



Long pulsed Nd:YAG laser with or without topical terbinafine 1% cream in the treatment of onychomycosis

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Abstract

Background: Onychomycosis, a fungal infection of the nail, is considered one of the most prevalent disorders of the nail.

Objective: The aim of the present study is to evaluate the efficacy of the long pulsed Nd:YAG laser with or without topical terbinafine 1% cream in the treatment of onychomycosis.

Methods: Comparative prospective interventional randomized control study was conducted on 45 adult patients with finger nail onychomycosis.

Results: Our results confirmed the efficacy of Nd:YAG laser therapy combined with a topical antifungal agent, as the highest efficacy rate of clinical cure was observed in group B (73.3%) followed by group C (66.7%) and then group A (33.3%) also there was a statistically significant higher percent of mycological cure in group B (60.3%) followed by group C (53.3%) then group A (13.3%).

Conclusion: Nd:YAG laser therapy combined with a topical antifungal agent, is effective in the treatment of onychomycosis. It can treat different types of onychomycosis safely and effectively, and is especially suitable for older patients with low immunity or liver and renal dysfunction who are not appropriate candidates for systemic antifungal agents. Thus, it could be considered as an alternative treatment modality.

Key words: Onychomycosis, nail, Nd:YAG laser, terbinafine and fungus .

1. Introduction

Onychomycosis, a fungal infection of the nail, is considered one of the most prevalent disorders of the nail. It occurs after primary infection of the nail bed that leads to subungual hyperkeratosis (*Bhatta AK et al., 2015*).

Primary caused by dermatophytes such as *Trichophyton rubrum* and *Trichophyton mentagrophytes* (*Gupta A and Nakrieko K.,2014*).

Other causative organisms are non dermatophyte mold .*Candida albicans* that presented 70% of onychomycosis caused by yeasts. Direct microscopic examination after (KOH) preparation and fungal culture are commonly used to confirm the diagnosis (*BhattaAk et al., 2015*).

Onychomycosis can be classified into distal lateral subungual onychomycosis (DLSO), superficial onychomycosis, proximal subungual onychomycosis (PSO), endonyx onychomycosis (EO) , and total dystrophic onychomycosis (TDO).This classification was extended by Hay and Baranto include mixed and secondary forms of infection (*Caraney C et al., 2011*).

Topical antifungals are ineffective due to their inability to penetrate nail plate and although Systemic treatments are effective but have limited application due to its side effects with at least 20% to 25% rate of relapse (*Piracini.,2010*).

Laser-based therapy is considered to be a new non-traditional method for treatment of onychomycosis (*Salem A et al.,2009*).

Laser-based therapy offers a number of advantages over traditional antimicrobial therapies as it has a broad spectrum action and is independent of patterns of antimicrobial resistance(*Grover and Khurana A., 2012*).

Laser-based treatments have been explored as a possible alternative treatment for onychomycosis. Long pulse 1064-nm neodymium:yttrium-aluminiumgarnet (Nd:YAG)

laser, diode laser and Q-switched Nd:YAG laser have all been studied and found to be safe and effective for treating onychomycosis. Many laser systems are available in clinical practice. It is estimated that long-pulsed Nd:YAG laser can deeply penetrate the tissue and effectively inhibit fungal growth in the nail bed owing to its long wavelength (**Bhatta A et al.,2015**).

Recently long-pulsed Nd:YAG laser and topical antifungals were found to be effective in treating finger nail onychomycosis (**Bhatta A et al., 2015**).

2. Patients & Methods

Comparative prospective interventional randomized control study was conducted on 45 adult patients with finger nail onychomycosis.

Inclusion criteria

Patients of both sexes with finger nail onychomycosis of any type.

Exclusion criteria

- Pregnancy and lactation
- Patients who received any systemic antifungals during the previous 3 months or/and topical antifungals during the previous month.
- Onychomycosis associated with paronychia.
- Associated diseases causing nail dystrophy such as psoriasis, eczema, and lichen planus.
- Immunodeficiency as patients on immune suppressive drugs for long periods, patients under chemotherapy or radiotherapy, patients on organ transplantation as well as HIV-infected patients.

Ethical considerations

- Informed consent was taken from all patients included in the study.
- All precautions were taken for the privacy of the patients.
- All results should be used only for scientific purposes.
- This study was taken out over the next year after agreement of the local ethical

committee.

Study protocol

Patients were divided randomly into 5 groups **A** & **B** & **C** each of 15 patients and was aged 20-50 years.

- a. Group **A** was treated by long-pulsed Nd:YAG.
- b. Group **B** was treated by long-pulsed Nd:YAG plus topical Terbinafine 1% cream .
- c. Group **C** was treated by topical Terbinafine 1% cream .

All patients were subjected to the following:

(A) History taking:

Full history taken including onset, course, duration and family history of onychomycosis.

- history of previous treatment methods and results.

(B) Clinical assessment:

- General examination to exclude systemic diseases.

Dermatological examination & local examination of the nail and calculation of score clinical index of onychomycosis (SCIO) (*Carney et al.,2011*).

This index gives 1–5 points, based on nail involvement and amount of involvement of the distal edge and finally ten extra points for a dermatophytoma or more than 2 mm subungual hyperkeratosis (*Carney et al., 2011*).

It is obtained by multiplying the score for the area of involvement (range,0-5) by the score for the proximity of the disease to the nail matrix (range ,1-5). Ten points are added for the presence of a longitudinal streak or patch (dermatophytoma) or for greater than 2mm of subungual hyperkeratosis. Mild nail involvement were classified as a score of five or less; moderate, 6 through 15; and severe, 16 through 35. Proximity to matrix scoring, The nail was divided transversely into quarters. Involvement of the distal quarter is given a score of 1 (distal groove in red);if involvement extends to the first half

of the nail, it is given a score of 2; the third quarter, a score of 3; and the proximal quarter, a score of 4. Involvement of the lunula (outlined in aqua) and the proximal nail fold (red) represents matrix involvement and is given a score of 5 (*Carney et al., 2011*).

