

SOLAR THERAPY: A BOON FOR NON-HEALING ULCERSVarunjikar M. D¹, Bejoy E Jayan², Varunjikar A. M³, S. C. Joshi⁴, C. Joshi⁵**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: Compound fractures are common following road traffic accidents. It leads to open wound which needs treatment by plastic repairs such as rotation flaps, cross leg flaps, and skin grafting. Similarly, raw wounds and non-healing ulcers especially in osteomyelitis is a challenge to Orthopaedicians. Wounds with infection heal slowly and this often results in prolonged hospitalization. Standard treatment includes dressing and use of antibiotics which leads to financial burden on poor patients. Irrational use of antibiotics has led to increasing resistance of bacteria to antibiotics. So far, sunlight has been utilized in treatment of rickets and osteomalacia. We have tried to utilize this mode of ecological treatment in an alternate way. Infected, non-healing wounds and ulcers were treated with exposure to sunlight which lead to scab formation and epithelisation leading to healing of wound due to UV rays. The purpose of this study was to determine the effects of ultraviolet radiation (UVR) on the healing of ulcers. **METHODS:** Our patients having non healing ulcers were subjected to this type of treatment. **RESULTS:** In selected patients having non-healing ulcers on extremities of various sizes were treated previously with routine line of treatment such as dressing and oral or parenteral antibiotics. Patients were explained mode of treatment and underwent solar therapy after receiving informed consent. Epithelisation on ulcer took place following UV therapy within average duration of 23 days. **CONCLUSION:** It was concluded that ultraviolet radiation had significant effects in destroying bacteria and also promoting wound healing. **KEYWORDS:** Solar therapy, non-healing ulcers, UV light, anti-bacterial effect.

INTRODUCTION: An ulcer is injury to the skin¹. Repeated surgical intervention and infection, reduces blood supply and this eventually causes cell death, which leads to development of slough and non-healing ulcer.^{1,2} Surgical closure of infected wounds is a challenge which leads to different complications, increase hospitalization period, recurrence of ulcer following sinuses at the site of the healed flap, is well known in wounds with underlying osteomyelitis.^{3,4,5} The treatment of ulcers requires repeated surgical procedures and nursing care⁶. During the extended period of treatment required, the patients remain at risk of developing new complications.⁶

There are a number of factors that influence the healing of ulcers. These include malnutrition, underlying medical conditions (such as diabetes mellitus), drugs, presence of residual necrotic tissue in the wound bed, hypoxia at site of ulcer, altered temperature, and wound infection.⁷ Wound infection is the deposition and multiplication of bacteria in tissues with an associated host reaction.⁸ It is a growing problem and in most cases, infection is hospital acquired. It is often associated with extended lengths of stays in the hospital. Most of the wounds are infected with *Staphylococcus aureus*.^{9,10}

Surgical management has been known to sometimes result in complications. There appears to be increasing resistance to both topical and systemic antibiotics for infected wounds. In most

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situations, endogenous bacteria predominate and many are potentially pathogenic in the wound environment.

Systemic antibiotics are generally accepted as being the preferred choice for treating infection, provided that ischemia does not interfere. However, the widespread use of systemic antibiotics is leading to the emergence of resistant bacterial strains such as methicillin-resistant *Staphylococcus aureus* (MRSA). A systematic review of antimicrobials carried out by O' Meare revealed that antibiotics with wound dressing are not generally effective for management of chronic wound infection. Resistance of bacteria to antibiotics has become a serious problem in recent years.

It has been found that radiation from ultraviolet radiation (Type C) is universally successful in destroying bacteria. But there is a depth of empirical data on the use of ultraviolet radiation type B (UVB) in effective destruction of bacteria. The objectives of this study were to determine the effects of sunlight in the healing of infected wounds and also to determine its effect on bacteria and epithelialization.

METHOD: Ulcers were exposed to sunlight for about 15 minutes per day. Sessions were divided to 5 min each in morning, afternoon & evening. . Peripheral beam concentration was taught to the patient / relatives under supervision using magnifying glass which lead to charring of granulation tissue with scab formation and underneath it, there is gradual epithelisation. Scab seals the wound and there is no added infection through dust from the atmosphere and probably it may kill the bacteria.



Fig. 1: a) Solar therapy being given to the patient. b) result after 3wks of therapy

It is important to note, that, wound was exposed to sunlight and patient was not exposed especially during afternoon session. Surrounding wide area of skin around ulcer was protected with cloth and coconut oil was applied to surrounding skin that acted as soothing agent to protect the skin around the ulcer. In between solar therapy sessions, dressing was not done and wound was protected from flies and dust by putting a thin cloth over it.

Granulation tissue, being insensitive to heat, patient didn't complain of any burning sensation or pain.

Inclusion criteria were cases of Chronic non- healing ulcer, wounds after debridement and sequestrectomy in cases of chronic osteomyelitis. The procedure was given only to those patients who gave consent for the therapy.

Solar Therapy was given In:

- 5 cases of non-healing wound of osteomyelitis
- 3 superficial wound infections
- 2 cases of delayed surgical wound healing

Each patient was followed up for 3 – 11 months.

