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Pulsed Dye Laser Versus Nd Yag Laser In Treatment Of Cutaneous Leishmaniasis, Comparative Study

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ABSTRACT

Background: Cutaneous leishmaniasis is a multilesional protozoan-induced infection that causes papules, nodules, plaques, and ulcers on exposed parts of the body with a well-defined erythematous boundary as well as a central crust. Several treatment modalities have been tried, such as systemic or intralesional medications, as well as destructive methods, but none is free of negative impacts. The Pulsed dye laser and the Nd: YAG laser have been studied in a variety of skin disorders and are considered promising treatments for cutaneous leishmaniasis.
Aim of the study: To assess and compare the effects of pulsed dye and the Nd YAG laser in treating cutaneous leishmaniasis.
Patients and Methods: Sixty patients suffering from cutaneous leishmaniasis were classified into two groups, each with 30 patients: Group I received pulsed dye laser treatment, while Group II received Nd: YAG laser treatment.
Results: Group I showed recovery of 22 cases after 3 sessions and 8 cases after 4 sessions while in group II 18 case recovered after 3 sessions and 12 cases after 4 sessions.
Conclusion: pulsed dye showed more rapid response compared to Nd-YAG laser but with statistically insignificant comparison. Both modalities showed minimal complication in the form of scarring.

Keywords: *Cutaneous leishmaniasis; pulsed dye laser; Nd Yag laser.*

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Authorship: *All authors have a substantial contribution to the article.*

INTRODUCTION

Leishmaniasis is a protozoal illness caused by protozoan parasites of the genus Leishmania that can be transmitted through the bite of sandflies, mainly Phlebotomus papatasi. There are 3 types of leishmaniasis: cutaneous, mucocutaneous, and visceral. Skin papules, nodules, and ulcers characterize the cutaneous type, while ulcers of the skin, lips, and nose characterize the mucocutaneous type. On the other hand, the visceral form begins with skin ulcers and progresses to fever, anemia, and hepatosplenomegaly. [1]

Cutaneous leishmaniasis (CL) has an incubating period of 2 weeks to many months and is distinguished by the development of papular, nodular, or ulcers with a well-defined erythematous border as well as a central crust which is frequently hemorrhagic and usually situated on exposed regions of the body. [2]

World Health Organization classified CL into new and old world variants. CL is endemic in 88 nations, including Asian, African, Latin American, and southern European countries. [3]

Cutaneous leishmaniasis occurs in both dry (urban) as well as wet (rural) types in the Middle East area, central and south-western Asia. The most important vector is the Caucasicus group of sand flies (Phlebotomus papatasi).[4]

Several treatment modalities have been tried, with variable degrees of side effects. Such treatments include intralesional injection, systemic oral, intravenous and intramuscular therapies [5]. Destructive methods applied include chemical application of trichloroacitic acid (TCA) [6], physical modalities such as Heat treatment [7] and [8], which is the basis of thermotherapy [9]. Additionally, Cryotherapy [10] as well as photodynamic therapy. [11]

The pulsed dye laser (PDL) has been widely studied in the treatment of a variety of skin problems, with the majority of results indicating that it is both effective and safe. [12]

In the treatment of cutaneous leishmaniasis, it was considered to be more effective and faster-acting than intralesional meglumine antimoniate treatment

[13]. In 100% of patients with cutaneous leishmaniasis, dermoscopic characteristics revealed the existence of vascular patterns, which could be the basis for PDL efficacy. [9]

More recently, Nd:YAG laser was proposed as treatment modality effectively used in treatment CL when applying special parameters , and repeating sessions at two weeks intervals up to complete recovery of lesions. [14]

The precise mechanism of laser treatment for cutaneous leishmaniasis remains not fully understood. Another factor could be the thermal impacts of laser therapy on Leishman bodies, which can't tolerate internal body temperature rather than laser heat. [9]

Immune modulation and immunological activation in photodynamic therapy could explain its beneficial effect in the treatment of CL lesions. [15]

PATIENTS AND METHODS

This research involved 60 patients having CL collected from the Dermatology clinic of Al-Azhar University and Kobry-Elkoba military hospital .

