

## CLINICAL EVALUATION OF LOW LEVEL LASER THERAPY IN TREATMENT OF CUTANEOUS LEISHMANIASIS

KLINICZNA OCENA LASEROTERAPII W LECZENIU SKÓRNEJ POSTACI LEISZMANIOZY

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### Abstract

This study aimed to evaluate the effectiveness of Low Level Laser Therapy (LLLT), with specific laser parameters, in the treatment of Cutaneous Leishmaniasis (CL). Thirteen patients, clinically and by positive smear diagnosed as cases of CL, were referred from Khartoum Teaching Hospital and were considered as study population. The Treatment was done using diode laser probe with wavelength of 820 nm, followed by cluster probe (assembly of non-coherent and coherent diodes). The dose was: I. Diode laser probe with energy density of 48 J/cm<sup>2</sup> for thirty seconds. II. Cluster probe with energy density of 9.6 J/cm<sup>2</sup> for two minutes.

The distance between the probe and the skin was less than 1cm. The frequency of treatment was three sessions weekly for total of ten sessions. The function of LLLT in this study was to reduce inflammation (anti-inflammatory effect) and accelerate healing. The results showed that the response was excellent in the majority of treated patient (92.3 %). The complications were minimal and transient. The results proved that LLLT is a successful treatment method for Cutaneous Leishmaniasis and it is easy to perform.

### Streszczenie

Celem badania była ocena efektywności laseroterapii (LLLT), przy określonych parametrach lasera w leczeniu skórnej postaci leiszmaniozy (CL). Trzynastu pacjentów zdiagnozowanych jako przypadki CL (badanie klinicznie i pozytywny rozmaz) z Teaching Hospital w Chartumie zostały zakwalifikowane do badanej grupy populacji. Leczenie wykonywano za pomocą sondy lasera diodowego o długości fali 820 nm, a następnie kłasterowej sondy (montaż diod nie-spójne i spójne). Dawka wynosiła: I. Dioda laserowa z sondą gęstości energii 48 J/cm<sup>2</sup> do trzydziestu sekund. II. Sonda kłasterowa z gęstością energii 9,6 J/cm<sup>2</sup> przez dwie minuty.

Odległość między sondą a skórą była mniejsza niż 1 cm. Częstotliwość leczenia wynosiła trzy sesje w tygodniu (łącznie dziesięć sesji). Funkcją LLLT w tym badaniu było zmniejszenie stanu zapalnego (działanie przeciwzapalne) i przyspieszenie gojenia. Wyniki wykazały, że reakcja była doskonała u większości leczonych pacjentów (92,3%). Komplikacje były minimalne i przemijające. Wyniki wykazały, że LLLT jest skuteczną metodą leczenia skórnej leiszmaniozy i jest łatwa do wykonania.

**Key words:** cutaneous leishmaniasis; low level laser therapy; anti-inflammatory laser effect; laser in dermatology

**Słowa kluczowe:** skórna leiszmanioza; laseroterapia; przeciwzapalne działanie lasera; laser w dermatologii

### Introduction

Leishmaniasis is a parasitic disease spread by the bite of infected sand flies. The disease is found in parts of about 88 countries on 4 continents. One of the most common forms of the disease is cutaneous leishmaniasis that occurs most commonly (over 90%). A form that affects some internal organs of the body, visceral leishmaniasis, mostly occurs in Bangladesh, India, Nepal, Brazil and Sudan [1].

Cutaneous leishmaniasis is endemic in many parts of Sudan, in Kordofan province, Darfur province and along the main river Nile. The first indigenous case was described by Archibald in 1911 in a native from the Nuba Mountains of Kordofan province in western Sudan [2]. The Promastigotes of *Leishmania* are transmitted to human skin by the bite of a sand fly.

Leishmania then invades human macrophages and replicates intracellular. A raised, red lesion develops at the site of the bite (often weeks or sometimes years afterwards). The lesion then ulcerates and may become secondarily infected with bacteria [3].

In many species (for example, *Leishmania major*) the lesion often spontaneously heals with atrophic scarring. In some species (for example, *Leishmania viannia braziliensis*) the lesion may spontaneously heal with scarring, but then re-appear elsewhere (especially as destructive mucocutaneous lesions).

Lesions of other leishmania species may spontaneously heal and then re-appear as satellite lesions around the site of the original lesion, or along the route of lymphatic drainage [4]. The clinical picture tends to vary with the geographic location. The eruption is popular and lasts for months in Africa, whereas in India, the lesions usually start as erythematous and hypopigmented macules that enlarge into patches. Later, these asymptomatic patches may become non-ulcerative erythematous nodules [5].

Exposed parts of the body, easily bitten by the sand fly, are usually affected.

The lesion begins with a nonspecific insect bite-like, erythematous papule(s) at the site of the sandfly bite(s).

Inflammatory satellite papules may develop around the primary lesion representing a reaction to local dissemination of the parasite or its antigenic products [6,7].

