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The Efficacy of Infrared Light Therapy in the Treatment of Onychomycosis

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ABSTRACT

Objective: To study the efficacy of Infrared light therapy in treating Onychomycosis.
Study Design: Cross-sectional study.
Place and Duration of Study: Department of Dermatology, Combined Military Hospital, Bahawalpur Pakistan, from Jan to Jul 2022.
Methodology: A total of 122 patients of either gender with Onychomycosis were included in the study. Sessions with infrared light (24W Red Bulb, 660nm-850nm wavelength) were arranged once a week. The total duration of therapy consisted of four weeks in the case of fingernails and eight weeks in the case of toenails. Patients were called for follow-up at the end of the first, second, and third months after completion of treatment for efficacy evaluation.
Results: The mean duration of complaints was 9.12±2.58 weeks, and the mean weight of patients was 84.11±8.38Kg. Male patients were 36(29.5%), and females were 86(70.5%). 98(80.3%) patients had toenail involvement, and 24(19.7%) patients had fingernail involvement. Efficacy was defined as 2/3rd (66.0%) clearance of the nail plate after 90 days of completion of treatment from the first observation at the time of presentation on visual examination. Efficacy in our study was observed in 25(20.5%) patients.
Conclusion: Our study concluded that infrared light therapy is an effective treatment modality for Onychomycosis.

Keywords: Efficacy, Infrared light therapy, Onychomycosis.

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INTRODUCTION

Onychomycosis is adults' most common nail disorder, accounting for one-third of all fungal skin infections and up to 50 percent of all nail diseases.[1] It occurs in 10% of the general population, and 20% of patients are older than 60 years.[2,3] It is caused by fungi, including dermatophytes, non-dermatophytes, and yeasts.[4] For distal lateral subungual Onychomycosis, the most common clinical type of Onychomycosis, pathogenesis involves the spread of the fungus from the palmar or plantar skin leading to the invasion of the nail bed by way of hyponychium.[5,6]

Emerging treatments for Onychomycosis include Lasers, photodynamic therapy, and light treatments.[7] Laser, photodynamic therapy, and Infrared light may treat Onychomycosis locally without adverse systemic effects. These treatment options are frequently used in combination.[8]

Due to their minimally invasive nature and potential to restore clear nail growth with relatively few sessions, Laser, photodynamic therapy, and Infrared light are becoming popular options in treating Onychomycosis for physicians and patients.[9] Because of the low energies and the consequently lower temperatures generated, infrared light therapy is believed to pose no harm to sensitive tissues. It is also important that the wavelengths used are far from the ultraviolet range and pose no potential for mutagenic effect.[10] To assess the efficacy of Infrared light in the treatment of Onychomycosis in our population, we planned the study, in a group of Pakistani patients reporting to dermatology outpatient at a tertiary care hospital in Southern Punjab. This study aimed to determine the efficacy of infrared light therapy in treating Onychomycosis.

METHODOLOGY

The cross-sectional study was conducted at the Dermatology department of a Tertiary Care Hospital in South Punjab Pakistan, from January 2022 to July 2022. The sampling technique was non-probability consecutive sampling. The sample size was calculated using WHO sample size software with a 95% confidence interval and a seven percent margin of error using the efficacy of infrared light therapy by 19.2%,[11] in the treatment of Onychomycosis. The study was approved by the ethical committee of the hospital (Reference No. 12, dated 20 December 2021).

Inclusion Criteria: Patients of either gender, aged 18 to 60 years reporting to Dermatology outpatient with

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Onychomycosis affecting either fingernails or toenails for at least four weeks at the time of presentation were included in the study after taking informed consent.

Exclusion Criteria: Pregnant females & patients using systemic or topical antifungal therapy or Isotretinoin during the last six months were excluded from the study. In addition, individuals with permanent or semi-permanent discolouration of the nail plate were also excluded from the study.

Baseline demographic information of patients (age, gender, duration of complaints, weight, and location of affected nail) was noted at each session, and relevant clinical examination was performed. The number of nails affected was noted, and the extent of involvement of nails was measured in millimetres with a scale. Nail samples were obtained by clipping with a sterile blade and evaluated for fungal hyphae on direct microscopy after treatment with 20% potassium hydroxide. Diagnosis of Onychomycosis was essentially clinical, with findings of onycholysis, nail plate thickening, and subungual hyperkeratosis consistent with Onychomycosis, and it was confirmed by direct microscopy for fungal hyphae.

