).

8.25"

11.5"

Multident:

Better than other Silver Nanoparticle

Almost all silver products today are based on an ionic or silver salts. The limitations with ionic silver includes:

- **It has very limited efficacy and bioavailability.**
- **It is quickly neutralized by other cells and thus, rendered ineffective as they are excreted in their first pass through the liver.**
- **It is highly unstable and because they require such high concentrations to be effective, they tend to react poorly when formulated into or with other compounds.**

On the other hand, SilverSol technology is based on a unique molecular construct of a MNSP (Metallic Nano-Silver Particle), which provides **superior disinfection and anti-inflammatory properties when compared to other forms of colloidal silver**. These MNSPs range in size from 5-7 nanometres and are surrounded by a multivalent silver oxide coating comprised of thousands of Ag_4O_4 molecules.

In the case of SilverSol, this resonance flux or vibration occurs at between 890- 910 terahertz (200-300 nanometers) which is the same resonance frequency at which germicidal ultraviolet light causes bacteria, viruses and yeast to be destroyed. **This vibrational frequency is unique to Multident (Colloidal Nano-Silver) and is passed from the metallic silver particle to the outer Ag_4O_4 coating** and then to the surrounding water molecules because of the strong molecular bond between the silver tetric oxide coating and the water molecules.

Limitations of Currently Available Antiseptic/ Antimicrobial agents

Antiseptic/ Antimicrobial agent	Type	Recommended concentration	Primary mechanism of antimicrobial action	Drawbacks
Povidone Iodine	Iodophors -oxidizing agents	1-2%	Inactivation of enzymes & proteins	Allergic reactions on site of application, impaired wound healing
Chlorhexidine gluconate	Non oxidizing bisbiguanide	2-4%	Cell membrane damage and cell lysis, coagulation of intracellular proteins	Stains tooth surfaces, resistant strains prevalent, inactivated by organic serum compounds in gingival fluid. No action against *P. aeruginosa*
Sodium Hypochlorite	Oxidizing agent	0.5% or 200-5000 PPM	Highly active cytotoxic oxidant, disrupts cell membrane transport chain	Irritates oral mucous membranes, black-brown discoloration of the teeth, less effective in presence of organic environment
Metronidazole	Antibacterial	1.5-25%	Inhibits nucleic acid synthesis by disrupting the DNA of microbial cells	Narrow antimicrobial coverage since it is active against oral anaerobic bacteria only, bacterial resistance development
Triclosan	Antibacterial & antifungal	0.30%	Triclosan is bacteriostatic, and it targets bacteria primarily by inhibiting fatty acid synthesis and interferes with enzymatic activities in microbes	May disrupt the endocrine system, Environmental concerns, use surrounded by controversy

Multident:

Established Safety

No discoloration/ No Argyria : Unlike conventional silver compositions, Silver Sol is completely colourless and stable to light and chemical changes without use of any additives. This means that Silver Sol remains in solution and is not deposited in the skin and thus will not cause argyria.

Environmental Protection Agency (EPA): <5mg/kg daily for 70 kg adult which is approx. 350mg/daily resistants. Multident tooth gel contains 22 ppm Silver i.e. 22 µg/gm of the gel. In a single application i.e. 11 µg Silver will be applied. When used 3 times a day to the affected area by fingertip the quantity is 33µg which is well within the limits.

The concentration of silver in Multident is very much within limits as recommended by the regulatory agencies. Therefore, there would be minimal absorption through oral mucosa.

SILVERSOL: What makes it so unique?

SilverSol technology (NMSTTO) based products in dentistry offers the advantage of superior antimicrobial with wound healing properties and helps better management of post-operative pain, inflammation and infection. The value-added features and benefits of these NMSTTO products revolve around its powerful, clinically proven antimicrobial, wound healing, anti-inflammatory and pain reducing properties.

