Low-level laser therapy of leg ulcer in sickle cell anemia

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Chronic leg ulceration affects about 1% of the population at some point in their lives. Additionally, leg ulcers are one of the sequels of sickle cell disease with physiological and psychosocial consequences.(1) Treatment aims at improving the quality of life of patients and effectively healing the lesion. Adherence to treatment is not always effective, especially considering the profession of individuals with sickle cell anemia and the time required for therapy. The results of current therapeutic conduct appear to be unsatisfactory even though much has been published on a wide range of therapies.(2)

Cutaneous lesions represent a dilemma and instigate clinical interest because of the high morbidity associated with changes in the normal healing process. An adequate choice of therapy and effort of the medical team can make the healing process quicker and reduce possible complications.(3) Among currently available methods, low-level laser therapy (LLLT) is an important, safe and practical tool. *In vitro* and *in vivo* studies have demonstrated that LLLT is an effective method to modulate tissue repair, thus significantly contributing to a faster and better organized healing process.(1,3)

Here we describe the results of a therapeutic intervention in a 35-year-old female sickle cell anemia patient with recurring leg ulcers who was prevented from maintaining employment and appropriate social activities due to the disease. She had been diagnosed at 8 years old; she is homozygous for the Bantu haplotype. Between 16 and 18 years old, the patient was repeatedly hospitalized for infections, leg ulcers, generalized pain and anemia. Leg ulcers were a recurring problem which affected day-to-day activities.

The patient participated in the "ulcer healing group" of Hospital de Base in São José do Rio Preto, São Paulo State, Brazil and the leg ulcers were treated. At an initial evaluation the patient had an active leg ulcer of the lower third of left leg above the medial malleolus. She also had whitish areas in the third anteromedial distal region of the left leg and on the dorsum of the foot, showing that several ulcers had healed. A macroscopic evaluation identified the presence of hyperpigmentation and the temperature in the region was elevated.

Treatment using LLLT was proposed to accelerate the healing of the ulcer. The device used was a He-Ne Laser (Plasmax IV - KLD Biosystems Inc.) with a wavelength of 632.8 nm and red (visible), 5mW peak emission, 10 - 60 mJ energy with an application area of 0.02 - 100 cm^2 and automatic dosimeter.

The application mode consisted of point action of 30 mJ for 9 seconds in order to accelerate local cell stimulation for healing. Points at 5 - 10 mm intervals on the edges of the ulcer were marked and laser therapy was applied. Moreover, with the aim of increasing circulation, 50 mJ were applied for 15 seconds in the region above the ulcer. A total of five treatment sessions were used twice weekly for 10 to 15 minutes each with progressive reduction as the ulcer healed.

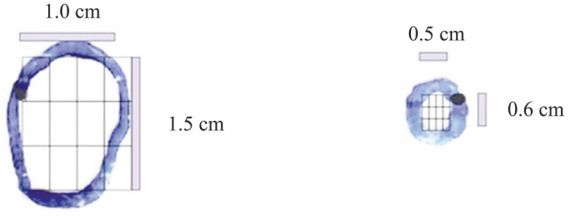

Figure 1 – Outline of the leg ulcer on clear plastic before treatment (left) and after laser therapy (right)

Figure 2 – Evolution of the ulcer: at the beginning (A), during treatment with low-power laser therapy (B and C) and after treatment (D)

An outline of the lesion was drawn on transparent plastic to evaluate the results; an estimation of the area of the ulcer was achieved by measuring the largest cephalocaudal (CC) and mediolateral (ML) lengths. The initial area of 1.5 cm^2 was reduced by 80% to 0.3 cm^2 with treatment: 60% in length and 50% in width (Figures 1 & 2).

Hydroxyurea improves the antioxidant defense of patients with sickle cell anemia and contributes to a higher catalase activity and trolox-equivalent antioxidant capacity levels and lower lipid peroxidation.[4] However this patient was not taking hydroxyurea and thus lipid peroxidation may be the cause of the recurring leg ulcers.

This easily applied therapy was effective and fast in the management of the ulcer and improved the quality of life of the patient.

References

1. Callam MJ, Harper DR, Dale JJ, Ruckley CV. Chronic ulcer of the leg: clinical history. Br Med J (Clin Res Ed). 1987;294(6584): 1389-91.

2. Powars DR, Chan LS, Hiti A, Ramicone E, Johnson C. Outcome of sickle cell anemia: a 4-decade observational study of 1056 patients. Medicine (Baltimore). 2005;84(6):363-76.

3. Rocha Júnior AM, Vieira BJ, Andrade LC, Aarestrup FM. Effects of low-level laser therapy on the progress of wound healing in humans: the contribution of in vitro and in vivo experimental studies. J Vasc Bras. 2007;6(3):258-66.

4. Silva DG, Belini Junior E, Torres L de S, Ricci Júnior O, Lobo C de C, Bonini-Domingos CR, et al. Relationship between oxidative stress, glutathione S-transferase polymorphisms and hydroxyurea treatment in sickle cell anemia. Blood Cells Mol Dis. 2011;47(1): 23-8.