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A COMPARATIVE STUDY OF POVIDONE-IODINE VERSUS SUPER OXIDIZED SOLUTION DRESSINGS IN DIABETIC FOOT ULCERS

Medicine

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ABSTRACT

Background: Diabetic foot ulcers are a serious complication of diabetes, leading to increased morbidity and risk of lower limb amputations. Effective wound management is crucial in preventing severe outcomes, and choosing the appropriate dressing is essential for optimal healing. **Aims & Objectives:** This study aimed to compare the efficacy of povidone iodine dressing (PID) versus super oxidized solution dressing (SOD) in managing Wagner's Grade 1 & 2 diabetic foot ulcers, focusing on wound healing, size reduction, and granulation tissue appearance. **Methods:** A prospective comparative study was conducted over 18 months, involving 100 diabetic patients with Wagner's Grade 1 & 2 ulcers. Patients were randomly assigned to receive either PID or SOD. Wound dimensions and granulation tissue appearance were monitored weekly for four weeks. Statistical analysis was performed using SPSS. **Results:** SOD led to faster wound healing, with greater size reduction and higher wound contracture (55.93% vs. 32.48% for PID) by week four. Granulation tissue appeared earlier in the SOD group, with 40% showing granulation by two weeks compared to 2% in the PID group. **Conclusions:** Super oxidized solution dressing is more effective than povidone iodine in treating Wagner's Grade 1 & 2 diabetic foot ulcers, promoting faster healing and earlier granulation tissue formation.

KEYWORDS

Diabetic foot ulcers; Povidone iodine; Super oxidized solution; Wound healing; Granulation tissue.

INTRODUCTION

Diabetic foot ulcers are a significant complication of diabetes mellitus, leading to substantial morbidity and an increased risk of lower limb amputations.[1] As the prevalence of diabetes continues to rise globally, with more than 500 million people affected, the burden of managing diabetic foot ulcers has become a critical concern.[2] These ulcers not only increase the risk of infection and hospitalization but also account for more than half of non-traumatic lower limb amputations in diabetic patients. Effective management of these ulcers is crucial to prevent severe outcomes, making the choice of wound dressing a key component of treatment.[3]

Povidone iodine has long been the standard antimicrobial dressing used in the treatment of diabetic foot ulcers due to its broad-spectrum antibacterial properties.[4] It is widely recognized for its ability to penetrate bacterial biofilms and control infections. However, its prolonged use has been associated with potential adverse effects, such as thyroid dysfunction and inhibition of granulation tissue formation, which can hinder the healing process.[5] This limitation has prompted the search for alternative antimicrobial dressings that can offer both effective infection control and promote wound healing without such risks.[6,7]

Super oxidized solutions have emerged as a promising alternative in this regard. These solutions, enriched with reactive oxygen species, have demonstrated potent antimicrobial activity against a wide range of pathogens, including bacteria, viruses, fungi, and spores.[8,9] Moreover, they have been shown to support tissue growth and granulation, crucial for the healing of diabetic foot ulcers. Despite these advantages, super oxidized solutions have not yet been fully integrated into standard treatment guidelines, highlighting the need for further research to establish their efficacy in comparison to more traditional options like povidone iodine.[8,9,10] This study aims to conduct a comparative evaluation of povidone iodine and super oxidized solution dressings in the healing of diabetic foot ulcers, providing valuable insights into their relative effectiveness and potential for broader clinical application.

MATERIALS & METHODS

This prospective comparative study was conducted over 18 months at the Department of General Surgery, F.H. Medical College and Hospital, Agra, a tertiary care center serving a socioeconomically underprivileged population. The study aimed to compare the efficacy of povidone iodine versus super oxidized solution dressings in the management of diabetic foot ulcers. Diabetic patients aged 18 years and above, with Type I or Type II diabetes and Wagner's grades I and II foot ulcers, were included. Patients with absent peripheral pulses, higher Wagner grades, or those unable to comply with follow-up were excluded. A total of 100 eligible patients were enrolled and randomly allocated into two groups of 50 each using a draw of lots.