1

Clinical pattern component :

***DLSO**: Distal lateral subungual onychomycosis.

***SWO** : Superficial white onychomycosis.

***PSO** : Proximal subungual onychomycosis.

***EO** : Endonyx onychomycosis

- Photography was at the beginning of the study, before the next laser session and after 4 weeks of treatment.

(C) Culture:

- Nail scrapping and direct microscopy using 30% KOH.
- Fungal culture on SDA containing chloramphenicol with and without cyclohexamide at the beginning of the study to confirm the diagnosis and 4 weeks after the end of laser sessions to evaluate mycological cure.

(D) Treatment protocol:

➤ **Long- pulsed 1064nm NdYAG laser treatment:**

Was used as a treatment for our patients with the fluencies in the range of 35-40 J/cm², a spot size of 4mm diameter, and pulse duration of 35ms. The variations of fluency was selected based on the thickness of the nail to be treated. With thicker nails requiring higher fluencies. The pulse rate will be 1Hz. The laser beam was applied to the entire nail plate by incrementally moving the beam in spiral pattern. After the entire nail plate was irradiated, two minute pause will be taken, then the treatment and pause was repeated twice more for a total of three passes. The sessions were repeated for four sessions at 2 weeks interval for 16 weeks in the finger of patients with finger nail onychomycosis plus topical Terbinafine 1% cream applied twice per day to the affected nail plates and nail folds for 16 weeks (*Rungsima et al.,2015*).

- Evaluation of treatment response was done through culture at the beginning of the study and at the end of cure.
- Calculation of Score clinical index of onychomycosis (SCIO) at the beginning of the study, before the next laser session and after 4 months of cure.
- Assessment of side effects as Pain, hematoma, onycholysis, dermatitis, itching, erythema, swelling, discolouration and subungual hyperkeratosis.

Data analysis

- Collected data was analyzed using SPSS program.
- Description of quantitative data was expressed as mean standard deviation using independent t-test if data were parametric.
- Qualitative data was expressed as number and percentage.

- Level of significance is set to be significant at 0.05.

Data were analyzed using the Statistical Package of Social science (SPSS) program for Windows (Standard version 26). The normality of data was first tested with one sample Kolmogorov-Smirnov test.

Qualitative data were described using number and percent. Chi square test was used compare qualitative variables while Montecarlo test used when expected count less than 5.

For all above mentioned statistical tests done, the threshold of significance is fixed at 5% level. The results were considered significant when $p \leq 0.05$. The smaller the p-value obtained, the more significant are the results.

3. Follow up:

All the patients were followed up for 4 weeks further after the last treatment session to detect any recurrence .

4. Results

Sociodemographic data of the studied groups.

Results of the present investigation showed that there is no significant statistical difference between the studied groups regarding age and residence, but There was a statistically significant higher percent in female (figure 1).

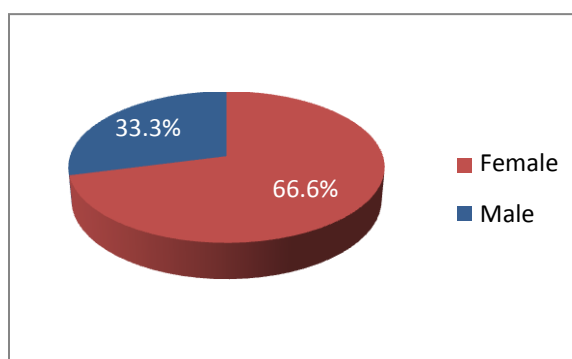


Figure (1):Sex distribution among the studied groups

Clinical data among the studied groups

Results of the present investigation showed that there is a significant statistical higher percent of DISO clinical pattern among groups compared to TDO & EO (figure 2).

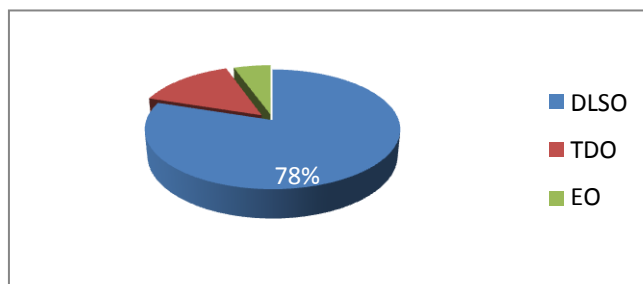


Figure (2):Types among the studied groups

Pathogen among the studied groups

Results of the present investigation showed that there is a significant statistical higher percent of Asperagillus and T. rabrum among groups compared to Peinicillin & Candida (figure 3).

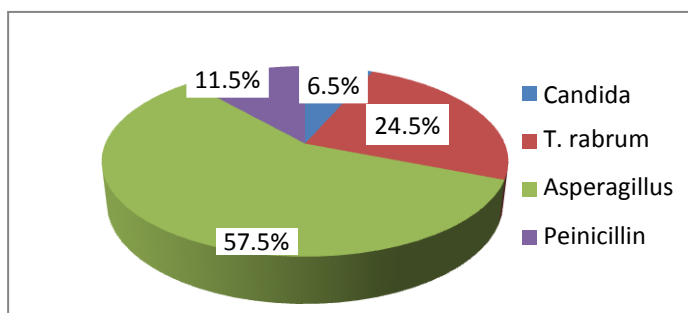


Figure (3):Pathogen among the studied groups

Clinical and mycological cure among the studied groups

Results of the present investigation showed that there is a significant statistical higher percent of clinical and mycological cure in group B followed by group C then A (figure 4).

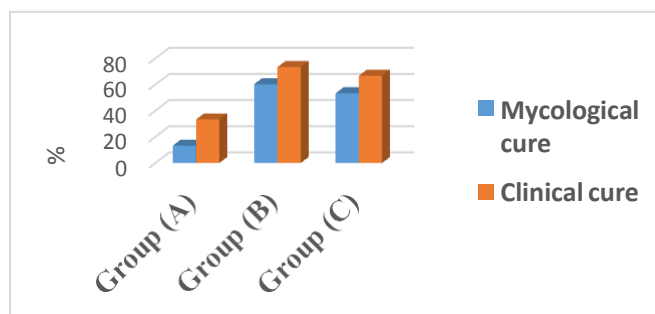


Figure (4): Mycological and clinical cure among the studied groups

Clinical response among the studied groups.

