Treatment of Superficial Infantile Hemangiomas of the Eyelid Using the 595-nm Pulsed Dye Laser

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BACKGROUND Despite the proven effectiveness of the 595-nm pulsed dye laser (PDL) in treating superficial infantile hemangiomas, many physicians are reluctant to treat such lesions involving the eyelid.

OBJECTIVE To examine the safety and efficacy of the 595-nm PDL for the treatment of superficial infantile hemangiomas of the eyelid.

MATERIALS & METHODS Records were reviewed for patients with superficial infantile hemangiomas of the eyelid treated with 595-nm PDL. Pre- and post-treatment photographs were compared. Reviewers rated the degree of improvement of the hemangioma as excellent (76–100%), good (51–75%), moderate (26–50%), or poor (0–25%) and indicated whether the hemangioma was 100% clear. Side effects of scarring, atrophy, hyperpigmentation, and hypopigmentation were assessed.

RESULTS Twenty-two patients met the study criteria. Eight (36.4%) demonstrated complete clearance of their hemangioma, 17 (77.3%) received an improvement rating of excellent, and five (22.7%) received a rating of good. No scarring, atrophy, or hypopigmentation was noted. Two patients (9.1%) were noted to have hyperpigmentation in the treated area.

CONCLUSION Early treatment with the 595-nm PDL can safely and effectively diminish proliferative growth and hasten resolution of superficial infantile hemangiomas of the eyelid.

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Hemangiomas affect 2% to 3% of newborns and up to 10% of infants within the first year of life, making them the most common tumors of infancy.[1,2] Sixty percent of hemangiomas occur on the head and neck, and approximately 16% of facial hemangiomas involve the eyelid.[3,4] Like elsewhere on the body, hemangiomas of the eyelid can be superficial, deep, or compound (having a superficial and a deep component). Superficial lesions appear bright red and can be flat patches or slightly elevated plaques extending no deeper than the papillary dermis histologically. Deep hemangiomas involve the reticular dermis to varying degrees and can protrude into the subcutaneous tissue, appearing clinically as skin-colored or bluish nodules.

Compound and deep eyelid hemangiomas warrant special attention because of their potential to compromise developing vision because of amblyopia resulting from anisometropia and, less commonly, because of strabismus or obstruction of the visual axis.[5] These findings can be seen with small hemangiomas, so evaluation by a pediatric ophthalmologist is recommended with all compound and deep periocular hemangiomas.[6] In the case of rapidly enlarging periocular hemangiomas, close monitoring by an ophthalmologist is essential, because vision may be permanently compromised in as little as 2 weeks.[7]

A majority of eyelid hemangiomas are superficial, posing no significant threat to the vision. These lesions are uncomplicated medically but can grow to become extensive and disfiguring and can persist for years. Hemangiomas typically undergo gradual spontaneous involution at a rate of approximately 10% per year such that 50% of lesions fully involute

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by age 5, 70% by age 7, and so on, regardless of their size or location.[3,8] According to these estimates, roughly half of hemangiomas will still be apparent when the affected children begin school.

Treatment methods for eyelid hemangiomas are numerous and should be chosen according to the clinical characteristics of the lesion. Observation is an acceptable treatment alternative for compound and deep eyelid hemangiomas that are proliferating slowly or stable in size and have been determined, upon evaluation by a pediatric ophthalmologist, to be no threat to the patient's vision. For rapidly proliferating deep or compound hemangiomas or those threatening the infant's vision, treatment alternatives include surgical excision or debulking procedures, intraarterial embolization, systemic medical therapy (e.g., oral corticosteroids and propranolol), or intralesional injections of corticosteroids or interferon.[9,10] Each of these therapies has its own set of risks and side effects and, therefore, consultation with a physician specializing in the treatment of vascular tumors is recommended.

It can be difficult during the proliferative phase to predict accurately whether a deep component will arise within a seemingly superficial hemangioma. For this reason, close monitoring during the proliferative phase is recommended. The majority of purely superficial eyelid hemangiomas have historically been managed with clinical observation. Corticosteroids have been used topically, with modest improvement.[11] Corticosteroids are also frequently administered orally or intralesionally, with better results, for rapidly growing superficial hemangiomas. Although somewhat controversial, the pulsed dye laser (PDL) is being used with increasing frequency and has become an accepted treatment alternative for superficial hemangiomas.

