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ARTICLE

Efficacy of the carbon dioxide fractional laser in the treatment of compound and dermal facial nevi using with dermatoscopic follow-up

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ABSTRACT

Background: Surgical excision for nevi can produce scar formation. Treatment of compound and dermal nevi, especially on the face, can be challenging.

Objectives: The study objectives included an assessment of the efficacy and safety of the CO_2 fractional laser for removing compound and dermal nevi and usefulness of dermoscopy for the monitoring of the nevus.

Methods: We performed a retrospective review of 330 patients with 684 facial nevi. CO_2 fractional laser was performed at 2-month intervals until complete clearance occurred. The global assessment scale (GAS) scores were used to assess the overall results.

Results: Five-hundred fifty-four nevi (81%) were successfully treated in one session. Eighty-nine (13%) and 34 (5%) required second and third sessions, respectively. Only seven (1%) required >3sessions. At the end of one year, patients' (87%) and physicians' (85%) GAS scores were rated as excellent and good, respectively. At the one year follow-up, fibrosis in 20 patients (3%), recurrences in 15 (2%), dimples in 12 (2%), scars in 12 (2%), hyperpigmentation in 8 (1.5%), and hypopigmentation in 6 (1%) were observed as side effects.

Conclusions: CO_2 laser produced excellent cosmetic results, led to high patient satisfaction, and could be easily performed. Dermoscopy can be helpful for long-term follow-up.

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KEYWORDS
Ablative laser; dermatoscopy; melanocytic nevus

Introduction

Congenital or acquired melanocytic nevi are well circumscribed; round or ovoid shape lesions with light or dark colors that result from benign proliferation of nevus cells. Acquired common melanocytic nevi can be divided into three clinical types: junctional, compound, and dermal. Dermatological examination reveals that a compound nevus with light brown color shows usually papular in morphology. On the contrary, dermal nevi with light brown color are usually more elevated papules and nodules (1). Dermatoscopic features of a compound nevus consist of globular network with round to ovoid globules, while dermal nevi are characterized by a focal globule or globular-like structures (2,3). Other prominent dermatoscopic features of dermal nevus are linear or comma-like vessels (4). It has been suggested that surgical excision should be the first choice of treatment for medium or large-size facial compound and/or dermal nevi. However, the occurrence of scarring and scar contracture may restrict surgical procedures (1). Different types of lasers (such as pigmented and ablative) have been used for congenital and acquired melanocytic nevus with variable results for a long time (5–9). Deeper situated nevus cells cannot be destroyed completely by pigment-specific lasers (10–12). Carbon dioxide (CO_2) laser has been used mainly for dermatological skin rejuvenation (13). And also, melanocytic nevi have been treated with fractional and continuous wave mode CO_2 laser from a cosmetic point of view (14–16). We considered two different issues in this study: First is using the ablative CO_2 laser with proper doses for complete removal of the nevus cells with considering the scar occurrence and second one is using the dermatoscopy for the monitoring of the nevus at the one year follow-up period.

Methods

Patients

We performed a retrospective review of 330 patients with 684 compound and dermal facial nevi on the face between June 2013 and June 2017 that were treated by ablative CO_2 fractional laser. Informed consent was obtained from all the patients. All lesions were pigmented, elevated, with brown or skin color, papular or nodular shape, and did not exceed 10 mm in diameter. For nevi localization, the face was segmented into five different areas: forehead, cheeks, chin, lips, and nose. Individuals with nevi such as congenital or acquired junctional melanocytic, Blue, or Spitz nevi and also with a personal or family history of melanoma, hypertrophic scarring, and/or keloid formation were excluded.

Dermatoscopic assessment

All lesions were examined with a dermatoscope (Dermlite II ProHR; 3Gen, San Juan Capistrano, CA) to exclude premalignant lesions before treatment using a 3-point checklist to detect abnormal nevus. Compound and dermal nevi were evaluated according to four global dermatoscopic patterns: globular pattern, thin reticular pattern, diffuse hypopigmentation, and comma-like

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vascularization. After treatment, dermatoscopic changes were evaluated at the one year follow-up period with respect to structures of nevus cell remnant, scars, hypo/hyperpigmentation, and fibrosis.

