

Evaluation of *in vitro* effectiveness of Nd: YAG (1064 nm) laser effect combined with common antifungal drugs in treatment of onychomycosis caused by common fungal species

Abstract

Onychomycosis is caused by dermatophyte species, non-dermatophyte molds and yeasts and can lead to a variety of clinical manifestations. Onychomycosis accounts for 18 to 40 percent of nail disorders that, while not fatal, can cause motor, aesthetic, occupational, and economic problems. Medication due to long courses of treatment, drug interactions, side effects, and slow treatment progression may be associated with a high probability of leaving treatment halfway. As the incidence of onychomycosis increases, new epidemiological information and treatments may help with treatment and prevention.

The aim of this study was to determine the epidemiological characteristics and etiological factors of onychomycosis in two mycology laboratories affiliated to Tehran University of Medical Sciences (Razi Hospital and School of Health); Study evaluating the effect of laser (Nd-YAG1064nm Ip) on some of the resulting fungal colonies and subsequently investigating the possible change in the minimum concentration (MIC) of common antifungal drugs compared to colonies without similar laser irradiation; Evaluation of the effect of laser on nail clippings infected with yeast fungi and investigation of possible change of MIC of common antifungals against control and evaluation of the effect of two types of lasers with different energies on the growth of fungal colonies resulting from clinical isolation compared to control .

Methods: A Type of experimental study, and descriptive-cross-sectional study over 24 months (1398-1400) on 169 patients with positive nail mycology test; referred to two mycology laboratory centers affiliated to TUMS and RH. Detection of fungal agent in nail clippings by direct smear; culture and, if necessary, molecular assay; thirty-seven samples of onychomycosis consisting of saprophytic (n: 13), dermatophyte (n: 12) and yeast (n: 12) colonies were isolated from the first stage samples, a series were irradiated with laser, then, the minimum concentration of antifungal inhibitor (MIC) by CLSI-M38-A2 method against common antifungals was performed and compared in both groups; 8 nail clippings of approved yeast onychomycosis was placed in two series in S/C medium, one series was immediately irradiated with laser, then both series after one week incubation were tested for antifungal susceptibility test (CLSI M27-A3 yeast method) with KET; VOR; FIC and TER and the results were compared. Six yeast colony of onychomycosis

samples were duplicated cultured, one series irradiated by laser. Each pair was examined for antifungal susceptibility and the results were compared and 23 fungal samples from colonies isolated from dermatophyte, yeast and saprophytic clinical samples were cultured in three series; after the colonies grew to a diameter of about 1 cm, a series of colonies with energy of 55 (L1) j/sec/cm² and a series of 45 (L2) j/sec/cm² treated with laser and a series without laser remained, colonies were compared with each other in terms of mean diameter of colonies.

Result:

10% of the nail lesions referred to the mycology laboratory of Razi Hospital and 30% of the nail lesions referred to the mycology laboratory of the Faculty of Health were positive. Middle-aged people (40 to 60 years old) were more likely to suffer from onychomycosis than other age groups. *Aspergillus flavus*, *Trichophyton mentagrophytes* and *Candida albicans* were the most common etiological agents in each of the three main classes of onychomycosis fungi. Women were more likely to be referred to mycology laboratories and more likely to develop onychomycosis. Onychomycosis was more common in women than men. The correlation between sex and fungal involvement was significant. The lowest incidence of onychomycosis was seen in people aged 0-17 years. Yeast in women's fingers (21.3%) and dermatophytes in men's toenails (20.71%) showed the highest prevalence in this study. Dermatophytes were the predominant etiologic factor and toenails were the most common site of onychomycosis. After laser irradiation, the MICs of the laser group were changed compared to the following control group; In saprophytes; TRB (P-value <0.035); dermatophytes; VOR (P2 value <.0210) and CAS in yeasts (P-value <0.037). The highest relative frequency of changes in the diameter of the stunted area due to laser irradiation; In all three groups of nails clippings; Yeast colonies and total were related to KET (78.5% and 83.3%; 87.5%) followed by ITR (50% and 66.8, ٦٢%).

Laser irradiation at two energy levels of 45 and 55 J / cm² reduced the diameter of the colonies in 80% of cases.

There was no significant difference between 55 and 45 J / cm² in growth rate according to colony diameter.

Conclusion: Long-term treatment of onychomycosis requires repeated reviews to reduce its duration. Nd-YAG1064nm Ip; Laser with changes in susceptibility to common antifungals in onychomycosis-causing fungi; can be an alternative to classical combinations in therapeutic methods.

Pattern of causative factors; the clinical signs and common site of onychomycosis are different depending on the geographical area and age, so repeated epidemiological studies of onychomycosis seem helpful. The present study provides new and appropriate therapeutic and epidemiological data on onychomycosis for better prevention and treatment of this fungal infection.

Keywords: Onychomycosis, Nd-YAG laser, Saprophyte. Dermatophyte, Yeast, Antifungal susceptible, Treatment