J Cosmetic & Laser Ther 2003; **5**: 1–4
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Taylor&Francis healthsciences

Original Research

Ablation of cutaneous lesions using an erbium:YAG laser

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Received 20 September 2002
Accepted 12 May 2003

Keywords:
ablation – erbium:YAG – laser – skin lesions

BACKGROUND AND OBJECTIVE: **This study was performed to evaluate the effectiveness and safety of erbium:YAG laser in removal of cutaneous lesions.**
STUDY DESIGN: **Data were collected after removing 363 benign, pre-malignant and malignant lesions in 27 patients at a dermatology and cosmetic laser surgery center.**
RESULTS: **All lesions were completely removed. Eight of 363 lesions recurred and the histological analysis showed complete removal of one malignant lesion with erbium:YAG laser ablation. There were no long term or permanent complications.**
CONCLUSION: **Erbium:YAG laser is safe and effective in removal of cutaneous lesions.** *J Cosmetic & Laser Ther* 2003; **5**: 1–4

Introduction

The use of lasers for cosmetic purposes has revolutionized the field of cosmetic surgery. It has not only given several new options to physicians and patients but also brought affordability to a large new group of patients. Marketing of cosmetic surgery has risen to new levels as the population bulge of the 1950s and 1960s has reached the stage where its possibilities have become relevant. Introduction of CO_2 laser skin resurfacing (LSR) and its media coverage brought laser terminology into common usage. In 1997 FDA cleared erbium:YAG laser for resurfacing and since then it has been used for LSR. It is an effective device for resurfacing and has a faster recovery time and fewer side effects when compared to the CO_2 laser resurfacing.[1] There are several published studies demonstrating the effectiveness of laser resurfacing.

Er:YAG laser has a wavelength of 2.94 µm, which has an absorption level in water 16 times greater than that of the CO_2 laser.[2] This property makes it an ideal tool for tissue ablation. Each pass of Er:YAG laser removes a thin layer of skin and the depth of ablation can be controlled by altering the effective fluence. Er:YAG laser has been used for conditions other than the resurfacing of wrinkle and acne scars.[3,4,5,6,7] Epidermal lesions can be removed without damaging the dermis, minimizing the risks of scarring. Er:YAG laser can be used to ablate or remove many benign, pre-malignant and superficial malignant cutaneous lesions. It can be used to remove or treat seborrheic keratosis, actinic keratosis, lentigines, epidermal nevus, benign nevi, xanthelasma, syringomas, sebaceous hyperplasia, warts, melasma, milia, acrochordons, dermatosis papilosa nigra, hypertrophic scars, rhinophyma, superficial basal cell carcinoma, squamous cell carcinoma in situ (Bowen's Disease), etc. The data presented here were collected to evaluate the safety and effectiveness of erbium:YAG laser in removing cutaneous lesions.

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Materials and methods

Ten female and seventeen male patients with skin types I to IV with various cutaneous lesions were treated with erbium:YAG laser at a private dermatology and cosmetic laser surgery center. The youngest patient was 22 and the oldest was 67 with an average age of 48. The first patient was treated in September 1999 and the last one in March 2002. An Er:YAG laser (Dermablate, Carl Zeiss Meditec

