Psoriasis is a chronic dermatologic disease affecting 2.6 percent of the US population.¹ It is debilitating both physically and mentally, and there is always a need to develop treatment options with better success rates, not only acutely, but long-term. Despite the wide range of treatment options available, UVB phototherapy remains one of the safest therapeutic modalities for psoriasis.² The latest development in UVB phototherapy is the excimer laser, a novel therapeutic option where a beam of coherent light with a wavelength of 308nm is transmitted through a handheld articulated arm.³ The device uses a spot diameter of 14 to 30mm, allowing targeted therapy to a small area on the skin and thus the ability to spare healthy skin from exposure to UV radiation. In addition, since psoriatic skin can usually tolerate a higher dose of UVB than unaffected skin can, treatment can be conducted at multiples of the minimal erythema dose (MED). This aggressive “supraerythemogenic” therapy greatly enhances the efficacy of UVB phototherapy and thereby results in fewer required sessions and a lower accumulated dose of UVB.⁴,⁵

Although the mechanism of action of targeted phototherapy appears to be similar to that of other modes of UV-based therapy, namely, induction of T-cell apoptosis, suppression of DNA synthesis, and generation of prostaglandins and cytokines, reports have demonstrated that 308nm excimer laser is more effective than NB-UVB.² Proposed mechanisms for this enhanced efficacy include deeper penetration of the skin and more potent capacity to induce T-cell apoptosis.⁶,⁷ Because of this, targeted phototherapy with excimer laser appears to induce longer remis-

Take-Home Tips. Growing evidence supports the safety, efficacy, and speed of clearance associated with the 308nm excimer laser for the management of not only localized plaque psoriasis, but also generalized as well as inverse, palmoplantar, and scalp psoriasis. Advantages of the laser include lack of systemic toxicity, protection of non-affected skin, flexible dosing, ability to treat areas difficult to reach through conventional phototherapy, and convenience relative to traditional phototherapy. Further investigation is warranted as the technology advances to explore combination, sequential, or rotational strategies. ●
sion than traditional UVB. This article reviews the efficacy and safety of excimer laser phototherapy and discusses potential uses in both localized and generalized psoriasis.

**Efficacy**

The use of excimer laser in psoriasis was first documented in 1997 by Bonis, et al., who described the superior effects of excimer over traditional NB-UVB phototherapy in a non-randomized, left to right comparison in six patients. They demonstrated that the cumulative dose for complete clearance was 6.47 times less with the excimer laser than with traditional NB-UVB and that the number of treatments needed was 3.6 times less, while the duration of phototherapy was 2.27 times shorter. No p-value was reported. More recent studies by Goldinger, et al. and Kollner, et al. both also suggest at least similar results with excimer laser treatment when compared to traditional NB-UVB.

Subsequently, Asawonda, et al. conducted another 26-week, open-label trial to determine the dose-response relationship of excimer laser generated irradiation. Four plaques in 13 patients received one, two, four, and 20 treatments, respectively. Within each plaque, eight doses based on multiples of MED were tested in distinct sites (0.5, 1, 2, 3, 4, 6, and 16 MED). Overall, treatment with higher fluences (8 and 16 times MED) produced significantly better results than low or medium (6 MED) fluences at weeks 4, 6, 8, and 10 (p<0.05). In addition, at four-month follow-up, all sites that received low or medium fluences had recurrences, whereas those that underwent a single treatment at 8 and 16 MED multiples remained in remission. The authors concluded that with 308nm UVB radiation, it may be possible to clear psoriasis with as little as one treatment, with moderately long remission. However, treatment with higher fluences may be associated with blistering of the psoriasis plaque and hence, dosing must be tailored to the individual patient.

