BJD
British Journal of Dermatology

308-nm excimer lamp vs. 308-nm excimer laser for treating vitiligo: a randomized study

F. Le Duff, E. Fontas,* D. Giacchero, L. Sillard, J.-P. Lacour, J.-P. Ortonne and T. Passeron†

*Departments of Dermatology, *Clinical Research, University Hospital of Nice, Rte de St-Antoine de Ginestiere, 06200 Nice, France and †Department of Dermatology and INSERM U895 team 1, University Hospital of Nice, France.*

Correspondence
Thierry Passeron.
E-mail: passeron@unice.fr

Accepted for publication
9 March 2010

Key words
308-nm excimer lamp, 308-nm excimer laser, phototherapy, vitiligo

Conflicts of interest
The authors received a research grant from Quantel®.

DOI 10.1111/j.1365-2133.2010.09778.x

Summary

Background The 308-nm excimer laser and 308-nm excimer lamp have both been shown to be effective in treating vitiligo but a direct comparison has never been performed.

Objectives To test the equivalence of these two devices for treating nonsegmental vitiligo.

Patients and methods A randomized monocentric study was undertaken. One lesion was treated with the 308-nm excimer laser and its counterpart with the 308-nm excimer lamp. Lesions were treated twice weekly with the same dose on both sides for a total of 24 sessions. The evaluation was done by two independent physicians blinded to the treatment on direct light and ultraviolet light photos.

Results Twenty patients were included: 17 completed the study and 104 lesions were treated. The two treatments showed similar results in terms of efficacy for a repigmentation of at least 50% ($P = 0{\cdot}006$). The lamp induced more erythema than the laser.

Conclusions The 308-nm excimer lamp and laser showed a similar efficacy in treating vitiligo. For the same fluence, the lamp induced more erythema suggesting photobiological differences between the two devices.

Nonsegmental vitiligo is an acquired chronic pigmentation disorder characterized by white patches, often symmetrical, corresponding to a substantial loss of functioning epidermal and sometimes follicular melanocytes.[1] About 0·5–2% of the general population is affected with no sexual or racial predominance.[2] The exact pathophysiology is still unknown but there is increasing evidence supporting the role of the immune system.[3–6] People affected by vitiligo have a vast reduction of their quality of life.[7] The treatment of choice for generalized vitiligo is narrowband ultraviolet (UV) B phototherapy while topical treatments with topical steroid or calcineurin inhibitors are preferred for localized forms.[8,9] Since the first reports in 2002, the 308-nm excimer laser and 308-nm excimer lamp have shown efficacy for treating localized vitiligos.[10–18] Both types of device are approved by the U.S. Food and Drug Administration (FDA) for treating vitiligo. However, although the excimer lamp and laser use the same wavelength, they are different devices with distinct radiation properties. Their costs are not equivalent as lasers are about ten times more expensive than lamps. No head-to-head trial has ever been performed to compare these two types of device in vitiligo treatment. The objective of this study was to test the equivalence of the 308-nm excimer lamp and the 308-nm excimer laser for treating symmetrical vitiligo.

Patients and methods

We conducted a prospective monocentric randomized comparative study with the 308-nm excimer laser (TALOS®; Quantel Medical, Clermont-Ferrand, France) and 308-nm excimer lamp (308®; Quantel Medical). The study was submitted to the local ethical committee (no. 08.026) and was registered on http://clinicaltrials.gov (NCT00696358). Twenty consecutive patients were included who were seen in the Department of Dermatology of University Hospital of Nice between May 2008 and March 2009 after informed consent was obtained. Adult patients with symmetrical vitiligo lesions of at least 10 cm^2 evolving for at least 3 months were included. Exclusion criteria were pregnancy, personal history of skin cancer or radiotherapy on the area treated or other contraindications for phototherapy (photodermatosis, photosensitive treatments), leucotrichia, topical or systemic treatment 4 weeks before inclusion, and phototherapy 12 weeks before inclusion. Vitiligo history, medical history, treatment(s) received for vitiligo and other treatments were recorded for each patient. In each patient two to eight symmetrical vitiligo patches were treated. In a pair, laser treatment was randomly assigned to a patch, lamp treatment was used on the counterpart lesion. Minimal erythemal dose

© 2010 The Authors
Journal Compilation © 2010 British Association of Dermatologists

(MED) was assessed for both lamp and laser. If the MED obtained with the two devices was different, the lower dose was chosen as reference to determine the initial treatment dose. Doses were then increased by 50 mJ cm^{-2} every two sessions.[14] If erythema lasted more than 48 h or if blisters were observed, the doses were decreased to the highest doses that did not induce such side-effects. The fluence was kept exactly identical for lamp and laser for the same pair of symmetrical patches. The diameter of the laser beam was 25 mm and the surface area of treatment with the lamp was 16 cm^2. In order to avoid overlap with pulses and onto normal skin, smaller beam diameters (down to 10 mm) and masks were used for laser and lamp, respectively. Treatment was conducted twice weekly on nonconsecutive days (every Tuesday and Friday) for 24 sessions.

