

The role of super oxidized solution in the management of diabetic foot ulcer: Our experience

*Ravi Kumar Chittoria,¹ Mutheeswaraiyah Yootla,² Leela Mohan Chandra Sekhara Rao Sampatrao¹
and S. Venkat Raman¹*

¹Department of Plastic Surgery and ²Department of General Surgery, Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India

Corresponding author: Dr. R. K. Chittoria, Head of the Dept, Dept. of Plastic Surgery, Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India. PIN: 517507, e-mail: drchittoria@yahoo.com

ABSTRACT

Dressing or Preparation of the diabetic foot ulcer is very essential not only to reduce or prevent infection but also for the preparation for definite surgery, if necessary. Present article is about our experience in the evaluation of effectiveness of Super Oxidized Solution in local treatment of diabetic foot ulcers. Out of 20 cases Super Oxidized Solution helped in total healing in 8 cases, and prepared wounds for definite cover by reducing infection and promoting granulations which are pre requisites for definitive surgery in remaining 12 cases.

Keywords: Super oxidized solution, diabetic foot ulcer, healing.

INTRODUCTION

Diabetic foot ulcers have been managed by local dressings with various agents like Povidone Iodine, EUSOL, Acetic acid, hydrogen peroxide, Silver sulfadiazine, local antibiotic ointments etc. These dressings are meant for preventing infection or reducing bacterial load and promoting granulations thus helping in wound healing.¹

Use of Super Oxidized Solution (Fig. 1.) is a new concept in wound management. This is a hypotonic solution with an osmolarity of 13 mOsm/kg and containing Hypochlorous acid, Sodium hypochlorite, Chlorine dioxide, Ozone, Hydrogen peroxide, and Sodium chloride. Super Oxidized Solution is an electrochemically processed aqueous solution manufactured from pure water and sodium chloride. During this electrolysis process reactive species of oxygen and chlorine are formed. These released reactive species creates an unbalanced osmolarity, so that it damages the integrity of the cell membrane, then reacts and denatures the lipids & proteins of single cell organisms. This is because of a direct result of the osmolarity difference between the ion concentrations of the solution and single cell organism. Multicellular organisms are not prone to such osmolarity changes.²

MATERIAL AND METHODS

In the present study, a total number of 20 patients with diabetic foot ulcer were included and managed during the period of January 2006 to November 2006. This study was done in the Dept. of Plastic Surgery, Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, Andhra Pradesh, India.

All patients were carefully examined clinically. Basic investigations like Haemoglobin, Total Count, Differential Count, Bleeding Time, Clotting Time, Erythrocyte Sedimentation Rate, Random and / or Fasting Blood Sugar, S.Creatinine, Blood.Urea, HIV, HBsAg, Complete urine Examination etc. were done for fitness for anaesthesia and to rule out underlying systemic illness. For all cases wound swab was sent for culture and sensitivity to know the type of organism & its sensitivity to antibiotic.

All diabetic ulcers were irrigated daily with Super Oxidized Solution and covered with gauze soaked in Super Oxidized Solution. Blood sugar was controlled by insulin and/ or oral hypoglycemic drugs. Endocrinologist opinion was taken for all cases.

Many wounds healed by use of Super Oxidized Solution only. For remaining non healed wounds definite wound cover (skin graft / flap) was provided once wound became sterile & healthy granulation appeared after local treatment with Super Oxidized Solution. Those patients who were unfit for surgery / anaesthesia or not willing for surgery, were treated with local dressings using Super Oxidized Solution only.

Status of the bacterial growth, time taken for wound to become sterile, time taken for the appearance of the granulation, time taken for healing, and complications were noted.

Once wounds healed completely patients were followed bi-weekly for three months.

RESULTS

Complications

In our study no observable complications were noted.

DISCUSSION

The incidence of Diabetes Mellitus is increasing in the present scenario because of sedentary life style, change in dietary habits, increase in stress, and increase in life span of human being. Management of Diabetes and its complications is a complex procedure involves all specialties as it involves all organs and systems of the body. If glycemic control is not adequate, patients present with various complications like Diabetic ulcers which are caused by trivial or noticeable trauma. Diabetic foot ulcer is a challenging problem to every clinician in day to day practice. These wounds have been managed by local dressings with various agents like Povidone Iodine, EUSOL, Acetic acid, hydrogen peroxide, Silver sulfadiazine, local antibiotic ointments or powders etc since long time.³

Super Oxidized Solution is a newer concept in the wound management. Researchers from many parts of the world have investigated Super Oxidized Solution as disinfectant for instruments. The literature also describes the use of this Solution on humans for various indications like ulcers, mediastinal irrigation, peritoneal lavage, hand washing etc.^{4,5}

European CE KEMA- Medical Device Class IIb (in 2004), and FDA (in 2005) approval was obtained for this Super Oxidized Solution for its use in acute and chronic wounds.⁶ This solution has been used by many clinicians with positive results in the management of wounds of various aetiology. No reaction or complication has been reported in literature.⁷⁻⁹

In our study, we selected infected diabetic ulcers and used Super Oxidized Solution as local agent for cleansing and sterilizing. In our study, all age groups were included and males were more than females in number (Table-1). All sizes of wounds were included in this study (Table-2).