Results of the present investigation showed that there is a significant statistical higher

percent of complete response in group B followed by group C then A. While group A show the higher percent of non response (figure 5).

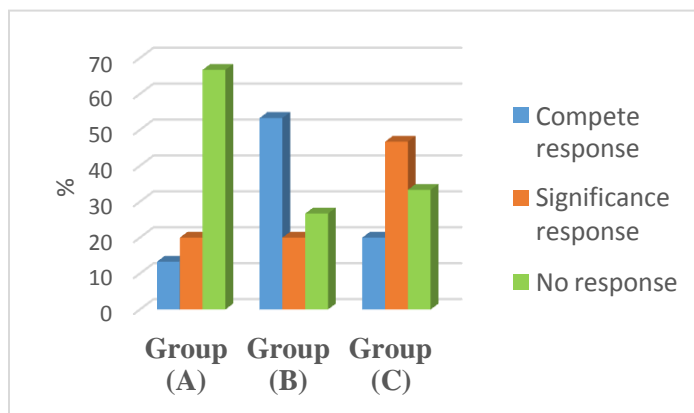


Figure (5): Response among the studied groups

Satisfaction among the studied groups.

Results of the present investigation showed that there was a significant statistical higher percent of patient satisfaction in group B followed by group C then A (figure 6).

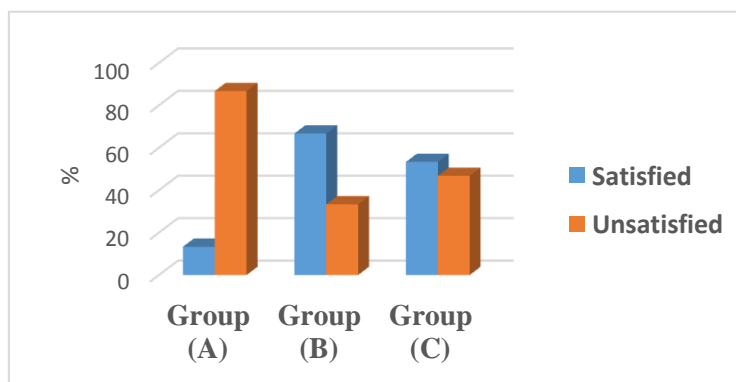


Figure (6): Satisfaction among the studied groups

Side effects among the studied groups

Results of the present investigation showed that there was some local side effects occurred in group B & C such as nail fold swelling, itching and contact dermatitis, but no patient in group C suffer pain, while other groups show pain complain group A and group B (figure 7).

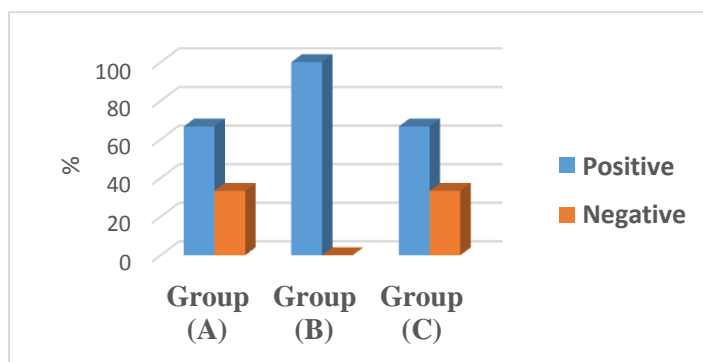


Figure (7): Side effects among the studied groups



FIGURE 8“patient from Group A” (a) Photographs of left-hand thumb fingernail with mild DLDO at baseline. (b) 4 months after treatment with Nd:YAG laser showed a significance clinical response



FIGURE 9 “patient from Group A” (a) Photographs of right-hand thumb fingernail with severe TDO at baseline. (b) 4 months after treatment with Nd:YAG laser showed a no clinical response

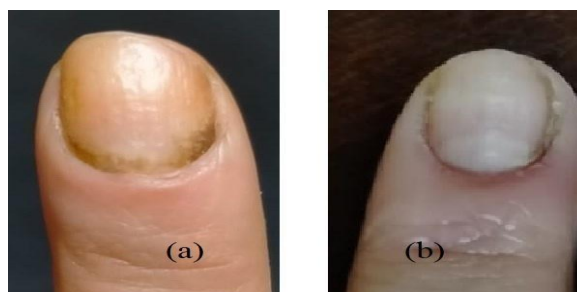


FIGURE 10 “patient from Group B” (a) Photographs of left-hand middle fingernail with mild DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser plus topical Terbinafine1% cream showed a complete clinical response

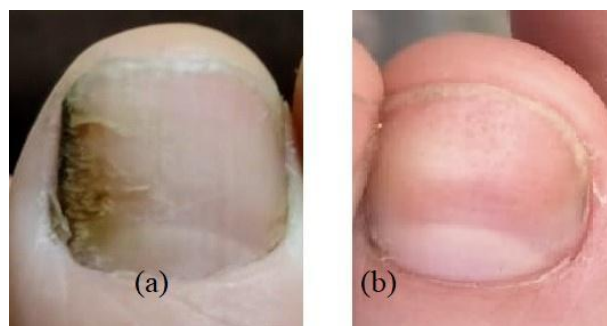


FIGURE 11 “patient from Group B” (a) Photographs of left-hand thumb fingernail with moderate DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser plus topical Terbinafine1% cream showed a complete clinical response

