Treatment of Actinic Cheilitis Using a 1,927-nm Thulium Fractional Laser

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Actinic cheilitis (AC) is a precancerous condition of the lip that primarily affects people with Fitzpatrick skin types I and II as a result of chronic exposure to solar irradiation. Additional factors include poor oral hygiene, chronic lip irritation, and excessive tobacco use.[1] The clinical spectrum of AC is varied and may include erythema, leukoplakia, scaling, atrophy, dryness, fissures, ulcers, and loss of the vermilion border. As with actinic keratosis (AK), AC has the potential to undergo malignant transformation into invasive squamous cell carcinoma (SCC). Although the exact rate of malignant conversion is unknown, SCC of the lip is the most common malignancy of the oral cavity and is more aggressive than SCCs in other sites,[2] so early diagnosis and effective treatment of AC is necessary to curtail its malignant transformation.

A wide array of reported treatment modalities for AC exist, all of which are aimed at destroying or reducing the damaged epithelium. These treatments include trichloroacetic acid, 5-fluorouracil, imiquimod, diclofenac, cryosurgery, electrocautery, carbon dioxide (CO_2) laser, erbium-doped yttrium aluminum garnet laser (Er:YAG), vermilionectomy, and photodynamic therapy (PDT).[3] One of the newest additions to the armamentarium of dermatological laser technology is the 1,927-nm thulium laser (Fraxel re:store Dual, Solta Medical Inc., Hayward, CA). This novel nonablative fractional laser technology offers superficial resurfacing and reduction of pigmentation with maximum sparing of adjacent tissue. This property allows for adequate treatment of AKs and other photodamage-induced pigmentation conditions. Herein, we present a case of moderate to severe AC that improved significantly after three treatments with the thulium laser.

Case Report

A 56-year-old Caucasian man with Fitzpatrick skin type II presented to our clinic for laser resurfacing of his face. He had a history of basal cell carcinomas on his bilateral temples that had been excised using Mohs micrographic surgery in 2009. He subsequently sought treatment at our clinic to minimize his postsurgical scarring and treatment for AKs. On physical examination, the patient had small scars on his bilateral temples. He also had several erythematous scaly patches on his forehead, bilateral cheeks, and scalp, consistent with AK. Close examination of his lips revealed leukoplakia, linear fissures, and an indistinct vermilion border, which were clinically consistent with the diagnosis of AC.

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A variety of treatment options for the AC were discussed with the patient, who elected to undergo laser treatment with the 1,927-nm thulium laser. The area was pretreated with 23% Lidocaine, 7% tetracaine topical emulsion applied 1 hour before and removed immediately before the procedure. Treatment settings of 20 mJ/cm^2 of fluence and 40% coverage were used, and the patient underwent four passes. He tolerated the procedure well and reported no pain or bruising. He underwent two more treatment sessions at monthly intervals, with significant clearance after the third treatment (Figure 1). There was no evidence of recurrence, bruising, or scarring at the follow-up appointments.

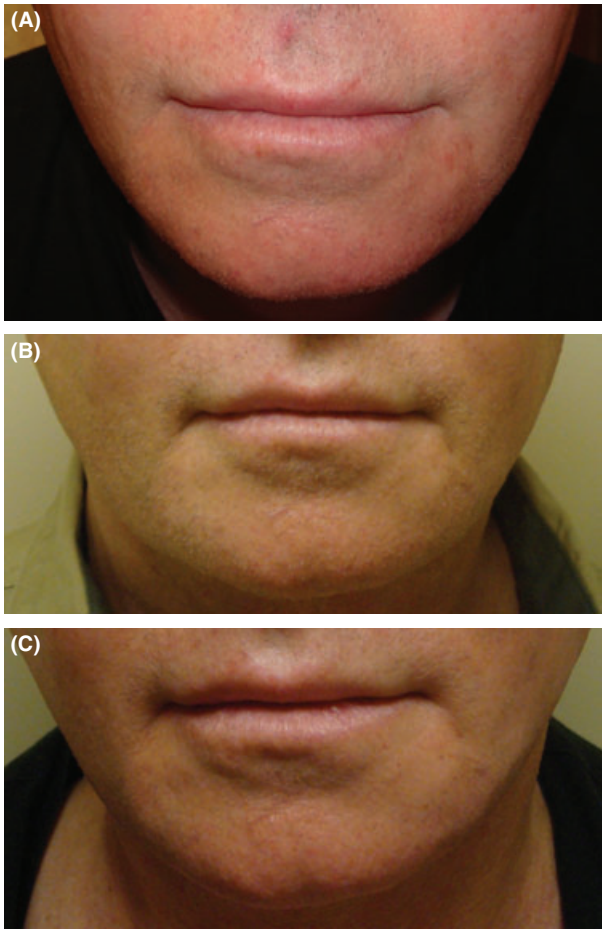

Figure 1. (A) Appearance of lips before thulium laser treatment. (B) Appearance after one laser treatment. (C) Appearance after three laser treatments.

