Original Research Paper

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Plastic Surgery

# EFFECT OF SUPEROXIDISED SOLUTION IN THE MANAGEMENT OF BURN WOUNDS.

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| **Dr. Alia Hussain** | Assistant Professor, Plastic Surgery, Kilpauk Medical College, Chennai. |
| **Dr. Swarnlata Shiromani** | Resident, Plastic Surgery, Kilpauk Medical College, Chennai. |
| **Dr. Murali** | Assistant Professor, Plastic Surgery, Kilpauk Medical College, Chennai. |
| **Dr. Mahadevan** | Professor, Plastic Surgery, Kilpauk Medical College, Chennai. |

**ABSTRACT** **Background:** Superoxidised solution (SOS), an electrochemically generated hypochlorous acid–based irrigant, offers broad antimicrobial activity with low cytotoxicity and may accelerate burn wound healing compared with conventional normal saline plus silver sulfadiazine (NS+SSD). **Objective:** To compare healing efficacy, pain, infection, and dressing burden between SOS and NS+SSD in acute burns. **Methods:** Prospective randomized comparative study of 20 patients (10–60 years) with ≤25% TBSA partial-thickness/mixed-depth burns, allocated to NS+SSD (Group A, n=10) or SOS dressings (Group B, n=10). Primary outcomes: time to epithelialization/90% wound closure and number of dressing changes. Secondary outcomes: pain (VAS 0–10), day-7 culture positivity, and complications. Statistical significance set at $p<0.05$. **Results:** Baseline demographics, etiology (flame/scald), sites, and TBSA were comparable. SOS yielded earlier granulation with fewer dressings (3–4 vs 6–7) and significantly faster healing: mean time to 90% closure 16.8 ± 2.3 days vs 21.2 ± 2.8 days for NS+SSD ($p<0.05$); mean time to epithelialization 16.4 ± 2.1 vs 20.6 ± 2.5 days ($p<0.05$). Early-phase pain scores were slightly higher with SOS (VAS 6–7 vs 5–6) but subsided by day 7. Day-7 culture positivity was similar (3/10 SOS vs 4/10 NS+SSD; common isolates *Klebsiella*/*Pseudomonas*), with no septicemia. Comorbid diabetes modestly delayed healing but did not alter between-group trends. **Conclusions:** In acute burns, SOS reduced dressing frequency and significantly shortened time to epithelialization compared with NS+SSD, with comparable infection control and only transiently higher early pain. SOS is a practical, tissue-friendly alternative for burn wound management.

**KEYWORDS :** superoxidised solution, hypochlorous acid, silver sulfadiazine, burns, epithelialization, wound care.

## Introduction

Burn injuries represent one of the most devastating forms of trauma, resulting in substantial physical, psychological, and socioeconomic burdens. The goal of burn wound management is to promote rapid epithelialization, prevent infection, and minimize scarring. Conventional wound care relies on cleansing with normal saline and topical antimicrobial agents such as silver sulfadiazine (SSD). However, repeated dressing changes, delayed healing, and cytotoxic effects on regenerating tissues have prompted the exploration of novel solutions (1).

Superoxidised solution (SOS), an electrochemically processed aqueous solution containing hypochlorous acid and other reactive oxygen species, exhibits potent broad-spectrum antimicrobial properties with minimal cytotoxicity. It mimics the natural oxidative burst mechanism of neutrophils, enhancing wound bed preparation and granulation tissue formation (2). Previous studies have suggested its usefulness in chronic ulcers, diabetic wounds, and surgical site infections. This study aimed to evaluate the efficacy of SOS in acute burn wounds compared to conventional NS + SSD dressings.

## MATERIALS AND METHODS

### Study Design And Participants

A prospective comparative study was conducted on 20 patients with acute partial-thickness or mixed-depth burns admitted to the burns unit. Patients were randomized equally into two treatment arms:

Group A: Dressings with normal saline and silver sulfadiazine.

Group B: Dressings with superoxidised solution (SOS).