The key clinical benefits of NMSTTO technology in dental procedures are as follows:

1. Profound antimicrobial efficacy - SilverSol Gel was tested against numerous bacterial and yeast strains (*Candida albicans*, *Staphylococcus aureus*, MRSA, *Pseudomonas aeruginosa*, *Escherichia coli*). Results indicate that SilverSol Gel completely destroyed all forms of bacteria. Silver Sol Gel far surpassed FDA required kill percentages by killing all yeast and bacteria tested at a significant level of 99.99%.

SilverSol kills MRSA and other bacterial strains tested and prohibits any mutation. This means SilverSol can be used safely and effectively every day without causing the bacteria to mutate and become resistant. *Porphyromonas gingivalis* is a gram-negative oral anaerobe involved in periodontitis, an inflammatory gum disease. *P. gingivalis* is promptly killed by SilverSol concentrations as low as 10 PPM.

2. Increased rate of wound / tissue healing – NMSTTO based products help rapid re-epithelialization and closure of wounds in the oral cavity. Also, SilverSol reduces swelling, inflammation and pain to speed up the healing process. Silver Sol destroys bacteria, viruses and fungus, thus reducing the burden on the immune system and allowing an already overworked immune system to prioritize its actions towards healing and rebuilding functions. Stem cells are activated and work to improve healing outcomes.

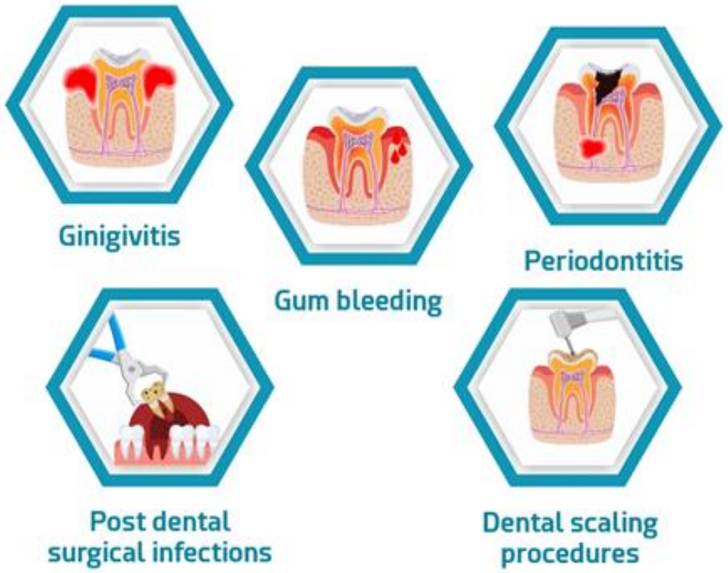
3. Decreased inflammation, redness, oedema and pain – When SilverSol is regularly applied by the patients post surgically, by 7-10 days post operatively the surgical site tissues are usually firm and pink and there is a noticeable lack of redness, exudates and puffiness at the surgical site. NMSTTO product has a profound pain reducing effect thus reduces the need for NSAID/analgesic medications.

4. Biofilm removal - The anti-biofilm activity of silver nanoparticles has been demonstrated in several studies. Several studies have demonstrated the inhibition of in vitro biofilm formation by a variety of bacterial species at specific nanoparticle concentrations. As per a recent study, over 6 logs of inhibition (100%) were found for *S. mutans, S. sanguinis,* and *S. salivarius* for the SilverSol gel-treated bacteria when compared with the control gel. In addition, the SilverSol gel also inhibited biofilm formation by these three bacteria mixed together.

5. Decreased infection and post-surgical complications – This is primarily due to increased healing via primary intention due to rapid re-epithelialization of the overlying gingival tissues. SilverSol gel 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.