PDL has been used for more than 25 years to treat port-wine stains, telangiectases, and vascular neoplasms, including infantile hemangiomas. Several studies have confirmed the effectiveness of PDL in treating hemangiomas, most concluding that PDL is more effective in the treatment of superficial hemangiomas than deep lesions because of the limited depth of vascular injury.[12–17] Some authors consider PDL to be the treatment of choice for superficial hemangiomas.[15]

Physicians who oppose treating superficial hemangiomas with PDL often cite a high incidence of side effects resulting from treatment and argue that uncomplicated hemangiomas are better managed with clinical observation. In a prospective, randomized controlled trial, Batta and colleagues[18] demonstrated that superficial hemangiomas treated with PDL showed significantly reduced redness and a six times greater rate of complete clearance at 1 year than lesions observed clinically. This study also demonstrated a significant difference with respect to the median change in surface area 1 year from baseline, supporting the concept that early treatment with PDL can slow or halt the proliferative growth phase of the hemangioma.[13] Despite their findings, the authors concluded that there is no benefit to treating superficial hemangiomas with PDL and implied that early treatment with PDL is inferior to observation because of the high incidence of atrophy (28%) and hypopigmentation (45%).[18]

Reported side effects associated with PDL treatment of hemangiomas include pigmentary alteration, ulceration, atrophy, and scarring.[19] The authors of one report cite 12 cases at three tertiary referral centers over a 5-year period, concluding that significant complications from PDL treatment of hemangiomas are rare.[20] This paucity of cases is consistent with the low rate of complications reported in other studies.[15,16,19] Pulsed dye laser technology has advanced in recent years, incorporating epidermal cooling using a cryogen spray, which protects the epidermis from thermal injury, reducing the risk of side effectsfrom treatment.

The study performed by Batta and colleagues excluded patients with periocular hemangiomas, stating that these lesions have the highest risk of psychosocial morbidity and complications.

Clinically, we have found that superficial periocular hemangiomas, and specifically superficial eyelid hemangiomas, respond exceedingly well to treatment with PDL. This retrospective study was designed to examine the efficacy and safety of the 595-nm PDL for the treatment of superficial infantile hemangiomas of the eyelid during the proliferative growth phase.

Materials and Methods

Medical records were reviewed for all patients with infantile hemangiomas of the eyelid treated with the 595-nm PDL at the Laser and Skin Surgery Center of New York from July 2004 to December 2008. With our intention to focus on hemangiomas treated during the proliferative growth phase, only patients with superficial eyelid hemangiomas initiating treatment before 9 months of age were included in the study. Patients with a deep component to their hemangioma were excluded, as were those receiving prior or concomitant medical or surgical treatment for their hemangioma. Additional exclusion criteria included inadequate photographic documentation and a lapse in follow-up exceeding 6 months.

Records for 39 patients with eyelid hemangiomas were reviewed. Twenty-two patients, 15 girls and seven boys, met the study criteria. Seventeen patients were excluded; eight had compound hemangiomas, four had received prior oral corticosteroid therapy, two had previously undergone surgical debulking procedures, two initiated treatment at an age older than 9 months, and one was excluded because of a 7-month lapse in follow up.

Patients were treated with the 595-nm PDL (Vbeam Perfecta, Candela Corp., Wayland, MA) with the following parameters: energy fluence of 11.0 to 11.5 J/cm^2, 7-mm spot size, and a pulse width of 0.45 ms or 1.5 ms. The dynamic cooling device settings consisted of a 30-ms cryogen spray duration with a 20-ms delay. The child was placed in the supine position on the examining table and gently held still by a nurse or parent. Tetracaine ophthalmic solution 0.5% (Bausch & Lomb, Inc., Tampa, FL) was administered before the insertion of a metal corneal eye shield (Stefanovsky & Associates Inc., Willowich, OH) to protect the patient's eye ipsilateral to the hemangioma. A nurse covered the contralateral eye with an external shield during the treatment. A thin layer of Surgilube (E. Fougera & Co., Melville, NY) was applied to the patient's eyebrows and eyelashes to prevent them from singeing. Lesions were treated until a purpuric end point was reached. This occasionally required double pulsing of the laser, but pulse stacking was avoided. In most cases, the entire treatment, including insertion of the intraocular shield, was completed in 1 to 2 minutes.