Inclusion criteria comprised patients aged 10–60 years with flame or scald burns involving ≤ 25% total body surface area (TBSA). Exclusion criteria included chemical/electrical burns, extensive burns (> 25% TBSA), or immunocompromised status.

### Procedure

After initial resuscitation wounds were cleansed using the allocated solution. Group A received SSD-impregnated gauze over saline-cleaned wounds. Group B wounds were irrigated and dressed using sterile SOS-soaked gauze. Dressings were changed daily for the first three days and subsequently every 48 hours depending on exudate. Patients were monitored until complete epithelialization or readiness for grafting.

Parameters recorded included demographics and burn characteristics (type, site, % TBSA), number of dressing changes, pain intensity (Visual Analogue Scale, VAS 0–10), microbiological culture (day 3 and day 7), time to epithelialization, complications and comorbidities. Descriptive statistics were used (mean ± SD, percentages). Comparative analyses were performed using Student's *t*-test and Chi-square test, with $p < 0.05$ considered significant.

## RESULTS

Among 20 patients (11 males, 9 females), the mean age was 22.4 years in Group A and 23.2 years in Group B. Flame burns were the predominant cause, followed by scalds. The upper limbs (65%) were most frequently affected, followed by the chest, face/neck, lower limbs, and back (Table no. 1).

Group B (SOS) exhibited faster epithelialization, requiring 3–4 dressings for visible granulation and re-epithelialization, compared to 6–7 dressings in Group A. Mean duration to 90% wound closure was 16.8 ± 2.3 days in Group B versus 21.2 ± 2.8 days in Group A ($p < 0.05$). Mean duration of wound healing in terms of readiness for further surgical procedures like grafting was 22.2 ± 3.1 days and 26.8 ± 2.4 days in Group B and Group A respectively.

Pain scores were slightly higher in the SOS group (mean VAS 6–7) than in the NS + SSD group (VAS 5–6), particularly during the first few dressings. Pain subsided significantly by day 7 in both groups.

Positive cultures were identified in 7 patients-4 from Group A and 3 from Group B. The most common isolates were *Klebsiella spp.* and *Pseudomonas aeruginosa*. All infections were responsive to targeted antibiotic therapy. No cases of septicemia were observed.

Diabetes mellitus was the most prevalent comorbidity (35%), followed by hypertension (10%). These factors modestly delayed wound closure but did not alter the comparative outcome trend.

**Table 1: Table Showing Demographic Data Of Both The Groups**

| Parameter | Group A (NS + SSD) | Group B (Superoxidised Solution) | p-value / Observation |
|---|---|---|---|
| No. of Patients (n) | 10 | 10 | — |

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|---|---|---|---|
| Mean Age (years) | 22.4 ± 4.3 | 23.2 ± 5.1 | NS |
| Gender (M:F) | 6:4 | 5:5 | — |
| Common Etiology | Flame (70%), Scald (30%) | Flame (65%), Scald (35%) | Similar pattern |
| Most Common Site | Upper limb (60%), followed by chest, face/neck | Upper limb (70%), followed by chest, face/neck | — |
| Mean %TBSA Involved | 12.8 ± 4.2% | 11.9 ± 3.7% | NS |

Case documentation demonstrated varying burn involvement (6–20% TBSA) over the face, trunk, abdomen, gluteal region, and upper limb. SOS-treated wounds showed healthier granulation and minimal slough by the third dressing.

**Table 2: Table Comparing The Outcomes Of Both The Groups**

| Parameter | Group A (NS + SSD) | Group B (Superoxidised Solution) | p-value / Observation |
|---|---|---|---|
| Mean No. of Dressing Changes | 6–7 | 3–4 | Significant reduction |
| Mean duration for readiness of wound bed for surgical procedure | 26.8 ± 2.4 days | 22.2 ± 3.1 days | $P<0.05$ |
| Mean Healing Time (days) | 21.2 ± 2.8 days | 16.8 ± 2.3 days | $p < 0.05$ |
| Pain Score (VAS 0–10) | 5–6 | 6–7 | Mildly higher in Group B |
| Day 5 Culture Positivity | 4 patients (Klebsiella, Pseudomonas) | 3 patients (Klebsiella, Pseudomonas) | Comparable |
| Comorbidities | Diabetes (40%), Hypertension (10%) | Diabetes (30%), Hypertension (10%) | — |
| Mean Time to Epithelialization (days) | 20.6 ± 2.5 days | 16.4 ± 2.1 days | $p < 0.05$ |
| Overall Clinical Outcome | Gradual granulation, delayed epithelialization | Early granulation, faster closure | Better healing with SOS |