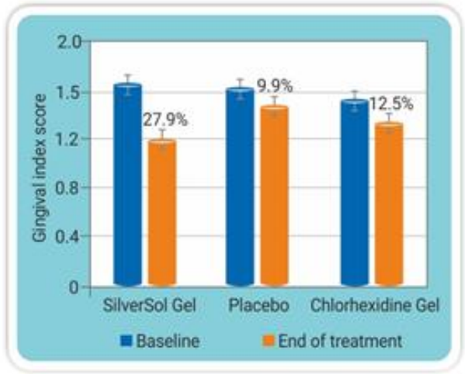
6. Decreased scar tissue formation – Enhanced healing by primary intention was observed following the topical application of SilverSol hydrogel into the surgical site and over the sutures after flap re-approximation . Rapid re-epithelialization also occurred with a dramatic lack of scar tissue formation. It appears that stem cell activation with SilverSol, could be responsible for the rapid adhesion of the laceration and assist in the removal of the scab and reduction of the scarring.

Clinical Usage:



Clinical Evidence:

Study 1. Efficacy of Colloidal Nanosilver Tooth Gel vs Chlorhexidine in various oro-dental conditions.



Aim: To assess the efficacy of Silversol tooth gel in the management of oro-dental hygiene.

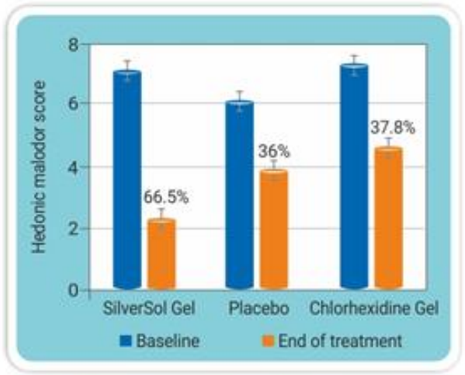
N=120 patients, 40 in each arm, viz., SilverSol® Tooth Gel (Test Product), Placebo Gel (Placebo), and Chlorhexidine Gel (Reference Product)

Primary Endpoints: Assessment of change in Breath odor from the screening to the end of the treatment.

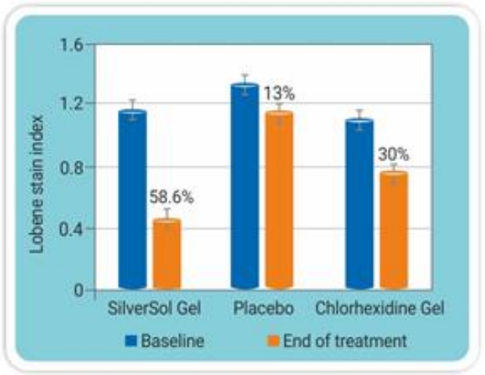
Evaluation of the changes in extrinsic tooth stains from screening to the end of treatment by Lobene Stain index.
Reduction in plaque formation in the mouth from baseline to the end of the treatment.

Plaque score was determined by using the scoring system for tooth surfaces as follows:

0 = No Plaque on the tooth surface
1 = 1/3 of the tooth surface covered
2 = Between 1/3 and 2/3 of the tooth surface covered
3 = More than 2/3 of the tooth surface covered



Breath odor assessment in the treatment groups



Extrinsic tooth stains assessment in the treatment groups

Results: SilverSol showed a significant effect in almost all the conditions monitored in the patients. There was a reduction in extrinsic tooth stains and pocket depth score in the mouth by 58.6% and 52.2% respectively. Breath malodor also showed improvement as the score reduced by 66%. Altogether, it contributed to the overall oral health improvement by 69%.

Conclusion: SilverSol® Tooth Gel is effective in several orodental conditions including periodontitis and gingivitis in comparison to chlorhexidine gel. Routine application of SilverSol Tooth Gel will prevent these conditions and maintain the overall orodental health.

Ref: Mahale SA, Walvekar AK, Tiwari S, et al. J Oral Health Comm Dent 2023;17(2):49–56.

Study 2: Visible Changes within 7 days

Aim: A pilot study was conducted on eight patients suffering from dental problems- dental plaque, bleeding, gingivitis and gingival inflammation.