Since that time, several other trials have focused on the treatment of localized psoriasis using dosimetry based on multiples of the MED (See Table 1). In the largest multicenter, open-label trial of 124 patients by Feldman, et al., 84 percent of patients (95 percent CI, 79-87 percent) achieved 75 percent improvement or better in their target plaques after 10 or fewer treatments and 50 percent of patients (95 percent CI, 35-61 percent) reached an improvement of 90 percent or better after 10 or fewer treatments. Of the patients who met the protocol requirements, 72 percent achieved at least 75 percent improvement in an average of 6.2 treatments. In general, dosing was started at 3 MED and then adjusted as per clinical response. Overall, the 308nm excimer laser appeared to be very effective for psoriasis, requiring fewer patient visits than conventional phototherapy.

In 2003, Taneja, et al. then introduced a new, convenient induration based dosage schedule with the excimer laser. They treated plaques twice weekly with an initial dose based solely on the induration component of the modified PASI score for that lesion rather than testing MED and relying on multiples of MED for treatment. Subsequent treatments were twice a week, with dosage increments of up to 50 percent, based on the change in induration. Fourteen patients completed the study with a mean of 10 treatments using a mean cumulative dose of 8.8J/cm². The treated plaques showed significant improvement from baseline (p<0.001), and the authors were able to demonstrate that selective targeting of laser-generated excimer irradiation with this convenient induration-based dosage schedule allows for individualized treatment plans for each plaque. Most laser protocols now use induration-based dosing rather than MED determination, given its good results and convenience in comparison to calculating multiples of MED.

Excimer laser can also be used in difficult-to-treat areas, such as palms, soles, and scalp. Nistico, et al. evaluated 54 patients with palmoplantar psoriasis in an open label trial treating with excimer laser every seven to 10 days. A mean number of 10 sessions was performed. After four months of therapy, complete remission was seen in 31 patients, a partial remission in 13 patients, and a moderate improvement in 10 patients. Greater than 75 percent
improvement was seen in 44 patients. Another study by Han, et al. also conducted the treatment of palmoplantar psoriasis with the excimer laser.15 All 15 patients in the study completed a total of 25 treatment sessions. At the completion of the treatment course, a single patient (6.7 percent) achieved clearance, seven patients (46.7 percent) showed marked improvement, and two patients (13.3 percent) failed to respond. This erratic efficacy may be due to the fact that UVB, even given through laser, may still not penetrate deeply enough for some patients with palmoplantar psoriasis.

Morison, et al. tested the use of the excimer laser in 35 patients with scalp psoriasis.16 Patients received twice-weekly treatment using the laser with manual separation of the hair to access the treatment site. All patients improved, with 49 percent of patients cleared with a mean of 21 treatments. An additional 45 percent of patients improved 50-95 percent. Another study by Taylor, et al. evaluated 13 patients with scalp psoriasis unresponsive to topical steroids.17 After 15 weeks of treatment on half the scalp with the excimer laser along with an air-blowing device to move hair out of the way, patients had statistically and clinically significant improvement \( (p<0.001) \). A mean decrease in a modified PASI score of 4 was seen on the treated side and a decrease in 2.61 on the untreated side.

Excimer laser may also be used simultaneously with other therapies. In a large trial of 272 patients, Trott, et al. showed that treatment with PUVA followed by four treatments with the excimer laser rather than PUVA alone did not change efficacy, but patients went into remission in half the treatment time and with half the cumulative UVA dose.18

Another study evaluated the use of topical psoralen plus treatment with excimer laser. Ten patients completed the study. Three different concentrations of 8-methoxypsoralen (0.001%, 0.01%, and 0.1%) were applied prior to irradiation with 4 MEDs of targeted UVB phototherapy once weekly for 12 weeks.19 With area under the curve analysis, 0.1% 8-MOP/NB-UVB with excimer laser was superior to other modalities, including traditional topical paint PUVA, in reducing the psoriasis severity index in the patients tested.

More recently, Dr. Klaus Fritz in Germany tested the combination of excimer laser with topical calcipotriol.20 In this single center, open label trial, 36 patients received 308nm UVB to all target lesions with half the lesions also receiving calcipotriol ointment twice daily. Clearing of infiltration, erythema, and scales was achieved in 25 percent of patients after two sessions for the excimer laser-treated side without calcipotriol and 40 percent in the calcipotriol plus excimer-treated side. Calcipotriol treatment needed fewer sessions of excimer laser treatment, fewer days to achieve a reduction of the PASI parameter, and a lower cumulative dosage. No \( p \)-values were reported.