The patients were subjected to through history taking as regard the following:

Personal history , history of chronic medical illness and history of the present illness including onset, course and duration of the condition (> 6 months or < 6 months). Moreover, we enquired about history of current or past phototherapy for any other dermatologic condition.

Complete clinical examination was done followed by local dermatological examination .confirmatory skin biopsy from the lesion was taken followed by histopathological examination for each patient.

Prior to intervention, patients provided informed written consent.

Detailed explanation was discussed regarding intervention and possible side effects.

Inclusion Criteria:

Patients with new lesions of cutaneous leishmaniasis.

Between the ages of 18 and 40 years.

Exclusion Criteria:

Patients with associated autoimmune diseases.

Patient with chronic medical illness such as: DM, liver and kidney diseases.

Patient on previous topical and systemic therapy.

Pregnant females

The patients have been classified into two groups of 30 patients each:-

Group I: were treated with pulsed dye laser by the following Parameters: 7 J/cm2 fluence, 10-mm spot size, and 0.45-ms pulse duration..

Group II: were treated with ND- YAG laser by the following Parameters: the Fluence 200 mj/cm2, Pulse duration 20 ms, Spot Size:3 mm.

Assessment of cure depend on

Papulonodular lesions:- disappearance of lesions

Ulcerative lesions :- healing of ulcer even with scar tissue formation is abase of clinical cure assessment.

Assessment of complications was done during laser sessions application ,inbetween sessions in the form of pain ,erythema and swelling and finally assessment of scarring and post inflammatory hyperpigmentation after last session.

Also we assess the results by two blind physicians by showing photographed patient lesions during and after completion of sessions by two persons out of research and was noticed good impression about nearly all cases of two groups

All patients photographed before and after treatment

The obtained results tabulated and statistically analyzed.

Statistical Analysis

The Statistical Program for Social Science (SPSS) version 22.0 was employed to analyze the data. The mean± standard deviation (SD) was employed to express quantitative data. Frequencies and percentages were employed to express qualitative data.

RESULTS

Age	Group I	Group II
Range	19 – 38	18 – 40
Mean ± SD	30.17 ± 5.69	29.0 ± 6.91
T. test	0.714	
P. value	0.478	

Table (1): Comparison of two groups based on age

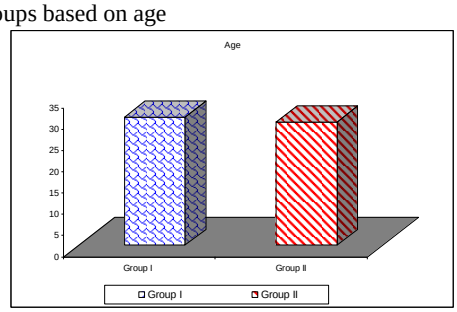

Figure (1): Comparison of two groups based on age

Non-significant difference between the two groups based on patient age.

Group I : Pulsed dye laser

Group II: Nd-Yag laser

	Group I (N=30)		Group II (N=30)		X^2	P-value
	N	%	N	%		
Papulonodular	18	60	20	66.7	0.287	0.592
Ulcer	12	40	10	33.3		
Total	30	100	30	100		

Table (2): Comparison of two groups based on papulonodular and ulcer lesions
Group 1 was divided into 18 papulonodular lesions and 12 ulcer lesions while group II divided to 20 papulonodular and 10 ulcerative lesions.

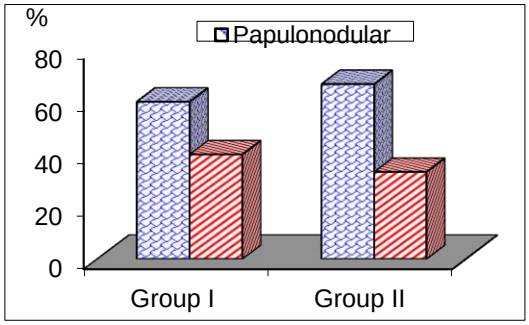

Figure (2): Comparison between two groups based on papulonodular and ulcer lesions
Non significant difference between two groups according to the types of lesions
Group I : Papulonodular
Group II: Ulcer

	Papulonodular (N=20)		Ulcer (N=10)		X^2	P-value
	N	%	N	%		
3 sessions	15	75	7	70	0.091	0.770
4 sessions	20	100	10	100		
Total	20	100	10	100		

Table (3): Comparison between papulonodular and ulcer lesions after 3 and 4 sessions in Nd Yag
After 3 sessions 15 cases of Papulonodular lesions were cured while 7 ulcerative lesions were cures after 4 sessions all lesions of both were completely cured.