Discussion

Appropriate and timely treatment of AC is necessary to prevent malignant transformation into invasive SCC of the lip. Surgical and nonsurgical approaches have been used to treat the hyperplastic, atrophic, hyperkeratotic, or dysplastic features of AC. Conservative, nonsurgical treatments that have been reported include topical applications of trichloroacetic acid, 5-fluorouracil, imiquimod, and diclofenac.[4–7] Although these treatments are feasible, they are limited by the development of erythema, induration, edema, and ulcerations at the treatment site and are associated with higher rates of recurrences than treatment with surgical techniques.

Surgical treatments that have been used for AC include cryosurgery, electrosurgery, laser ablation, PDT, and vermilionectomy.[8] Cryosurgery and electrosurgery are readily accessible procedures with proven efficacy, but their use is generally limited to focal areas of cheilitis in order to prevent edema and ulcerations. PDT is another effective treatment option, especially for patients who cannot tolerate invasive techniques. Nonetheless, the widespread use of PDT for AC is precluded because of pain and a burning sensation during light exposure and an extended recovery period, with inflammation lasting up to 15 days.[9] Surgical vermilionectomy provides an alternative method for treatment of AC, especially in the presence of severely dysplastic features, although as with other invasive surgery techniques, it is associated with intraoperative difficulty, bleeding, and pain and postoperative edema, scarring, and dysesthesia.

Combining the low complexity of nonsurgical techniques with the efficacy of surgical procedures, laser therapy provides a promising treatment option for AC. CO_2 laser ablative treatments for AC have been studied extensively and have demonstrated remarkable curative and cosmetic results. CO_2 laser is also associated with low recurrence; three of 43 patients were found to have recurrences, of whom two

developed SCC.[10] Nonetheless, secondary complications, including pain, edema, delayed re-epithelialization, and scarring, have been reported, probably owing to its deep ablative thermal effects. The 2,940-nm Er:YAG was introduced as an alternative solution. The properties of the Er:YAG laser prevent it from being absorbed as deeply as the 10,600-nm CO_2 laser, which results in less postoperative morbidity,[11,12] but because of its high water absorption, the Er:YAG laser has insufficient coagulative effects, resulting in higher rates of intraoperative bleeding.

Fractional photothermolysis offers a novel approach for the treatment of AC, because it overcomes the detrimental effects of ablative laser surgery and the poorer efficacy of conservative nonsurgical techniques. As with the 1,550-nm erbium-doped fiber laser, the mechanism behind the 1,927-nm thulium laser involves the emission of a concentrated beam that produces multiple zones of microscopic thermal injury known as microscopic treatment zones (MTZs).[13] Within the first few hours of the formation of these MTZs, the viable epidermis surrounding each MTZ begins to regenerate and aids in the healing process. The preservation of the epidermal barrier may account for the minimal side effects and the faster healing process than with ablative laser resurfacing. These unique properties have rendered the 1,550-nm fractional laser a well-established modality for the treatment of such common conditions as acne scars, surgical scars, melasma, and photodamaged skin.[14]

The recent introduction of the 1,927-nm thulium fractional laser provides the technology of a superficial wavelength that penetrates only the epidermis and upper dermis, providing a nonablative resurfacing that is ideal for the treatment of discoloration and uneven texture. Ongoing studies show the superior efficacy of the 1,927-nm thulium fractional laser for the treatment of photodamaged skin, including AK. The use of the 1,927-nm thulium fractional laser results in excellent clearance of AK, with a mean clearance rate of 62.7% after the first treatment, 84.3% after the second treatment, and 88.5% after three treatments.[15] A recent multicenter study reviewing 15 patients with AC who had been treated using the 1,927-nm thulium fractional laser showed 76% to 100% (9 patients) and 51% to 75% (6 patients) improvement after one or two treatments. The only side effects seen in this study were transient erythema and edema lasting 1 to 4 and 1 to 3 days, respectively.[16]

Because SCCs of the lip have a higher chance of metastasizing than those of the skin, an effective treatment with a good cosmetic outcome is needed. In light of the promising results of the 1,927-nm thulium laser in the treatment of superficial skin conditions, we present this case as another demonstration of its efficacy for the treatment of AC. We used the maximum energy of 20 J/cm^2 to destroy the damaged epithelium and treated with multiple passes to further enhance the efficacy of the treatment protocol. This treatment modality requires minimal downtime, resulting in only transient erythema and edema, and lack of the intraoperative bleeding and postoperative scarring and dysesthesia that have been reported with the use of other lasers or the ulceration and induration that can be seen with topical treatments. The 1,927-nm thulium fractional laser is promising for the treatment of AC. Further larger studies are needed to establish its efficacy, to determine the optimal settings and duration of treatment, and to further evaluate for any adverse effects.

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