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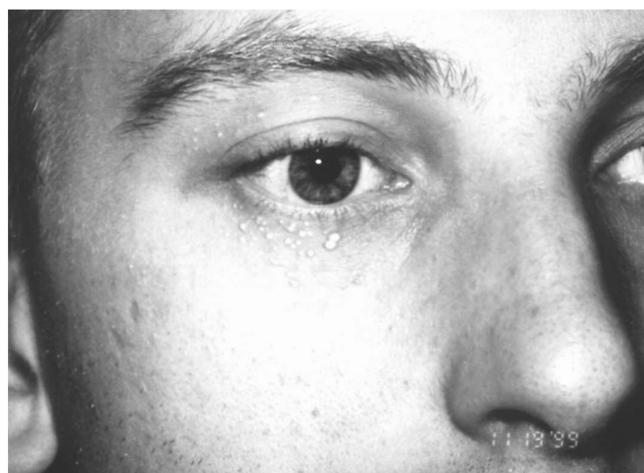
AG, Jena, Germany) with a wavelength of 2.94 μm was used with a fixed pulse width of ~250 μs. All patients signed an informed consent after initial consultation. Patients' eyes were covered with wet gauze and all personnel in the operating room used protective goggles and masks. A smoke evacuator was used. A fluence of 5 to 60 J/cm^2, spot size 1.5, 3.0 and 5.0 mm, with repetition rate of 1, 2, 4 or 8 Hz was used to ablate benign, pre-malignant and superficial malignant skin lesions. Depending upon the nature, size, thickness, number and site of the lesions, various different parameters of treatment were used. For example one patient with multiple milia in peri-orbital area underwent traditional resurfacing procedure to remove all lesions with one treatment (Figure 1). A single lesion of milium needed one pulse with a 1.5 mm spot and a fluence of 60 J/cm^2 to ablate the lesion and wiping with a piece of gauze or a Q tip removes the contents of the milial cyst. A small, light brown superficial solar lentigo required only three passes with a 5 mm handpiece (Figure 2) and a fluence of 10 J/cm^2 whereas a dark brown lesion needed six passes with the same parameters. If the lesions were bulky and raised, a smaller handpiece (1.5 mm) was used to obtain high fluence in order to debulk the lesion. A larger handpiece (5 mm) with lower fluence was then used to make the ablated area smoother and even, and edges were treated for blending.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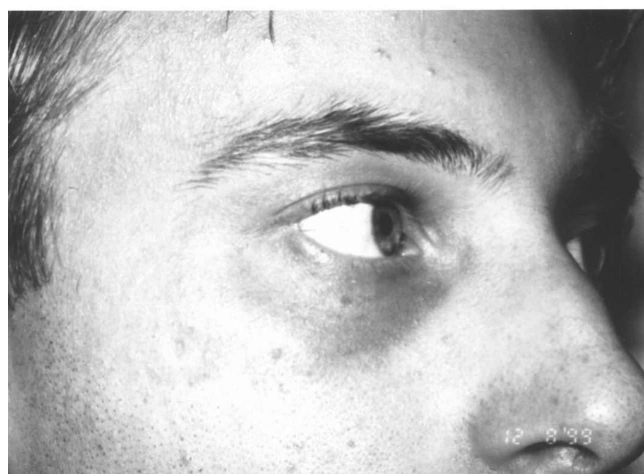
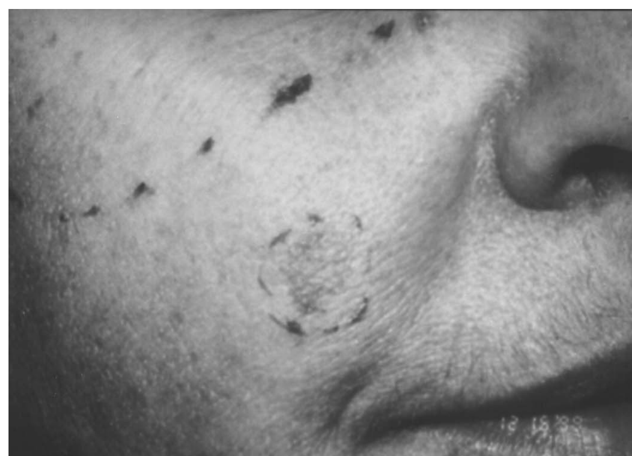

(B)

Figure 1
(A) and (B) Laser ablation of milia, before and 3 weeks after treatment (10 J/cm^2, 5 mm spot, four passes, 8 Hz).