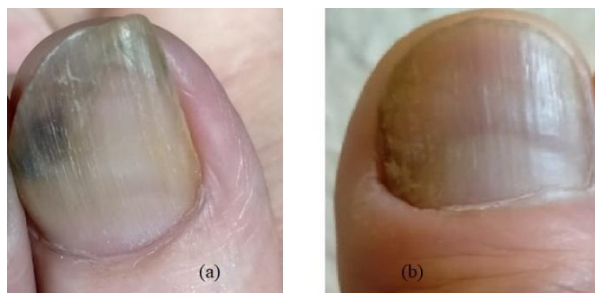


FIGURE 12 “patient from Group C” (a) Photographs of right-hand thumb fingernail with moderate DLSO at baseline. (b) 4 months after treatment with topical terbinafine1% cream showed a significance clinical response



FIGURE 13 “patient from Group C ” (a) Photographs of right-hand index fingernail with moderate DLSO at baseline. (b) 4 months after treatment with topical terbinafine 1% cream showed a complete clinical response

5. Discussion

In our study patients was divided randomly into 3 groups **A** & **B** & **C** each of 15 patients group **A** will be treated by long-pulsed Nd:YAG ,group **B** will be treated by long-pulsed Nd:YAG plus topical Terbinafine 1% cream and finally group **C** will be treated by topical Terbinafine 1% cream . Assessment of clinical improvement was done by SCIO at baseline and at the end of treatment sessions .

In our study, onychomycosis was found to be more common in females representing (66.6%) versus males who represent (33.3%) of cases, similar results were reported by many studies such as *Zhou et al. (2016)*, *Shi et al. (2017)*, and *Afshar, P et al. (2014)*. This can be attributed to the fact that females do household wet work like laundry and house cleaning with repeated trauma to the nails facilitating easy entry of fungal pathogens. Females also are more concerned about the cosmetic appearance of their nails.

In our study, the commonest clinical type was DLSO; seen in 35 patients (78.0%) followed by TDO in 8 patients (17.5%). The same findings were detected in the study of *Bhatta et al. (2016)* who reported that DLSO was found in 36 patients (48%) followed by TDO in 27 (36%).

Our study showed that asperagillus (57.5%) was the commonest species causing

onychomycosis in all studied groups followed by *T. rubrum* (24.5%), In contrast, other studies showed that the most common fungal isolate was dermatophyte (mainly *Trichophyton rubrum*) followed by yeast (mainly *Candida albicans*) (**Kaur et al., 2008; Matos & Mariano, 2010**). Overall, the predominance of causative agents varies on ethnicity and different environmental factors such as climate, humidity, occupation, and different lifestyles and upon geographical location and temporal distribution.

Our results confirmed the efficacy of 1064-nm Nd: YAG laser combined with topical antifungal in treatment of onychomycosis, as There was a highly statistically significant higher percent of clinical cure in group B (73.3%) followed by group C then A [(66.7%) (33.3%)].also there was a statistically significant higher percent of mycological cure in group B (60.3%) followed by group C then A [(53.3%) (13.3%)] respectively.

In agreement of our study many other studies **Yang et al.(2015)**, found that the mycological and clinical efficacy of laser treatment combined with topical drugs was significantly higher than that produced by laser treatment alone or topical drugs alone .

In our study The efficacy rate of laser treatments only without topical antifungal treatment were less than topical antifungal treatment as only 7 patients (46.7%) in group A were showed clinical cure, these finding are in agreement with studies which have shown that laser therapies are somewhat effective in achieving cosmetic endpoints in onychomycosis, but do not exceed or equal the efficacy of current topical and oral antifungal therapies **Christenson JK et al. (2018)**.

In our study a statistically significant higher percent of complete response in group B (53.3%) followed by group C then A [(20.0%) (13.3%)] respectively, While group A show the higher percent of non response (66.7%) .

In group C only 20% of patients show complete response This low efficacy of topical antifungal monotherapy was expected and has been previously attributed to the low penetration of the lacquer to the nail plate. The poor patient compliance to the daily lacquer application and to the strict avoidance of excessive water use might be the cause.

Some studies as **Gupta AK.(2017)** claimed that Nd: YAG can achieve a success rate of 60% in accelerating nail clearance over a treatment period of 6 months. But other as **Karsai et al.(2017)** in a randomized controlled trial of short-pulsed Q-switched Nd: YAG laser, concluded that it was not effective as monotherapy.

Rungsima et al. (2015) found The long-pulsed 1064-nm Nd:YAG laser exhibited better efficacy than the short pulsed 1064-nm Nd:YAG laser. as the long-pulsed 1064-nm laser to be more easily absorbed by melanocytes, giving rise to better therapeutic results.

In our study These findings are in agreement with, **Bhatta et al. (2015)** and **Zhou et al. (2016)** as following:

Bhatta et al. (2015) where 75 patients received 3 sessions of laser therapy at 4-week intervals and once-daily application of terbinafine cream for 3 months. They reported that 92% of the treated patients showed positivity for mycological cure .

In agreement of our study **Yang et al.(2015)**, found that the mycological and clinical efficacy of laser treatment combined with topical drugs was significantly higher than that produced by laser treatment alone.

Evaluation of patient satisfaction at the end of our study showed there were (66.7%) of patients who were satisfied with the results of Nd:YAG laser treatment combined with terbinafine 1% cream. These findings are in agreement with that of **Lim et al. (2014)** (59%) and **Bhatta et al. (2015)** (66.6%).

It is estimated that long-pulsed Nd:YAG laser can effectively inhibit fungal growth in the nail bed owing to its long wavelength through what called photothermal effect as heat transfer to fungal mycelium, reaching fungicidal temperatures of 43°C to 51°C. Such high temperatures can promote increased local circulation and ultimately strengthen the body's natural immunological response. The heat-induced mitochondrial production of reactive oxygen species within the fungal pathogens also pushes these cells to undergo apoptosis. (**Bhatta A et al.,2015**).

Regarding treatment complications of our study; Some local side effects occurred in group B & C such as nail fold swelling [(26.7%) (33.3%)],itching [(6.6%) (13.3%)] and contact dermatitis [(13.3%) (20.0%) respectively but no patient in group C suffer pain ,while other groups show pain complain group A (66.7%) and group B (53.3%) .These findings are in agreement with *Lim et al.(2014)* and *Zhou et al. (2016)*.