Group A received povidone iodine dressings, while Group B received super oxidized solution dressings. Routine wound care, including debridement and cleansing, was performed before applying the assigned dressing. Wounds were dressed on alternate days, and patients were monitored weekly for four weeks. Wound dimensions were measured at each follow-up to calculate the rate of wound contraction, and the presence of granulation tissue was noted. Data were recorded and analyzed using SPSS software, with statistical significance set at a p-value of less than 0.05.

The study employed standard statistical methods, including the Chi-square test and independent samples 't' test, to compare outcomes between the two groups. The primary outcomes measured were the rate of wound contraction and the appearance of granulation tissue, with results expressed as mean values and standard deviations. The findings from this study are expected to provide valuable insights into the relative effectiveness of these two dressing methods in managing diabetic foot ulcers.

RESULTS

The study compared the efficacy of povidone iodine dressing (PID) with superoxide dressing (SOD) for managing Wagner's Grade 1 & 2 diabetic foot ulcers in 100 patients, evenly divided into two groups: 50 patients received PID, and 50 received SOD.

Table 1 Demographic and Clinical Characteristics of Patients in Povidone Iodine (PID) and Super Oxidized Solution (SOD) Study Groups

CHARACTERISTIC	GROUP A - PID (N=50)	GROUP B - SOD (N=50)	TOTAL (N=100)
AGE GROUP			
≤40 Years	7 (14.0%)	4 (8.0%)	11 (11.0%)
41-50 Years	21 (42.0%)	13 (26.0%)	34 (34.0%)
51-60 Years	20 (40.0%)	26 (52.0%)	46 (46.0%)
>60 Years	2 (4.0%)	7 (14.0%)	9 (9.0%)

Mean age±SD (Range) in years	**49.28±7.90 (30-72)**	**52.18±7.45 (33-63)**	**50.73±7.78 (30-72)**
GENDER			
Male	31 (62%)	30 (60%)	61 (61%)
Female	19 (38%)	20 (40%)	39 (39%)
Sex-ratio (M)	**1.63**	**1.5**	**1.56**
TYPE OF DIABETES			
Type 1 Diabetes	3 (6.0%)	2 (4.0%)	5 (5%)
Type 2 Diabetes	47 (94.0%)	48 (96.0%)	95 (95%)
AFFECTED SIDE			
Left Side	21 (42%)	24 (48%)	45 (45%)
Right Side	29 (58%)	26 (52%)	55 (55%)
Mean HbA1c±SD (Range) %	**8.46±1.17 (6.5-12.0)**	**8.62±1.06 (6.9-10.2)**	**t=0.753; p=0.454**

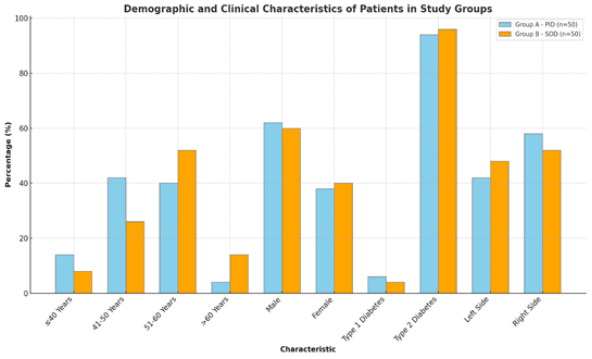


Table 2 Comparison of Wound Metrics (Length, Breadth, Size, and Contracture) at Baseline and Follow-Up Intervals Between Group A (PID) and Group B (SOD)