Eight patients were treated with the silversol tooth gel for 1 week, twice a day.

99% patients exhibited signs of clinical improvement- reduction of plaque, gingival inflammation and bleeding.

Marked decrease in inflammation in 50% patients.

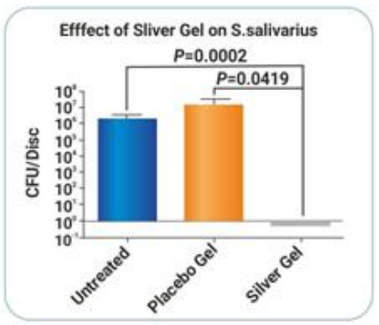
Gingival tissue was healthier (pink and firm) after treatment.

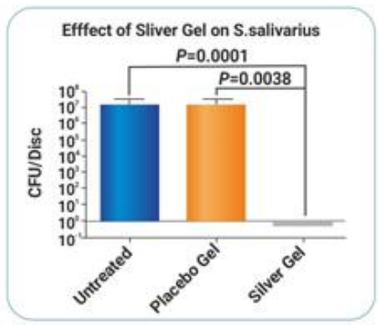
Data on file

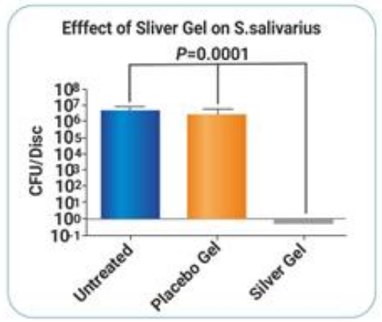
Study 3: Excellent inhibition (100%) of bacterial biofilm formation

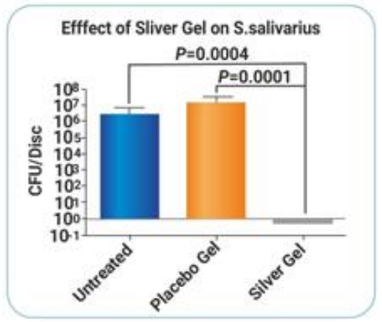
Aim: To assess the efficacy of a colloidal silver gel formulation for inhibiting bacterial biofilm formation (Ag-gel)..

The effect of Ag-gel on viability of *S. mutans*, *S. sanguis*, and *S. salivarius* was assessed by quantifying their Colony Forming Units (CFU) in presence or absence of the test gel.







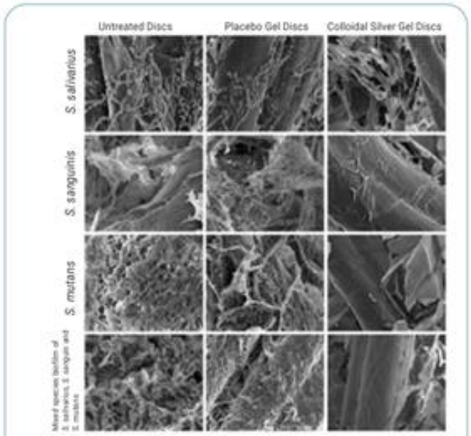


An Ag-gel was found to be capable of 100% inhibition of *S. salivarius*, *S. sanguis*, or *S. mutans* bacteria, or a mixture of all three bacteria forming biofilms on cellulose discs by Colony Forming Units (CFU) studies.

Effect of Ag-gel dressing on bacterial biofilm formation for in vitro Scanning electron microscopy studies (SEM) studies: 100% Inhibition of Biofilm Formation

The biofilm formation of *S. salivarius, S. sanguinis*, *S. mutans* or the mixture of all three strains was studied on cellulose discs by SEM. *S. salivarius, S. sanguinis, S. mutans* and the mixture of all three strains, were inoculated onto the discs in the same manner as for the CFU biofilm assay. Untreated discs were coated with placebo gel only. As above the discs were incubated for 24 h under micro-aerobic conditions at 37°C.