The results of the present study have certain limitations: The methods employed in the included studies were heterogeneous. The subjects included in the studies also differed in basic characteristics such as age, duration of disease and duration of follow-up. Because of these differences, despite the present analysis more randomized controlled trials are needed to verify the findings regarding the efficacy of laser treatment for onychomycosis.

6. Conclusion

Laser therapy, combined with a topical antifungal agent, is effective in the treatment of onychomycosis. It can treat different types of onychomycosis safely and effectively, and is especially suitable for older patients with low immunity or liver and renal dysfunction who are not appropriate candidates for systemic antifungal agents. Thus, it could be considered as an alternative treatment modality.

Oral antifungal therapies are effective, but significant adverse effects and potential negative drug-to-drug interactions limit their use. Although topical antifungal therapies have minimal adverse events, they are less effective than oral antifungal therapies, due to poor nail penetration.

As such, there is a need in exploring more effective and/or alternative treatment modalities for onychomycosis which are safer and more effective. Combination therapies hold promise for improving patient outcomes.

Table (1): Socio-demographic data among the studied groups

Demographic data	Group (A) no=15	Group (B) no=15	Group (C) no=15	p value
Age				
20-40 y	7 (46.7%)	7 (46.7%)	10 (66.7%)	0.441
>40 y	8 (53.3%)	8 (53.3%)	5 (33.3%)	
Sex				
Male 15 (33.3%)	7 (46.7%)	3 (20.0%)	5 (33.3%)	0.046*
Female 30 (66.6%)	8 (53.3%)	12 (80%)	10 (66.7%)	
Residence				
Rural	10 (66.7)	7 (46.7%)	9 (60.0%)	0.431
Urban	5 (33.3%)	8 (53.3%)	6 (40.0%)	

Chi square test and Monte carlo test were used, *significant $p \leq 0.05$

Table(1) illustrates that there was no statistically significant difference between studied groups regarding age and residence. [(P= 0.441) , (P= 0.431)] respectively but There was a statistically significant higher percent of onychomycosis in female (66.6%)

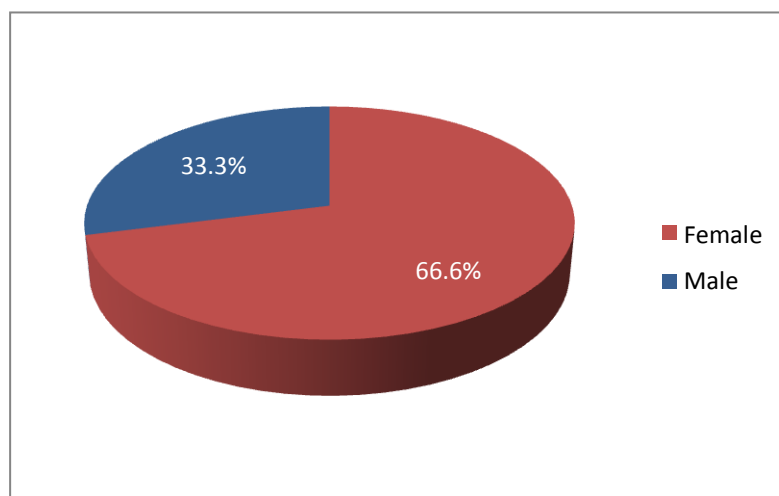


Figure (14): Sex distribution among the studied groups

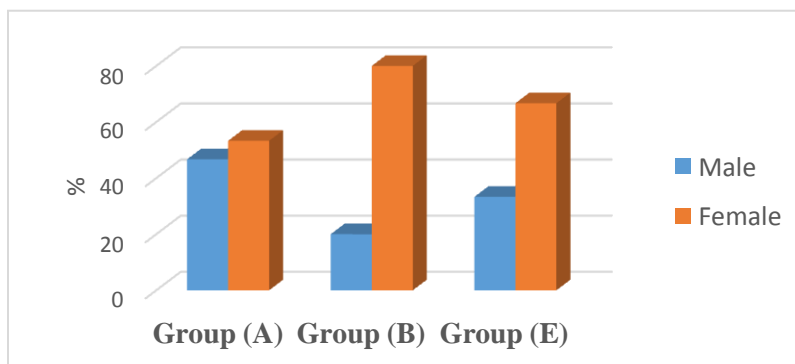


Figure (15): Sex distribution among the studied groups

Table (2): Clinical data among the studied groups

Type	Group (A) no=15	Group (B) no=15	Group(C) no=15	p value
TDO8 (17.5%)	5 (33.3%)	0 (0%)	3 (20.%)	0.03*
DISO35 (78%)	10 (66.7%)	13 (86.7%)	12 (80%)	
	0 (0%)	2 (13.3%)	0 (0%)	

EO2 (4.5%)				
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Table (2) illustrate a statistically significant higher percent of **DISO** clinical pattern among groups (78.0%) compared to **TDO & EO** (17.5% &4.5%) respectively .

