

## Cicatrization Prepare in Diabetic Foot Ulcers Based on the Generation of Responsive Oxygen Species

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### Abstract

The present study aimed to evaluate the correlation between the formation of free radicals and the healing effects of ulcers of the lower extremities in a randomized controlled trial with the use of a derived binder. From natural latex combined with a circuit of light-emitting diodes. The sample included 15 participants with lower extremity injuries divided into three groups: case group 1 received the proposed natural rubber adhesive tape system in combination with the LED circuit; control group 2 received home dressings administered by a nurse as prescribed and established by a clinic wound was treated with calcium alginate or silver foam and group 3 also received home dressings using a derived adhesive bandage from natural latex combined with LED circuit. Collected data were analyzed qualitatively and quantitatively by paramagnetic resonance to determine the formation of free radicals. The Kruskal-Wallis statistical trial was used to evaluate the effect of treatment on ulcer healing of the lower extremities and its correlation with free radicals. The obtained outcomes confirmed the hypothesis that the reduction in the number of these molecules at the end of treatment is related to wound healing.

**Keywords:** Wound; Radicals

### Introduction

The number of people with diabetes has increased from 108 million in 1980 to 422 million in 2014. The global prevalence of diabetes in adults has increased from 4.7% in 1980 to 8.5% in 2014. The prevalence of diabetes increased more rapidly in the low and medium areas, income countries. This pathology develops silently and develops complications such as retinopathy, kidney disease, and neurological disease, cardiovascular and vascular disease. Among the difficulties, it involves vascular and neurological complications that contribute to wound formation in the lower extremities. In this regard, vascular and neurological complications often progress to lower extremity injuries, which constitute a serious public health problem. Among the comorbidities, the etiology of diabetic foot is a diverse pathophysiological condition characterized by ulceration, infection, or deep tissue destruction of the foot in diabetics. The above occur due to neuropathy, peripheral vascular disease, or lower extremity anomalies [1-3]. Diabetic foot is one of the most devastating complications of diabetes, as it can lead to ulcers, leading to small to large amputations. The wound healing process has many different stages, from pressure sores to the process of repairing damaged tissue. These stages are hemostasis, inflammation, proliferation, epithelialization, and scar maturation. In this regard, it is fundamental to choose the right method for better wound treatment and to evaluate the healing effect. One example is the use of new coatings, among them latex derived from *Hevea brasiliensis* in animals and humans. In one study, Quege analyzed the healing effects of essential fatty acid dressings in 11 participants and natural latex treatments in 8 participants. We found that in both procedures, wound size decreased and improved slightly in those treated with Biocure. development of a new model of vascular grafts that are micro-perforated in tissue and coated with a natural latex compound that shows good structural qualities as a vascular substitute, endothelial growth stimulant and provides full tissue integration in dogs. The recent increase in awareness of free radicals and reactive oxygen species in biological research is fueling a medical revolution that promises a new era of health and disease management. Most of the potential harmful effects of oxygen are due to the formation and action of certain chemical compounds, known as ROS, which tend to

give up electrons to other substances. Free radicals and antioxidants have become commonly used terms in modern discussions of disease mechanisms. Free radicals and other ROS are derived from standard essential metabolic processes in the human body or from external sources such as exposure to X-rays, ozone, smoking, air pollutants industrial gases and chemicals. The formation of free radicals occurs continuously in the cell as a outcome of enzymatic and non-enzymatic reactions [4-6]. Therefore, the use of novel coatings such as rubber biofilms and other dressings associated with LEDs has proven to be an option for lower extremity wound healing. The wound healing method used in this study is based on a device called RAPHA, and consists of a light-emitting device with a group of 30 red high-brightness LEDs, which are intended to promote wound healing. injury by irritating the patient's tissues, regardless of the underlying cause of the ulcer. The treatment with the device lasts 35 minutes. LED light therapy combined with non-invasive and non-destructive latex biomaterial. Exposure to light produced by LEDs accelerates cell growth. An array of LEDs emits light in the visible spectrum that increases cellular energy, helping to accelerate the patient's healing process. LED therapy is based on the fact that light can change the metabolism of cells due to its absorption by mitochondria. This study aimed to examine the correlation between the formation of free radicals and the healing effects of ulcers of the lower extremities in a randomized controlled trial using an adhesive derived from Natural rubber latex combined with LED based circuit [7]. The main objective of this study was to demonstrate the benefits of using LEDs and latex biofilms in ulcer healing. In addition, the outcomes could pave the way to modifying current treatments, by reducing treatments and ulcer healing time.

