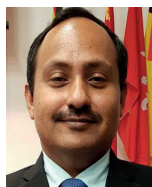


A patented formulation of $\text{SiO}_2^- + \text{Ag}^+ + \text{Chlorhexidine} + \text{Hyaluronic acid}$



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In the management of chronic wounds, some of the important objectives include reduction of wound size and elimination of infection signs and pain management (Malaysian Ministry of Health [MOH], 2014). Most wound dressings are not able to support wound healing with a single product or therapy, hence, the introduction of a new formulation (Nair, 2017). To demonstrate its efficacy, nine patients were chosen which involved five cases of diabetic foot ulcer and four cases of venous leg ulcer. All wounds were cleaned and debrided where necessary, then a patented combination technology of $\text{SiO}_2^- + \text{Ag}^+ + \text{Chlorhexidine} + \text{Hyaluronic acid}$ was applied as the primary dressing, with a non-adherent dressing as a secondary dressing. In cases where patients had exudating wounds, a pressure ulcer foam was added. The results of this case series demonstrated that it is possible for a single formulation to effectively support wound healing by reducing wound size and pain and eliminating infection signs.

Statistics from the Malaysian Ministry of Health (MOH) showed that out of the over 3 million diabetic Malaysian citizens, 15% will develop lower extremity ulcers (MOH, 2014). This number is steadily rising as it is predicted that an alarming 7 million adults in Malaysia will be affected by diagnosed and undiagnosed diabetes by 2025 (Bernama, 2019). Chronic wounds of the lower limb are often difficult to heal and can account for a decrease in patients' quality of life, an increased morbidity and mortality rate and significantly rising health care costs (Järbrink et al, 2017). This problem calls for a modernization of traditional wound management methods.

As modern wound dressings continue to evolve, a novel therapy and method was introduced. It provides a patented 4-in-1 solution for the treatment of a wide range of wound types.

This advance wound management medical device disinfects, protects and hydrates wounds, while restoring the physiological condition of the affected body part. It works by exerting the antimicrobial effects of silver together with the disinfection capabilities of chlorhexidine and the moisture-balance properties of hyaluronic acid (Li et al, 2019; Lu et al, 2017). Simultaneously, silicon dioxide

forms a protective barrier over the wound (Sood et al, 2014).

Application

All of the aforementioned individual compounds have been combined in a specialized powder spray, so that $\text{SiO}_2^- + \text{Ag}^+ + \text{Chlorhexidine} + \text{Hyaluronic acid}$ are delivered to the wound in one single application.

In the following case series, the wounds were cleaned and debrided where necessary. The can was agitated by a brisk upward and downward movement. The spray nozzle was pointed about 10 centimetres from the wound and a thin layer of $\text{SiO}_2^- + \text{Ag}^+ + \text{Chlorhexidine} + \text{Hyaluronic acid}$ was dispersed, covering the entire wound surface. Precaution was taken not to massage or rub the mixture into the wounds. The wounds were then covered with non-adhesive dressing. For exudative wounds, however, pressure ulcer foam was used for absorption. In all these cases, the wounds were bandaged (Nair, 2017).

Results

There was rapid wound healing evidenced by absence of infection, presence of granulation, reduction of wound size as well as reduction in pain (Frykberg and Banks, 2015).

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Table 1. Wound evaluation based on observation of wound area and infection signs			
Evaluated wounds (9 patients)	2 weeks after treatment	3 weeks after treatment	4 weeks after treatment
Area reduction (to >50%)	3/9 (33%)	4/9 (44%)	2/9 (22%)
Signs of infection	none	none	none

Patient 1

A 52-year-old male with a history of diabetes mellitus developed a diabetic foot ulcer on the right plantar. After 45 days of treatment, there was a significant reduction in the size of the wound area. There was also presence of granulation. After 50 days, the wound had fully closed up [Figure 1a and b].

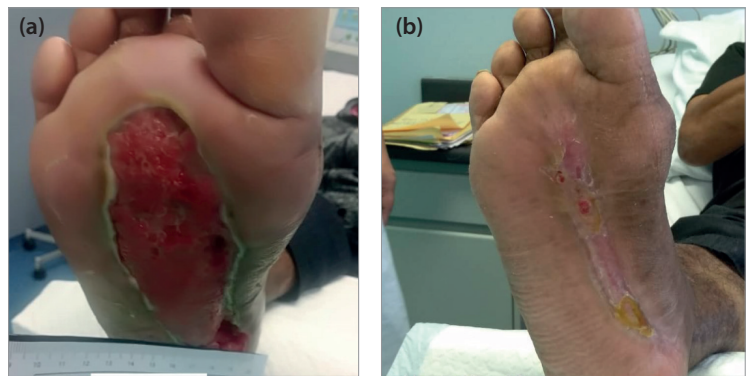


Figure 1. Patient 1 at the start (a) and after 50 days of treatment (b)

Patient 2

A 46-year-old female with a history of venous leg ulcers on the left leg. Within 20 days of treatment, there was a significant restoration of blood supply and a reduction in the size of the wound area. There was also presence of healthy wound edge, granulation and the absence of infection [Figure 2a and b].