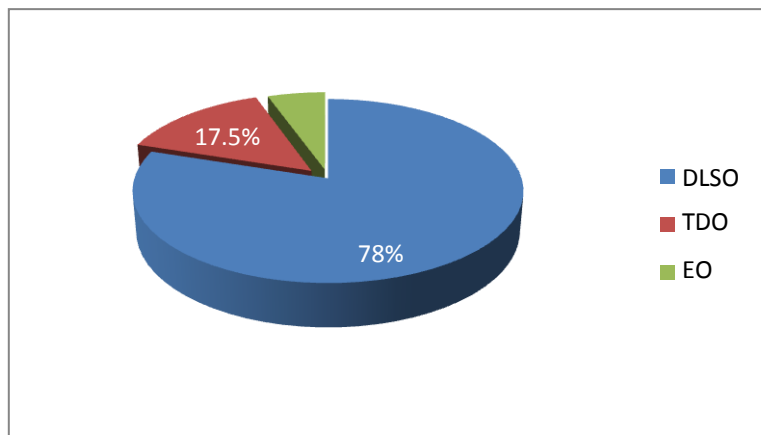


Figure (16):Types among the studied groups

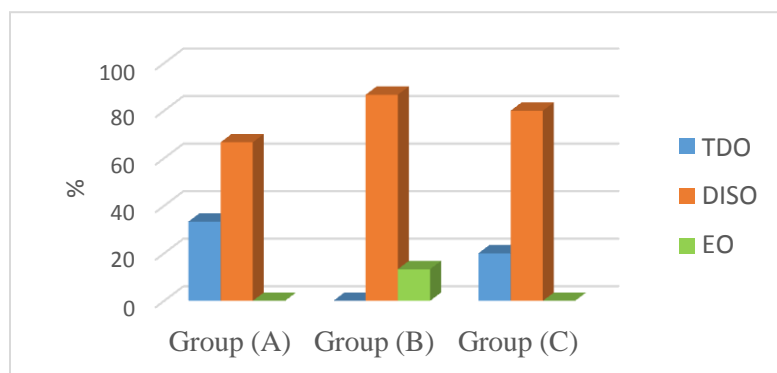


Figure (17): Types among the studied groups

Table (3):Pathogen among the studied groups

Pathogen	Group (A) no=15	Group (B) no=15	Group (C) no=15	p value
Candida 3(6.5%)	0 (0.0%)	0 (0.0%)	3 (20.0%)	0.03*
T. rabrum 11(24.5%)	3 (20.0%)	3 (20.0%)	5 (33.3%)	
Asperagillus 26 (57.5%)	12 (80.0%)	7 (46.6%)	7 (46.6%)	
Peinicillin 5(11.5%)	0 (0.0%)	5 (33.3%)	0 (0.0%)	

Table (3) illustrate a statistically significant higher percent of Asperagillus and T.

rabrum among groups (57.5%) & (24.5%) compared to Peinicillin& Candida (11.5% & 6.5%) respectively .

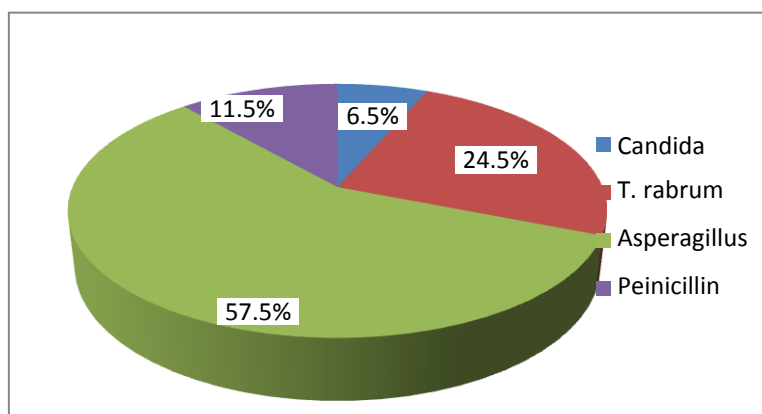


Figure (18):Pathogen among the studied groups

Table (4): clinical cure among the studied groups

Clinical Cure	Group (A) no=15	Group (B) no=15	Group (C) no=15	p value
Positive	5 (33.3%)	11 (73.3%)	10 (66.7%)	0.05*
Negative	10 (66.7%)	4 (26.7%)	5 (33.3%)	

Table (4) illustrate a statistically significant higher percent of clinical cure in group B (73.3%) followed by group C then A [(66.7%) &(33.3%)] respectively.

Table (5): Mycological cure among the studied groups

Mycological cure	Group (A) no=15	Group (B) no=15	Group (C) no=15	p value

Positive	2 (13.3%)	9 (60.3%)	8 (53.3%)	0.008*
Negative	13 (86.7%)	6 (39.7%)	7 (46.7%)	

Table (5) illustrate a statistically significant higher percent of mycological cure in group B (60.3%) followed by group C then A [(53.3%) &(13.3%)] respectively.

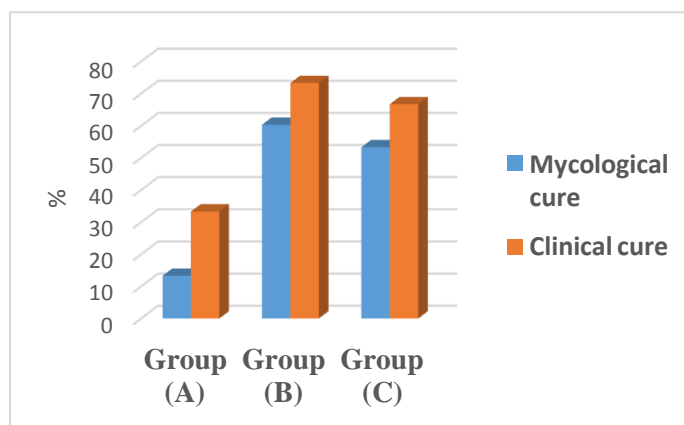


Figure (19): Mycological and clinical cure among the studied groups

Table (6): Response among the studied groups

Response	Group (A) no=15	Group (B) no=15	Group (C) no=15	p value
Complete response	2 (13.3%)	8 (53.3%)	3 (20.0%)	0.012*
Significance response	3 (20.0%)	3 (20.0%)	7 (46.7%)	0.209
No response	10 (66.7%)	4 (26.7%)	5 (33.3%)	0.05*

Table (6) illustrate a statistically significant higher percent of complete response in group B (53.3%) followed by group C then A [(20.0%) & (13.3%)] respectively.

While group A show the higher percent of non response (66.7%) .