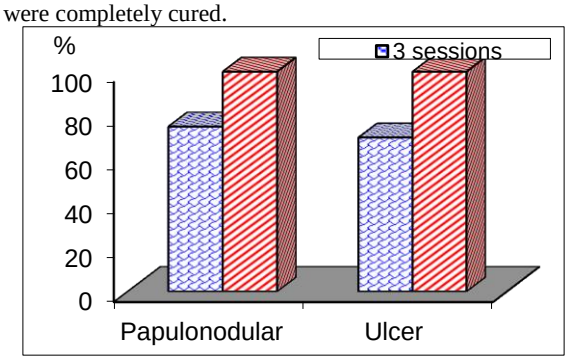

Figure (3): Comparison between papulonodular and ulcer lesions after 3 and 4 sessions in Nd Yag
Non significant difference between two groups based on the types of lesions
Group I : Papulonodular
Group II: Ulcer

	Papulonodular (N=20)		Ulcer (N=10)		X^2	P-value
	N	%	N	%		
3 sessions	12	66.7	9	75	0.243	0.626
4 sessions	20	100	10	100		
Total	18	100	12	100		

Table (4): Comparison between papulonodular and ulcer lesions after 3 and 4 sessions in Pulsed Dye Laser
After 3 sessions 12 cases of 20 Papulonodular lesions were cured while 9 ulcerative lesions of 10cases were cured. after 4 sessions all lesions of both were completely cured.

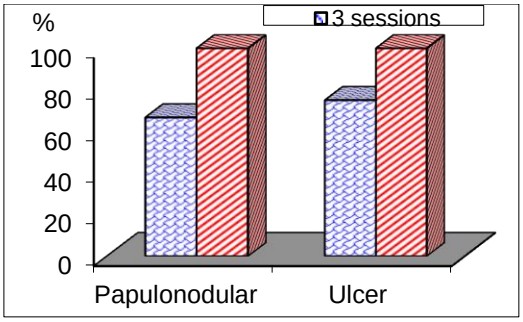

Figure (4): Comparison between papulonodular and ulcer lesions after 3 and 4 sessions in Pulsed Dye Laser
Non-significant difference between the two groups based on the types of lesions
Group I: Papulonodular
Group II: Ulcer

Full cure response	Group I (N=30)		Group II (N=30)		X^2	P-value
	N	%	N	%		
After 3 sessions	22	73.3	18	60	1.203	0.273
After 4 sessions	30	100	30	100		
Total	30	100	30	100		

Table (5): Comparison of two groups based on full cure response
Non significant difference between two groups according to Full complete cure response
Group I : Pulsed dye laser
Group II: Nd-Yag laser

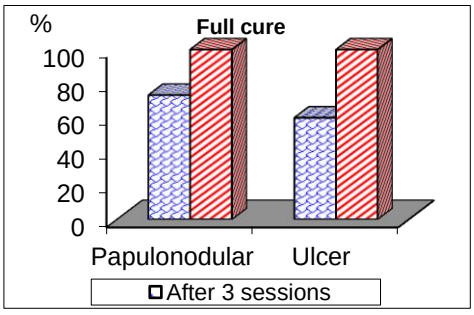

Figure (5): Comparison between two groups according to Full cure response
Non significant difference between two groups according to Full complete cure response
Group I : Pulsed dye laser
Group II: Nd-Yag laser

Size After 3 sessions	Group I	Group II
Range	1 – 2.4	1.2 – 2.5
Mean ± SD	1.71 ± 0.49	1.81 ± 0.40
T. test	0.256	
P. value	0.619	

Table (6): Comparison between two groups according to size after 3 sessions
Non significant difference between two groups according to size after 3 sessions
Group I : Pulsed dye laser
Group II: Nd-Yag laser