Digital photographs with direct and UV light [Finepix S1 Pro Fuji® (Fujifilm Corporation, Tokyo, Japan) with UV filter (Canfield Scientific, Inc., Fairfield, NJ, U.S.A.)] were taken before treatment, at the end of the 24 sessions and 1 month after the last session. The evaluation of repigmentation was made by blinded comparison of pictures between the first and final visit by two independent observers. In case of discordance, a third observer was involved. A score was attributed between 0 and 4 (0, 0%; 1, 1–25%; 2, 26–50%; 3, 51–75%; 4, 76–100%). The main criterion used was the rate of repigmentation > 50% (score 3 and 4) at the final visit compared with baseline in each treatment group. At each session an evaluation of the tolerance of the previous session was done using a visual analogue scale ranging from 0 (perfect tolerance) to 10 (intolerable pain). Potential side-effects including erythema were also noted.

Testing for equivalence was performed using the equivalence score test for paired data.[19] An acceptable prespecified difference of 10% was used. To evaluate the difference between light and laser MED we used Student's t-test for paired samples.

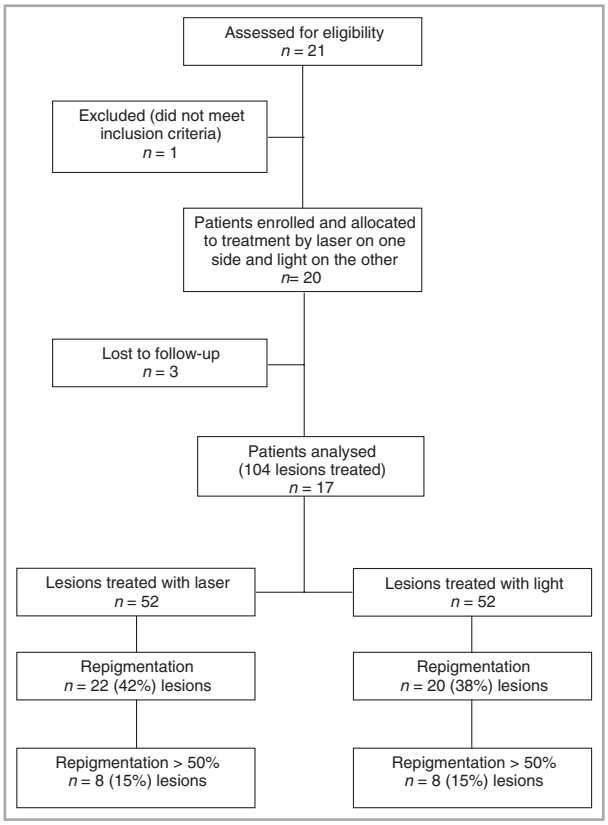

Fig 1. Flowchart of the 20 patients included in the trial.

Results

Of the 20 patients included, 17 were analysed (three withdrew for professional reasons) (see Fig. 1). Five patients (29%) were phototype V, one (6%) was phototype IV, six (36%) were phototype III and five (29%) were phototype II. The sex ratio (female : male) was 1·4 : 1. The mean age was 38 (range 21–54) years. The median duration of the disease was 17 (range 3–35) years. All patients except two had already been treated with at least one other treatment and failed to respond. Repigmentation was observed in 12 patients (70%). A total of 104 plaques were treated (52 with laser and 52 with lamp) and 42 (40%) achieved a repigmentation [22 (42%) with the laser and 20 (38%) with the lamp]. Fourteen pairs of lesions were located on difficult to treat areas (extremities and bony prominences), 16 were located on the face and the rest were located on other parts of the body. A repigmentation rate of at least 50% was achieved for 15% of the patches for both devices. The mean repigmentation score was 1·6 for the laser and 1·8 for the light. The mean repigmentation score for bony prominences and extremities was 0·3 and 0·3 and for the rest of the body 2·1 and 2·4 for laser and light treatments, respectively. In relation to repigmentation scores (3 and 4 being > 50%), light and laser were equivalent ($P = 0{\cdot}006$) (Fig. 2).

