

# Pulsed Dye Laser for Treatment of Basal Cell Carcinoma

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**Background:** Basal cell carcinoma (BCC) is the most common malignancy worldwide. The incidence of BCC is increasing up to 10% per year worldwide. Surgical excision and Mohs surgery are the gold standard treatment modalities. However, patients may not be candidates for surgery. Pulsed dye laser (PDL) is a novel technique for treating BCC.

**Methods:** Patients with biopsy-proven BCC underwent two treatments with PDL at 6-week intervals at Berkshire Cosmetic and Reconstructive Surgery Center. Patients returned 6 weeks after the second treatment for evaluation for response to treatment. Follow-up examinations were conducted at 6, 12, and 18 months after treatment with PDL.

**Results:** Twenty patients with 21 biopsy-proven BCCs were treated with PDL at Berkshire Cosmetic and Reconstructive Surgery Center between 2019 and 2021. Nineteen BCCs had a complete response after two treatments, for a clearance rate of 90%. Two of the 21 lesions did not respond for an incomplete response rate of 10%.

**Conclusion:** PDL is an effective nonsurgical treatment option in the management of BCC. (*Plast Reconstr Surg Glob Open* 2023; 11:e4850; doi: 10.1097/GOX.0000000000004850; Published online 6 March 2023.)

## INTRODUCTION

Basal cell carcinoma (BCC) is the most common malignancy worldwide.<sup>1</sup> There are 5.4 million cases of nonmelanoma skin cancer diagnosed annually, of which eight of 10 are BCC.<sup>2</sup> The incidence of BCC is increasing up to 10% per year worldwide.<sup>1,3</sup> Surgical excision and Mohs surgery are the gold standard treatment modalities for reasons including high clearance rates, low recurrence rates, and favorable cosmetic outcomes.<sup>3,4</sup> However, surgery may not be feasible in certain patient populations for reasons such as age, medical comorbidities,

and immunosuppression. Nonsurgical treatment options have a wide range of clearance rates and recurrence rates. Common nonsurgical modalities include external beam radiation (EBR), desiccation and curettage (D&C), cryosurgery, and topical chemotherapy/immunotherapy agents.<sup>3,4</sup>

Pulsed dye laser (PDL) has historically been used to treat hemangioma and port wine stains.<sup>5</sup> It uses a concentrated beam of light that is converted into heat to destroy the blood supply of the tumor with minimal damage to surrounding tissue. PDL is a novel technique for the treatment of BCC that offers unique advantages. It has a clearance rate comparable to other nonsurgical modalities, cosmetic outcomes seem favorable, and the procedure can be performed in the office setting.

The objective of this study was to evaluate the clearance rates of patients treated with PDL at Berkshire Cosmetic and Reconstructive Surgery Center (BCRSC) and compare these results with the growing body of literature.

## METHODS

This study is a retrospective case series conducted at Berkshire Medical Center and BCRSC approved by institutional review board exemption approval 45 CFR 46.104(d)(4). Written informed consent was obtained from patients electing to undergo PDL treatment for BCC

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at BCRSC. Inclusion criteria included any patients over the age of 18 with a biopsy-proven BCC who did not wish to proceed with surgical excision and who were poor surgical candidates for reasons of age, medical comorbidities, or immunosuppression. Exclusion criteria included recurrent or incompletely cleared lesions previously treated with PDL or surgical excision. Twenty patients with 21 biopsy-proven BCCs underwent two treatments with PDL at 6-week intervals. Laser parameters included 595 nm, one pass, 15 J/cm<sup>2</sup> energy, 3 mc pulse length, and 7 mm spot size with 10% overlap. No cooling was used; instead the selected area for treatment was anesthetized with 1% lidocaine without epinephrine. Patients returned 6 weeks after the second treatment. The treated area was independently evaluated by two plastic surgeons for complete clinical response. If there was any discrepancy among surgeons or skin depigmentation, the area was biopsied and evaluated histologically for residual tumor. Follow-up examinations were conducted 6, 12, and 18 months after treatment with PDL.

### RESULTS

Twenty patients with 21 biopsy-proven BCCs were treated with PDL at BCRSC between 2019 and 2021. The age range of patients was 60–101. Seven patients were over the age of 90. Nine men and 11 women were treated. The Fitzpatrick scores were 1 (eight patients), 2 (10 patients), and 3 (two patients). Six lesions were less than 1 cm, 10 lesions were 1–1.5 cm, three lesions were 1.6–2 cm, and two lesions were greater than 2 cm (Table 1).