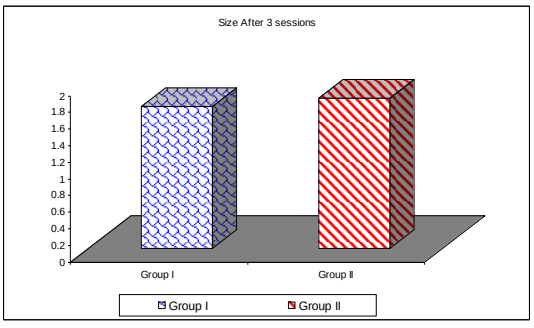

Figure (6): Comparison between two groups according to size after 3 sessions
Non significant difference between two groups according to size after 3 sessions
Group I : Pulsed dye laser
Group II: Nd-Yag laser

Hypertrohic scars	Group I (N=30)		Group II (N=30)		X^2	P-value
	N	%	N	%		
Yes	2	6.7	4	13.3	0.742	0.389
No	28	93.3	26	86.7		
Total	30	100	30	100		

Table (7): Comparison between two groups according to hypertrophic scar.

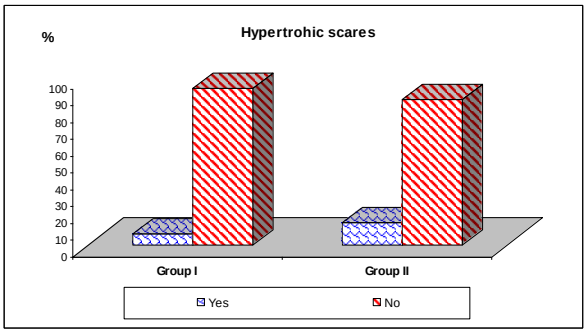

Figure (7): Comparison between two groups according to hypertrophic scares
Non significant difference between two groups according to hypertrophic scares
Group I : Pulsed dye laser
Group II: Nd-Yag laser

PIH	Group I (N=30)		Group II (N=30)		X^2	P-value
	N	%	N	%		
Yes	20	66.7	24	80	1.363	0.243
No	10	33.3	6	20		
Total	30	100	30	100		

Table (8): Comparison of two groups based on PIH

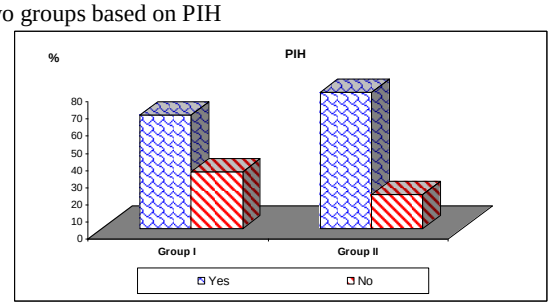

Figure (8): Comparison between two groups according to PIH
Non significant difference between two groups according to PIH
Group I : Pulsed dye laser
Group II: Nd-Yag laser

Ulcer	Group I (N=30)		Group II (N=30)		X^2	P-value
	N	%	N	%		
After 3 sessions	29	96.7	28	93.3	0.352	0.554
After 4 sessions	1	3.3	2	6.7		
Total	30	100	30	100		

Table (9): Comparison between two groups according to ulcer healing after 3 and 4 sessions

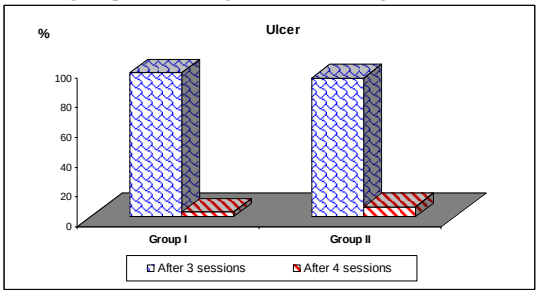

Figure (9): Comparison between two groups according to ulcer healing after 3 and 4 sessions
Non significant difference between two groups according to ulcer after 3 and 4 sessions
Group I : Pulsed dye laser
Group II: Nd-Yag laser

Popule and nodule	Group I (N=30)		Group II (N=30)		X^2	P-value
	N	%	N	%		
After 3 sessions	25	83.3	23	76.7	0.418	0.519
After 4 sessions	30	100	30	100		
Total	30	100	30	100		