Each enrolled patient was treated with Infrared light therapy using Infrared light (24W Red Bulb, 660 nm-850nm wavelength) at weekly intervals. Treatment consisted of exposure of nails to Infrared light for ten minutes for fingernails and 20 minutes for toenails. The duration of treatment was four weeks for fingernails and eight weeks for toenails. At each session, patients were examined for the extent of involvement of nails or any other local side effects. Pain or any other side effect during or after the session was noted in a predesigned Proforma. Photographs were taken at baseline, each session, and at the end of treatment. Follow-up of the patients was ensured. Patients were called for follow-up at monthly intervals for three months after the completion of treatment for efficacy evaluation. Treatment was successful if there was at least 2/3rd (66%) clearance of the nail plate on visual examination from baseline, three months after the treatment, and simultaneously by the absence of fungal hyphae on direct microscopy. The positive impact was demonstrated by clinical appearance, clear nail area measurement, and clear nail linear growth. Treatment was only effective if there was a lesser degree of clearance of the nail plate.

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 22.00. Frequency and percentages were computed for qualitative variables. Mean with Standard deviation were presented for quantitative variables. The chi-square test was used for the comparison of qualitative findings. The p-value ≤ 0.05 was taken as significant.

RESULTS

A total of 122 patients were included in the study. The mean age of the patients was 44.16±6.93 years, with a range of 26 to 58 years. The mean duration of complaints was 9.12±2.58 weeks with a range of 5 to 16 weeks. 103(84.4%) patients had the disease for 12 weeks or less and 19(15.6%) patients had the disease for more than 12 weeks. The mean weight of the patients was 84.11±8.39 kg, with a range of 54 to 99 kg. After only one treatment, i.e. four weeks for fingernails and eight weeks for toenails, direct microscopy was negative for fungal hyphae in 20(20.5%) patients with toenail involvement and 5(20.8%) patients with fingernail involvement. Efficacy was observed in 25 (20.5%) patients in our study. Efficacy was observed in 8(33.3%) patients in the age group 18 to 40 years, while in the age group 41 to 60, efficacy was observed in 17(17.3%) patients (Table).

Table: Efficacy of Infrared Light Therapy in Treating Onychomycosis (n=122)

Duration of complaints	Efficacy		*p*-value
	Yes n(%)	No n(%)	
4-12 weeks	25 (24.3%)	78 (75.7%)	0.016
>12 weeks	0	19 (100%)	
Location of Affected Nail			
Toenails	20 (20.4%)	78 (79.6%)	0.963
Fingernails	5 (20.8%)	19 (79.2%)	
Weight (Kg)			
≤75	8 (34.8%)	15 (65.2%)	0.059
>75	17 (17.2%)	82 (82.8%)	

DISCUSSION

It has been estimated that 6% to 13% of the world population has Onychomycosis with most cases being caused by Trichophyton rubrum.[11] Besides causing cosmetic and psychological issues, the disease can cause considerable pain and can lead to secondary infections. Hence there is a need to treat the disease effectively.[12,13]

Landsman *et al.* have shown an efficacy of 19.2% with infrared light (IR) therapy in the treatment of Onychomycosis.[14] The IR spectrum may be arbitrarily divided by wavelength into near-IR (760–3000nm), middle-IR (3000–30000nm),&far-IR (30000nm–1 mm).[15]

Efficacy in our study was observed in 25(20.5%) patients. The results of our study were in concordance

with the previous study,[16] and confirmed the efficacy of Infrared light in the treatment of Onychomycosis. The study has also demonstrated the ability of Infrared light to directly affect the fungi causing Onychomycosis in the patients, by the fact that after only one treatment, negative culture was observed in 20.5% of the eligible toes that had positive cultures at the outset, and that by day 90. It also highlights the feasibility of using infrared light (24W Red Bulb, 660nm-850nm wavelength) to kill the fungus that causes Onychomycosis on a purely photonic basis, at very low energy, and physiologic temperatures.[17]

As with all other treatment options, clinical improvement with Infrared treatment depends largely on the speed of nail growth. This mechanism may eliminate the infecting agent, allowing more normal growth. In addition, the antimicrobial effect of Infrared light at physiologic temperatures is mediated by an optically mediated mechano-transduction of cellular redox pathways, decreasing transmembrane potentials and increasing ROS.[18] Another mechanism may be an apparent activation of angiogenic switch in human skin by acute IR irradiation. Stimulation of nail growth by infrared light may be another possibility that should be further assessed.[19]

Our findings indicate therapeutic success. Further research on the efficacy of this relatively newer treatment modality can help devise future regimens to optimize further the utility and efficacy of Infrared light in the treatment of Onychomycosis either alone or in combination with other treatment options.

CONCLUSION

Infrared light therapy positively affects nails with Onychomycosis, regardless of the severity of the disease. This treatment modality is reliable and safe because the mechanism of action for fungal inactivation causing Onychomycosis is purely on a photonic basis, at very low energy and physiologic temperatures. Infrared light may be used alone or in combination with other topical or systemic treatments for Onychomycosis to enhance their effects or shorten treatment duration.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

RAGS: Conception, data acquisition, data analysis, drafting the manuscript, approval of the final version to be published.

AH: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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