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## Clinical trial

The proposed method for this prospective study is the simultaneous operation of the natural latex binder and the LED circuit. Both agents have properties and properties capable of inducing tissue regeneration and neoplasia. The application flowchart of a randomized clinical trial with wound: Natural rubber and LED circuit. The latex extracted from the Brazilian rubber tree is a polydisperse system in which negatively charged particles of different types are suspended in the serum due to its properties which induce new angiogenesis and tissue regeneration. Natural latex has a healing effect, as it is the plant's natural protective layer [8]. It has natural origin, low cost, no risk of pathogen transmission and has great clinical and social application potential. The adhesive manufacturing process is accomplished by mixing twice centrifuged latex with double distilled water, placing the mixture in a previously sterilized mold, selected to approximate the size of the wound. The mixture is then supplied in the mold without leaving any additional material or creating air bubbles. After the above mentioned processes, the material undergoes vulcanization inside the greenhouse. The adhesive is then removed from the mold and undergoes sterilization and packaging before being used by the study participant.

The LED circuit consists of two modules, a control module and an LED module. The control module has a timer to indicate the duration of the glow, which beeps at the end of the procedure [9]. It is directly connected to the LED module which has 30 monochromatic LEDs. The system supports the healing process.

Wound and venous blood were thawed and 50  $\mu$ L of the sample treated with a solution containing 400  $\mu$ M 1-hydroxy-3-methoxycarbonyl-2, 2, 5, 5-tetramethylpyrrolidine and sodium heparin in 1: 1 rate. The tubes were incubated with gentle shaking at 37°C for 30 min. Then, 50  $\mu$ L of the outcomeing solution was placed between two ice cubes in a 1 mL decapsulated syringe and rapidly frozen in liquid nitrogen. All samples were stored at -80°C until paramagnetic resonance measurements were performed. The principle of the method is based on the interaction of ROS with MHC to form a stable 3 methoxycarbonyl-2, 2, 5, 5-tetramethylpyrrolidine-1-oxyl moiety, which is detectable by EPR, which is the signature of ROS generation [10].

## Discussion

It is widely reported that ROS act as inflammatory signaling molecules in endothelial dysfunction. During inflammation, oxidative stress, generated by immune cells, leads to the opening of endothelial junctions and promotes the migration of inflammatory/immune cells across the barrier Endothelium. The migration of immune cells triggers the acute inflammatory response needed to repair damaged tissues. Therefore, the increase in ROS formation, observed in the venous blood of patients in the middle of the treatment period, may be related to endothelial dysfunction and mobilization of immune cells in the wound area. The described mechanism leads to higher ROS formation in venous blood on day 15. Similarly, a change in the amount of ROS in the wound tissues was observed between initiation and end of treatment, which corresponds to a decrease in inflammation. It concerns the role of ROS antioxidants in skin wound healing, their possible relevance in

chronic wounds, and the potential value of ROS-induced biomarkers in the prognosis of wound healing.

## Conclusion

No adverse effects were observed in this survey, although participants reported burning and pain during and after treatment. Considering that this is a subjective perception, there is no need to specify the concentration and magnitude of the gain point for future studies. This system offers better scalability and faster wound healing with granulation tissue formation, compared to current standard procedures. We also emphasize the need to train the healthcare team on product handling, sampling and, above all, managing a patient's ability to obtain samples from a healed wound. The use of latex has shown water immersion of wound edges and granulation tissue that is susceptible to fragmentation due to its soft nature. The system presented in this study can be applied to different stages of the healing process in different etiologies, but it still needs to be studied further. We conclude that the high formation of ROS in the blood of the wound, at the start and between treatments, corresponds to the inflammatory process and that the reduction in the number of these molecules at the end of treatment is related. to the wound healing process.

## Conflict of Interest

None

## Acknowledgment

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