TIME INTERVAL	WOUND LENGTH (GROUP A - PID)	WOUND LENGTH (GROUP B - SOD)	WOUND BREADTH (GROUP A - PID)	WOUND BREADTH (GROUP B - SOD)	WOUND SIZE (GROUP A - PID)	WOUND SIZE (GROUP B - SOD)	WOUND CONTRACTURE (GROUP A - PID)	WOUND CONTRACTURE (GROUP B - SOD)
Baseline	3.59±0.87	3.61±0.82	3.13±0.84	3.16±0.73	11.91±5.87	11.95±5.48	N/A	N/A
Week 1	3.57±0.88	3.52±0.80	3.12±0.83	3.08±0.70	11.84±5.84	11.40±5.24	0.54±1.78	4.54±2.24
Week 2	3.39±0.87	3.17±0.75	2.94±0.79	2.85±0.66	10.63±5.43	9.52±4.47	11.10±6.85	20.53±3.45
Week 3	3.07±0.81	2.55±0.61	2.72±0.73	2.29±0.53	8.89±4.60	6.16±2.90	25.66±5.66	48.36±4.80
Week 4	2.92±0.80	2.35±0.56	2.59±0.77	2.12±0.48	8.16±4.54	5.25±2.45	32.48±11.41	55.93±4.45

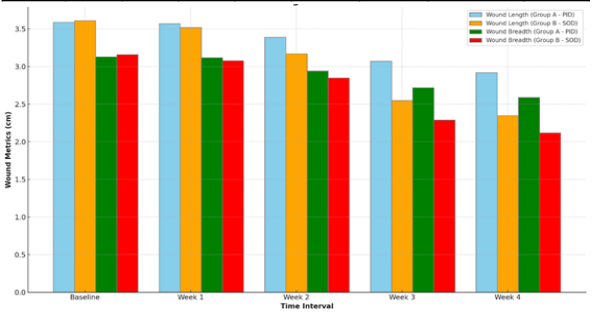


Table 3 Distribution of Patients According to Time Taken for Appearance of Granulation Tissue

TIME	GROUP A - PID (N=50)	GROUP B - SOD (N=50)	TOTAL (N=100)
Two weeks	1 (2%)	20 (40%)	21 (21%)
Three weeks	22 (44%)	17 (34%)	39 (39%)
Four weeks	26 (52%)	13 (26%)	39 (39%)
No appearance	1 (2%)	0 (0%)	1 (1%)
Median time	3.5 weeks	3 weeks	3 weeks

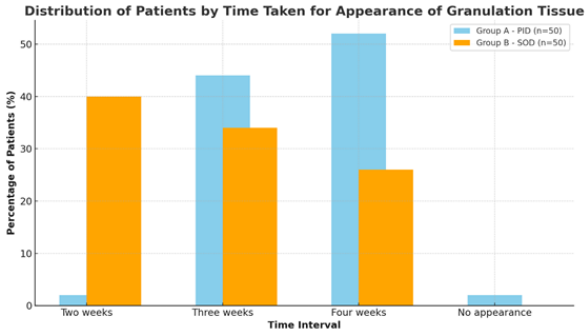
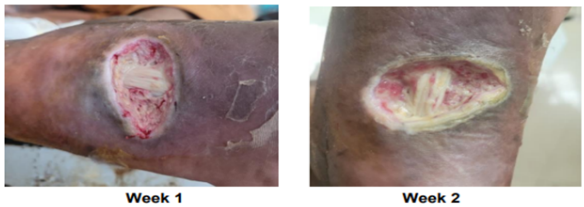


Photo Plates



Weekly follow-up pictures of betadine dressing in a patient of diabetes foot ulcers

Weekly follow-up pictures of super oxidized solution dressing in a patient of diabetes foot ulcers

DISCUSSION

In our study, patients' ages ranged from 30 to 72 years, with a mean age of 50.73±7.78 years, and the majority were male (61%). This profile aligns with **Shridhar et al.**[11], who reported a mean age of 54.5 years and 73.5% males. Other studies have similarly noted a mean age range of 50-55 years, with a male predominance of over 70%. However, **Mishra et al.**[12] found a younger mean age (40-45 years) and a lower male proportion (58%) in a study focused on chronic wounds, with only 36% being diabetic. The dominance of type 2 diabetes (95%) in our study is consistent with **Chaudhary et al.**[13], who reported a similar distribution. The mean HbA1c levels were 8.46% and 8.62% in the two groups, indicating poor glycemic control, which is crucial for ulcer healing. Unlike most reviewed studies, which did not monitor HbA1c, we integrated HbA1c target setting into the treatment plan to enhance outcomes.