Both treatments were well tolerated. One blister was observed with the lamp and three with the laser. A difference between the mean MED of the laser (278 mJ cm^{-2}, SD 174) and the light (223 mJ cm^{-2}, SD 136) was noted ($P = 0{\cdot}06$) (Fig. 3). The majority of patients had persistent erythema with the lamp without consequence on the tolerance (mean tolerance of 5 of 10 for the lamp and 5 of 10 for the laser).

Discussion

Our study showed an equivalence between the 308-nm excimer laser and lamp to repigment vitiligo patches. Although 70% of the patients showed some repigmentation, only 15% of the patches obtained a repigmentation of more than 50%. This rate is surprisingly low compared with the literature, including previously reported data from our group.[11–17] However, many factors could explain these relatively low rates of repigmentation: the relatively limited number of sessions, several patches located in difficult to treat areas and the history of failure of previous therapies in 18 of the 20 patients treated. Of note, the lamp took a longer time to deliver the same dose

© 2010 The Authors

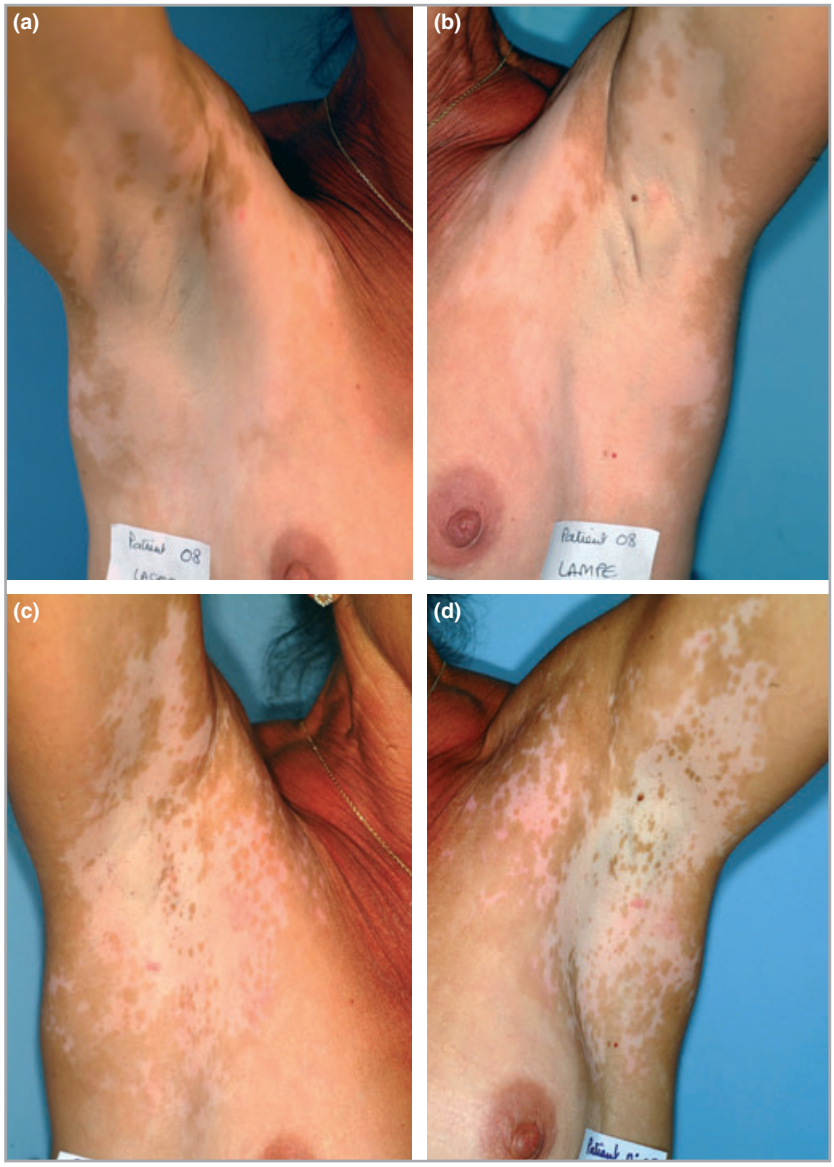

Fig 2. Clinical example of repigmentation after treatment with 308-nm excimer laser and lamp. (a) Laser side before treatment; (b) lamp side before treatment; (c) laser side 1 month after the end of the treatment; (d) lamp side 1 month after the end of the treatment.

as the laser (average power density 50 and 270 mW cm^{-2} for the lamp and laser, respectively). Although the difference is only a couple of seconds with low doses, it increases with the dose and can significantly extend the duration of sessions compared with the laser when relatively high doses are delivered on numerous and large lesions. The tolerance and the satisfaction rate were similar for both treatments. Interestingly, the lamp induced more erythema than the laser when the exact same doses were applied for both devices.