Laser treatment

Patients were examined clinically, the number of the lesions was counted, and clinical photography and dermatoscopic images were taken before and immediately after treatment and again at two, six, and 12 months. EMLA 5% cream (mixture of 2.5% lidocaine and 2.5% prilocaine, Astra Zeneca, Sweden) was applied to the nevi 30 min before laser application. The areas were cleaned with antiseptic solution. Each patient was treated with 10.600 nm CO_2 laser (CO_2RE®, Syneron, Israel). At each session, nevi were irritated with laser energy of 4–6 mJ and fluences between 20 and 35 J/cm^2. Between three and ten passes of ablation were done in 50 μm ablation mode and 100 μm thermal ablation for each application with a 0.9/2.0/2.9 (mm) square spot size and 30% overlap. CO_2 laser was utilized to ablate the target lesions. After ablation of the lesions, all nevi controlled by dermatoscopy for to detection the cluster of nevus cell remnants. If we detected structure of the nevus compound or dermal nevus, the laser was performed at two months intervals until complete clearance was obtained. This meant that up to 10 passes were performed into the reticular dermis for removal of as much of the pigment as possible. During laser application, residual tissues on the wound surface were removed with a cotton sponge. The wound area was treated with topical epithelialisan cream for up to three weeks after the laser application. The patients were advised to avoid sun exposure.

After checking for adverse events at each session, all nevi were evaluated with respect to pigmentary changes, signs of recurrence, and textural and adverse skin changes such as dimples, fibrosis, post-inflammatory hypo/hyperpigmentation, scars, and infections. The number of treatment sessions was adjusted based on the dermoscopic appearance and clinical response. If hyperpigmentation due to structure of the nevus cells were detected after the first sessions, the patients were treated with another laser application. Laser application ended when complete pigment clearance was dermatoscopically noticed by the investigator.

Follow-up

All patients were followed for one year. At each visit, the treated areas were evaluated clinically and dermoscopically. Clinical and dermoscopic pictures were taken at the initial visit, and two, six, and if required 12 months after the final treatment by using a Canon EOS 400 D digital camera (Canon Inc., Tokyo, Japan).

The global assessment scale (GAS) scores were performed to assess the overall results, and the degree of the patient and physician satisfaction with the laser therapy at two, six, and 12 months according to several ratings: excellent (>75%), good (50–75%), fair (25–50%), or poor (<25%).

Results

The patients consisted of 210 females (64%) and 120 males (36%) between 20 and 55 (mean 32.8 ± 2.8) years. All patients had Fitzpatrick's skin types I–III. Skin types were classified as Type I (in 33, 10%), Type II (in 82, 25%), and Type III (in 215, 65%). Most of the patients were in skin type III. Nevi diameter ranged from 2 to 10 mm (mean 4.55 mm). According to nevi localization, right cheek (in 174, 25%), left cheek (in 170, 25%), and nose (in 162, 23%) were the most commonly involved facial sites followed by the forehead (in 78; 11%), chin (in 58; 9%), and lips (in 42; 7%).

Clinical dermatoscopy

Of the 684 lesions, 554 (81%) nevi were treated with one session and 89 (13%) and 34 (5%) nevi required for second and third sessions, respectively. Only seven nevi (1%) required >3 sessions. All treated nevi showed complete clinical and dermatoscopic pigmentation clearance at the end of the last session. Three females patients treated with laser were shown in Figure 1. Nevi were evaluated from the time to re-epithelization and the duration period of post-treatment erythema. Transient crusting and erythema were observed immediately after treatment. In general, re-epithelization occurred within two weeks post-treatment. Post-treatment erythema lasted for 3–4 weeks in 90% of the treated compound or dermal nevi. Erythema lasted for 12 weeks in 10% of the nevi. On dermoscopic examination, the globular pattern was found to be the most common pattern of compound and dermal nevi. It is characterized by a pigmented network covering most parts of the lesion. Globular patterns in 585 (86%), thin

Figure 1. Three female patients presented with a compound nevi on their (a) forehead, (b) glabella, (c) infraorbital localisations. No side effects were observed 12 months after only one session laser treatment (d,e,f).