Table (10): Comparison between two groups according to papule and nodule after 3 and 4 sessions

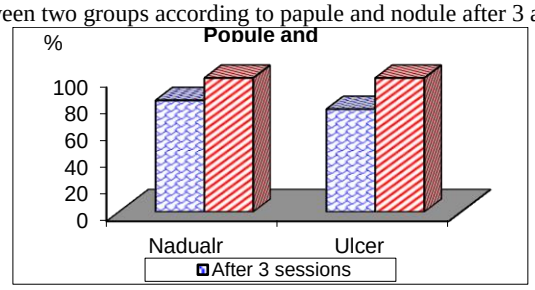

Figure (10): Comparison between two groups according to papule and nodule after 3 and 4 sessions

Non significant difference between two groups according to papule and nodule after 3 and 4 sessions

Group I : Pulsed dye laser

Group II: Nd-Yag laser

Patient satisfaction	Group I (N=30)		Group II (N=30)		X^2	P-value
	N	%	N	%		
Excellent	12	40	10	33.3	0.689	0.877
Very good	8	26.7	9	30		
Good	5	16.7	7	23.3		
Acceptable	5	16.7	4	13.3		
Total	30	100	30	100		

Table (11): reveal patient satisfaction about results on both groups after sessions

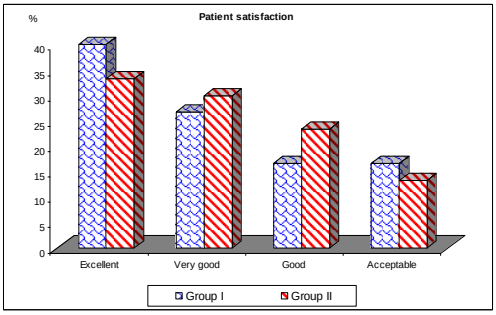

Figure (11): reveal patient satisfaction about results on both groups after sessions.

There is good feedback of patient about the results of the study to a great extend .

Cases that showed improvement after laser treatment:

Photo (1-a): Patient with leishmania lesion before treatment

by pulsed dye laser

Photo (1-c): The same patient showing improvement after treatment of with pulsed d

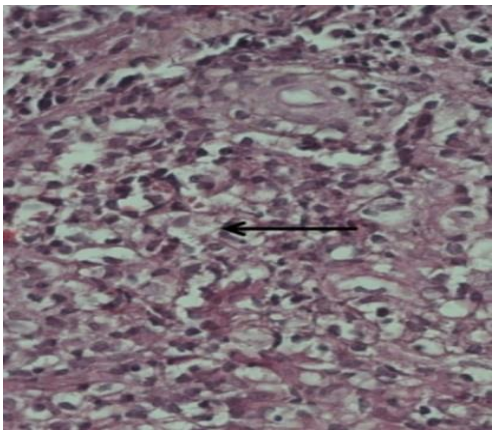

Photo (1-b): Case 1: cutaneous leishmaniasis histology **(H&E stain):** a) Diffuse chronic inflammatory cell infiltrate in dermis with multiple **non-caseating granulomata b) Tuberculoid-type granulomata with central histiocytes and peripheral inflammatory cells c) Leishman**-Donovan bodies (arrow) inside epithelioid histiocyte cytoplasm d) Langhans type giant cells within a granuloma

Photo (2-a): Patient with leishmania lesion before treatment by pulsed dye laser

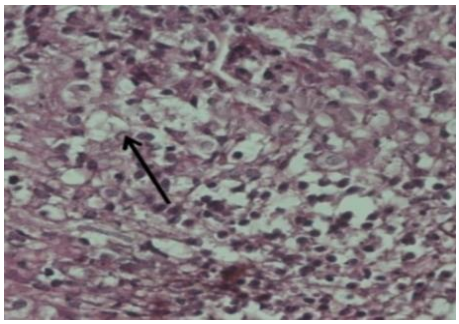

Photo (2-b): Case 2: cutaneous leishmaniasis histology **(H&E stain):** a) Diffuse chronic inflammatory cell infiltrate in dermis with multiple non-caseating granulomata b) Tuberculoid-type granulomata with central histiocytes and peripheral inflammatory cells c) Leishman-Donovan bodies (arrow) inside epithelioid histiocyte cytoplasm d) Langhans type giant cells within a granuloma

