

Comparison of the Clinical Effectiveness of Excimer Lamp and Laser for Vitiligo: A Randomized Trial

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Abstract: 308 nm excimer laser and the 308 nm excimer lamp have demonstrated effectiveness in the treatment of vitiligo, but a direct comparison of their effectiveness has never been made. The purpose of the work is to evaluate the effectiveness of excimer laser and lamp phototherapy for the treatment of limited forms of vitiligo. A randomized study was conducted. One lesion was treated with a 308 nm excimer laser, and the other symmetrical lesion was treated with a 308 nm excimer lamp. The lesions were treated 3 times a week with equal doses on both sides for 20 procedures. The evaluation was carried out by two independent groups of dermatologists who were blinded to the treatment, using photographs under normal light and using a Wood's lamp. The study included 50 patients, 100 lesions were treated - 2 lesions in each patient. Both treatments showed similar results in terms of repigmentation efficiency of at least 50% ($p = 0.006$). The excimer lamp and the 308 nm excimer laser have shown similar efficacy in the treatment of vitiligo. At the same fluence, the lamp produces more pronounced erythema, indicating photobiological differences between the two devices.

Keywords: 308 nm wavelength; excimer laser with a wavelength of 308 nm; phototherapy; vitiligo.

Non-segmental vitiligo is an acquired chronic pigmentation disorder characterized by the presence of depigmented patches, often symmetrical, corresponding to a significant loss of functioning epidermal and sometimes follicular melanocytes. The frequency of occurrence is 3% of the general population, regardless of gender and race. The exact pathophysiology of the process has not been studied. The quality of life of patients with vitiligo is significantly reduced.

The main treatment for generalized vitiligo is narrow-band ultraviolet B (UVB) phototherapy, and local treatment with topical corticosteroids or calcineurin inhibitors is preferred for localized forms.

Initially reported in 2002, the 308 nm excimer laser and 308 nm excimer lamp have proven effective in the treatment of localized forms of vitiligo.

Both devices are approved for use. But despite the fact that an excimer lamp and a laser use the same wavelength, these devices are characterized by different radiation properties.

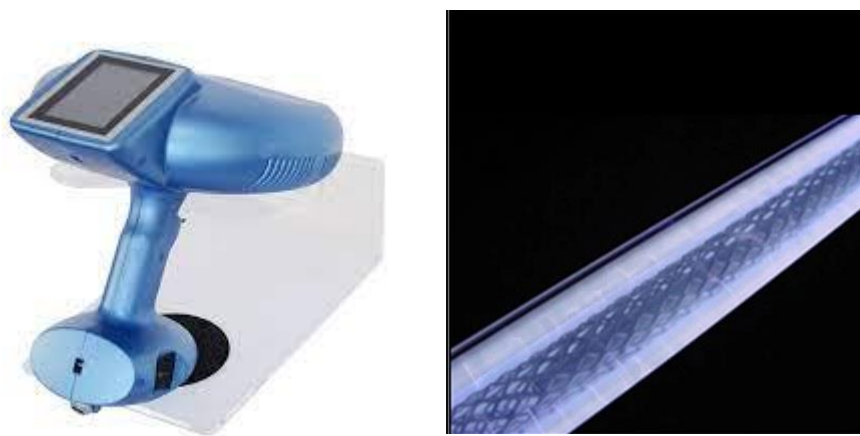
Their cost is not equivalent, since lasers are about 10 times more expensive than lamps. There have been no comparative studies of these two types of devices for the treatment of vitiligo.

The purpose of this work is to determine the therapeutic efficacy of the equivalence of a 308 nm excimer lamp and a 308 nm excimer laser for the treatment of vitiligo.

Materials and methods

We conducted a prospective monocentric randomized comparative study of the 308 nm excimer laser (Xtrac XL" Photomedex Inc. ", USA) and an excimer lamp with a wavelength of 308 nm (" Quantel Medical ").

After obtaining informed consent, the study included 20 patients observed in the dermatology department of the Andijan Regional Center for Dermatological and Venereal Diseases. The study included adult patients with symmetrical vitiligo lesions measuring at least 10 cm² that appeared over a period of 3 months or more. Exclusion criteria were pregnancy, a history of cancer or other contraindications for phototherapy (photodermatoses, taking photosensitive drugs), topical or systemic therapy 4 weeks before inclusion in the study, and phototherapy 12 weeks before the study.



Rice. 1. Appearance of a 308 nm excimer lamp and a 308 nm excimer laser.

Each patient had 2 to 8 symmetrical vitiligo lesions treated. Laser and lamp treatment of lesions was carried out on symmetrical lesions. The minimum erythematous dose (MED) was determined for both the lamp and the laser (Fig. 2). If the MED for both devices was different, the lower dose was used as the reference to determine the primary treatment dose. Subsequently, after every second procedure, the dose was increased by 50 mJ cm².

If erythema persisted for more than 48 hours, the dose was reduced to suberythema. The lamp and laser power for symmetrical lesions remained the same. The diameter of the laser beam was 25 mm, the working surface area of the lamp was 16 cm². In order to avoid overlap of pulses and treatment of healthy skin areas, a smaller spot diameter (up to 10 mm) and a working window for the laser and lamp, respectively, were used. Treatment was carried out 3 times a week on certain days (every Monday, Wednesday and Friday), a total of 20 procedures.

