

Study of Fractional Carbon Dioxide Laser in Treatment of Onychomycosis (100 Cases)

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DOI: <https://doi.org/10.52403/ijrr.20221152>

ABSTRACT

Background: Onychomycosis is a fungal infection of nail unit. Tinea unguium is dermatophytic nail infection. common dermatophytes causing onychomycosis is Trichophyton rubrum. Onychomycosis increase in frequency with age, amongst them adult males are more frequently affected than females. There are various topical and systemic antifungal agents available for onychomycosis. Despite this it is difficult to treat onychomycosis as higher local concentration of drug is required for clearing the infection and it is difficult to achieve.

Aim and objectives: To ascertain efficacy of fractional carbon dioxide laser in onychomycosis. To evaluate fractional carbon dioxide laser's effectiveness in total clearance of onychomycosis from nails.

Materials and methods:

- Methods:** 100 patients of clinically diagnosed onychomycosis were selected. All patient's KOH smear examination was done by collecting samples from scrapings of nail material. All patients were given systemic antifungals along with topical antifungals. Laser sittings had been done at an interval of 1 month. Total 6 monthly sittings were done. Topical lignocaine hydrochloride 2% w/v gel were applied for 20-30minutes before giving laser therapy. Standard digital photographs were taken before initiating the therapy and then repeated monthly. After completion of 6

months all patients were followed up for 9 months with an interval of 3 and 6 months.

Results: At 6 months after completion of 6 sittings of CO₂ laser 68 patients had complete response, 16 patients had significant response, 8 patients had moderate response, 8 patients had no response at 6 months of therapy.

Limitations: Small population size, absence of control group, mycological culture was not performed were the main limitations of our study.

Conclusion: Fractional carbon dioxide laser is effective in treating onychomycosis along with topical and systemic antifungals and it has minimal side effects.

Key Words: Onychomycosis, fractional carbon dioxide (CO₂) laser.

INTRODUCTION

The term onychomycosis is derived from the Greek word ONYX (nail) and MYKES (Fungus)^[1] which is the fungal infection of nail unit is known as onychomycosis. It is most common infective nail disorder. It is more prevalent in males and with advanced age.

Onychomycosis is most commonly caused by dermatophytes and is known as Tinea unguium. Most common dermatophytes causing onychomycosis is Trichophyton Rubrum. Other dermatophytes causing onychomycosis are Trichophyton Mentagrophytes var Interdigitale,

Epidermophyton Floccosum, microscopy species. [2] Other causative agents include non dermatophytic moulds and yeasts.

Onychomycosis increase in frequency with age, whereas they are very rare in young children, adult males are more frequently affected than females, this is probably due to more nail damage from sports and leisure activities among adult males. [3]

Onychomycosis is clinically divided into five types. Distal and lateral subungual onychomycosis, proximal superficial onychomycosis, white superficial onychomycosis, endonyx onychomycosis, total dystrophic onychomycosis.

Onychomycosis has negative physical and psychological impact on patients. It also increases risk of onychomycosis in close contacts, can cause diabetic foot and cellulitis in diabetic patients if left untreated. [4,5] There are different topical and systemic antifungal agents, surgical modalities and laser therapies available for the treatment of onychomycosis. Topical antifungals used are ciclopirox olamine, amorolfine, tavaborole, efinaconazole, terbinafine, luliconazole etc. Most commonly used systemic antifungals are fluconazole, itraconazole and terbinafine. Despite availability of various topical and systemic antifungal agents it is difficult to cure as nail plate is thick and it requires higher concentration and prolonged duration of antifungal agents. It leads to increase in non-compliance from patients, drug interaction and drugs related systemic side effects.

Newer strategies targets on increasing nail penetration of topical agents and by that it helps in reducing the duration of treatment. Recent advances include iontophoresis, microporation, electric and manual nail abrasion and laser therapy induced nail ablation. Different lasers used for onychomycosis are CO₂ laser, Q-switched laser, long pulsed 1064nm Nd:YAG.

MATERIALS AND METHODS

STUDY DESIGN

This was a single blinded, prospective study and it was carried out in department of Skin V.D. & Leprosy at G.G.G Hospital, Shri M.P. Shah Government medical college over a period of 2 years. 100 patients of clinically diagnosed onychomycosis of different duration with different parts of nail involvement were selected.

All the patients were informed regarding the nature of the disease, course and prognosis. They were also explained regarding the need for the consistency in treatment. Approval for conduction of the study was obtained from the institutional ethical Committee and patient's written consent was taken.