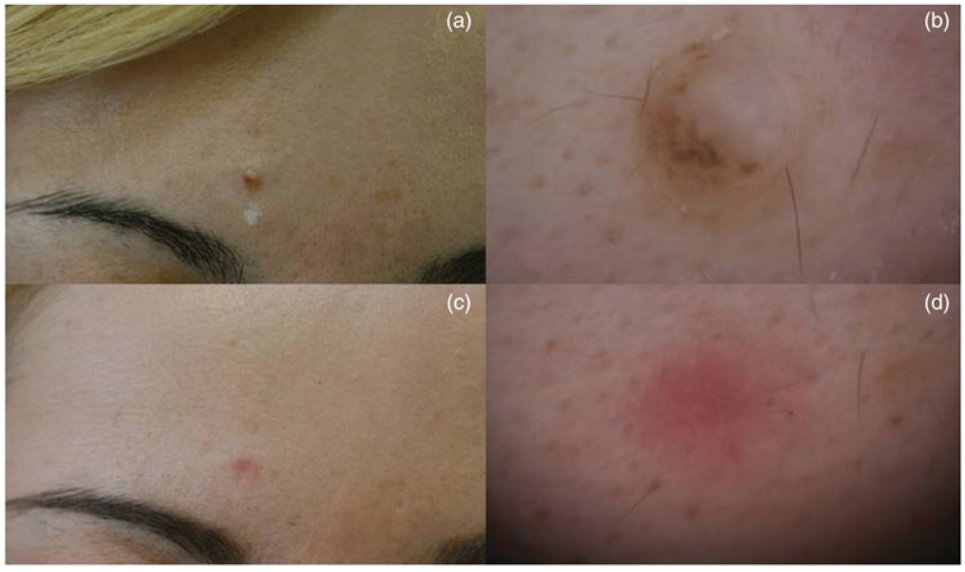

Figure 2. Twenty-five-year-old female presenting with compound nevi on her forehead measuring 4 mm diameter with clinical photography and dermoscopic images. Focal globular network with ovoid globules appearance before treatment (a/b). Slight erythema was observed two months later post-treatment clinically and dermoscopically (c/d).

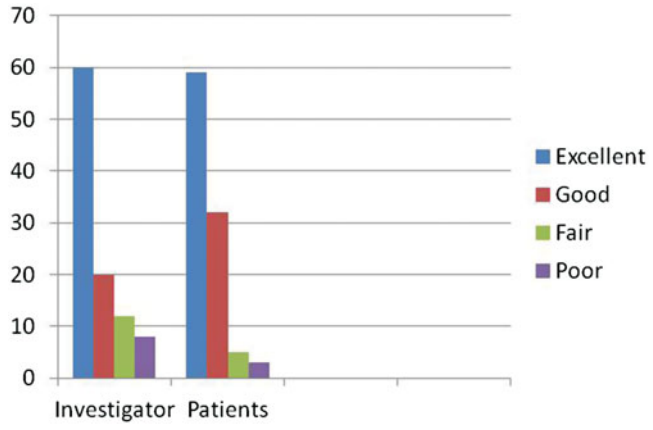

Figure 3. Global assessments scores (GAS) with the respect to the investigator and patients at the end of the one year.

reticular patterns in 446 (65%), diffuse hypopigmentation in 417 (61%), diffuse hyperpigmentation in 375 (55%), and comma-like vascularization in 275 (40%) were found before treatment. Figure 2 shows that clinical photography and dermoscopic images in one patient before and one month later after treatment.

Satisfaction

With the respect to the investigator, 60% of the patients were rated as excellent, 20% patients were rated as good, 12% patients were fair, and 8% were poor with respect to response to CO_2 fractional laser treatment based on the GAS scores. In contrast, for patients' GAS scores at the end of one year, 59% rated treatment as excellent, 32% good, 5% fair, and just 3% of the patients rated treatment as poor (Figure 3).

Side effects

Side effects were detected as clinically and dermoscopically. Eighty eight different types side effects were seen in 60 patients (18%), and the majority was temporary and mild in intensity. At the one year follow-up, hyperpigmentation in 23 (4%), fibrosis in 20 (3%), dimples in 12 (2%), recurrences in 15 (2%), scars in 12 (2%), and hypopigmentation in 6 (1%) were observed as side effects. Two patients presented with side effects on Figure 4.