All 20 cases were infected (wound culture and sensitivity positive) at the time of presentation to our Department. After 5 days use of Super Oxidized Solution 19 wounds became sterile and only 1 case came out positive for growth (Table-4). Of the 20 cases, 8 wounds were healed by simple local dressings with Super Oxidized Solution without any complications (Fig. 2, 4). Skin grafting was done for 11 cases and local flap was done for 1 case (Table-5). All the above definite procedures were done once wounds became sterile with healthy granulations after the use of Super Oxidized Solution.

Many authors have used Super Oxidized Solution with no complications.^{10,11} In our study also none of the patients suffered from noticeable complications.

In the management of diabetic foot ulcer, a Super Oxide Solution debrides necrotic tissue, reduces microbial load, promotes granulation and decreases the healing time, without damaging the normal tissue or complications. Those patients, who have small superficial ulcers or not fit for definite surgery, can be managed conservatively with Super Oxidized Solution only. The moistening effect and minimum toxicity found with the use of this super oxidized solution makes it a good choice for diabetic foot ulcer management. However, new controlled trials must be conducted to fully establish the antimicrobial, anti-inflammatory, and positive effects in wound healing.

REFERENCES

1. Tanaka N, Tanaka N, Fujisawa T. The use of electrolyzed solution for the cleansing and disinfecting of dialyzers. *Artif Organs* 2000; 24: 921-8.
2. Nelson D. Newer technologies for endoscope disinfection: Electrolyzed acid water and disposable- component endoscope system. *Gastrointestinal Endosc Clin N Am* 2000; 10: 319-28.
3. Park H, Hung YC, Kim C. Effectiveness of electrolyzed water as a sanitizer for treating different surfaces. *J Food Prof* 2002; 65: 1276-80.
4. Inoue Y, Endo S, Kondo K *et al.* Trial of electrolyzed strong acid aqueous solution lavage in the treatment of peritonitis and intraperitoneal abscess. *Artif Organs* 1997; 21: 28-31.
5. Sakashita M, Iwasawa A, Nakamura Y. Antimicrobial effects and efficacy on habitually hand-washing of strong acidic electrolyzed water – a comparative study of alcoholic antiseptics and soap and tap water. *Kansenshogaku Zasshi* 2002; 76: 373-7.
6. Meschter C. Safety and Efficacy of Treatment for Cutaneous wound study. Comparative Biosciences, Inc. Study Number, 2005: 8212-04.
7. Yahagi N, Kono M, Kitahara M *et al.* Effect of electrolyzed water on wound healing. *Artif Organs*. 2000; 24: 984-7.
8. Landa Solis C, Gonzalez Espinosa D, Guzman Soriano B *et al.* Microcyn: a novel super oxidized water with neutral; pH and disinfectant activity. *J Hosp Infect* 2005; 61: 291-9.
9. Sekiya S, Ohmori K, Harii K. Treatment of infectious skin diseases or ulcers with electrolyzed strong acid aqueous solution. *Artif Organs* 1997; 21: 32-8.
10. Dalla Paola L, Brocco E, Senesi A *et al.* use of Dermacyn, a new antiseptic agent for the local treatment of diabetic foot ulcers. *J Wound Healing* 2005; 2: 201.
11. Dang CN, Prasad YD, Boulton AJ, Jude EB. Methicillin-resistant *Staphylococcus aureus* in the diabetic foot clinic: a worsening problem. *Diabet Med* 2003; 20: 159-61.

Table-1: Distribution of cases with respect to age and sex

Age	Male	Female	Total	Percentage
10-20 yrs	0	0	0	0 %
20-30 yrs	1	0	1	5 %
30-40 yrs	3	1	4	20%
40-50 yrs	4	2	6	30%
>50 yrs	5	4	9	45%
Total	13	7	20	100%

Table-2: Distribution of cases with respect to type of Diabetes

Type of Diabetes	No. of cases	Percentage
Type 1	1	5%
Type 2	19	95%
Total	20	100%

Table-3: Distribution of cases with respect to size of wound

Size of the wound	No. of cases	Percentage
< 5 cm	10	50%
5 – 10 cm	6	30%
>10 cm	4	20%
Total	20	100%

Table-4: Distribution of cases with respect to infection

Growth in Culture	No. of cases	No. of cases positive for infection after use of Super Oxidized solution		
		After 1 day	After 3 days	After 5 days
Staph. aureus	6	4	1	
E.coli	4	1	0	
Enterococci	3	2	1	1
Pseudomonas	3	2	1	
Proteus.mirabilis	2	1	1	
Streptococci	2	2	0	
Total	20			

Table-5: Distribution of cases with respect to procedure

Procedure	No. of cases	Percentage
No procedure	8	40%
Skin graft	11	55%
Flap	1	5%
Total	20	100%



Fig. 1. Super Oxidized Solution is available as OXUM in a bottle of 100 ml, 250 ml and 500ml. Cost of 500ml bottle is INR 380/-.



Fig.2. (a) A case of diabetic ulcer left foot



Fig.2. (b) Healed completely in 2 weeks with super oxide Solution without any definite procedure



Fig. 3. (a) A case of diabetic ulcer left foot



Fig. 3. (b) Healed completely in 2 weeks with super oxide Solution without any definite procedure



Fig. 4. (a) A case of diabetic ulcer right foot



Fig. 4. (b) A case of diabetic ulcer right foot
Prepared by super oxidized solution
and later covered