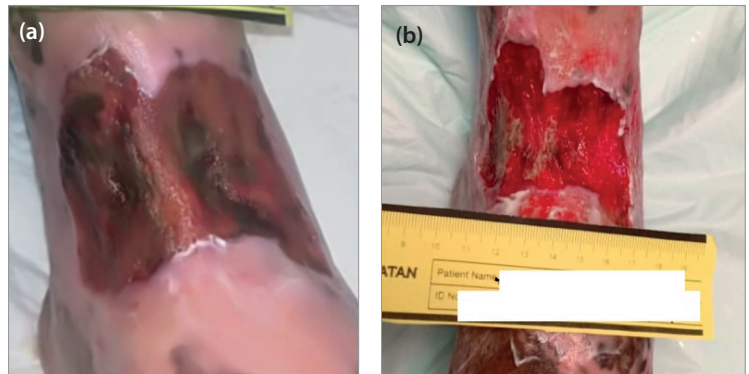


Figure 2. Patient 2 at the start (a) after 20 days of treatment (b)

Patient 3

A 36-year-old male with a history of venous leg ulcers on the right leg. Within 3 days of treatment, there was a reduction in the suspected biofilm formation. There was also restoration of blood supply. In 6 days, granulation was observed [Figure 3a and b].



Figure 3. Patient 3 at the start (a) after 6 days of treatment (b)

Patient 4

A 52-year-old male with a history of diabetic foot ulcers on the right leg. Within 2 weeks of treatment, there was a reduction of wound size from 4 cm x 6 cm to 2.5 cm x 4 cm. Progressive granulation was also observed [Figure 4 a and b].

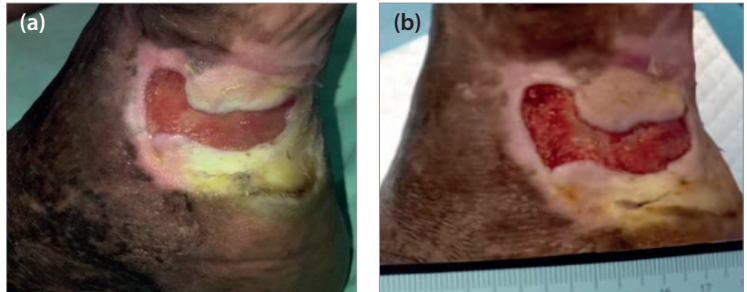


Figure 4. Patient 4 at the start (a) and after 14 days of treatment (b)

Patient 5

A 52-year-old African lady with a long history of diabetes. She had developed an ulcer on her right leg with varicose veins. She has been managing the wound traditionally for the past 17 years. The patient was initiated on the following dressing regimen under home nursing care: cleaning with sterile water, bedside desloughing, novel spray followed by a non-adhesive dressing. In 10 days, the wound size reduced to less than half of its original size. In 24 days, the wound had closed up [Figure 5 a and b].

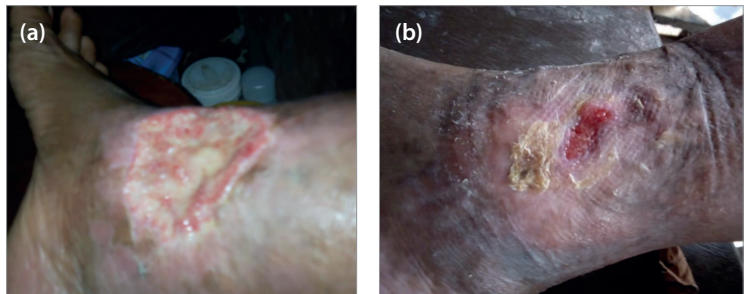


Figure 5. Patient 5 at the start (a) after 24 days of treatment (b)

Patient 6

A 46-year-old Malay lady with a history of diabetes. She had developed an ulcer on her right leg. Over time, the ulcer had become chronic with moderate and clear exudate. The patient was initiated on the following dressing regimen: cleaning with sterile water, novel spray followed by a non-adhesive dressing. In 7 days, wound size had reduced significantly, and granulation was observed. The wound size reduction continued over a period of 43 days [Figure 6 a and b].

