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Low Intensity Laser and Deproteinized Extract of Sanguin on Lower Limb Ecthymatous Ulcerations

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Abstract: Purpose: to evaluate the efficacy of low intensity laser therapy (LILT) and deproteinized extract of sanguin on lower limb ecthymatous ulcerations. Methods of evaluation (Measurement of the ulcer surface area and the colony count). **Methods:-** Forty five patients (Males and Females) who had ecthymatous ulcerations of lower limbs, their ages ranged from 12 to 22 years, they were free from any immuno-deficiency disorders or disease that can affect healing process, they were selected randomly from patients of the dermatological department of Cairo university Hospitals. They were divided into three groups. Group A: (LILT group): composed of 15 patients who received the LILT in addition to the medical care of ecthymatous ulcerations. Group B:(Solcoseryl jelly group): composed of 15 patients who received the solcoseryl jelly in addition to the medical care of ecthymatous ulcerations. Group C : (LILT and solcoseryl jelly group): composed of 15 patients who received the LILT and solcoseryl jelly in addition to the medical care of ecthymatous ulcerations. Measurements were conducted before starting the treatment as a first record and at the end of the fourth week of treatment as a second (final) record. **Results and conclusion:-** Results showed that application of both the LILT and solcoseryl jelly had a valuable healing effects on ecthymatous ulcerations as evidenced by the highly significant decreases in ulcer surface area and colony count. But the cumulative effect of both the LILT and solcoseryl jelly was more fruitful than application of any one of them alone.
Key words (Low intensity laser therapy, Solcoseryl jelly, Ecthymatous ulcerations, Ulcer surface area and Colony count).

Introduction:

Bacterial infections of the skin are specific and non-specific; the specific bacterial skin infections are tuberculosis, leprosy and syphilis, while the non-specific bacterial skin infections are impetigo contagiosa, bullous impetigo, Bockhart's impetigo, ecthyma (ulcerative impetigo), bacterial intertrigo, pityriasis alba, sycosis barbae, furuncle, carbuncle, erysipelas (streptococcal cellulitits) and perleche (angular stomatitis).[2,3,5.]

Impetigo is an inflammatory, pustular, skin disease usually caused by staphylococcus, occasionally by streptococcus. Impetigo contagiosa is a highly contagious form of impetigo, commonest on the face and scalp, characterized by bullae which become pustules and then honey-colored crusts. Impetigo contagiosa (crusted impetigo) is an acute superficial infection of the skin caused by streptococci and / or staphylococci. It starts with a thin walled vesicle on an erythematous base, which is filled at first with a clear fluid then purulent material, and ruptures very rapidly, the exudating serum gives yellowish brown crusts . The crusts dry separate and leave fading erythema without scar. Advancement at the edge and central clearing may occur with circinate impetigo.

It is common on the face of children but may complicate other skin diseases as pediculosis, capitis, scabies or eczema. [9,10,11,12.]

Ecthyma (ulcerative impetigo) is characterized by the appearance of thick adherent crusts, removed with difficulty and on removal superficial ulceration is seen. It is more common on the lower limbs of children with poor hygiene. The lesions start by small vesicle or bulla that is followed by ulceration and crusting. It tends to be protracted as the etiology is continued and on healing, the post inflammatory pigmentation and superficial scarring is seen. It is commonly streptococcal infection, rarely mixed staphylococcal and streptococcal. [13,14,16,25.]

The effect of low intensity laser therapy for the treatment of many bacterial skin diseases as types of impetigo especially the ulcerative type (ecthyma) and viral skin infections as herpes simplex and herpes zoster show an immune- stimulating effect. The laser treatment is a non invasive treatment; it causes no pain, and the patient exhibits an excellent tolerance. The laser treatment confers to the patient as supplement of physical and psychic comfort. Also laser treatment shows better results as the classical treatment in most affection and no side effects were observed. Laser treatment has no negative interactions with other types of treatment or medical substances. [1,4,6,7,8,19,24.]