Three nontreating reviewers, all board-certified dermatologists, compared pretreatment photographs with photographs taken on the date of the patient's final laser treatment or on the date of the first visit that complete clearance was documented and treatment deemed unnecessary. Considering color and elevation of the lesion, the reviewers rated the degree of improvement of each hemangioma as excellent (76–100%), good (51–75%), moderate (26–50%), or poor (0–25%) and indicated whether the hemangioma was 100% clear. The reviewers also evaluated the photographs for the presence of side effects, including scarring, atrophy, hyperpigmentation, and hypopigmentation, and the authors reviewed the chart to note any occurrence of ulceration, infection, or other complications resulting from treatment.

In the cases in which the reviewers' ratings were not unanimous, a majority rule was applied. (The rating selected by two of three reviewers was used.) The same majority rule was applied in determining whether there was 100% clearance of the hemangioma or the presence of a treatment-related side effect. There was one case in which all three reviewers selected different degrees of improvement. In this instance, the highest and lowest ratings were disregarded and the middle rating was used.

Results

Table 1 summarizes patient characteristics, treatment details, and outcomes. Twenty-two patients with superficial infantile hemangiomas of the eyelid were treated with the 595-nm PDL during the study period (15 girls and 7 boys). The patients' ages ranged from 5 to 28 weeks at their initial treatment (average age 13.8 weeks). Patients received an average of 5.6 treatments (range 2–14) with an average treatment course of 14.9 weeks. The treatments were generally administered every 2 weeks during the proliferative growth phase and every 3 weeks once the hemangioma was believed to have stopped growing.

Eight patients (36.4%) demonstrated complete clearance of their hemangiomas.

Seventeen patients (77.3%) received an improvement rating of excellent, and the remaining five patients (22.7%) received a rating of good. Figures 1–5 illustrate responses to treatment.

Of the 14 patients achieving less than complete clearance, nine (64%) failed to schedule a follow-up appointment. Treatment was discontinued for the remaining five patients (36%) because, based upon clinical examination, it was felt that no further improvement would be obtained with additional PDL treatments.

No scarring, atrophy, or hypopigmentation was noted. Two patients (9.1%) were believed to have hyperpigmentation in the treated area. No ulcerations or infections occurred during the study period.

TABLE 1. Patient Characteristics, Treatment Details, and Outcomes

Sex	*Location*	*Widest Diameter (cm)*	*Age at First Treatment (Weeks)*	*Number of Treatments*	*Treatment Course (Weeks)*	*Improvement Rating (%)*	*100% Clearance (Y/N)*	*Side Effect(s)*
F	LE, MC	1.2	8	7	20	76–100	Y	
F	LE, MC	3.6	27	4	13	76–100	N	
F	UE	0.6	19	3	8	76–100	Y	
F	MC	1.4	11	5	18	76–100	N	
F	UE	4.1	5	11	27	76–100	N	
F	LE	0.3	17	2	3	76–100	Y	
F	UE	0.4	26	4	10	76–100	Y	
M	UE	0.7	9	2	2	76–100	N	
F	LE	2.6	6	9	16	76–100	Y	
M	LE	1.7	15	14	57	76–100	N	Hyperpigmentation
F	UE	0.8	7	3	4	51–75	N	
M	UE	0.7	18	2	4	76–100	N	
M	LE	0.8	14	4	9	76–100	N	
F	LC	1.3	7	4	10	51–75	N	Hyperpigmentation
M	LE	1.0	5	6	13	76–100	Y	
F	LE	0.6	14	9	23	51–75	N	
F	BE, LC	3.3	22	11	35	76–100	N	
F	UE	0.7	9	7	13	51–75	N	
F	LE	0.7	15	5	8	76–100	N	
M	UE, MC	0.8	9	3	6	76–100	Y	
F	MC, UE	1.2	12	6	12	51–75	N	
M	LE	0.7	28	3	15	76–100	Y	

*LE, lower eyelid; UE, upper eyelid; BE, bilateral eyelids; LC, lateral canthus; MC, medial canthus; Hyper, Hyperpigmentation. Treatment course rounded to nearest whole number week.