In our study, we also observed that wound healing, as measured by length, breadth, size, and contracture, was significantly better in the SOD group compared to the PID group. By the fourth week, the wound size in the SOD group had reduced to 5.25 ± 2.45 cm², compared to 8.16 ± 4.54 cm² in the PID group. Additionally, wound contracture was markedly higher in the SOD group, with a mean of 55.93% ± 4.45 at week four, compared to 32.48% ± 11.41 in the PID group. **Meera et al.**[14] conducted a study comparing the efficacy of superoxidized solution versus povidone iodine in treating diabetic foot ulcers. They reported that the wound size reduction in the SOD group was more significant than in the PID group. Specifically, at four weeks, the SOD group had a mean wound size reduction of 45% compared to 30% in the PID group. This aligns with the current study, where wound contracture at week four was 55.93% in the SOD group compared to 32.48% in the PID group. **Chaudhary et al.**[13] also observed that superoxidized solution led to faster and more significant wound contraction compared to povidone iodine. By week four, their study showed that 50% of the SOD group achieved substantial wound contraction, compared to 33% in the PID group. This supports the findings of our study, where SOD consistently outperformed PID in reducing wound size and promoting wound contracture. **Jain et al.**[15] found that wound length and breadth were reduced more effectively in patients treated with superoxidized solution. In their study, the SOD group showed a 40% reduction in wound length and a 35% reduction in wound breadth by the fourth week, compared to 25% and 20% in the PID group, respectively. These results are consistent with our study, where SOD led to a significant decrease in wound length (from 3.61 cm at baseline to 2.35 cm at week four) and wound breadth (from 3.16 cm to 2.12 cm), outperforming PID.

Our study found that granulation tissue appeared more quickly in the SOD group compared to the PID group. By two weeks, 40% of patients in the SOD group had granulation tissue compared to only 2% in the PID group. By three weeks, 34% of the SOD group and 44% of the PID group showed granulation tissue. By four weeks, the majority of the PID group (52%) had granulation tissue compared to 26% in the SOD group. **Sridhar et al.**[11] reported that superoxidized solution resulted in a quicker appearance of granulation tissue compared to povidone iodine. In their study, 35% of patients in the SOD group developed granulation tissue by the second week, while only 5% in the PID group did. By the third week, the SOD group had 65% of patients with granulation tissue, whereas the PID group had only 30%. These findings closely match our study, where 40% of the SOD group showed granulation tissue by the second week, compared to just 2% in the PID group. **Akula et al.**[16] found that superoxidized solution facilitated faster granulation tissue formation in lower limb ulcers, with 30% of patients showing granulation tissue by the second week and 55% by the third week. This study's results are similar to our study, where SOD led to faster granulation tissue formation compared to PID.

In summary, the findings of our study are consistent with several previous studies, which also demonstrated the superior efficacy of superoxidized solution over povidone iodine in promoting wound healing, reducing wound size, and accelerating the appearance of granulation tissue. The current study reinforces the evidence supporting the use of SOD for more effective management of diabetic foot ulcers.

CONCLUSION

Our study found that superoxide dressing (SOD) outperformed povidone iodine dressing (PID) in treating Wagner's Grade 1 & 2 diabetic foot ulcers. SOD led to faster wound healing, with a greater reduction in wound size and higher wound contracture (55.93% vs. 32.48% for PID) by week four. Granulation tissue appeared earlier in the SOD group, with 40% showing granulation by two weeks compared to 2% in the PID group. The median time for granulation was shorter in the SOD group (3 weeks) than in the PID group (3.5 weeks). These results suggest SOD as a more effective treatment for diabetic foot ulcers.

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