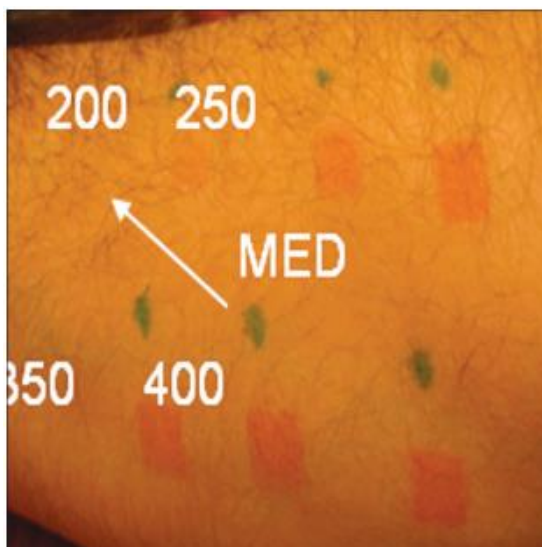
Digital photographs were taken under normal and UV lighting before treatment, after 20 procedures, and 1 month after the last procedure. The main criterion for assessing repigmentation by the two groups of dermatologists was the degree of repigmentation greater than 50% at the last visit compared with the baseline level in each treatment group. During each procedure, the tolerability of the previous procedure was assessed using a visual analog scale from 0 (perfect tolerability) to 10 (minor pain). Possible side effects were also noted, including severe erythema.

Equivalence was determined using the paired lesion equivalence scale.

A difference of 10% was considered acceptable. To determine differences in lamp and laser DER, the Student's t test for paired lesions was used.

Results

Phototype V , 1 had phototype IV , 6 had phototype III, and 38 had phototype II . The female:male ratio was 1.4:1. The average age of patients was 35 years (from 20 to 52 years), the average duration of the disease was 15 years (from 3 to 35 years). All but 2 patients had already received at least one of the other treatments, with no apparent effect. Repigmentation was observed in 35 (70%) patients.



Rice. 2. Determination of the minimum erythral dose.

A total of 50 lesions were treated with a laser and 50 with a lamp; repigmentation was observed on 42 (40%) lesions, of which on 20 (42%) lesions after the laser and on 20 (38%) after the lamp (Fig. 3, a , b). There were 14 paired lesions located in difficult-to-treat areas (limbs and bony protrusions), 16 on the face, and the rest on other parts of the body. In 15% of cases, the degree of repigmentation reached 50% or less for both devices. The average repigmentation rate for the laser is 1.6, for the lamp - 1.8. The average repigmentation rate for bony prominences and limbs is 0.3 and 0.3; for other parts of the body - 2.1 and 2.4 for the laser and lamp, respectively. Regarding the repigmentation score (3 and 4 more than 50%), lamp and laser are equivalent ($p = 0.006$).

Both treatment methods were well tolerated. The appearance of severe erythema was observed in 1 patient after phototherapy with an excimer lamp and in 3 patients after phototherapy with an excimer laser. There was a difference between the DER values of the laser (278 mJ cm²) and the lamp (223 mJ cm²) ($p = 0.06$). Most patients experienced mild, long-lasting erythema after lamp treatment with no effect on tolerability (average tolerability scores ranged from 5 to 10 for lamp and 5 to 10 for laser).



Rice. 3. A patient with vitiligo before phototherapy with a UVB 308 nm excimer lamp (a) and 1 month (b) after the end of treatment (20 procedures).

Discussion

The study proved the equivalence of the excimer laser and the 308 nm wavelength lamp in the repigmentation of vitiligo lesions. Tolerability and satisfaction with the procedure were similar for both treatments. Interestingly, the lamp produced more erythema than the laser at the same dose for both devices.

Two hypotheses can be considered. Unlike a laser, a lamp does not emit a strict monochromatic spectrum (between 306 and 310 308 nm with a peak at 308 nm). Wavelengths close to 300 308 nm cause more pronounced erythema without increasing effectiveness. However, most of the radiation occurs at 308 nm , with only very small portions at 306 and 307 308 nm . Therefore, such a hypothesis is unlikely to explain erythema. Another explanation may be due to the different physical properties of lasers and lamps. The 308 nm excimer laser produces pulsed (200 Hz), coherent radiation, while the 308 nm excimer lamp produces nearly continuous, incoherent radiation. Additionally, a lamp takes longer than a laser to deliver the same energy density, and with UV radiation , the time required to deliver a similar dose can be potentially carcinogenic.

308 nm excimer lasers confirm that they can be similar to narrowband UVB phototherapy. However, data on the potential differences in photobiological effects of laser and UV lamp are lacking. The differences we observed in the intensity of erythema induced by the excimer lamp and the 308 nm laser at the same fluence suggest that these two devices may have different photobiological effects at the cellular level.

Conclusions. Thus, the effectiveness of the 308 nm excimer laser and the 308 nm excimer lamp is equivalent in vitiligo repigmentation . Although both devices provide approximately the same wavelength, they are not completely comparable. Thus, a laser and a lamp differ in terms of physical properties and cost. The 308 nm excimer lamp produces more severe erythema than the 308 nm excimer laser , presumably causing different photobiological effects that require further study. Although the 308 nm excimer laser allows the procedure to be performed faster, it remains unreasonably expensive, both in terms of the cost of the device itself and its maintenance, which limits its use. An excimer lamp with a wavelength of 308 nm is more compact, much cheaper and practically does not require maintenance, which allows this type of phototherapy to be carried out in most specialized medical institutions.

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