S. salivarius, S. sanguinis, S. mutans and the mixture of all three strains, formed typical biofilms characterized by the presence of micro-colonies on the cellulose. discs receiving no treatment, or treated with the placebo gel. **However, no bacteria were seen on the cellulose discs treated with colloidal silver gel.**



Conclusion: The Ag-gel was effective in preventing biofilm formation by *S. mutans, S. sanguis, and S. salivarius*. Use of a colloidal silver gel is an effective way to inhibit the formation of biofilms by the most common bacteria implicated in oral plaque formation, and this gel stands good potential.

Ref: Tran PL, Luth K, Wang J et al. F1000Research 2019, 8:267

8.25"

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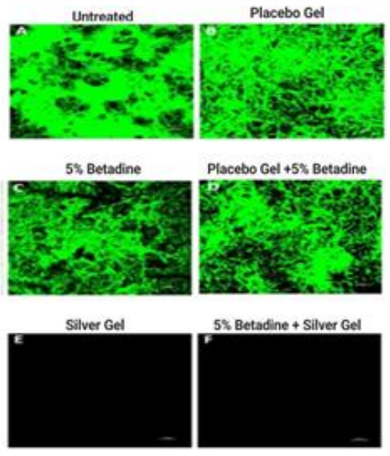
Effect of 5% Betadine treatment on bacterial biofilm formation for in vitro CFU studies

The study found that Ag-gel is fairly effective in inhibiting bacteria from forming biofilms on cellulose. The Ag-gel was 100 % effective in blocking bacterial attachment of *Staphylococcus aureus, Pseudomonas aeruginosa, S. epidermidis*.

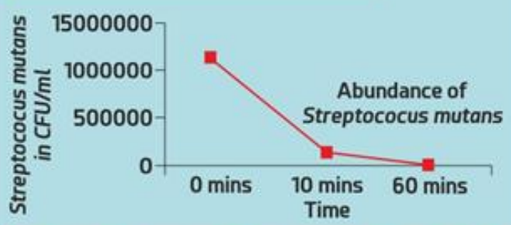
The present study was undertaken to determine if the combination of 5% Betadine solutions and silver colloidal gel (Ag-gel), is more effective than the individual materials in inhibiting the growth of both Gram negative and Gram positive bacteria.

These determinations were carried out by both the colony forming unit (CFU) assay, and confocal laser scanning microscopy (CLSM). Ag-gel showed complete inhibition on all the bacteria.



Study 4: Xylitol kills 99.99% bacteria

Abundance of *Streptococcus mutans*



Results Show that Silversol tooth Gel with xylitol reduces abundance of *Streptococcus mutans* by 99.99938% in an hour.

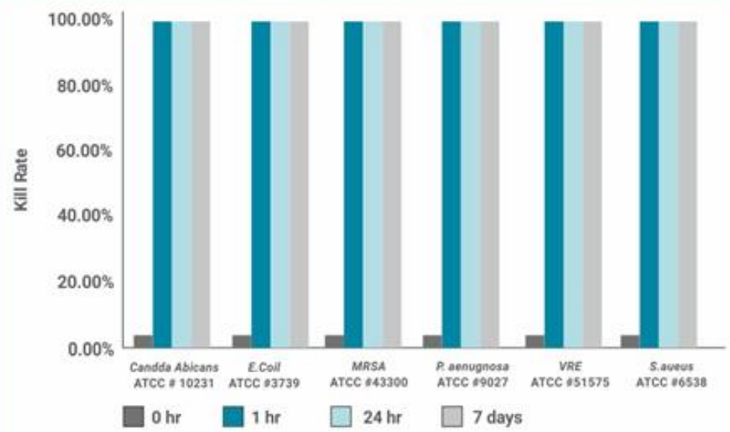
Xylitol is a dynamic ingredient. That aids in the prevention of dental caries, and reduces plaque formation. Xylitol reduces the levels of *Streptococcus mutans* (MS) in plaque and saliva by disrupting their energy production processes, leading to futile energy cycle and cell death. It reduces the adhesion of these microorganisms to the teeth surface and also reduces their acid production potential.