Two hypotheses can be considered. In contrast to the laser, the lamp does not emit a strict monochromatic spectrum [between 306 and 310 nm with a peak at 308 nm (Fig. 4)]. Wavelengths near 300 nm are known to be more erythematogenous without increasing efficacy.[20] However, most of the emission is delivered at 308 nm and only a very small proportion is emitted at 306 and 307 nm. Therefore, such a hypothesis appears quite unlikely to explain the erythema. Another explanation could relate to the differing physical properties of the lasers and lamps. The 308-nm excimer laser produces a pulsing (200 Hz), coherent radiation, while the 308-nm excimer lamp produces an almost continuous, incoherent radiation. Moreover, the lamp takes longer than the laser to deliver the same fluence, and some authors have shown that with UVA radiation the length of time needed to deliver a similar dose can influence potential carcinogenic effects.[21] The FDA and European approval of 308-nm excimer lasers considered that they could be assimilated to narrowband UVB phototherapies. However, no data are available on the potential differences of the photobiological effects of laser and lamp UV irradiation. The differences that we observed in terms of the intensity of the erythema induced by the 308-nm excimer lamp and laser for the same fluence suggest that these two devices could have different photobiological effects at the cellular level.

© 2010 The Authors
Journal Compilation © 2010 British Association of Dermatologists

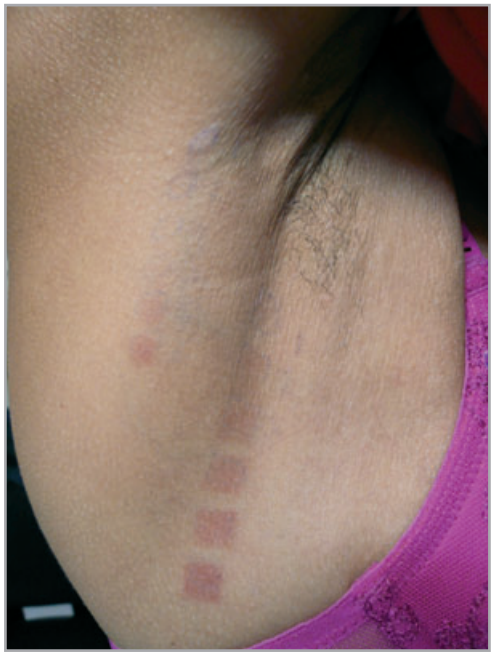

Fig 3. Minimal erythema dose (MED) difference between 308-nm excimer laser and lamp. Increased doses from top to bottom (100–550 mJ cm^{-2}); left side delivered with 308-nm excimer laser and right side delivered with 308-nm excimer lamp. Note that the MED is lower with the lamp.

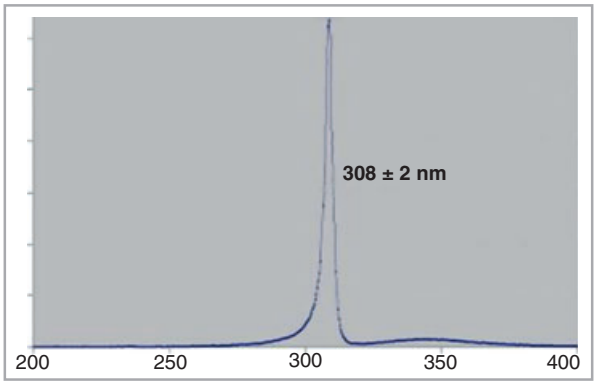

Fig 4. Spectral emission of the 308-nm excimer lamp used in the study.

In conclusion, the 308-nm excimer laser and the 308-nm excimer lamp are equivalent for inducing repigmentation of vitiligo. While both devices deliver roughly the same wavelength, they are not totally comparable. Indeed, the laser and lamp are different in terms of physical properties and cost. The 308-nm excimer lamp induces more erythema than the 308-nm excimer laser suggesting different photobiological effects that require further investigation. Although the 308-nm excimer laser allows quicker treatments, it remains expensive and its use is restricted to rare specialized centres. The 308-nm excimer lamp is smaller and less expensive and could allow 308-nm excimer targeted phototherapy to become more accessible.

What's already known about this topic?

- The 308-nm excimer laser and 308-nm excimer lamp have both been shown to be effective in treating vitiligo and they are both FDA approved in this indication.
- A direct comparison between these two devices has never been performed.

What does this study add?