INCLUSION CRITERIA

- Any adult with onychomycosis
- Onychomycosis of one or more than one nails
- Onychomycosis in patient with other immunocompromised conditions
- Patients who are on prolonged antifungals but did not get relief.

EXCLUSION CRITERIA

- Active nail infection / Paronychia
- Pregnant women
- Patients < 18 years of age.

INITIAL ASSESMENT

The patients who were fulfilling the inclusion criteria were enrolled in the study. Each patient was subject to detailed relevant clinical history regarding onset, duration of symptoms, history of past medication, occupation. Before initiating study, the nail scrapping of all the patients were taken and subjected to direct microscopic examination in 10-20% potassium hydroxide (KOH). All patients given systemic antifungals for 3months along with topical antifungals. Standard digital photographs of each patients affected nail were taken before initiating laser treatment and there after repeated before performing next laser sitting.

MATERIALS: Carbon dioxide laser machine

STATISTICAL METHOD:

Chi-Square test was employed in stratifying data with validity according to p-value. Chi square value come out to be 17.40 and p-value come out to be 0.00058 (<0.001) suggesting the study to be statistically significant.

PROCEDURE OF FRACTIONAL CO₂ LASER

Laser sittings had been done at interval of 1 month. Total 6 sittings were done over a period of 6 months. Topical lignocaine hydrochloride 2% w/v gel were applied for 20-30 minutes before giving laser therapy.

Fractional carbon dioxide laser given using pulse energy of 110 mJ, a density of 256 spots/cm² pulse interval of 0.5 mm, pulse duration of 0.1 ms, and a rectangular spot size of 2-10 mm length and 0.6-5 mm breadth. Three passes were administered at the same site in static operating mode over the affected area including 1 mm normal appearing areas around them at interval of 4 weeks.^[6]

Outcome were assessed by using digital photography, KOH mounting, and the response was graded on basis of fully normal appearing nail, modified from Lim et al,^[7] as

1. Complete response (CR): Fully normal appearing nail measured from the proximal nail fold to involved nail.
2. Significant response (SR): >60% normal appearing nail.

3. Moderate response (MR): 20%-60% normal appearing nail.

4. No response (NR): <20% normal appearing nail.

FOLLOW UP EXAMINATION

Patients were followed up at 3 months and 6 months for assessment of response.

RESULT

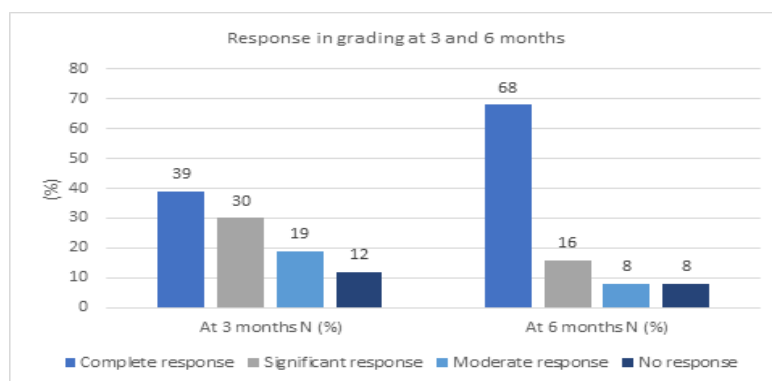
In my study majority of the patients were from age group of 31-40 years. Female patients have outnumbered male patients. Duration of onychomycosis has been varied from 2 months to 5 years. Response was assessed at 3 months and 6 months of therapy. Chi-Square test was applied, Chi-Square test come out to be 17.40 and p value come out to be 0.00058 (<0.001), suggesting that study is statistically significant.

RESPONSE AT 3 MONTHS

At 3 months after completion of 3 sitting of CO₂ laser 39 patients were showed complete response (CR), 30 patients were showed significant response (SR), 19 patients were showed moderate response (MR), 12 patients were showed no response (NR) at 3 months. (Figure – 1)

RESPONSE AT 6 MONTHS

At 6 months after completion of 6 sittings of CO₂ laser 68% patients had Complete response (CR), 16 patients had Significant response (SR), 8 patients had Moderate response (MR), 8 patients had No response (NR) at 6 months of therapy. (Figure -1)



Chi-Square value = 17.40 and p value = 0.00058

Figure 1: Response in grading at 3 and 6 months

COMPLICATIONS

Only 4% patients had complaint of pain, only 3% patients had complaint of burning sensation, and 1% patient had complaint of nail fold swelling. (Figure – 2)