Infections persisting for more than 1–2 years are regarded as chronic CL. Patients with chronic lesions have an increased morbidity not only because of the prolonged length of their illness but also because chronic lesions tend to be larger, more diverse in their clinical manifestations, and more difficult to diagnose (absence or small number of organisms in tissue), thus invoking a wide range of differential diagnosis.

Different modes of therapy were used for treatment of Cutaneous Leishmaniasis, like:

Pentavalent antimony [8], Amphotericin B & Liposome Amphotericin B [9].

Pentamidine isethionate, Topical paromomycin [10], Oral antifungals [11], Allopurinol [12], Heat and cryo-therapy, Excision [13], Substituted Quinolines [14].

Recently lasers were suggested as treatment tool due to its successful Clinical applications that show high potential effectiveness in treating soft tissue injury, chronic pain, and wound healing. Resolution of viral and bacterial infections has been claimed, but no plausible mechanism for this has been proposed. One clinical application of interest is the treatment of inflammation, where the possible anti-inflammatory effect of location-and-dose-specific laser irradiation is promising [15].

This work aimed to evaluate the clinical results of treatment

of cutaneous leishmaniasis using LLLT, with specific laser parameters.

## Material and Methods

Thirteen patients were selected for this study. The Inclusion criteria were:

- Confirmed cutaneous leishmaniasis cases.
- (Confirmed by positive smear for LD-bodies).

The Exclusion criteria were:

- Patients with negative smear for LD-bodies.
- Pregnant women.
- Patients with lesions in glandular areas.
- Patients with epilepsy.

All patients were requested to participate voluntarily and a written informed consent was done with ethical clearance from patient himself before being enrolled in the study. They were informed about the possible side effects and the hazard of laser therapy. Confidentiality of the patient was maintained. The data collection from (Questionnaire sheet) was designed, and filled for every patient (Questionnaire sheet filled by the principle investigator). This sheet was used to record detailed information about personal and medical history of the patient, the site, duration and the characteristics of the lesion, the laser parameters and complication in each follow up visit. Analysis was done using Excel Worksheet Treatment was done using the single probe (820 nm) with energy density of 48 J/cm<sup>2</sup> for thirty seconds followed by the cluster probe with energy density of 9.6J/cm<sup>2</sup> for two minutes. The distance between the probe and the skin was less than 1cm.

The frequency of treatment was three sessions weekly for total of ten sessions.

Clinical evaluation was done by observation. Photographs for lesions before and after the treatment were used to assess the results. Follow up was done weekly during the period of treatment and up to ten weeks after the last session. Complete healing was achieved when the clinical manifestation was disappeared totally (e.g. erythema, wetness, crusting, ulceration, and pain).

Dressings and antibiotics were the only drugs used to assist in the procedure.

## Results

### 3.1 Sex distribution of the patients:

Gender distribution of the patients included in the study showed that males (Nine patients-69%) were more affected than females (Four patients-31%). The main affected ages were between 1- 9 and 10 to 19 years.

### 3.2 History of the patients:

#### 3.2.1 Concomitant Diseases: (Tabl. I)

Disease	Number	Percent
Diabetes and Hypertension	1	7.7
Chronic infections	2	15.4
Non	10	76.9
<b>Total</b>	<b>13</b>	<b>100%</b>

Table I. Incidence of concomitant diseases encountered by the patients included in this study

### 3.2.2 Drug history:

More than 60% of the patients applied topical antiseptic and antimicrobial agents. This can be explained by the nature of the disease itself, because it is wet and oozing in appearance. In addition, doctors might diagnosed the lesions as pyoderma and some health care providers even seem to believe that CL does respond to antimicrobial agents, like antibiotics and antifungal medicines.

Approximately one third of the patients used traditional

medicine for the symptomatic relieve from the signs of the disease, because most of the population has a strong believe that CL does not need a specific treatment, and that the disease is self limited.

### 3.3 Clinical data of the patients:

3.3.1 Number of lesions: (Tabl. II)

3.3.2 Morphology of lesion: (Tabl. III)

3.3.3 Site of lesions: (Tabl. IV)

Number of Lesions / Patient	Number of Patients	Percent
1	3	23.0
2	1	7.7
3	4	30.8
4	2	15.4
6	2	15.4
15	1	7.7
<b>Total</b>	<b>13</b>	<b>100%</b>

Table II. The distribution of the number of lesions per individual seen on the 13 patients included in the study

Lesion	Number	Percent
Papule	2	3,6
Nodule	6	10,9
Ulcer	0	0
Crusted ulcer	32	58.2
Crusted nodule [Nodulo ulcerative]	15	27.3
Total	55	100%

Table III. The distribution of the morphological features of all the lesions seen on the 13 patients included in the study

Region of lesion	Number of lesions	Percent
Scalp	1	1.8
Face	2	3.6
Trunk	2	3.6
Upper limb	20	36.3
Lower limb	30	54.5
Total	55	99.5%

Table IV. Anatomical distribution of lesions on the 13 patients included in the study

### 3.3.4 Duration of lesions:

61.5% of the patients came at an early stage of the diseases. This can be explained by the fact that the majority of the patients live in Khartoum state & its surrounding areas. Additionally, these patients have an easier access to medical health care providers, who diagnose the diseases and refer them to the appropriate hospital.