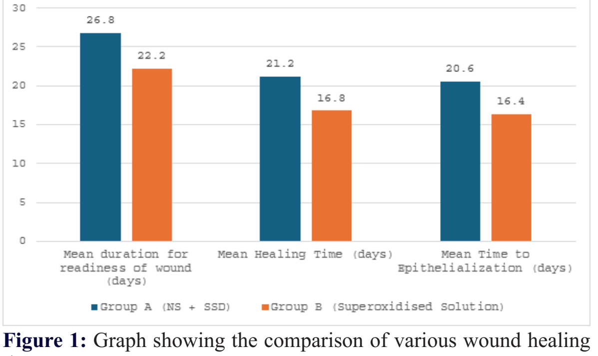


**Figure 1:** Graph showing the comparison of various wound healing times


**Figure 2:** Results of SOS in a 60 year old male with burns over the chest and neck


**Figure 3:** Results of SOS in a 20% flame burn affecting a 8 year old child

## DISCUSSION

Burn wound management continues to evolve with the objective of achieving rapid wound healing, minimizing infection, and reducing pain and dressing frequency. Traditional dressings employing normal saline for wound cleansing followed by topical antimicrobial agents such as silver sulfadiazine (SSD) have long been considered the gold standard for partial-thickness burns. However, these agents often delay epithelialization and cause cytotoxicity to regenerating tissues due to the sustained presence of silver ions. In this context, superoxidised solution (SOS) has emerged as a promising alternative owing to its dual antimicrobial and wound-stimulatory properties (3).

In the present study, patients treated with SOS demonstrated significantly faster wound healing, earlier granulation, and reduced dressing requirements compared to those treated with NS + SSD. The mean duration of epithelialization was approximately four days shorter in the SOS group (16.8 days) than in the conventional group (21.2 days). This observation aligns with the findings of Muangman et al., who reported enhanced epithelial regeneration and reduced sloughing in burn wounds treated with superoxidised water compared to 1% SSD. Similarly, Landa-Solis et al. demonstrated that the hypochlorous acid component in SOS possesses potent antimicrobial activity without impairing keratinocyte or fibroblast viability-a key advantage over silver-based formulations.

The mechanism underlying SOS efficacy can be attributed to its oxidative potential and ability to replicate the natural respiratory burst of neutrophils. The solution contains reactive oxygen species (ROS) such as hypochlorous acid (HOCl), which exerts bactericidal activity by disrupting cell membranes, denaturing proteins, and oxidizing nucleic acids of microorganisms (4-5). Despite this strong oxidative capacity, its neutral pH and isotonicity ensure minimal cytotoxicity to host tissues. Consequently, SOS provides an ideal environment for wound healing-maintaining a moist, oxygen-enriched, and microbe-free milieu conducive to fibroblast proliferation and collagen remodeling (6-7).

Microbiological surveillance in our study revealed comparable infection rates between the two groups. Both groups showed positive cultures predominantly for *Klebsiella* and *Pseudomonas* species, but all isolates responded well to culture-directed antibiotic therapy. These findings corroborate those of Selkon et al., who reported a significant reduction in bacterial counts in chronic wounds irrigated with hypochlorous acid-based solutions. The absence of systemic infection or septicemia in either group underscores the safety of SOS as a topical adjunct in acute burn management (8-9).

Pain assessment revealed slightly higher Visual Analogue Scores (VAS) among SOS-treated patients during early dressings (6–7 vs 5–6). This transient discomfort could be attributed to the mild stinging sensation induced by oxidative compounds on exposed nerve endings, especially in superficial burns. However, the discomfort diminished with repeated application as re-epithelialization progressed. Importantly, no allergic or adverse reactions were observed, indicating excellent tolerability.

