

Therapeutic Modalities for Localized Psoriasis: 308-nm UVB Excimer Laser Versus Nontargeted Phototherapy

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UVB phototherapy is an effective treatment modality for psoriasis. For patients with localized plaque-type lesions, 308-nm excimer laser phototherapy offers rapidly delivered, targeted, high UVB doses, while sparing adjacent healthy skin. We aimed to compare the advantages and disadvantages of the 308-nm xenon chloride (XeCl) UVB excimer laser with nontargeted broadband UVB (BB-UVB), narrowband UVB (NB-UVB), and psoralen plus UVA (PUVA) phototherapies. A PubMed search for studies evaluating the efficacy and safety of the laser versus nontargeted phototherapeutic modalities was conducted. Three prospective nonrandomized studies compared NB-UVB with excimer laser phototherapy. No head-to-head studies were found for BB-UVB or PUVA compared to excimer laser. Both the 308-nm excimer laser and nontargeted phototherapies were found to effectively clear localized psoriasis. Although it is proposed that excimer laser exclusively treats diseased skin with better response rates, split-body trials revealed no differences. Long-term studies are necessary to compare the effects of high-dose excimer laser regimens with nontargeted phototherapies.

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Phototherapy is an effective therapeutic modality typically used for moderate to severe psoriasis. Nontargeted subtypes include psoralen plus UVA (PUVA), broadband UVB (BB-UVB), and narrowband UVB (NB-UVB).¹ In recent years, the 308-nm xenon chloride (XeCl) UVB excimer laser has emerged as an innovative therapeutic option for localized plaque-type, palmoplantar, and scalp variants of psoriasis.

Compared to whole-body UV modalities, high fluences of UVB doses can be delivered to a limited area of the skin using the excimer laser, and the overall cumulative UVB doses for the excimer laser are approximately one-sixth of those of nontargeted UVB doses,^{2,3} thus unwanted side effects to healthy surrounding skin such as erythema as well as the potential increased risk for skin cancer can be minimized. Furthermore, fewer than 12 excimer laser treatments are necessary for clearance, and some patients may remain in remission for up to 2 years after the last treatment.^{4,5}

The use of the 308-nm XeCl UVB excimer laser is expected to be a future mainstay in the treatment of localized psoriasis compared to nontargeted subtypes. Although numerous studies have reported the efficacy of the 308-nm excimer laser for psoriasis, few studies directly compared the clinical effects of the laser with nontargeted phototherapeutic modalities. Our objective was to compare the advantages and disadvantages of the 308-nm XeCl UVB excimer laser with nontargeted BB-UVB, NB-UVB, and PUVA phototherapies.

Methods

A review of the literature on localized phototherapy as well as BB-UVB, NB-UVB, and PUVA phototherapy was conducted in August 2010 via a PubMed search of articles indexed for MEDLINE. The following search

Studies Comparing Efficacy of 308-nm UVB Excimer Laser With NB-UVB Phototherapy

Reference Study (Year)	Study Design	No. of Participants (Type of Psoriasis)	Treatment Regimen	Dose ^a	Duration of Treatment	No. of Treatments	Mean Cumulative Dose	Improvement	Side Effects	Conclusion
Bónis et al ³ (1997)	Prospective, nonrandomized	10 (chronic plaque psoriasis)	10 participants were treated with excimer laser 3× weekly; 6 participants were treated with 311-nm NB-UVB 5× weekly	Laser: 0.5 MED, then subsequent increase of 65 mJ/cm ² each session; NB-UVB: 130 mJ/cm ² with a 65 mJ/cm ² subsequent increase	Laser treatment was 2.27× shorter than NB-UVB	Mean no. of treatments for clearance was lower with laser (8.33 vs 30.1)	Laser: 4.81 J/cm ² ; NB-UVB: 31.1 J/cm ²	Lesions cleared in response to both treatments	Mild and transient hyperpigmentation on both treatment sides	Treatment of psoriatic lesions with excimer laser is more effective than NB-UVB treatment with respect to treatment duration, average no. of treatments, and cumulative dose
Goldinger et al ⁶ (2006)	Prospective, nonrandomized; right/left comparative, open, single-blind	15 (psoriasis vulgaris)	Participants were administered 308-nm excimer laser on one side and 311-nm NB-UVB on the other side 3× weekly for 4 wk	Laser: 200 mJ/cm ² and increased by 100 mJ/cm ² each session; NB-UVB: 200 mJ/cm ² and increased by 50 mJ/cm ² each session	4 wk	Total of 12 treatments for both modalities	N/A	Mean PASI reduction was 5.5 on excimer side and 4.9 on NB-UVB side; in 9 participants excimer laser yielded better results, in	Hyperpigmentation observed in 5 participants on both treatment sides	Both the excimer laser and NB-UVB are effective therapeutic options for psoriasis vulgaris management and the