Although all earlier studies have focused on the use of excimer laser in more localized, mild to moderate psoriasis, advances in laser technology may allow the treatment of a larger surface area, that is, generalized, moderate to severe plaque type psoriasis. Gattu, et al., in a pilot, open-label trial, treated 13 patients with 10-30 percent body surface area twice weekly for 12 weeks and then followed these patients for six months following treatment completion.5 Of the 12 patients who completed the study, 54 percent of patients achieved PASI-75 at 12 weeks. However, in a retrospective analysis that eliminated two suboptimal patients (one who was morbidly obese and the other with skin type 1) 77 percent of patients achieved PASI-75. During the six month follow-up period 83 percent maintained PASI-50 with no treatment whatsoever. This study suggests that treatment with the excimer laser is becoming a viable therapeutic option even for patients with moderate to severe generalized psoriasis.

Safety
Overall, no serious adverse events were noted in the trials with the 308nm excimer laser for treatment of psoriasis (See Table 1). The treatments were usually well-tolerated with common side effects generally limited to erythema, blistering, hyperpigmentation, and peri-lesional edema secondary to a phototoxic reaction. Other less common side effects included mild irritation, moderate
### Table 1: Summary Table on Results of Psoriasis Treatment with 308-nm Excimer Laser

<table>
<thead>
<tr>
<th>Authors</th>
<th>No. of Patients (N) Completed Study</th>
<th>Study Design</th>
<th>Total Number of Tx Sessions</th>
<th>Results</th>
<th>Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonis, et al.</td>
<td>10 (6 compared with NB-UVB)</td>
<td>0.5 MED then increase 61mJ/cm² per session – 3 sessions per week</td>
<td>Mean, 6</td>
<td>Complete clearance with both treatments (better than NB-UVB on cumulative dose and no. of sessions)</td>
<td>No serious side effects observed; paper did not specify otherwise.</td>
</tr>
<tr>
<td>Asawonda, et al.</td>
<td>13</td>
<td>Dose response study. Twice weekly dosing at 0.5 – 16 MED</td>
<td>1 (1st plaque) 2 (2nd plaque) 3 (3rd plaque) 20 (4th plaque)</td>
<td>Best results with high fluencies (p&lt;0.05). Recurrence after 4 months in low and medium fluences.</td>
<td>Erythema in 23% with 4 and 6 MED. Blisters in 100% with 8 and 16 MED (increasing with higher fluences).</td>
</tr>
<tr>
<td>Trehan and Taylor</td>
<td>13</td>
<td>Single dose 8 – 16 MED</td>
<td>1</td>
<td>11 patients clearance of &gt;75% (p&lt;0.001). 100% of recurrence at 6 months</td>
<td>Erythema, blisters, and moderate pain</td>
</tr>
<tr>
<td>Feldman, et al.</td>
<td>80</td>
<td>2 sessions/week 3 MED, then adapted from clinical response</td>
<td>10</td>
<td>Improvement of &gt;90% in 50% of patients.</td>
<td>Erythema (50.8%), hyperpigmentation (37.9%), blisters (45.2%).</td>
</tr>
<tr>
<td>Trehan and Taylor</td>
<td>15</td>
<td>3 sessions/week 1 MED, then increase of 25-30% each session</td>
<td>Mean, 11</td>
<td>&gt; 95% improvement in modified PASI score (p&lt;0.01)</td>
<td>Blisters (46%), hyperpigmentation in pts with skin type II or greater, erythema</td>
</tr>
<tr>
<td>Taneja, et al.</td>
<td>14</td>
<td>2 sessions/week fixed doses depending on thickness of plaques then decrease depending on clinical improvement</td>
<td>Mean, 10</td>
<td>Complete clearance in all patients (p&lt;0.001)</td>
<td>Erythema (14%), hyperpigmentation (57%) that resolved in 2–6 months</td>
</tr>
<tr>
<td>He, et al.</td>
<td>40</td>
<td>2 sessions/week 1 – 2 MED then increase of 20-30% every 2-3 sessions Both macular and chronic plaque type psoriasis</td>
<td>15</td>
<td>90% improvement of macular type 77.34% improvement in chronic plaque type</td>
<td>Hyperpigmentation after 5 sessions, itching 35%, erythema 15%, small partial blisters 7.5%</td>
</tr>
<tr>
<td>Gerber, et al.</td>
<td>102</td>
<td>2 sessions/week for 3 weeks, then 1 session/week, 3 MED, then increase 1 MED/session</td>
<td>Mean, 11</td>
<td>Improvement of &gt;90% in 84% of patients</td>
<td>Erythema, blisters &amp; hyperpigmentation</td>
</tr>
<tr>
<td>Pahlajani, et al.</td>
<td>4 children 12 adults</td>