(A)

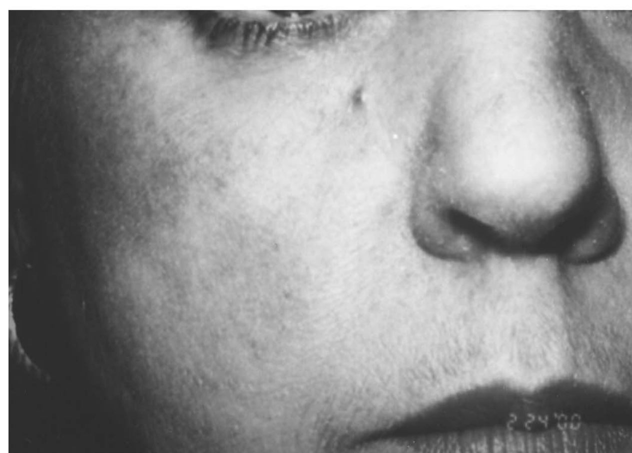

(B)

Figure 2
Laser ablation of solar lentigo, before and 2 months after treatment (10 J/cm^2, 5 mm spot, three passes, 4 Hz).

In general, all lesions were exposed to the laser pulses until they were visibly removed. Photographs were taken before and after treatment at all follow-up visits. All patients were seen one week after treatment and follow-up visits ranged from three months to more than a year after initial treatment. A total of 363 lesions were treated. Data of specific lesions are given in Table 1. A surgical excision was performed and microscopic evaluation was carried out

Lesion	Number	Lesion	Number
Achrocordon	92	Nevus	20
Milia	80	Xanthelasma	03
Seborrheic keratosis	79	Actinic keratosis	02
Solar lentigo	34	Verruca vulgaris	01
Sebaceous hyperplasia	26	SCC in situ	01
Syringoma	25		

Table 1
Specific lesions removed with laser ablation.

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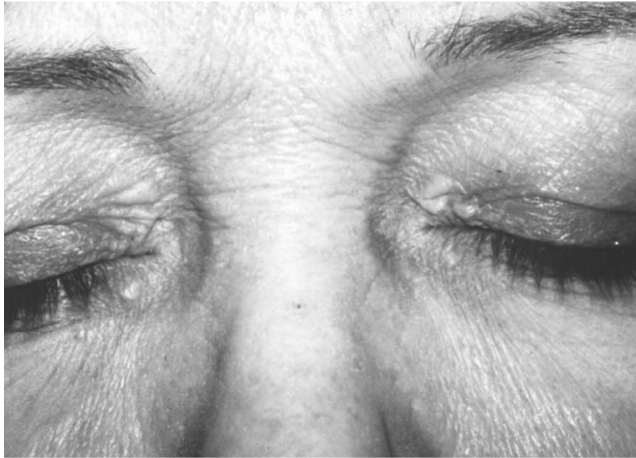
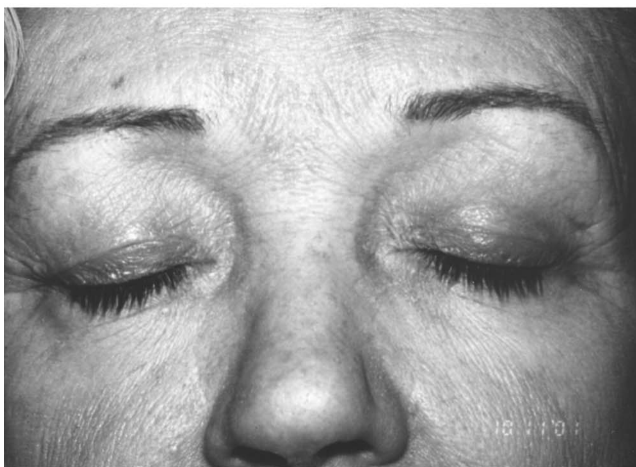


(A)



(B)

Figure 3
(A) and (B) Laser ablation of xanthelasma, before and 9 months after treatment. (56 J/cm^2, 1.5 spot, six pulses, 2 Hz).

after the ablation of squamous cell carcinoma in situ, in order to verify that complete removal had been achieved with laser ablation.