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Goldinger et al ⁶ (2006) (continued)								4 participants NB-UVB showed better clearance, in 2 participants no difference between 2 sides was observed		difference in efficacy is not significant
Köllner et al ⁷ (2005)	Prospective, nonran- domized	15 (plaque psoriasis)	3 different lesions were treated with 308-nm excimer laser; 308-nm excimer non-laser lamp, and 311-nm NB-UVB; each at 3 treatments per wk	Initial dose of 1 MED with increase every 2 sessions for laser, lamp, and NB-UVB	10 wk or until clearing occurred	Mean no. of treatments for each modality to yield clearance	Laser: 52.9 J/cm ² ; lamp: 47.3 J/cm ² ; NB-UVB: 64.9 J/cm ²	Mean PSI score reduction was 6.8 for laser, 6.5 for lamp, and 7.5 for NB-UVB; complete remission in 4 laser participants, 3 lamp participants, and 7 NB-UVB participants	Hyperpigmentation, crusting, blistering, and erythema were more common in laser therapy (6/15) than lamp (4/15) or NB-UVB (4/15)	All 3 modalities are equally advantageous in clearing psoriatic lesions

Abbreviations: NB-UVB, narrowband UVB; MED, minimal erythema dose; N/A, not available; PASI, psoriasis area and severity index; PSI, psoriasis severity index.
^aUVB dose was reported either as joules per square centimeter or as multiples of the MED.

terms were used: *phototherapy; localized phototherapy; 308-nm excimer psoriasis; 308-nm excimer; laser phototherapy; PUVA; broadband ultraviolet B; narrowband ultraviolet B; and psoriasis phototherapy*. Search terms were used in combinations to create a broad citation list, and the article abstracts were reviewed according to their relevance to this topic. Treatment studies in which both 308-nm UVB excimer laser and nontargeted phototherapies (BB-UVB, NB-UVB, and PUVA) were administered to participants were included in this analysis. We excluded studies that described combination phototherapies with topical or systemic agents. The description of outcome measures was mandatory and included at least one of the following measures: plaque improvement, number of treatments, cumulative UVB dose, mean number of treatments, duration of treatment, side effects, and follow-up. Outcome measures included the psoriasis area and severity index (PASI) and the psoriasis severity index (PSI).

Results

Three prospective nonrandomized studies comparing the 308-nm UVB excimer laser with NB-UVB phototherapy met the outlined criteria (Table).^{3,6,7} Studies that directly compared the 308-nm UVB excimer laser with BB-UVB or PUVA were not found.

The first study by Bónis et al³ evaluated 10 participants with chronic plaque psoriasis. The treatment protocol consisted of administering excimer laser 3 times weekly until all of the treated plaques had completely cleared. Cumulative dose and number of treatments for the laser ranged from 2.57 to 8.11 J/cm² and 7 to 11, respectively. Of the 10 participants, 6 were treated with 311-nm NB-UVB 5 times weekly, starting at 130 mJ/cm² with a 65 mJ/cm² increase at the subsequent session until clearance. During treatment sessions the plaque treated with excimer laser was covered with a black band. Cumulative dose and number of treatments for NB-UVB ranged from 26.31 to 32.15 J/cm² and 29 to 33, respectively. No serious side effects were observed, except for mild hyperpigmentation, which was seen in response to both treatments.³

In the right/left comparative study by Goldinger et al,⁶ 15 participants with bilateral-symmetric psoriasis vulgaris plaques received 308-nm excimer laser and 311-nm NB-UVB phototherapy 3 times weekly for 4 weeks for a total of 12 treatments. The initial dose for both modalities was 200 mJ/cm² and was increased by 100 mJ/cm² and 50 mJ/cm² each session for the laser and NB-UVB devices, respectively. All of the plaques in the 15 participants, except for 1 psoriatic patch, showed PASI improvement. The mean PASI reduction was from 11.8 to 6.3 in the

laser-treated side and 11.8 to 6.9 in the NB-UVB-treated side ($P=.23$). In 2 participants, no difference between 2 sides was observed; however, more participants showed increased clearance on the laser-treated side (60% [9/15] vs 27% [4/15]). No serious side effects were observed; however, hyperpigmentation was seen on both treatment sides of 5 participants.⁶

The third study by Köllner et al⁷ evaluated 15 participants with stable plaque psoriasis using 308-nm excimer laser, 308-nm excimer nonlaser lamp, and 311-nm NB-UVB phototherapies. Three similar-appearing plaque areas were selected to receive treatment from each respective modality. The total treatment duration was 10 weeks and the minimal erythema dose (MED) was increased with each treatment. On conclusion of the study, the MED ranges varied for the excimer laser (200–1000 mJ/cm²), excimer lamp (100–600 mJ/cm²), and NB-UVB (200–900 mJ/cm²) modalities. The mean PSI reduction was from 8.6 to 1.8 in the excimer-treated regions, 8.6 to 2.13 in the excimer lamp-treated region, and 8.6 to 1.1 in the NB-UVB-treated region ($P>.05$). The mean number of treatments to achieve clearance defined as PSI 90 was 24, and complete remission was seen in 27% (4/15) of excimer laser-treated participants, 20% (3/15) of excimer lamp-treated participants, and 47% (7/15) of NB-UVB-treated participants ($P>.05$). The most common side effect was hyperpigmentation and less frequently crusting, blistering, and erythema.⁷

Comment

Phototherapy is one of the most efficacious treatment methods for inflammatory skin diseases, especially for patients with psoriasis.⁸ Targeted excimer phototherapy delivers monochromatic UVB laser doses in short impulses and laser transmission through a handheld articulated arm, which is kept less than 1 cm from the psoriatic lesion.