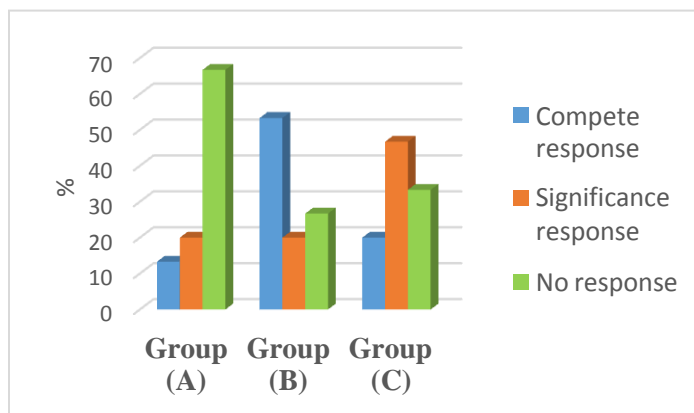


Figure (20): Response among the studied groups

Table (7):Satisfaction among the studied groups

Satisfaction	Group (A) no=15	Group (B) no=15	Group (C) no=15	p value
Satisfied	2 (13.3%)	10 (66.7%)	8 (53.3%)	0.006*
Unsatisfied	13 (86.7%)	5 (33.3%)	7 (46.7%)	

Table (9) illustrate a statistically significant higher percent of patient satisfaction in group B (66.7%) followed by group C then A [(53.3%) & (13.3%)] respectively.

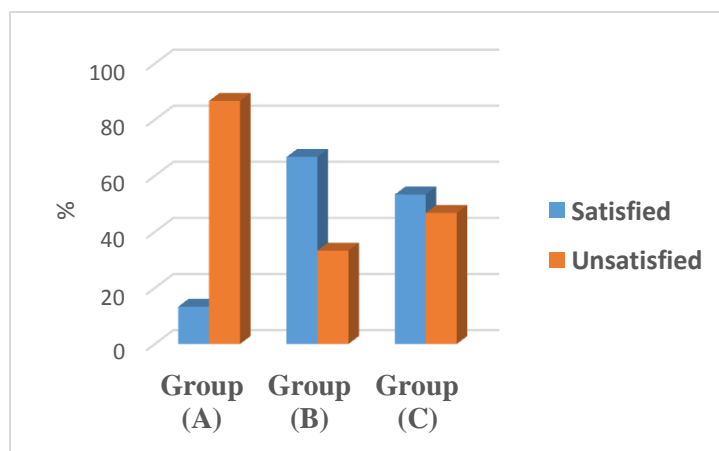


Figure (21): Satisfaction among the studied groups

Table (8):Side effects among the studied groups

Side effects	Group (A) no=15	Group (B) no=15	Group (C) no=15	p value
Pain	10 (66.7%)	8 (53.3%)	–	<0.001*
nail fold swelling	–	4 (26.7%)	5 (33.3%)	
Itching	–	1 (6.6%)	2 (13.3%)	
Contact dermatitis	–	2 (13.3%)	3 (20.0%)	

Table (10) Illustrate that Some local side effects occurred only in group B & C such as nail fold swelling [(26.7%%) (33.3%)],itching [(6.6%) (13.3%)] and contact dermatitis [(13.3%) (20.0%) respectively but no patient in group C suffer pain ,while other groups show pain complain group A (66.7%) and group B (53.3%) .

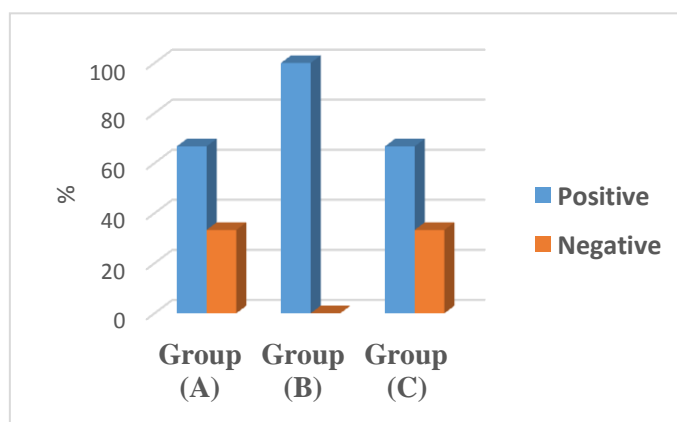


Figure (22): Side effects among the studied groups



FIGURE 23 “patient from Group A” (a) Photographs of left-hand thumb fingernail with mild DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser showed a significance clinical response

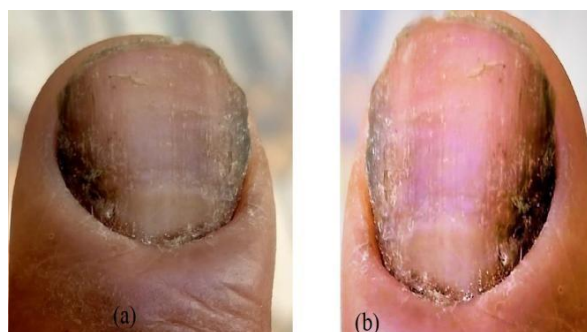


FIGURE 24 “patient from Group A” (a) Photograph of right-hand middle fingernail with severe DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser showed a no clinical response



FIGURE 25 “patient from Group A” (a) Photograph of right-hand thumb fingernail with severe TDO at baseline. (b) 4 months after treatment with Nd:YAG laser showed a no clinical response



FIGURE 26 “patient from Group A” (a) Photograph of left-hand index fingernail with moderate DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser showed no clinical response



FIGURE 27 “patient from Group A” (a) Photograph of right-hand ring fingernail with mild DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser showed a complete clinical response



FIGURE 28 “patient from Group A” (a) Photograph of right-hand index fingernail with severe DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser showed no clinical response



FIGURE 29 “patient from Group B” (a) Photograph of left-hand thumb fingernail with moderate DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser plus topical Terbinafine 1% cream showed a complete clinical response



FIGURE 30 “patient from Group B” (a) Photograph of left-hand middle fingernail with mild DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser plus topical Terbinafine 1% cream showed no clinical response



FIGURE 31 “patient from Group B” (a) Photograph of right-hand ring fingernail with severe EO at baseline. (b) 4 months after treatment with Nd:YAG laser plus topical Terbinafine1% cream showed no clinical response