Results

All lesions were removed successfully at the time of treatment (Figures 1–4). Two patients had recurrence and needed further treatment. At the time of submission of this manuscript, total number of recurrent lesions was 8 out of 363, a rate of 2.2%. Five of these lesions were sebaceous hyperplasia and three were solar lentigines. A microscopic evaluation confirmed the complete ablation of squamous cell carcinoma in situ. Familiar levels of erythema, swelling and pinpoint bleeding associated with the use of erbium:YAG laser were noted. None of the patients experienced any side effects, including infection, scarring or permanent change in pigmentation. These data suggest that erbium:YAG laser is another safe and effective device that can be used to remove benign, pre-malignant and superficial malignant cutaneous lesions. The recurrence rate is low and the risk of complications is minimal.

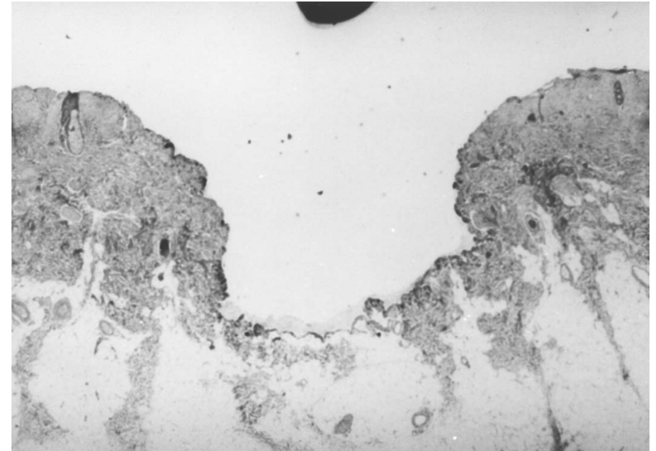


Figure 4
Laser ablation of SCC in situ, immediately after treatment – H & E. (10 J/cm^2, 5 mm spot, ~20 passes, 8 Hz).

Discussion

Until recently a very small number of people opted for cosmetic surgery and generally they wished to maintain confidentiality. Cosmetic surgery has become more acceptable in society and a growing number of female and male patients are undergoing various types of cosmetic treatments. Lasers are now part of general vocabulary. Most people with obvious or disfiguring facial growths had to tolerate them for life or received treatment through third party insurance. With diminishing health care coverage and increasing awareness of cosmetic procedures, more people are choosing to have unsightly growths removed. While physicians from all specialties are treating these lesions, dermatologists are responsible for the majority of them.

The discipline of dermatology has changed significantly in recent years. More recently-qualified dermatologists perform surgical and cosmetic procedures which have become part of dermatology practice only recently. The use of lasers has revolutionized dermatology since the pulsed dye laser was first used, based on the theory of selective photo-thermolysis.[8] All dermatologists treat patients affected by various skin growths. Most of these lesions can be treated with a variety of surgical methods, including excision, shave removal, cryosurgery, cauterization, etc.

There is significant awareness in the general population on the use of lasers through the media, and through marketing by the laser industry and laser surgeons. This has created a general perception that lasers are preferable surgical tools. They are considered to be at the leading edge of technology, and most patients prefer laser treatment compared with traditional surgical methods. The potential advantage of Er:YAG laser over other methods of treatment is that it gives the surgeon a precise control over tissue removal with a minimal risk of scarring. We collected this data form our patient population to evaluate the safety and effectiveness of Er:YAG laser. The data show that Er:YAG laser can be used safely and effectively to remove cutaneous lesions. Great care is needed when removing malignant or pre-malignant lesions. It is safe

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to laser ablate superficial skin cancers, i.e. superficial basal cell carcinoma and squamous cell carcinoma in situ. Extreme caution is needed when removing nevi. Nevi should not be removed by any method which would not allow a microscopic diagnosis in any patient with personal and/or family history of melanoma or dysplastic nevi. Any nevus that appears atypical should be biopsied before laser ablation.

It remains unclear if the use of Er:YAG laser ablation is superior to any other traditional methods of removing cutaneous lesions. Further comparative studies are needed to evaluate different modalities.

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