Photo (3-a): Patient with leishmania lesion before treatment by Nd-YAG laser
Photo (3-c): The same patient showing improvement after treatment with Nd-YAG laser

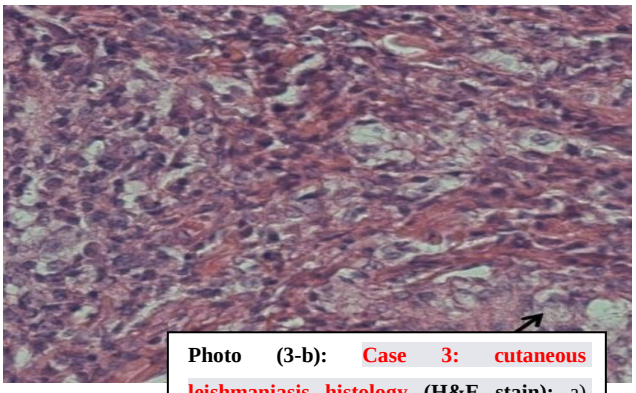

Photo (3-b): Case 3: cutaneous leishmaniasis histology **(H&E stain):** a) Diffuse chronic inflammatory cell infiltrate in dermis with multiple non-caseating granulomata b) Tuberculoid-type granulomata with central histiocytes and peripheral inflammatory cells c) Leishman-Donovan bodies (arrow) inside epithelioid histiocyte cytoplasm d) Langhans type giant cells within a granuloma

Photo (4-a): Patient with leishmania lesion before treatment by Nd-YAG laser

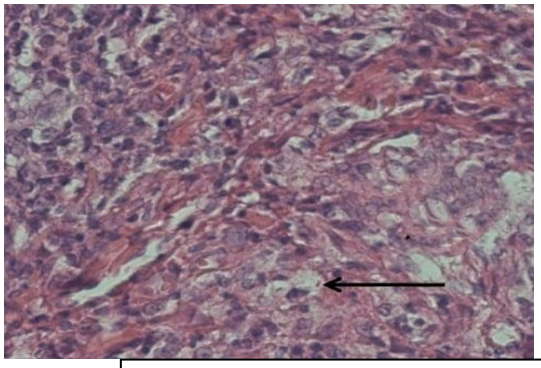

Photo (4-b): Case 4: cutaneous leishmaniasis histology (H&E stain): a) Diffuse chronic inflammatory cell infiltrate in dermis with multiple non-caseating granulomata b) Tuberculoid-type granulomata with central histiocytes and peripheral inflammatory cells c) Leishman-Donovan bodies (arrow) inside epithelioid histiocyte cytoplasm d) Langhans type giant cells within a granuloma

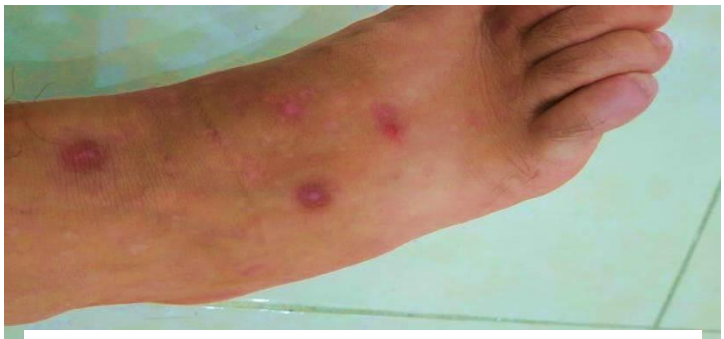

Photo (4-c): The same patient showing improvement after treatment of Nd-YAG laser

DISCUSSION

Leishmaniasis is caused by the threanosomatoid protozoan Leishmania species, which is transmitted to mammals via the bite of infected sand flies. Leishmaniasis is classified into two categories by the World Health Organization: new world and the old world. [4]

Erythematous nodules as well as papules at the location of the insect bite are the classic clinical symptoms of cutaneous leishmaniasis that develop into a lesion and recover within a few months to many years. Erysipeloid, annular, paranochial, palmoplantar, sporotrichoid, as well as zosteriform are all uncommon variants. [16]

Although intralesional meglumine antimoniate (MA) remains the therapeutic option for leishmaniasis, its usage is linked to a variety of adverse impacts, ranging from mild local reactions to hepatotoxicity, nephrotoxicity, and even shock [5]

The limits of MA, according to Nouri et al. (2010)[12], necessitate the employment of alternate approaches, including laser application.