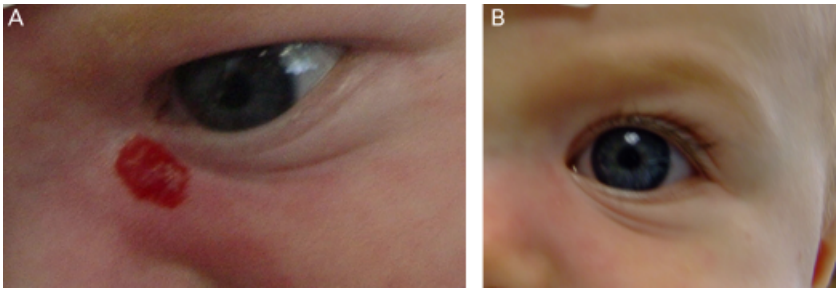

Figure 1. An 8-week-old infant shown before (A) and after (B) seven treatments over 20 weeks demonstrating complete (100%) clearance.

Conclusions

The results of this study demonstrate the safety and efficacy of PDL for the treatment of superficial infantile hemangiomas of the eyelid. With an average of 5.6 treatments, 77.3% of patients experienced excellent (76–100%) clearance of their hemangioma, with 36.4% of patients experiencing complete clearance. The average treatment course for all patients in the study was 14.9 weeks, which is dramatically shorter than the expected course of spontaneous involution had the lesions been observed clinically.

In addition to hastening the resolution of superficial hemangiomas, this study suggests that early treatment with PDL can slow and, in some cases, halt the proliferative growth phase. All study patients initiated treatment before 9 months of age; the average age at the first treatment was roughly 3 months (13.8 weeks). The average treatment course for our patients was 14.9 weeks. Thus, the average patient age upon completion of treatment in this study was roughly 7 months, well within the proliferative growth phase that spans from birth to 12 months. By undergoing early treatment with PDL, 77.3% of the study patients experienced excellent improvement in their hemangioma, thereby avoiding potential years of observing the lesion had they not intervened.

The accelerated clearance of hemangiomas with PDL often has a significant psychological benefit. Facial hemangiomas can negatively affect a child's confidence and self-image, especially if they are slow to involute. In addition, these lesions can create considerable emotional stress in parents, an overwhelming majority of whom experience feelings of anxiety, disbelief, panic, or fear when faced with

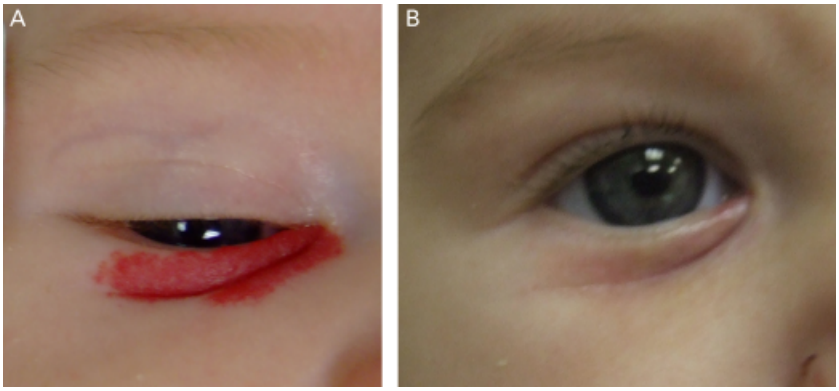

Figure 2. A 6-week-old infant shown before (A) and after (B) nine treatments over 16 weeks demonstrating complete (100%) clearance.

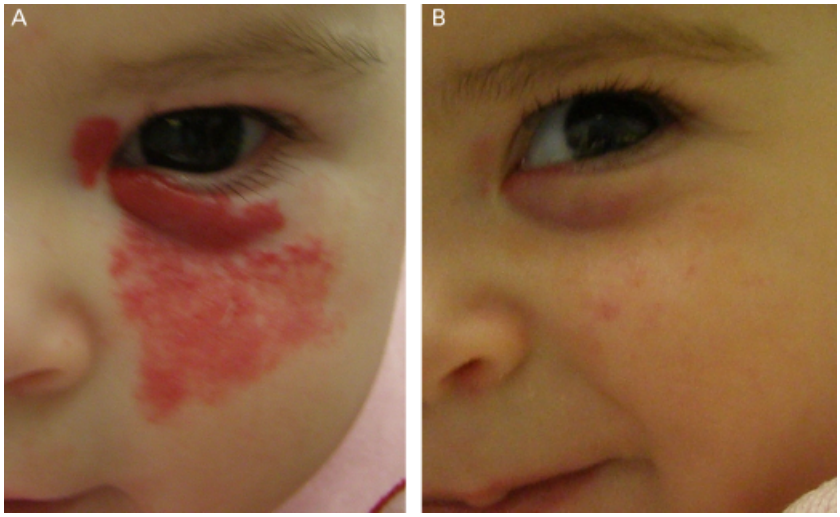

Figure 3. A 27-week-old infant shown before (A) and after (B) four treatments over 13 weeks demonstrating excellent (76–100%) clearance.