LASER is an acronym for light Amplification by the stimulated Emission of Radiation; it is a form of phototherapy which involves the application of monochromatic light ore biological tissue to elicit a biomodulative effect within that tissue, the low level laser therapy (LLLT) has gained in the present a very large spreading between practicing physicians. Low level laser therapy at adequate wave length, intensity and dose can accelerate tissue repairing. However, there is still unclear information about light characteristics, such as coherence and polarization. [17,18,20,21,22.]

Solcoseryl jelly 10% (15 gram) is a deproteinized extract of blood of cloves with high reticulo-endothelial system activity. It improves oxygen utilization even in tissues with poor oxygen supply and promotes granulation and epithelialization. Solcoseryl ampoules, ointments and jelly are used in skin ulcers and burn preparations. [10,15,25.]

Material and Methods

Subjects:

This study was carried out on forty five patients (Males and Females) who had ecthymatous ulcerations of lower limbs, their ages ranged from 12 to 22 years, they were free from any immuno-deficiency disorders or disease that can affect healing process, they were selected randomly from patients of the dermatological department of Cairo university Hospitals. They were divided into three groups. Group A: (LILT group): composed of 15 patients who received the LILT in addition to the medical care of ecthymatous ulcerations (removal of crusts by gentle debridement and hydrogen peroxide). Group B:(Solcoseryl jelly group): composed of 15 patients who received the solcoseryl jelly in addition to the medical care of ecthymatous ulcerations. Group C :(LILT and solcoseryl jelly group): composed of 15 patients who received the LILT and solcoseryl jelly in addition to the medical care of ecthymatous ulcerations. Measurements were conducted before starting the treatment as a first record and at the end of the fourth week of treatment as a second (final) record.

Instrumentation:

In this study the measuring tools and equipment were the ulcer surface area (USA) and the colony count (CC), while the therapeutic tools and equipment were the Helium – Neon Laser apparatus, protective eye glasses and the Solcoseryl jelly 10% (15 gram) [4,8,15,20,22.]

Procedures

Evaluation:

1- Ulcer surface area: was measured by tracing (transport sheet, marker pen, metric graph paper, carbon paper and white paper were used), [3,9,12,25.]

1- **2- Colony count with the tools for taking swap; sterile swab, media used for culture samples and gloves:**

Semi quantitative culture of the ecthymatous ulcer area**:** A sterile cotton swab is rolled completely on the surface of the ecthymatous ulcer, the swab material was emulsified well in a 5 ml sterile (0.9% NaCl), three serial 1:10 dilutions of the suspension were made with 0.5ml aliquots and 4.5ml of sterile saline per aliquot. A 0.1 ml aliquot of the original suspension and of each dilution was spread on the surface of the blood gar plate, all plates were incubated at $37C^0$ for 24 hours, the number of organisms per ml of the swab suspension was determined by counting the number of colonies on the plate that grew between 30 and 300 colonies, the number of colonies on the plate was calculated by multiplying the count in step 6 by the dilution factor, the count was done for each colony count separately. Gram stain and key tests including oxidase, and catalase tests as well as colony morphology were performed to preliminary identify each colony count [2,9,12,16,25.]

1- Treatment procedures of the LILT and Solcoseryl jelly:

With the patient in the suitable comfortable position, duration of treatment was a session daily (6 minutes) for 4 weeks as the ecthymatous ulcer was about 2cm in diameter (surface area of $4cm^2$ approximately), so each cm^2 was irradiated for 90 seconds, 360 seconds as a total (about 6 minutes). The probe of He-Ne laser was stabilized in horizontal alignment opposite to the patient but the beam of laser was in perpendicular direction to the ecthymatous ulcer. The distance between the laser probe and the ecthymatous ulcer was 1mm length and according to the grid technique each cm^2 of the ecthymatous ulcer and each cm of the ulcer perimeter was subjected to 90 seconds laser irradiation for a session of 6 minutes, where ulcer surface area before treatment was $4cm^2$ approximately, also solcoseryl jelly treatment was applied daily for 4 weeks[1,5,6,8,9,17,21,24].