From a clinical perspective, the reduced number of dressing changes (3–4 in SOS vs 6–7 in NS + SSD) holds significant implications for patient comfort, nursing workload, and hospital resource utilization. Faster wound closure also potentially reduces the risk of hypertrophic scarring, infection, and fluid loss, thereby improving overall burn outcomes. Additionally, SOS's ready-to-use liquid form ensures better standardization and reduces cross-contamination risks associated with multi-use ointments.

Our findings also suggest potential cost benefits. Although the per-unit price of SOS may be slightly higher than saline, the cumulative cost considering fewer dressing materials, reduced hospitalization days, and faster wound recovery is likely to be lower. These advantages make SOS a feasible option even in resource-limited burn units where advanced biological dressings may not be accessible.

The biological plausibility of SOS's wound-healing benefits can be further understood in the context of oxidative stress modulation. Low concentrations of ROS act as signaling molecules stimulating angiogenesis, fibroblast migration, and cytokine release — all of which are vital for wound contraction and epithelialization (10). Therefore, the controlled oxidative environment created by SOS may optimize the inflammatory-to-proliferative phase transition in burns.
Nevertheless, the present study's limitations warrant mention. The small sample size (n=20) limits the statistical power to generalize findings across larger populations and varying burn depths. Pain quantification was subjective and may benefit from additional objective markers in future trials. Moreover, parameters such as scar quality, pigmentation, and long-term functional outcomes were not evaluated. Future randomized controlled trials involving larger cohorts, cost-effectiveness analysis, and histopathological assessment of granulation tissue could provide stronger evidence for incorporating SOS into standard burn protocols.

## CONCLUSION

Superoxidised solution offers an effective, safe, and practical alternative to conventional NS + SSD dressings in burn wound care. It significantly reduces the number of dressing changes and accelerates healing, though pain perception during initial applications may be slightly higher. Its broad antimicrobial activity and promotion of tissue regeneration make it a valuable addition to modern burn management practices.

## REFERENCES


1. Demling RH. Burn wound healing and wound infection. *J Burn Care Rehabil.* 2005;26(4):356–368.
2. Selkon JB, Babb JR, Morris R. Evaluation of hypochlorous acid-generating electrolysed water for wound care. *J Hosp Infect.* 2006;62(3):244–252.
3. Landa-Solis C, González-Espinosa D, Guzmán-Sánchez DA, et al. Microcyn 60 super-oxidized solution as an anti-infective agent in chronic wounds. *Int Wound J.* 2005;2(3):240–248.
4. Thorn RM, Lee SW, Greenman J, Reynolds DM. Electrochemically activated solutions for wound irrigation: an in-vitro evaluation. *J Hosp Infect.* 2012;80(3):199–205.
5. Muangman P, Pundee C, Opasanon S, et al. Comparison of efficacy of superoxidised water and 1% silver sulfadiazine in partial-thickness burn wound management. *J Med Assoc Thai.* 2011;94(2):254–260.
6. Leaper DJ, Schultz G, Carville K, Fletcher J, Swanson T, Drake R. Extending the TIME concept: wound bed preparation revisited. *Int Wound J.* 2012;9(Suppl 2):1–19.
7. Eftekharizadeh F, Dehnavieh R, Noori Hekmat S, Mehrolhassani MH. Health technology assessment on super oxidized water for treatment of chronic wounds. Med J Islam Repub Iran. 2016 Jun 7;30:384
8. Menéndez-Skertchly, et al. Super oxidized water: therapeutic option in the treatment of deep second-degree burns. *Analesmedicosabc*. 2025 68 (4)
9. Karthikeyan, et al. (2024). The Significance of Super Oxidized Solution in Thermal Burns Wound Management. Mathews J Case Rep. 9(5):166.
10. Bharat Mishra, D.J. Sharma, Chetna Arora. Comparative study of the efficacy of Ionic Silver Solution and Super Oxidized Solution in the management of chronic wounds. Medical Journal Armed Forces India. 2023;79(1) 40-45,