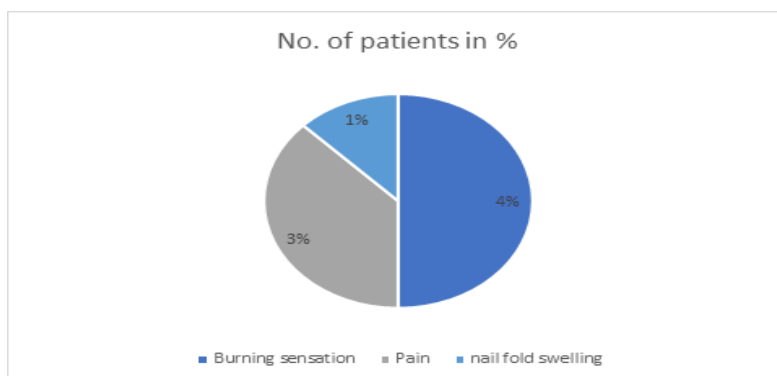


Figure 2: Complications



Figure 3: Pre-Treatment Image



Figure 4: Post-Treatment Image

DISCUSSION

Isolated LASER treatment, or in conjunction with Oral antifungal in treatment of Onychomycosis has been proven to not be beneficial. We employed fractional CO₂ LASER along with topical and systemic anti-fungal treatment in proven Onychomycosis cases.

Whilst Topical antifungals alone are not effective, systemic antifungals are associated with increased incidence of adverse events. [8,9] Also the duration of treatment is prolonged, around 6-12 months for systemic and topical treatment with toe nails taking around 18 months to show remission. [10]

LASER therapy is fairly recent and used extensively nowadays due to promising results. Fractional CO₂ LASER causes a sterilizing effect in the nailbed by increasing the local temperature and creating

vaporizing channels in the nail plate causing a decomposition. [11]

Selective Photothermolysis is the basic principle on which the LASER therapy is evolved. The fungus is structurally damaged because of the photomechanical a photothermal action of the LASER. [12] Similarly a parallel understanding developed stating that there is immune reaction towards secondary vasodilation due to heating of the target tissue. [13] LASER therapy causes islands of discontinuity in the cell membrane, which leaks the cytoplasmic contents. [14] Local hyperthermia caused by the LASER has an additive effect of stimulation of healing cascade along with targeted killing of pathogens. One more benefit of LASER therapy can be the increased permeability of the nail fenestrae, augmenting the topical drug penetration. [15]

Our study revealed 39% of patients exhibiting a complete remission in just 3 months of therapy. Saving them from an additional three months of therapy. At the end of 6 months, an additional 29 patients reached at complete remission state. 68% of cases had complete cure in 6 months of therapy with monthly sittings. Only 8% of cases were refractory.

Pain was only observed in only 4% of cases despite application of a local anaesthetic. One case showed nail fold swelling. The complications were acceptable with none showing any serious development leading to cessation of the therapy.

Multiple studies come up to the same conclusion that combination therapy is much more beneficial with favourable results as compared to monotherapy with LASER either/or topical / systemic therapy. [7,16]

CONCLUSION

- The study showed that majority of onychomycosis patients were from 31-40 years age group. Majority patients were female in our study group which further co relate with more cosmetic concern in them.
- Majority patients were married and homemakers, this suggested that as they are more in contact with water and detergent which promotes fungal invasion.
- Maximum number of patients had disease duration of less than 6 months.
- In my study majority patients had finger nail involvement. Amongst them single nail involvement was common.
- Patients who had past history of medicines like oral hypo-glycemic agents, anti-retro viral therapy, anti tubercular therapy and systemic corticosteroids were required more number of sitting. And even after completion of 6 sittings of CO₂ laser at they showed moderate to no response compared to the patients who had no similar history.
- The majority of patients were KOH smear negative at the end of the therapy

(after 6 months), they were followed up for next 3 months, and result were similar as that of 6 months result.

- Only a few patients had complaints of pain and burning sensation this suggested that fractional CO₂ laser has minimal side effect.
- The present study concluded that along with topical and systemic antifungal agents fractional CO₂ is effective in clearing fungal invasion from nails. Additionally, it helps in reducing duration of systemic antifungal agents.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Prachi Mehta, Deval Vora, Nidhi Patel et.al. Study of fractional carbon dioxide laser in treatment of onychomycosis (100 cases). *International Journal of Research and Review.* 2022; 9(11): 386-391.
DOI: <https://doi.org/10.52403/ijrr.20221152>