Data analysis:

Ulcer surface area (USA) and the colony count (CC), were measured pre-treatment as a first record and after 4 weeks as a second final record in the three groups. Collected data were fed into computer for the statistical analysis; descriptive statistics as mean, standard deviation, minimum and maximum were calculated for each group. The t-test was done to compare the mean differences of the three groups before and after application and within each group. Alpha point of 0.05 was used as a level of significance,[23.]

Results

As shown in table (1) and figure (1), the mean value of the USA before treatment was (4.12640 ± 0.11036) cm^2 in the first study group (LILT), while after treatment was (2.96450 ± 0.43524) cm^2. These results revealed a highly significant reduction in USA ($P < 0.0001$). While in the second study group (Solcoseryl jelly), the mean value of the USA before treatment was (4.12431 ± 0.11124) cm^2, while after treatment was (3.15320 ± 0.54321) cm^2. Also these results revealed a highly significant reduction in the USA ($P < 0.0001$). Where in the third study group (LILT and solcoseryl jelly), the mean value of the USA before treatment was (4.12420 ± 0.11212) cm^2, while after treatment was (1.45410 ± 0.44230) cm^2. Also these results revealed a highly significant reduction in the USA ($P < 0.0001$).

Table (1): Comparison of the mean values of the ulcer surface area (USA) in cm^2 before and after treatment in the three study groups

	Before treatment		After treatment		Mean difference	T-value	P.value	Level of significance
	Mean	±SD	Mean	±SD				
First Study Group (LILT group)	4.12640	0.11036	2.96450	0.43524	1.16190	10.02	0.0001	Highly significant decrease
Second study Group (Solcoseryl jelly group)	4.12431	0.11124	3.15320	0.54321	0.971110	6.78	0.0001	Highly significant decrease
Third study Group (Both LILT and solcoseryl jelly	4.12420	0.11212	1.45410	0.44230	2.67010	22.66	0.0001	Highly significant decrease

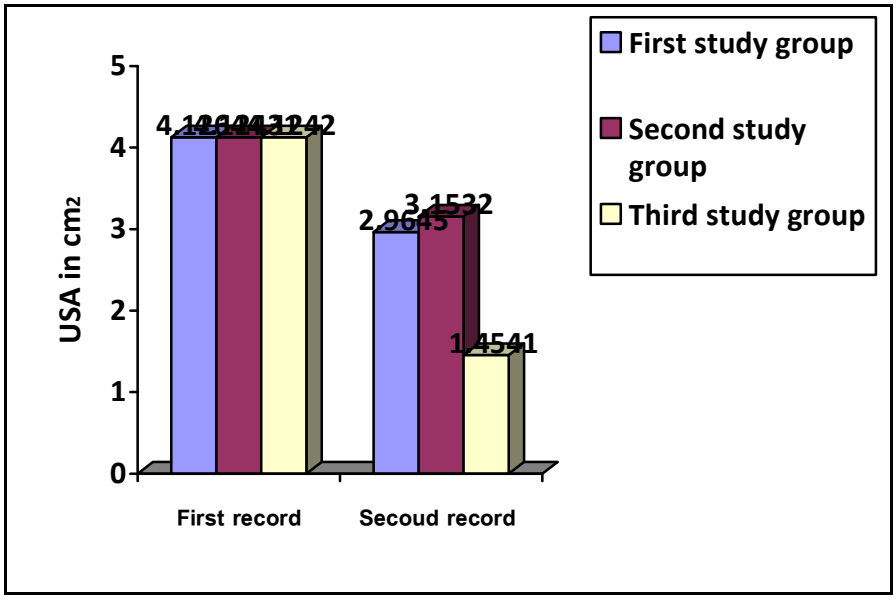

Fig (1): Mean values of the ulcer surface area (USA) before and after treatment in the three groups.