Discussion

There are many treatment options for compound/intradermal nevi that are described in the literature. These include dermabrasions, cryosurgery, surgical excision, and laser treatment. Surgical excision is the most common option, but it leads to postoperative linear scarring (1). Many types of laser have been used for compound/intradermal nevi treatment, including either pigment or ablative lasers or a combination of the two groups of lasers (8,12,17–19). Pigment lasers are effective only for upper dermal nevus cells; since they cannot reach deeper part of the nevus cells, some nevus cells may not be targeted (5,10,11). On the contrary, ablative laser such as Erbium:YAG and CO_2 lasers reach the reticular dermis for complete removal of nevus cells. These lasers can be arranged for shallower thermal injury, and they also require shorter re-epithelialization time (9,16,20). CO_2 lasers use a wavelength of 10.600 nm and penetrate past the stratum corneum into the epidermis. The laser beam absorbs water in human tissues, and converts it to thermal energy, thus leading to tissue evaporation (14). The main modes of CO_2 laser action in the dermal nevi are fragmentation, vaporization, and ablation. CO_2 laser induces fresh ulcers followed by primary wound healing occur. After that process, granulation and re-epithelization are complete in two weeks.

We are concerned with the analysis of the nevus using noninvasive imaging techniques such as dermatoscopy. Dermatoscopy was used in this situation not only to help observe the benign condition of the nevus before treatment, but also to determine the presence the structure of the nevus cells after treatment. In cases of excessive irradiation, laser treatment can be associated with scarring. To prevent scarring, we controlled the skin surface using dermatoscopy during the laser therapy. We started laser energy between 4 and 6 mJ and fluence 20 mJ/cm^2 at first session followed by decreasing energy (3–5 mJ) applied gradually if nevus cells structure in the lesions are detected using dermatoscopy. Ablation of the nevi was done with approximately 50–100 μm.

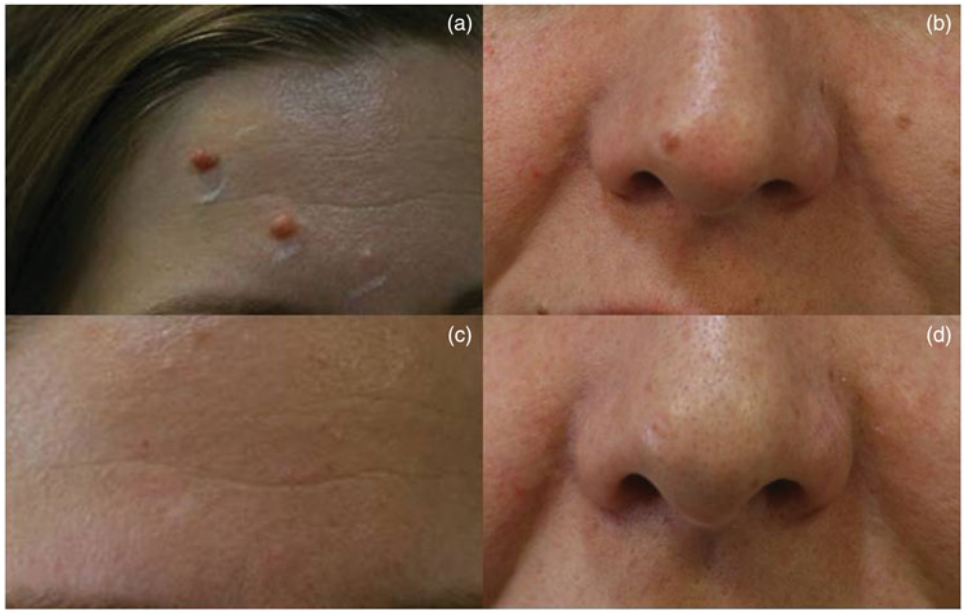

Figure 4. Two patients presented side effects (a): Thirty-one-year-old female presented with three dermal nevi on her forehead, (c): Slight hypopigmentation was noticed on the middle one after one session treatment, (b): Forty-two-year-old female presenting with compound nevus tip of the nose, (d): Dimple was detected at the one year.

This indicated that ablations were performed lower than the reticular dermal layer (middermis). After CO_2 laser treatment, the surfaces became irregular followed by complete healing after 3–4 weeks in general. We can speculate that slight ablation can cause successful results without any serious side effects in our cases. In totally, 100–200 μm ablation will not cause scarring, and tissue healing occurs in a short period of time.