### 3.3.5 Clinical appearance of lesions: (Tabl. V)

Appearance	Number of patient	Percent
Wet	22	40
Oozing	25	45.5
Dry	8	14.5
Total	55	100%

**Table V. Incidence of the clinical appearance of lesions observed on the 13 patients included in the study**

### 3.3.6 Associated symptoms:

Most of the patients (69%) suffered from pain, while some of them suffered from itching, fever and fatigue.

### 3.4 Response of CL to LLLT:

#### 3.4.1 Number of sessions: (Tabl. VI)

Seven patients out of thirteen needed six sessions for treatment of CL by LLLT, this seems very convenient when comparing this mode of treatment to the widely used treatment with medicines, namely Pentostam (Sodium Stibogluconate, SSG).

The majority of the patients (69.2%) completed all planned

treatment sessions until they achieved complete healing. Less than one third did not complete the planned number of sessions (Defaulters). Even though they admitted that they were satisfied by the achieved results.

#### 3.4.2 Patients satisfaction:

More than half of the patients were claimed that they well satisfied from the laser therapy almost at the third session. One quadrant admitted their satisfaction at six sessions. Latest one quadrant their satisfaction not arrived till before ten sessions. No more sessions were needed (Tabl. VII).

Number of sessions	1	2	3	4	5	6	7	8	9	10	>10
Number of patients	0	0	0	1	1	7	0	2	1	1	0

**Table VI. Number of sessions done for the thirteen patients**

Number of sessions	Number of patients
1-3	7
4-6	3
7-9	3
10->10	0

**Table VII. Satisfaction reported by patients in relation to number of sessions**

## Discussion

According to the clinical evaluation, complete healing was achieved in majority of the patients (92.3%). Moderate healing was reported in (7.7%) of patients. No failure was recorded. The results of treatment are listed in Table VIII below.

Result	Number of sessions				Total (%)
	1-3	4-6	7-9	≥10	
Complete healing	0	8	4	0	92.3
Moderate healing	0	0	0	1	7.7
Failure	0	0	0	0	0

**Table VIII. Results of treatment in relation to the numbers of sessions**

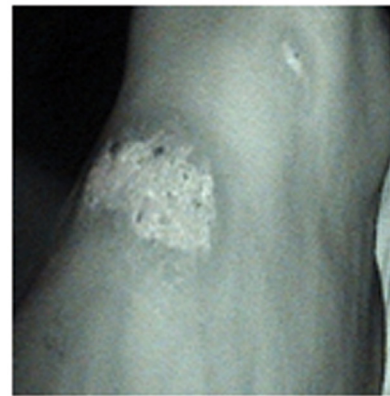
Number of sessions of treatment needed was proportional to the period between the detection of the lesions and the initiation of the treatment. That means the earlier the patient arrived the clinic after discovering the lesions, the shorter the time needed to achieve prognosis. A fraction of less than 25% of the patients in this study reported a mild central hypo-pigmentation and peripheral hyper-pigmentation, a color change that is known to

vanish with time. None of the patients complained of, nor showed any signs of burns, erythema, tissue inflammation, nor do even any sign of tissue atrophy (Tabl. IX).

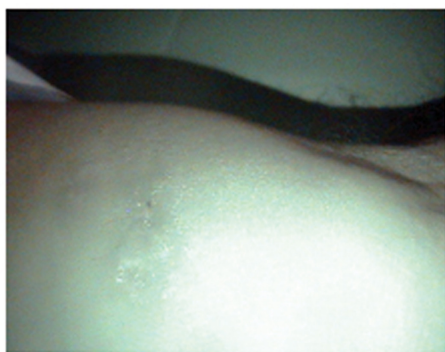
The results of this study showed that Low Level Laser Therapy used for Cutaneous Leishmaniasis was a very successful, safe procedure and avoid serious side effects when performed properly. Figures 1 and 2 show examples for some treated lesions.

Side effect	Number	Percent
Hyper-pigmentation	0	0
Hypo-pigmentation	1	7.7
Hyper and Hypo-pigmentation	3	23.1
Burns	0	0
Erythematic	0	0
Inflammation	0	0
Atrophy	0	0

**Table IX. Incidence of side effects observed after LLLT in the 13 patients included in the study**



**Figure 1a. Before treatment. b. After 6 laser sessions**



**Figure 2a. Before treatment. b. After 6 laser sessions**

The response of patients with Cutaneous Leishmaniasis for Low Level Laser Therapy was excellent in the majority of treated patients (92.3%) in a relative short time. LLLT proved to be successful, safe procedure and the complications were minimal and transient. The clinical response was not related to demographic data (age, sex and tribe) or specific factor (family relation, morphology and site of the lesion) but an obvious relation was established for the duration of the lesion in respect to the number of sessions needed.

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