As shown in table (2) and figure (2), the mean value of the colony count (CC) in cells before treatment was (24640.0 ± 5454.5) cells in the first study group (LILT), while after treatment was (265.6 ± 113.6) cells. These results revealed a highly significant reduction in colony count (CC), ($P < 0.0001$), while in the second study group (Solcoseryl jelly), the mean value of the colony count (CC) before treatment was (24642.0 ± 5455.4) cells, while after treatment was (303.8 ± 124.5) cells, also these results revealed a highly significant reduction in the colony count (CC), ($P < 0.0001$). where in the third study group (LILT and solcoseryl jelly), the mean value of the colony count (CC) before treatment was (24644.0 ± 5464.2) cells, while after treatment was (211.7 ± 101.2) cells, also these results revealed a highly significant reduction in the colony count (CC), ($P < 0.0001$).

Table (2): Comparison of the mean values of the colony count (CC) in cells before and after treatment in the three groups

	Before treatment		After treatment		Mean difference	T-value	P.value	Level of significance
	Mean	±SD	Mean	±SD				
First Study Group (LILT group)	24640.0	5454.5	265.6	113.6	24374.4	17.30	0.0001	Highly significant decrease
Second study Group (Solcoseryl jelly group)	24642.0	5455.4	303.8	124.5	24338.2	17.27	0.0001	Highly significant decrease
Third study Group (Both LILT and solcoseryl jelly	24644.0	5464.2	211.7	101.2	24432.3	17.31	0.0001	Highly significant decrease

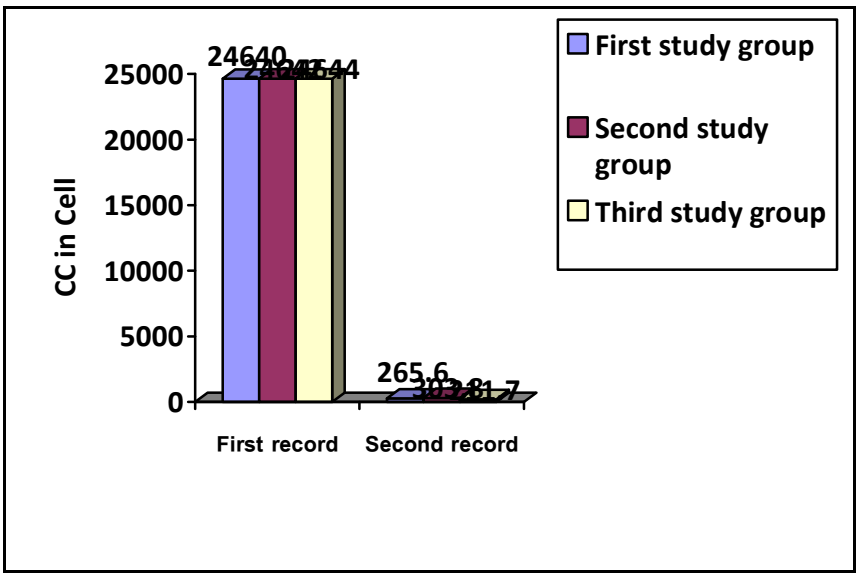

Fig (2): Mean values of the colony count (CC) in cells of the two records in the three groups.

Discussion

Impetigo is usually initiated by infection with group A β- hemolytic streptococci, which are present on normal skin. Subsequently, super infection with staphylococci, usually of nasal origin, can occur. Thus, streptococci alone or in combination with staphylococci can be isolated from impetiginous lesions. In later stages of the infection staphylococci may be the only agent isolated by usual means, although streptococci are present. Historically, these variable results of culture have led to the belief that staphylococci were initiators of impetigo and could occur alone in this disease. These older concepts have been challenged by the new data [3, 9,11,16.]