<td>2 sessions per week 3 MED (2 MED in folds) then reduction to 1 MED when plaque flat</td>
<td>Mean, 10 (children) Mean, 12 (adults)</td>
<td>Children mean improvement of 91% (p = 0.02). Adults mean improvement of 62% (p=0.05)</td>
<td>Children: hyperpigmentation 50%, blisters 25% Adults: erosions 50%, blisters and pain 33.3%, hyperpigmentation 25%, koebnerization 8.3%</td>
</tr>
<tr>
<td>Kollner, et al.</td>
<td>15</td>
<td>3 sessions/week 1 plaque treated with laser, 1 plaque treated with 308-nm lamp, and 1 plaque treated with NB-UVB</td>
<td>24</td>
<td>Clearance &gt;90% with all 3 treatments (p&lt;0.05). Slight recurrence at 4 months (not statistically significant between the 3 regimens).</td>
<td>Erythema, pigmentation, blisters (laser), 40%; vs. others, 27%</td>
</tr>
<tr>
<td>Goldinger, et al.</td>
<td>15</td>
<td>3 sessions/week 1 plaque treated with laser and 1 plaque treated with NB-UVB</td>
<td>12</td>
<td>Complete clearance in 33% of both treated lesions. Mean PASI reduction of 5.5 in excimer, 4.9 in NB-UVB (p=0.23)</td>
<td>Hyperpigmentation 33.3%</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Study Design</td>
<td>Treatment Details</td>
<td>Results</td>
<td>Side Effects</td>
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<tr>
<td>Talibjee, et al.</td>
<td>15</td>
<td>2 plaques treated with PDL, 2 with excimer, and 2 no treated (controls)</td>
<td>Mean, 19.8</td>
<td>PASI: excimer&gt;PDL&gt;controls (p&lt;0.001). 41% pts clear with excimer and 27% with PDL. Blistering and hyperpigmentation.</td>
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<tr>
<td>Fikrle, et al.</td>
<td>26</td>
<td>3 sessions/week, 2 MED with increase by 1 MED every second treatment</td>
<td>NA</td>
<td>Improvement of &gt;50% in 90% of patients. Erthema, pruritis, and blistering.</td>
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<tr>
<td>Trott, et al.</td>
<td>256</td>
<td>PUVA vs. PUVA + excimer laser 2 sessions/week. PUVA 0.4-0.8 J/cm² then increase by 0.5 J/cm² each 2nd to 3rd session. Excimer 1 MED then increase of 0.2 J/cm² per session.</td>
<td>PUVA mean 27. PUVA + excimer, mean 15, 2.8</td>
<td>PUVAb 90% clearance in 67.3%. PUVA + excimer 90% clearance in 63.6%. PUVA relapse in 18 patients, PUVA + excimer relapse in 13 patients. Erthema, hyperpigmentation, and blistering.</td>
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<tr>
<td>Neumann, et al.</td>
<td>10</td>
<td>4 sessions/week Palmoplantar Excimer vs. Soak PUVA. Excimer started at 0.75 J/cm² up to 4.5 J/cm², PUVA starting from 0.5 J/cm² up to 8 J/cm²</td>
<td>Mean, 20</td>
<td>Mean improvement of 63.57% excimer and 64.4% with PUVA. Erthema, mild irritation.</td>
<td></td>
</tr>
<tr>
<td>Nistico, et al.</td>
<td>54</td>
<td>Every 7-10 days, Palmoplantar 1-3 MED 250-500 ml/cm² every application</td>
<td>Palmar mean 10. Sole mean 13</td>
<td>&gt;75% clearance in 44 patients. Persistence &gt;75% clearance in 46 patients, maintenance of achieved result that completed treatment. Erthema, pruritis.</td>
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<tr>
<td>Morrison, et al.</td>
<td>35</td>
<td>2 sessions/week; scalp 1 MED and increased 10-20% as tolerated</td>
<td>Mean, 21</td>
<td>&gt;90% improvement in 48% patients. Erthema, blistering.</td>
<td></td>
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<tr>
<td>Taylor, et al.</td>
<td>13</td>
<td>2 sessions/week Hald scalp laser and half scalp untreated Hair blowing device</td>
<td>Mean, 29</td>
<td>Decrease in PASI score by 4 in laser, 2.61 in untreated (p&lt;0.0001). Relapse in 4 patients by 1 month, 3 patients by 2 months, 1 by 4 months, 1 by 6 months, and persistence in improvement in 3 patients at 6 months. None reported.</td>
<td></td>
</tr>
<tr>
<td>Gattu, et al.</td>
<td>12</td>
<td>2 sessions/week Generalized psoriasis 10-30% BSADosing based on induration protocol and Fitzpatrick skin type</td>
<td>24</td>
<td>54% of patients achieved PASI&lt;75. 86% of these patients were at PASI 90. At 6 month follow-up 83% of pts remained at PASI 50. Peri-lesional edema, blistering, hyperpigmentation, erythema, pain, and pruritis.</td>
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</tbody>
</table>