RESULTS: No patients showed any superadded infections. Average time of healing was of 23 days. Earliest healing was seen in superficial wound at 15 days. 1 patient had delayed healing in case of osteomyelitis, but the wound gradually healed over 45 days. 1 patient had pigmentation of surrounding skin which is slowly subsiding.



Fig. 2: a) case of chronic osteomyelitis. b) treatment after solar therapy



Fig. 3: A & B) superficial infection treated with solar therapy

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**Fig. 4: a) case of chronic osteomyelitis on solar therapy
b) Picture of 2 wks on treatment**



Fig. 5: a & b) Infected postoperative wound being treated with solar therapy

DISCUSSION: There is potential of ultraviolet C (UVC) irradiation as an alternative approach to current methods used to treat localized infections⁽¹⁾ It has been reported that multidrug-resistant microorganisms are equally sensitive to UVC irradiation as their wild-type counterparts⁽²⁾

With appropriate doses, UVC may selectively inactivate microorganisms while preserving viability of mammalian cells and, moreover, is reported to promote wound healing.

UVC is also found in animal studies to be less damaging to tissue than UVB. Even though UVC may produce DNA damage in mammalian cells, it can be rapidly repaired by DNA repair enzymes.^(3,4)

Ultraviolet (UV) irradiation is electromagnetic irradiation with a wavelength (100–400 nm) shorter than that of visible light (400–700 nm), but longer than x-rays (<100 nm). The mechanism of UVC inactivation of microorganisms is to damage the genetic material in the nucleus of the cell or nucleic acids in the virus.⁽⁵⁾ UV irradiation is divided into four distinct spectral areas including vacuum UV (100–200 nm), UVC (200–280 nm), UVB (280–315 nm) and UVA (315–400 nm).^(6,7)

The UVC spectrum, especially the range of 250–270 nm, is strongly absorbed by the nucleic acids of a microorganism and, therefore, is the most lethal range of wavelengths for microorganisms. This range, with 262 nm being the peak germicidal wavelength, is known as the germicidal spectrum. The damage to the DNA and RNA of a microorganism often results from the dimerization of pyrimidine molecules, in particular, thymine (which is only found only in DNA) produces cyclobutane dimers.^(7,8)

When thymine molecules are dimerized, it becomes very difficult for the nucleic acids to replicate and if replication does occur it often produces a defect that prevents the microorganism from being viable. Although it has been known for the last 100 years that UVC irradiation is highly germicidal, the use of UVC irradiation for prevention and treatment of localized infections is still in the very early stages of development. Furthermore, UV generates nitric oxide (NO), which may reduce blood pressure and generally improve cardiovascular health. UVA induced NO may also have antimicrobial effects and furthermore, act as a neurotransmitter UV exposure may improve mood through the release of endorphin.⁽⁸⁾

Effects of UVC Irradiation on Wound Healing: In addition to the eradication of microorganisms that can impede wound healing, it is hypothesized that judicious UV exposure might be beneficial for wound healing and restoration of skin homeostasis. The effects of UVC on wound healing include hyperplasia and enhanced re-epithelialization or de-squamation of the leading edge of periulcer epidermal cells, granulation tissue formation and sloughing of necrotic tissue.^(9,10)

In addition, UV exposure of wounds might stimulate and restore normal melanocyte number and distribution in re-epithelialized wounds while preventing hypopigmentation.

Furthermore, exposure of re-epithelialized wounds to UV irradiation might exert a photo protective effect in the skin by the production of melanin by melanocytes. It is therefore proposed that moderate UV exposure should be commenced early in the healing process of cutaneous wound.^(9,10)

Most of the positive effects of solar radiation are mediated via ultraviolet-B (UVB) induced production of vitamin D in skin. However, several other pathways may exist for the action of ultraviolet (UV) radiation on humans as focused on in this review.

One is induction of cosmetic tanning (immediate pigment darkening, persistent pigment darkening and delayed tanning).

We are not aware regarding the mode of action of sunlight on the ulcer. We hope that it is ultraviolet and infrared rays which is playing part for the healing.

Similarly, whether sunlight has deep radiation effect on deeper tissues is debatable. However, we have used god gift sunlight judiciously for healing of wound. Wounds were kept open during the solar sessions which might have helped in drainage of infected material and drying of superficial epithelium resulting into epithelisation.

There are some disadvantages and side effects of this therapy such as:

1. It cannot be used in cloudy sky when sunlight is not available.
2. Co-operation of the patient is required.
3. Informed consent is required.
4. Patient may need surgical intervention in case of failure.
5. Puckering of the skin and bad scar may not be acceptable to some patients.
6. Pigmentation of skin at earlier stage is seen which subsides later but may not be acceptable.

This therapy is almost free of cost and some disadvantages may be out weight against the non-healing ulcers due to resistant strains of the bacteria. Scarring and pigmentation was accepted by the patients rather than undergoing repeated and costly surgical procedures for penniless patients.

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We have tried to find out parallel study of solar therapy for comparison and guidelines, but we were unable to get it.

This is a primary study done in medical college in rural set up with gratifying results. However, long term follow-up is awaited.

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