Of the 21 biopsy-proven BCCs treated with PDL, 19 had a complete response at the 6-week evaluation after completion of two treatments for a clearance rate of 90% (Figs. 1–3). Thirteen of these lesions were clinically cleared, and six lesions were re-biopsied with no evidence of residual tumor cells. Two of the 21 lesions did not respond for an incomplete response rate of 10%. The two lesions that did not respond were larger in size; one was 1.6–2 cm and the second was greater than 2 cm. Incomplete responders went on to surgical excision.

Follow-up to monitor for tumor recurrence occurred at 6 months, 12 months, and 18 months. Thus far, eleven patients have completed follow-up out to 18 months and have had no evidence of clinical recurrence (Figs. 4–5). Four patients are still being followed up and have had no evidence of clinical recurrence at 12 months. Two patients were deceased. Three patients were in hospice and declined follow-up.

**Table 1. Demographics of Patients Treated with PDL**

Patient Demographics							
Age (y)	Gender		Fitzpatrick Score		Size of Lesion (cm)		
<90	7	Men	9	1	8	<1	6
70–89	11	Women	11	2	10	1–1.5	10
<70	2			3	2	1.6–2	3
						> 2	2

### Takeaways

**Question:** Is there a nonsurgical treatment modality for basal cell carcinoma with high clearance rates and favorable cosmetic outcomes?

**Findings:** Twenty-one patients underwent two treatments with pulsed dye laser at 6-week intervals. The clearance rate at 6-week follow-up was 90%. Lesions less than 1.5 cm had a 100% clearance rate.

**Meaning:** Pulsed dye laser is an effective nonsurgical treatment modality for basal cell carcinoma.

### DISCUSSION

This study is the first to compare multiple articles of BCC treated with PDL. A review of the literature was conducted for articles evaluating PDL treatment for BCC. Five articles met criteria of biopsy-proven BCC treated with PDL with end points of clinical response or re-biopsy.<sup>5–9</sup> The clearance rates for BCC treated with PDL in the literature were 95%, 91.7%, and 75% (Table 2).<sup>5–7</sup> Surgery, including Mohs, is the optimal treatment for BCC because it has the highest clearance rate (>95%) and lowest recurrence rate (2%–7%).<sup>3,4</sup> However, with the aging population and increased incidence of BCC,<sup>2</sup> we have seen a growing subset of patients who are poor surgical candidates for reasons such as age and medical comorbidities. The most common nonsurgical modalities include EBR, D&C, cryosurgery, and topical chemotherapy/immunotherapy agents.<sup>3,4</sup> In this study, we wanted to compare PDL with other nonsurgical treatment modalities and evaluate our results in relation to the current body of literature for treating BCC with PDL.

Nonsurgical treatment options commonly evaluated in the literature include EBR, D&C, cryosurgery, and topical chemotherapy/immunotherapies.<sup>3,4</sup> Rezakovic et al<sup>3</sup> reported that EBR has the highest clearance rate of 90% with the lowest recurrence rate of 7%–15%, but requires numerous appointments and has less patient satisfaction with regard to cosmetic outcomes. D&C has similar clearance rates of 90%–92%; however, this modality has reported recurrence rates as high as 33% and poor cosmetic outcomes as well.<sup>3</sup> Cryosurgery and topical therapies have lower clearance rates of 80% and are often poorly tolerated by patients due to local painful reactions with erythema and skin blistering.<sup>3</sup> PDL has become a favorable nonsurgical modality because it can be performed in the office setting with good cosmetic outcomes, but clearance rates are still being studied.<sup>3–5</sup>

In our results, 21 BCCs treated with two sessions of PDL at 6-week intervals had a clearance rate of 90%. For lesions 1.5 cm or less, we had a 100% clearance rate. Our results were similar to those seen in the study by Shah et al,<sup>6</sup> where they treated 20 BCCs with four treatments and had a 91.7% clearance rate for lesions less than 1.5 cm. Compolmi et al<sup>8</sup> treated 20 BCCs on the face and extremities with similar treatment parameters and had an 80% clearance rate; however, the size of the lesion was not recorded. Lastly Tannous et al<sup>9</sup> reported a 92% clearance rate for 20 BCCs treated with three to five sessions of PDL.