Data on file.

Study 4: Remarkable Kill rate (99.999%) in the first hour of contact

As per an in vitro study, Colloidal Nano silver solution has an excellent activity against this pathogen achieving 99.99% kill rate as shown below.

Time Intervals	Inoculation CFU	Recovered CFU	Log Reduction	Reduction %
3 Minutes:	1,200,000	<15	4.9	99.99%
10 Minutes:	1,200,000	<15	4.9	99.99%
30 Minutes:	1,200,000	<15	4.9	99.99%



Results indicated that SilverSol gel quickly and completely destroys Yeasts (*Candida albicans*) and bacteria (*Staphylococcus aureus*, MRSA, *Pseudomonas aeruginosa, E. coli*) within one hour. SilverSol gel kills quickly and completely to a Log 5 reduction. This is significant because an FDA Category 1 wound care approval requires the approved product to be able to achieve a 1 Log reduction (90% kill rate) in 7 days of contact and a 3 Log reduction (99.9% kill rate) within 14 days. **Remarkably, SilverSol achieved a 4-5 Log reduction (99.999% kill rate) in the first hour of contact. In addition to bacteria, nano silver solution has cidal effects on a wide range of fungi, protozoa, and even viruses.**

Analytical Report, Northeast Laboratories Inc. USA, Data on File

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11.5"

Clinical Indication:

Oro-dental conditions:

- Gingivitis including bleeding gums
- Periodontitis
- Post-dental surgical infections
- Dental scaling procedures

Duration: 7-14 days

Directions For Use:

Rinse your mouth thoroughly prior to gel application.

Apply Multident Tooth Gel on the affected area with a clean finger or cotton swab 2-3 times a day or as directed by the doctor. Do not rinse the mouth or drink or eat anything for 30 minutes after application.

Nano Metallic Silver Tetrahedral Tetraoxide (NMSTTO): Summary

SilverSol, or Nano Metallic Silver Tetrahedral Tetraoxide (NMSTTO), is a uniquely engineered colloidal nano-silver with broad-spectrum antimicrobial, anti-inflammatory, and wound-healing properties. Unlike traditional ionic silver, it leverages metallic nanoparticles coated with multivalent silver oxide (Ag_4O_4) for enhanced bioavailability and stability.

Advantages over Ionic Silver

- Superior bioavailability: Remains effective in vivo, unlike ionic silver, which is quickly neutralized and excreted.
- Lower toxicity & dosage requirement: Works at ultra-low concentrations due to nano-catalytic and electrostatic activity.
- Stable structure: Avoids clumping; disperses uniformly in pure water due to its electric charge barrier.
- No bacterial resistance: Does not promote bacterial mutation or resistance.

Salient Features

1. Antimicrobial Efficacy

Kills a wide range of pathogens with >99.999% effectiveness.

2. Enhanced Healing

Promotes rapid tissue repair and re-epithelialization; reduces immune burden, enabling faster recovery.

3. Anti-inflammatory & Analgesic

Reduces IROP: Inflammation Redness Oedema and Pain.

4. 100% Inhibition of Bacterial Biofilm formation

Effectively removes oral biofilms *(S. mutans, S. sanguis, S. salivarius)*, preventing plaque build-up and infection.

5. Decreased Post-Surgical Complications

Accelerates healing and reduces post-op infection risk through rapid re-epithelization of gingival tissue

Conclusion: SilverSol represents a next-generation nanotechnology in antimicrobial care, offering unmatched stability, safety, and efficacy across medical and dental applications. Its multi-modal action and unique structure distinguish it from conventional silver products, making it both a potent pathogen destroyer and a wound healing accelerator.

Analytical Report, Northeast Laboratories Inc. USA, Data on File