**Sources:**
Excimer Laser for Psoriasis

skin pain, and pruritus. Most of these side effects were transient and most commonly resolved within 12-24 hours of treatment. Severe burns causing extensive pain or disability were not reported in any of the trials.

Another major concern with NB-UVB phototherapy is the hypothetical risk of increased skin cancer. Although no long-term laser studies have been performed, with regards to UVB in general, an analysis by Lee, et al., reviewing 11 clinical trials with NB-UVB phototherapy, except for one PUVA cohort (who were also exposed to UVB) analysis on genital cancer. Therefore, based on currently available data, even for fair-skinned Caucasians, no precise limit with regard to the number of allowable UVB treatments can be defined. This concern should be even less for darker skinned, non-Caucasians who are less prone to damage from UV rays. Overall, they suggest that UVB phototherapy remains a very safe therapeutic option for psoriasis.

No specific studies have examined the risk of skin cancer in treatments with the excimer laser. However, unlike traditional UVB phototherapy, UVB irradiation using the excimer laser spares the non-involved skin and therefore, it is theoretically possible that the risk of skin cancer may be less with excimer laser UVB as compared to traditional UVB phototherapy.

Discussion

Growing evidence supports the safety, efficacy, and speed of clearance associated with the 308nm excimer laser for the management of not only localized plaque psoriasis, but also generalized as well as inverse, palmoplantar, and scalp psoriasis. The laser has many advantages including lack of systemic toxicity, protection of non-affected skin, flexibility in dosing, ability to treat areas difficult to reach through conventional phototherapy, and convenience relative to traditional phototherapy, due to better efficacy, requiring fewer treatment sessions. Although further investigation is warranted, the excimer laser is likely to gain more widespread use as the technology becomes more powerful and treatment technique is further refined through exploration of combination, sequential, or rotational strategies in the future.

Dr. Bhutani has no relevant disclosures. Dr. Koo is a consultant for PhotoMedex.