Toenail onychomycosis treated with a fractional carbon-dioxide laser and topical antifungal cream

Eun-Hwa Lim, MD,[a] Hyeong-rae Kim, MD,[a] Young-Ok Park, PhD,[b] Young Lee, MD,[a] Young-Joon Seo, MD,[a] Chang-Deok Kim, PhD,[a] Jeung-Hoon Lee, MD,[a] and Myung Im, MD[a]
Daejeon and Seoul, Korea

Background: Traditional pharmacotherapy for onychomycosis has low to moderate efficacy and may be associated with adverse reactions and medication interactions limiting its use in many patients.

Objective: We evaluated the clinical efficacy and safety of a fractional carbon-dioxide laser with topical antifungal therapy in the treatment of onychomycosis.

Methods: In all, 24 patients were treated with fractional carbon-dioxide laser therapy and a topical antifungal cream. The laser treatment consisted of 3 sessions at 4-week intervals. Efficacy was assessed based on the response rate from standardized photographs, a microscopic examination of subungual debris, and subjective evaluations.

Results: Among the patients, 92% showed a clinical response and 50% showed a complete response with a negative microscopic result. The factors that influenced a successful outcome were the type of onychomycosis and the thickness of the nail plate before treatment. The treatment regimen was well tolerated and there was no recurrence 3 months after the last treatment episode.

Limitations: The study followed up only 24 patients and there were no relevant treatment controls.

Conclusions: Fractional carbon-dioxide laser therapy, combined with a topical antifungal agent, was effective in the treatment of onychomycosis. It should be considered an alternative therapeutic option in patients for whom systemic antifungal agents are contraindicated. (J Am Acad Dermatol 2014;70:918-23.)

Key words: fractional laser; laser therapy; onychomycosis.

Onychomycosis is a common fungal infection of the nail. More than just a cosmetic concern, onychomycosis can lead to infections of the toes and cause considerable pain, especially in older, diabetic, or immunocompromised patients.[1] The most common therapeutic options are systemic and topical antifungal agents[1]; however, oral antifungals are associated with adverse effects that can cause patients to discontinue treatment, which may be complicated by the presence of comorbid conditions.[1] Furthermore, topical agents have low efficacy because of their limited ability to penetrate the nail plate and reach the affected nail bed.[1,2] Thus, new therapies that broaden the treatment options and reduce side effects for patients are needed.[1,2]

Lasers have become a popular option in the treatment of onychomycosis.[2] Laser or light systems that have been investigated for this indication include carbon dioxide (CO_2),[3] neodymium:yttrium-aluminum-garnet,[4,5] 870/930-nm dual wavelength,[6,7] ultraviolet light, and photodynamic therapy.[8,9] The CO_2 laser system is the oldest of the laser therapies for onychomycosis.[3] It is ablative in

From the Department of Dermatology, School of Medicine, Chungnam National University, Daejeon[a]; and Departments of Statistics, College of Business and Economics, Korea University, Seoul.[b]

Supported by a grant from the Korea Ministry of Health and Welfare (A091121).
Conflicts of interest: None declared.
Accepted for publication January 19, 2014.

Reprint requests: Myung Im, MD, Department of Dermatology, School of Medicine, Chungnam National University, 33-Munhwa-ro, Daejeon, 301-747, Korea. E-mail: im1177@hanmail.net.

Published online March 20, 2014.
0190-9622/$36.00

http://dx.doi.org/10.1016/j.jaad.2014.01.893

nature and therefore can serve as a primary treatment for onychomycosis or as an adjunct to topical antifungals, providing a means of penetration through the nail plate to the nail bed.[3,10] However, this approach takes considerable time to perform, requires a digital block, and is associated with the same postoperative pain as surgical avulsion of the nail.[3,10]

Recently, the use of a fractional CO_2 laser to treat various dermatologic conditions was investigated, especially for scar and skin resurfacing.[11] This laser creates multiple columns of destruction in the tissue, called microscopic treatment zones.[11] The fractional CO_2 laser system has been developed that uses fractional laser technology to maximize the effect of ablative laser therapies and minimize side effects.[11,12]

CAPSULE SUMMARY

- Onychomycosis is difficult to treat and is associated with a high rate of persistence or recurrence.
- Fractional carbon-dioxide laser therapy is a promising adjunctive treatment option for onychomycosis.
- This study showed that fractional carbon-dioxide laser therapy combined with a topical cream was efficacious in the treatment of onychomycosis.

The purpose of this study was to evaluate the treatment of onychomycosis using a fractional CO_2 laser and topical antifungal agent. To our knowledge, this is the first report on the efficacy of fractional CO_2 lasers for the treatment of onychomycosis.

METHODS

Patients

In all, 24 patients were enrolled in this prospective clinical trial. Participants were chosen from patients who had dystrophic nails that were clinically consistent with a fungal infection. To qualify for enrollment, subungual debris from the involved nail plate was obtained by using a small curette and then direct microscopy using 15% potassium hydroxide confirmed the fungal infection. All patients were not candidates for oral antifungal therapy because of drug interactions with other internal medicines or a history of liver or kidney disease. In addition, all patients had failed to improve on only topical amorolfine cream for several weeks (mean duration 8 weeks, range 4-17 weeks). Exclusion criteria included systemic antifungal treatment during the previous 6 months, and concomitant nail disease, eg, psoriasis, lichen planus, or atopic dermatitis. Demographic data such as age, sex, duration before treatment, type of onychomycosis, and medical history were collected before enrollment in the study. In addition, we measured the initial thickness of the nail plate using a micro caliper (Mitutoyo Corp, Kawasaki, Japan). This study was approved by the Institutional Review Board of Chungnam National University Hospital, Daejeon, Korea. All subjects provided written informed consent before participating in the study.

Treatment

All patients were treated with an ablative fractional CO_2 laser (Mosaic eCO_2 Laser, Lutronic Corp, Goyang, Korea) and daily topical amorolfine cream (Loceryl, Galderma, Lausanne, Switzerland). Fractional CO_2 laser treatment consisted of 3 sessions at 4-week intervals. After 30 minutes of topical anesthesia (EMLA, AstraZeneca, Wilmington, DE) on periungual skin, treatment was performed with a pulse energy of 160 mJ and a density of 150 spots/cm^2. Treatment parameters were determined by investigator experience. Depending on the severity of the lesions, 2 or 3 passes at the same site were

Fig 1. Nails before (**A**) and immediately after (**B**) the first ablative fractional carbon-dioxide laser therapy. The treated nail had multiple pinholes in the infected area.