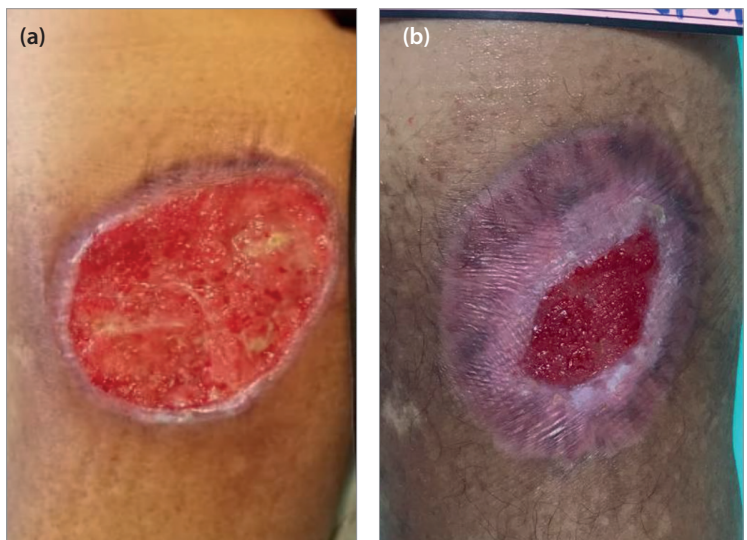


Figure 5. Patient 6 at the start (a) after 43 days after treatment (b)

Patient 7

A middle-aged Malay man with history of diabetes. He had developed an ulcer on his left leg. Over time, the ulcer had become chronic with moderate and clear exudate. The patient was initiated on the following dressing regimen: cleaning with sterile water, novel spray followed by a non-adhesive dressing. In 22 days, the wound was free from infection signs and granulation was observed. In 37 days, the wound had epithelialized [Figure 7 a and b].

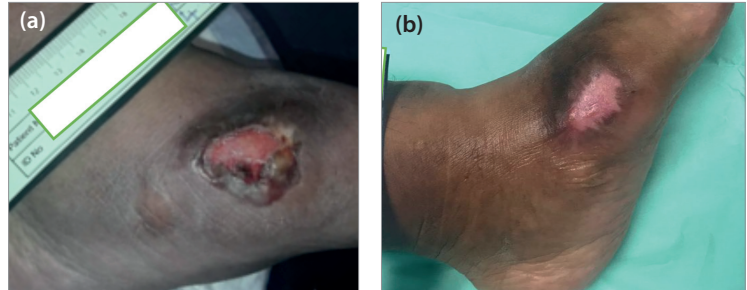


Figure 7. Patient 7 at the start (a) after 37 days of treatment (b)

Patient 8

A middle-aged Indian man, with history of diabetes. He had developed a venous ulcer on his right leg. Overtime, the ulcer had become chronic with exudate. In 14 days, all signs of infection had been eliminated and wound size was significantly reduced [Figure 8 a and b].

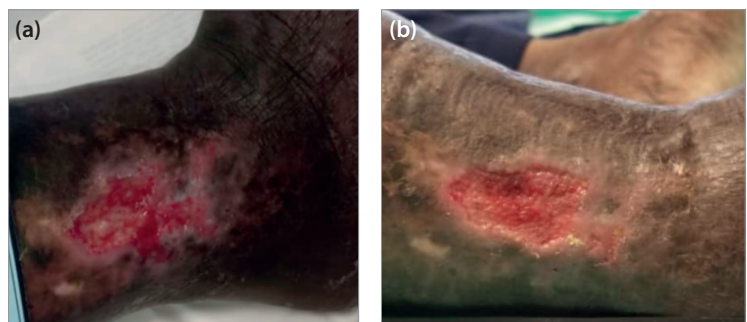


Figure 8. Patient 8 at the start (a) after 14 days of treatment (b)

Patient 9

A 62-year-old Chinese woman with a history of diabetes. She had developed diabetic foot ulcer on her left foot and subsequently undergone Ray's amputation of left big toe. Within 58 days, the wound size progressively reduced and eventually healed [Figure 9 a and b].



Figure 9. Patient 9 at the start (a) after 58 days of treatment (b)

Discussion

In all the patients, the absence of infection signs was characterized by the absence of slough, pus, inflammation while the moist wound healing method of $\text{SiO}_2^- + \text{Ag}^+ + \text{Chlorhexidine} + \text{Hyaluronic acid}$ was manifested in the form of superficial epithelization.

As the treatment was implemented, any underlying factors present in any of the patients were appropriately addressed by a multidisciplinary approach (MOH, 2014). Diabetic foot cases were offloaded and venous ulcers were treated with compression bandaging as per standard of care (MOH, 2004; Mani et al, 2018).

Conclusion

The unique patented $\text{SiO}_2^- + \text{Ag}^+ + \text{Chlorhexidine} + \text{Hyaluronic acid}$ is a powdery formulation that creates a protective barrier to treat wounds, abrasions, minor burns and particularly skin lesions with the presence of exudate, creating an environment protected from microbial aggression and promoting restoration of the normal physiological conditions.

The barrier function is performed by the patented complex in association with Kaolin. This acts as an absorbent material in the case of wounds with exudate. Ag^+ acts as a broad-spectrum antimicrobial agent and chlorhexidine provides an antiseptic environment. Hyaluronic acid hydrates and acts as a polymer film and favours the moisturizing of tissues thus accelerates granulation and physiological aspects of wound healing. Therefore, this dressing has potential in terms of managing the bacterial bioburden and help in re-epithelialization of chronic wounds. However, comparative studies are needed to further support these observational findings. WAS

Acknowledgement

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