42

HISTOLOGICAL AND BIOMETRICAL COMPARISON AMONG THREE IRRADIATION CONFIGURATIONS FOR SKIN WOUND HEALING ACCELERATION IN RATS, USING AN 830 nm DIODE LASER

S.B. Rezende,[1] M.S. Ribeiro,[1] V.G. Garcia,[2] and E.P. Maldonado[1]

[1]Mestrado Profissionalizante Lasers em Odontologia, IPEN-CNEN/SP, São Paulo, Brazil
[2]GEPLO' Faculdade de Odontologia, UNESP, Araçatuba, São Paulo, Brazil

In this work we investigate the effects of skin wound healing acceleration in rats, using an 830 nm diode laser. Biometrical and histological analysis were performed for three different irradiation configurations, one punctual and two homogeneous. Two values of intensity and two values of energy density were used. One skin biopsy of about 8 mm was made on the back of 64 male adult Wistar rats divided in 4 groups. Group 1 was the control and the lesion was not irradiated; for the groups 2 and 4 the dose was the same ($D = 3$ J/cm^2) but the irradiation method was different: the lesion was punctually and uniformly irradiated, respectively. For the group 3, the dose was 1, 3 J/cm^2 and the lesion was uniformly illuminated. The lesions of the groups 2, 3 and 4 were irradiated immediately post-wounding. We have taken photographs from the wounded areas on the 3rd, 7th and 14th post-operative day for a biometrical analysis. Sacrifice proceeded on the 3rd, 7th and 14th days post-lesion and one round skin biopsy with 10 mm in diameter were made for histological analysis. All lesions have shown healing process acceleration when compared to control group. However, our results clearly indicate that, the lower values of intensity and energy density leaded to best results. The combination of 50 mW/cm^2 and 1,3 J/cm^2 for intensity and energy density (group 3), respectively, have shown the optimum biological result, considering biometrical and histological views.

43

POLYCHROMATIC LED IN BURN HEALING OF NON-DIABETIC AND DIABETIC RATS

A.H. Farouk, Al-Watban, and Bernard L. Andres

Laser Medicine Section, Biological & Medical Research Dept., King Faisal Specialist Hospital & Research Centre, Riyadh, Saudi Arabia

The advancement of photo-medicine has been encouraged by the observed photochemical alterations in bio-molecules from exposure to light, so that a growing interest in laser and other light sources such as LED emerged. In this study we determined the effect of polychromatic LED (Diomedics, Inc.) on the healing of burn wound in the Streptozotocin induced diabetic and non-diabetic rat. The polychromatic LED is a cluster of 25 diodes emitting photons at wavelengths 510–543 nm, 594–599 nm, 626–639 nm, 640–670 nm and 842–679 nm. A number of age-matched, male S-D rats were randomly assigned to the diabetic and non-diabetic groups. Streptozotocin dose of 70 mg/kg was used for diabetes induction. Rat weight, hyperglycemia and glycosuria were monitored for the first three days and weekly thereafter. After one week of diabetes, rats were anesthetized and shaved in the right flank. Burn wounds of 1.3 cm^2 was created using metal rod heated up to 600°C then applied for two seconds. Non-diabetic and diabetic groups were further divided into LED treatment groups: Control, 5, 10, 20 and 30 J/cm^2. Burn healing during diabetes by was impaired by -54.21%. Polychromatic LED treatment using 5, 10, 20 and 30 J/cm^2 effected healing by 6.5%, 5.18%, -3.65% and -5.93% in the non-diabetic rat and 71.28%, 94.17%, 54.34% and 40.19% in the diabetic rat, respectively. While our results showed minimal acceleration in the non-diabetic rat at 5 and 10 J/cm^2 and inhibition at 20 and 30 J/cm^2, the acceleration of burn healing in the diabetic rat was outstanding in any of the doses used. Studies making use of polychromatic LED together with the determination of biochemical and bio-mechanical properties of healed tissues after treatment is recommended to define the quality of burn healing during polychromatic LED therapy.

44

INTERACTION OF LOW-INTENSITY LINEARLY POLARIZED LASER RADIATION WITH LIVING TISSUES: EFFECTS ON TISSULAR ACCELERATION OF SKIN WOUND HEALING

M.S. Ribeiro,[1] D.F.T. Silva,[1] A.Z. Freitas,[1] C.M.R. Pellegrini,[2] S.F. Oliveira,[2] C.E.N. Araújo,[2] T.M.T. Zorn,[2] and D.M. Zezell[1]

[1]Centro de Lasers e Aplicações, IPEN-CNEN/SP, São Paulo, Brazil
[2]Departamento de Histologia, ICB/USP, São Paulo, Brazil

According to the Maxwell's equations to optical properties of surfaces, the energy deposition efficiency in a microroughness interface depends on the electrical field polarization component. Considering a linearly polarized beam, this efficiency will depend on the roughness parameters to p-polarized light and it will not depend on such parameters to s-polarized light. In this work it was investigated the effects of low-intensity, linearly polarized He-Ne laser beam on skin wounds healing, considering two orthogonal directions of polarization. We have considered a preferential axis as the animals' spinal column and we aligned the linear laser polarization first parallel, then perpendicular to this direction. Burns about 6 mm in diameter were created with liquid N_2 on the back of the animals and the lesions were irradiated on days 3, 7, 10 and 14 post-wounding, $D = 1{,}0$ J/cm^2. Control lesions were not irradiated. The degree of polarization was measured in normal and pathological skin samples on the 3rd, 7th, 10th and 14th post-operatory, and it was verified that linearly polarized light can survive in the superficial layers of skin and it can be more preserved in skin under pathological condition when compared with health skin. During the healing process, the degree of linear polarization for wounded skin samples has been getting similar to that of health skin samples. The analysis of skin wound healing process has demonstrated that the relative direction of the laser polarization plays an important role on the wound healing process by light microscopy, transmission electron microscopy and radioautography.