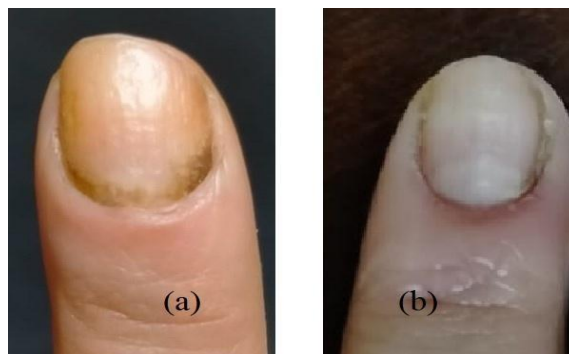


FIGURE 32 “patient from Group B” (a) Photograph of left-hand middle fingernail with mild DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser plus topical Terbinafine1% cream showed a complete clinical response

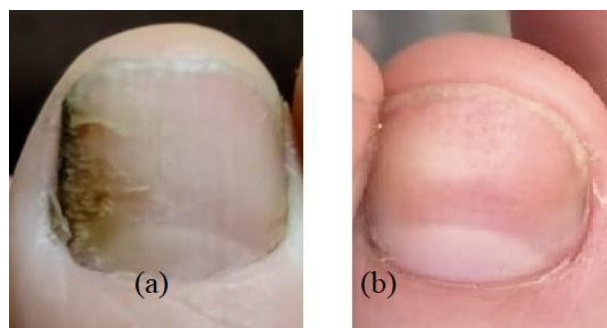


FIGURE 33 “patient from Group B” (a) Photograph of left-hand thumb fingernail with moderate DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser plus topical Terbinafine1% cream showed a complete clinical response



FIGURE 34 “patient from Group B” (a) Photograph of right-hand thumb fingernail with mild DLSO at baseline. (b) 4 months after treatment with Nd:YAG laser plus topical Terbinafine1% cream showed a complete clinical response

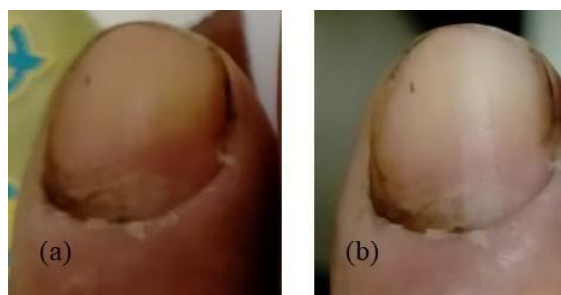


FIGURE 35 “patient from Group C ” (a) Photograph of right-hand index fingernail with mild DLSO at baseline. (b) 4 months after treatment with topical terbinafine1% cream showed a no clinical response

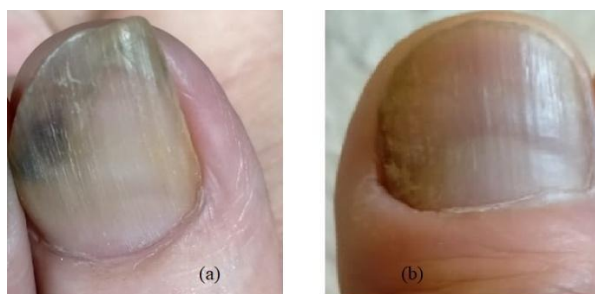


FIGURE 36 “patient from Group C ” (a) Photograph of right-hand thumb fingernail with moderate DLSO at baseline. (b) 4 months after treatment with topical terbinafine1% cream showed a significance clinical response

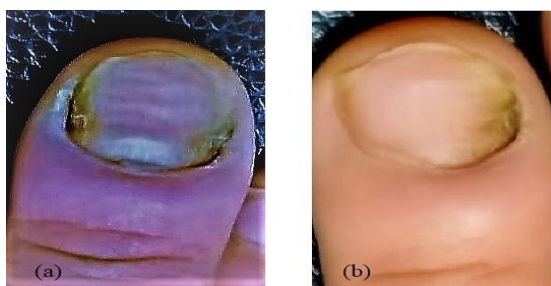


FIGURE 37 “patient from Group C” (a) Photograph of left-hand ring fingernail with moderate DLSO at baseline. (b) 4 months after treatment with topical terbinafine 1% cream a significance clinical response



FIGURE 38 “patient from Group C” (a) Photograph of right-hand index fingernail with moderate DLSO at baseline. (b) 4 months after treatment with topical terbinafine 1% cream showed a complete clinical response

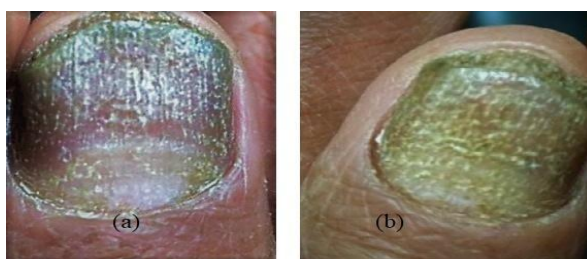


FIGURE 39 “patient from Group C” (a) Photograph of left-hand thumb fingernail with severe DLSO at baseline. (b) 4 months after treatment with topical terbinafine 1% cream showed a no clinical response

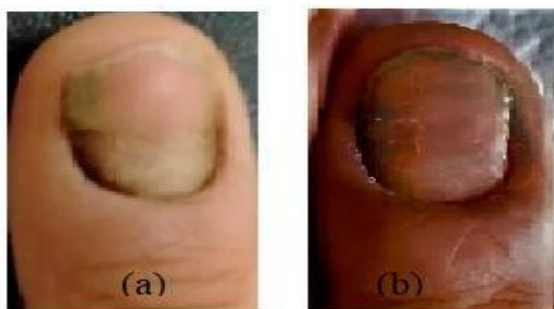


FIGURE 40 “patient from Group C” (a) Photograph of right-hand ring fingernail with moderate

DLSO at baseline. (b) 4 months after treatment with topical terbinafine 1% cream showed a significance clinical response

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