- We have shown that that the 308-nm excimer lamp and laser showed similar efficacy in treating vitiligo.
- Although a bit slower than the laser, the cost/effectiveness ratio appears more favourable for the lamp.
- For the same fluence, the 308-nm lamp induced more erythema suggesting photobiological differences between the two devices that were thought to have similar effects as they share the same wavelength.

References

1 Taieb A, Picardo M. The definition and assessment of vitiligo: a consensus report of the Vitiligo European Task Force. *Pigment Cell Res* 2007; **20**:27–35.
2 Ortonne JP, Mosher DB, Fitzpatrick TB. Vitiligo and other hypomelanosis of hair and skin. In: *Monograph in Topics in Dermatology* (Parrish JA, Fitzpatrick TB, eds). New York: Plenum Press, 1983; 1–683.
3 Ongenae K, van Geel N, Naeyaert JM. Evidence for an autoimmune pathogenesis of vitiligo. *Pigment Cell Res* 2003; **16**:90–100.
4 Passeron T, Ortonne JP. Physiopathology and genetics of vitiligo. *J Autoimmun* 2005; **25** (Suppl.):63–8.
5 Jin Y, Mailloux CM, Gowan K *et al.* NALP1 in vitiligo-associated multiple autoimmune disease. *N Engl J Med* 2007; **356**:1216–25.
6 Spritz RA. The genetics of generalized vitiligo and associated autoimmune diseases. *Pigment Cell Res* 2007; **20**:271–8.
7 Ongenae K, van Geel N, De Schepper S *et al.* Effect of vitiligo on self-reported health-related quality of life. *Br J Dermatol* 2005; **152**:1165–72.
8 Gawkrodger DJ, Ormerod AD, Shaw L *et al.* Guideline for the diagnosis and management of vitiligo. *Br J Dermatol* 2008; **159**:1051–76.
9 Whitton ME, Ashcroft DM, Gonzalez U. Therapeutic interventions for vitiligo. *J Am Acad Dermatol* 2008; **59**:713–17.
10 Baltas E, Csoma Z, Ignacz F *et al.* Treatment of vitiligo with the 308-nm xenon chloride excimer laser. *Arch Dermatol* 2002; **138**:1619–20.
11 Spencer JM, Nossa R, Ajmeri J. Treatment of vitiligo with the 308-nm excimer laser: a pilot study. *J Am Acad Dermatol* 2002; **46**:727–31.
12 Leone G, Iacovelli P, Paro Vidolin A, Picardo M. Monochromatic excimer light 308 nm in the treatment of vitiligo: a pilot study. *J Eur Acad Dermatol Venereol* 2003; **17**:531–7.
13 Taneja A, Trehan M, Taylor CR. 308-nm excimer laser for the treatment of localized vitiligo. *Int J Dermatol* 2003; **42**:658–62.

© 2010 The Authors
Journal Compilation © 2010 British Association of Dermatologists

14 Ostovari N, Passeron T, Zakaria W *et al.* Treatment of vitiligo by 308-nm excimer laser: an evaluation of variables affecting treatment response. *Lasers Surg Med* 2004; **35**:152–6.
15 Hofer A, Hassan AS, Legat FJ *et al.* Optimal weekly frequency of 308-nm excimer laser treatment in vitiligo patients. *Br J Dermatol* 2005; **152**:981–5.
16 Hofer A, Hassan AS, Legat FJ *et al.* The efficacy of excimer laser (308 nm) for vitiligo at different body sites. *J Eur Acad Dermatol Venereol* 2006; **20**:558–64.
17 Casacci M, Thomas P, Pacifico A *et al.* Comparison between 308-nm monochromatic excimer light and narrowband UVB phototherapy (311–313 nm) in the treatment of vitiligo – a multicentre controlled study. *J Eur Acad Dermatol Venereol* 2007; **21**:956–63.
18 Xiang L. Once-weekly treatment of vitiligo with monochromatic excimer light 308 nm in Chinese patients. *J Eur Acad Dermatol Venereol* 2008; **22**:899–900.
19 Tango T. Equivalence test and confidence interval for the difference in proportions for the paired-sample design. *Stat Med* 1998; **17**:891–908.
20 Parrish JA. Phototherapy and photochemotherapy of skin diseases. *J Invest Dermatol* 1981; **77**:167–71.
21 Shorrocks J, Paul ND, McMillan TJ. The dose rate of UVA treatment influences the cellular response of HaCaT keratinocytes. *J Invest Dermatol* 2008; **128**:685–93.

© 2010 The Authors
Journal Compilation © 2010 British Association of Dermatologists • *British Journal of Dermatology* 2010

BB 06/2010/068