Shamsi Meymandi et al. (2011)[5] highlighted that numerous alternative forms of treatments were explored, but none were without adverse impacts. Localized therapies, systemic oral treatments, intravenous and intramuscular therapies, and laser treatment are examples of these.

Varied types of lasers with various wavelengths might be considered a helpful resource for cutaneous therapy [(12)] .

The majority of laser-treated patients (92.3%) had great results. The problems were minor and temporary, and the results demonstrated that low-level laser treatment is an effective and simple treatment technique for cutaneous leishmaniasis [(17)].

The pulsed dye laser (PDL) has been widely studied for a variety of skin problems, with the majority of results indicating that it is both effective and safe [(12)].

In dermatology, the Nd: YAG laser is also one of the most frequently used lasers. It has the greatest penetration depth of any type of laser and a wavelength of 1064 nm. Its primary chromophore is haemoglobin[(4)].

The present work was performed to study the PDL Versus Nd Yag Laser in the therapy of cutaneous leishmaniasis.

The specific mechanism of PDL's effect on CL is still unknown. Research of the dermoscopic characteristics of CL found that vascular patterns were present in 100% of patients with such infection, which could explain PDL's efficiency[(9)].

In parallel line with these results Omidian et al., (2019)[4] stated that presence of vascular pattern in

leishmaniasis, explaining the mechanism of PDL might be through vascular affection .

Another mechanism is through the PDL's thermal impacts on leishman bodies, which could only grow on the surface of the body to avoid internal body warmth; the basis of thermotherapy is heat ablation of leishman bodies . [18]

This vaporization and heat generation has also been proposed as a significant probable mechanism through which lasers act. [19].

This was in agreement with the study of Radmanesh and Omidian (2017)[13], who reported that the mechanism of PDL on CL therapy is unknown, although it could be partly related to heat creation from the laser, as leishman bodies are heat sensitive and could only grow on the surface of the body.

Finally, the PDL's influence on CL lesions could be explained by immune modulation and cutaneous immunologic stimulation. [19]

Also, these results were agreed upon by Shamsi Meymandi (2011)[5]. They supported the protective effect of PDL that it stimulates the immune system and inflammatory reactions as well as changes in cytokines.

It has previously been claimed that high-power lasers like the Nd: YAG laser could be effective at destroying bacteria, apparently through a thermal impact. The bactericidal activity of a high-powered Nd: YAG laser on an E. coli suspension has been investigated. [20]

The Nd-YAG laser has a good therapeutic impact and a smooth postsurgical period with minimal pain and suffering, making it a viable choice for complex disease therapy. [21]

Kranendonk et al. (2010)[20] reported that a temperature increase of up to 50 oC has been detected in a thermocouple fitted cuvette following the usage of a laser with a power output of 100 watts for 23 seconds, which has bactericidal effect.

Overall, the findings of this research and a review of other investigations show that the alternative approach of laser treatment for the management of patients having cutaneous leishmaniasis may result in full healing in less time and with fewer complications. Indeed, it is proposed that comparable research with a bigger sample size and patient follow-up over a prolonged period of time be conducted in order to get better outcomes when employing the YAG laser. [4]

The findings of the current work showed that the response was more rapid with PDL than with Nd: YAG, which is insignificant, although both give good results with different mechanisms This rapid response with PDL give it upper hand in treatment of leishmaniasis which explained by this work that it cause rapid response and decrease size of lesion and minimal complications although Nd:YAG laser also with good results with minimal complications.

CONCLUSION

pulsed dye showed more rapid response compared to Nd-YAG laser but with statistically insignificant comparison. Both modalities showed minimal complication in the form of scarring.

Conflict of interest : none

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