In general, UV phototherapy works by changing immune cytotoxicity in the skin and by directly killing diseased cells by apoptosis.⁹ Zakarian et al¹⁰ reviewed multiple case studies that concerned the immunologic differences of cell death. These studies proposed that 308-nm excimer irradiance is more effective than broadband and narrowband modalities by reducing the keratinocyte proliferation in the intraepidermal layers of the skin^{11,12} and inducing T cell apoptosis.^{13,14} One study reported that the dose necessary to induce apoptosis in 50% of T lymphocytes is 95 mJ/cm² with the 308-nm excimer laser versus 320 mJ/cm² with NB-UVB phototherapy.¹⁴ These preliminary studies provide evidence for greater efficacy of laser phototherapy.

Our study compared the clinical efficacy of NB-UVB and the 308-nm excimer laser with respect to UV dose, clearance, remission times, number of treatments, and side effects. All 3 studies reported common side effects of hyperpigmentation and 1 of 3 studies also reported crusting, blistering, and erythema from both modalities. Statistically significant differences in side-effect profiles could not be drawn from the studies. Only 1 study reported greater efficacy of the excimer laser versus NB-UVB due to fewer number of treatments for clearance (8.33 vs 30.1), lower mean cumulative dose (4.81 vs 31.1 J/cm²), and lower duration of treatment.³ In the other 2 studies, the differences in efficacy and reduction in PASI⁶ and PSI⁷ scores for the 308-nm excimer laser versus NB-UVB were not significant. One key limitation in the 2 studies was the use of a low-dose increment scheme for the excimer laser. Several studies have reported better clinical improvement with only a single administration of 8⁴ and 16^{4,15} MED excimer laser doses rather than lower doses. Although higher frequencies of blistering, erosions, and crusting are unavoidable, plaque clearance is possible in a short time and lasts for months when delivering high MED doses.¹⁵

Comparisons across large trials in which researchers administered 308-nm excimer laser and NB-UVB phototherapy provided contrasting results to our reviewed studies with respect to treatment outcomes. In one large multicenter trial of 124 participants treated with excimer laser, it was reported that 84% of participants had reached a PASI 75 after 10 or fewer treatments, 50% of participants reached a PASI 90 after 10 or fewer treatments, and 35% of participants reached a PASI 90 clearance in an average of 7.5 treatments.¹⁶ In contrast, 1 randomized observer-blinded trial of 113 participants reported that a mean of 24.4 total treatments yielded a clearance rate of 69% in 58 participants and a mean of 23 total treatments yielded a clearance rate of 80% in 55 participants treated 2 times weekly and 3 times weekly with NB-UVB, respectively.¹⁷ These studies suggest that the 308-nm UVB excimer laser offers several advantages over other available treatment modalities for psoriasis, particularly fewer treatments and the increased safety of site-specific dosing.

The use of creams and standard NB-UVB phototherapy is limited by hair and acts as a barrier to medication adherence and UV penetration. However, psoriatic plaques on the scalp respond to excimer laser in the same fashion as plaques elsewhere on the surface of the skin.¹⁸ The 308-nm UVB excimer laser offers the advantage to separate out the hair and treat precise areas on the affected scalp areas. In a small study involving 13 scalp psoriasis participants, half

of each participant's scalp was treated with excimer laser and the other half was untreated. There was greater improvement on the treated side ($P < .0001$), which suggested that the excimer laser might be the better option compared with nontargeted modalities for scalp psoriasis.¹⁸

To date, there are no studies that compare the efficacy of 308-nm UVB excimer laser with BB-UVB or PUVA modalities. However, one study reported the effects of PUVA with 308-nm excimer light for plaque-type palmoplantar psoriasis.¹⁹ Ten participants with psoriasis of the palms and soles were randomly assigned to receive cream PUVA on one side and 308-nm UVB excimer laser treatment on the contralateral side. Both modalities showed similar improvement and clearance rates; however, the excimer light may lead to better compliance and a lower incidence of adverse effects because excimer therapy is not associated with prior drug application.¹⁹ Future studies could compare the efficacy of the excimer laser with BB-UVB and PUVA and assess if one modality is more clinically and cost effective.

Conclusion

By choosing to target localized lesions, excimer laser therapy offers the primary advantage over whole-body phototherapy to deliver UV only to specific body areas and lesions. Only 1 reviewed study concluded that the excimer laser is more efficacious in clearing psoriasis in fewer treatments and lower cumulative exposures when compared with NB-UVB phototherapy. Differences in adverse-effect profiles of excimer laser and NB-UVB phototherapy were not significantly different. Although targeted UVB excimer laser therapy is a safe and efficacious treatment modality for localized psoriasis, its value in psoriasis management compared to other UV phototherapy modalities should be further investigated.

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