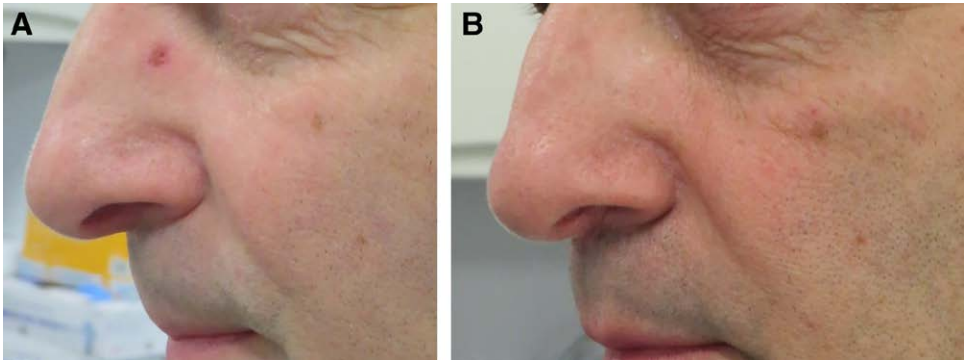
**Fig. 1.** Basal cell carcinoma of the left leg. A, Before treatment. B, After treatment with pulsed dye laser.



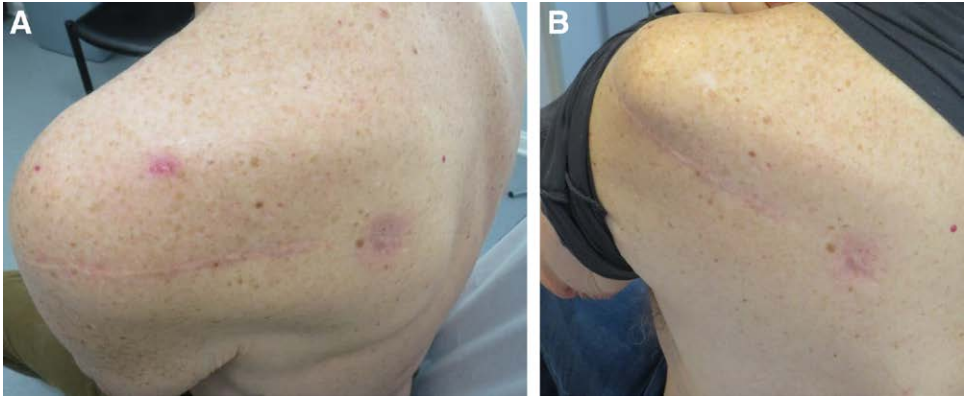
**Fig. 2.** Basal cell carcinoma of the nose. A, Before treatment. B, After treatment with pulsed dye laser.



**Fig. 3.** Basal cell carcinoma of the face. A, Before treatment. B, After treatment with pulsed dye laser.



**Fig. 4.** Basal cell carcinoma of the nose. A, Before treatment. B, At six month follow-up after treatment with pulsed dye laser.



**Fig. 5.** Basal cell carcinoma of the shoulder. A, Before treatment. B, At 12 month follow-up after treatment with pulsed dye laser.

**Table 2. Clearance Rates of Basal Cell Carcinoma Treated with PDL**<sup>5-9</sup>

BCRSC	PDL Clearance Rates				
	Konnikov et al	Shah et al	Miners et al	Compolmi et al	Tannous et al
90%	95%	91.7%	75%	80%	92%

These studies, in addition to our data, support PDL as an effective option for the treatment of BCC.

We had a 10% incomplete response rate. In our experience, this was thought to be more attributable to lesion size rather than to histologic subtype or location. In the studies by Shah et al<sup>4</sup> and Compolmi et al,<sup>5</sup> treatments were performed, and larger lesions had a significant decrease in tumor burden.<sup>6,8</sup> Further studies are needed to investigate if the number of treatments is correlated with a higher clearance rate and if size is the most important factor for predicting tumor clearance.

Follow-up data are not well reported in studies of BCC treated with PDL. We monitored patients for clinical recurrence at 6, 12, and 18 months. We are still collecting follow-up data, and there have been no recurrences to date in 15 patients. We had three patients who transitioned to hospice and two patients who died, which is a reflection of the comorbid conditions of nonsurgical patients. Konnikov et al<sup>5</sup> published promising data of 19 BCCs treated with PDL and follow-up at 12–27 months with a 95% clearance rate for lesions with a size of less than 1.7 cm. However, aside from this study and our results, we were unable to find other data with clearance and recurrence rates beyond 1 year.

PDL is an increasingly popular treatment modality for the treatment of BCC in nonsurgical candidates. It offers advantages, including good cosmetic outcomes and office-based capabilities. Data thus far have promising clearance rates; however, additional studies are needed to test its efficacy in relation to lesion size, location, and histologic subtype. Furthermore, follow-up data beyond 1 year is needed to understand recurrence rates.

## CONCLUSIONS

PDL is an effective nonsurgical treatment option in the management of BCC. When compared with other nonsurgical modalities, it offers high clearance rates, favorable cosmetic outcomes, and can be performed in the office setting. The initial studies are promising, but additional research evaluating recurrence rates, lesion size and subtype, and treatment protocols are needed to understand the efficacy profile of PDL for the treatment of BCC.

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