CO_2 lasers have been used alone or combined with other pigment or ablative lasers (7,14). Hammes et al. declared that CO_2 laser was found to be effective treatment for melanocytic nevus but with scarring risk. In this study, 130 intradermal nevi were removed using combined therapy with CO_2/erbium:YAG and ruby lasers. After therapy, 2.3% of the intradermal nevi recurred as a pigmented macule, while 6.9% reappeared as a papule or nodule. Ninety-nine percent of the patients were very satisfied or satisfied with the result (7). In contrast, August et al. found that treatment success was based on the type and location of the melanocytic nevus. Mammillated congenital melanocytic nevus (CMN) responded better to CO_2 laser treatment when compared to macular CMN (15). Ozaki et al. performed serial excisions with a CO_2 laser for facial melanocytic nevi with diameter between 5 and 10 mm. They found that the CO_2 ablative laser was effective without any significant side effects for melanocytic nevi (14).

It has been estimated that the lifetime risk for acquired melanocytic nevi on any 20-year-old that undergoes individual transformation into melanoma by age 80 is ∼0.03% for men and ∼0.009% for women (22). In the last report, it was described that dermoscopic examination can be helpful in understanding the benign morphology of nevi before laser treatment. It was concluded that individuals with ≥50 melanocytic nevi have an increased risk for melanoma, and they also carry the risk for melanoma (23).

Laser-induced malignant transformation of nevus cells remains a theoretical concern, but such concerns have not been found in actual in clinical settings (15,21,22).

The possible mutagenic effect of lasers on nevomelanocytic nevus has been cited as an unestimated risk, but to date, there is no sufficient evidence to support this. It was demonstrated that 90% of presenting melanomas exhibit dermatoscopic changes within three months of the initial clinical presentations. This result shows that the probability of detecting an occult melanoma in a dermatoscopically stable pigmented lesion is small (23). Imayama et al. noticed that long- and short-term histological observation of congenital nevi treated with the normal-mode ruby laser. They could not find any histologic evidence about melanoma progressions in treated nevus (24). On the other hand, it was suggested that melanocytic cell load reduction with laser may adequately reduce risk of malignant transformation to an acceptable level (19). It is suggested that dermatoscopy or reflectance confocal microscopy should be used for evaluation of the nevus before laser treatment (25).

We presented a new approachment to treat compound and dermal nevi using CO_2 laser monitoring with dermatoscopy. CO_2 laser treatment has some advantages when compared with other non-ablative laser treatments. First, ablation of the papillary dermis removes the nevus cells with 2–3 passes with proper energy levels. CO_2 laser has not been applied to deeper parts of the dermis; therefore, scarring due to this regimen can occur. Second, using dermatoscopy is helpful for laser treatment management. Dermatoscopy is not only helpful for understanding ablation levels during treatment but also detects the nevus cell remnants and to decide the requirement of the new session again. Third, ablation of the nevus with laser leads to removal of most of the mid-dermal nevus components, and this had been confirmed in prevention of melanoma development. Fourth, it is beneficial for treating nevus located on the face in a sensitive area. With respect to side effects in our study, no severe complications were reported.

The main study limitation was the lack of histopathological examinations at the one-year follow-up. Acceptance of the taking skin biopsy from the nevus on the face is difficult because of probability the surgical scar formation. Positive cosmetic results demonstrated that this method has become a valuable way to treat compound/dermal nevi and it can be the best alternative option to a surgical resection.

In conclusion, to our knowledge, this study is the first and largest study in the literature that has investigated the efficacy of

CO_2 laser in compound and dermal nevi. Dermatoscopic examination should be performed by a dermatologist before laser treatment for compound and dermal nevi to eliminate premalignant and malignant lesions. In this study, we report that CO_2 fractional laser is regarded as the best option for compound/intradermal nevi due to its simple post-treatment care, fast recovery, lack of bleeding, and no serious side effects. It can be suggested that multiple nevi can be treated in a short time with CO_2 lasers, and post-operative care is easy and short. This method showed a good cosmetic outcome with a high degree of satisfaction as reported by both the physicians and the patients.

Disclosure statement

Author confirms that he has no interest with any commercial company.

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