Ecthyma resembles impetigo in onset and appearance but gradually evolves into a deeper, more chronic infection. The initial lesion is a vesicle or vesicopustule with an erythematous base that erodes through the epidermis into the dermis to form an ulcer with elevated margins. The ulcer becomes obscured by a dry, heaped-up, tightly adherent crust that contributes to the persistence of the infection and to scar formation. Lesions vary in size but may be as large as 4cm and sites of predilection are the legs, where trauma probably plays a major role [11, 12, 13,16.]

Unlike ordinary light, which is composed of all the colors of the spectrum, laser light is composed of only one color. All the light waves in the beam are composed of the same wavelength. Each laser produces its own characteristic color of light. Some lasers are tunable and can be adjusted to produce several different colors, but they can emit only one color at a time. Laser light is approximately 10 million times more monochromatic than conventional light sources**.** Because laser light is coherent it is highly collimated or directional. Laser beams are narrow, travel in virtually parallel lines, and will not spread out or diverge as light from most normal sources. Because of this small divergence the intensity of laser light, unlike ordinary light, is fairly constant over long distances. This property of lasers significantly increases the hazard potential of the beam. The beam can be easily focused to a small point by a simple lens, dramatically increasing the energy concentration of the beam [6,7,8,18,21.]

Cellular response to laser irradiation is as follow; Irradiation → photoreceptors on Mitochondrial. Chains → Electron Transport chains proton Motive Forces → Respiration chain activity oxidation of NADH pool → reDox changes in mitochondria and cytoplasm → cell membrane activity (Membrane Transport mechanisms) → cytoplasm changes (H^+, PH, Ca^{++}, (CAMP)→ DNA: RNA synthesis →Growth and Proliferation, Studies have demonstrated a bactericidal effect of laser irradiation when lasers with power outputs of ≤5 mW are directed toward pathogenic or opportunistic bacteria previously treated with a photosensitizing agent. Two bacteria that commonly infect skin lesions, staphylococcus aureus and pseudomonas aeruginosa, were used. The 2 lasers used, o.95-mW helium-neon laser and the 5-mW indium-gallium-aluminum-phosphate

laser, emit light at a wavelength close to the absorption maxima of the sensitizing agent chosen, toluidine blue 0. This agent was used because of its proven effectiveness in sensitizing bacteria [17, 18,21,22, 24.]

The findings of the present study showed non-significant differences in the pre-treatment records of both USA and CC between the mean values of the first and second study groups, and between the mean values of the third and second study groups, as well as between the mean values of the third and first study groups.

Results of the first study group revealed a highly significant decrease in the mean values of USA and CC, after application of the LILT, when compared against the pre-application results. Also results of the second study group revealed a highly significant decrease in the mean values of USA and CC, after application of the solcoseryl jelly, when compared against the pre-application results. As well as results of the third study group revealed a highly significant decrease in the mean values of USA and CC, after application of the LILT in addition to the solcoseryl jelly, when compared against the pre-application results.

Significant differences showed in the first, second and third study groups were consistent with those observed and recorded by Antonio et al, 2007; Dagan and David, 2007; Damante et al., 2004; Franek et al., 2002; Georges et al., 2005; Lagan et al., 2002; Lucas et al., 2003; Luther, 2004; Merdrado et al., 2003; Novoselova et al., 2006; Okamoto et al., 2005 and Simon, 2004.

Results of this study support the expectation that application of both the LILT and solcoseryl jelly had a valuable healing effects on ecthymatous ulcerations as evidenced by the highly significant decreases in ulcer surface area and colony count. But the cumulative effect of both the LILT and solcoseryl jelly was more fruitful than application of any one of them alone.

Conclusion

Application of both the LILT and solcoseryl jelly had a valuable healing effects on ecthymatous ulcerations as evidenced by the highly significant decreases in ulcer surface area and colony count. But the cumulative effect of both the LILT and solcoseryl jelly was more fruitful than application of any one of them alone.

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