their child's proliferating hemangioma.[21,22] Public reactions to their child's hemangioma invoke feelings of anger, hurt, frustration, and helplessness. It is not uncommon for uninformed strangers or acquaintances to accuse these parents of child abuse, and some parents even cite their child's hemangioma as a reason for not taking them out in public. We do not support the treatment of hemangiomas solely to alleviate parental anxiety, but we recognize that this is an important secondary benefit of treatment.

There were no cases of scarring, atrophy, hypopigmentation, ulceration, or infection resulting from PDL treatment in this study. The side effect profile is comparable to the use of ultrapotent topical corticosteroids and considerably more favorable than the results published by Batta and colleagues, with atrophy and hypopigmentation seen in 28% and 45% of patients, respectively.[11,18] The high incidence of side effects seen in the Batta study are attributable to the treatment parameters used—high energy settings with small spot sizes—and the lack of epidermal cooling. To our knowledge, no other study using PDL to treat hemangiomas has reported such a high incidence of side effects.

Our results suggest that PDL results in a better final cosmetic outcome than untreated hemangiomas that involute spontaneously. Studies have shown that textural changes in the skin result after spontaneous involution of hemangiomas in up to 50% of cases.[23]

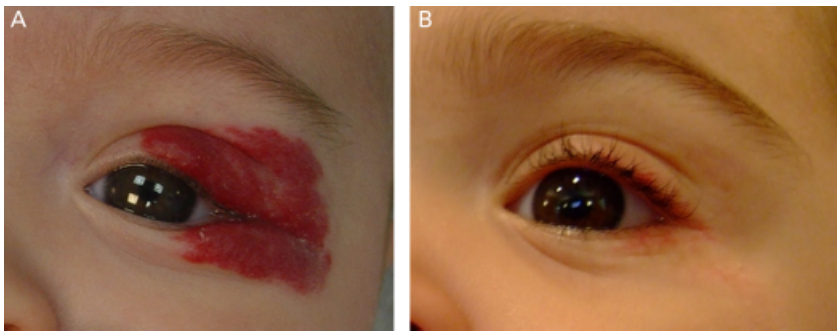

Figure 4. A 22-week-old infant shown before (A) and after (B) 11 treatments over 35 weeks demonstrating excellent (76–100%) clearance.

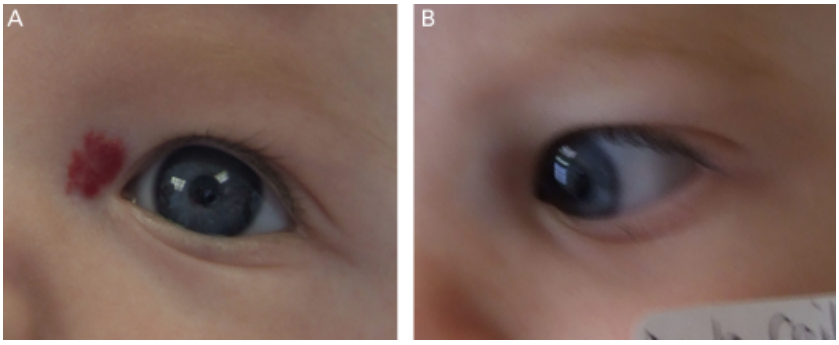

Figure 5. An 11-week-old infant shown before (A) and (B) after five treatments over 17 weeks demonstrating excellent (76–100%) clearance.

Superficial hemangiomas predispose skin to atrophy and telangiectasia, whereas untreated deep hemangiomas often leave behind residual fibrofatty tissue. The absence of atrophy in our study provides a strong argument in favor of early PDL treatment. Early treatment minimizes the risk of atrophic skin changes by stunting the proliferative growth of the hemangioma and expediting its resolution. Additionally, PDL has been shown to increase the production of dermal collagen and elastic fibers.[24,25] It is plausible that treatment with PDL simultaneously shrinks the vascular component of the hemangioma and increases collagen and elastic fiber production in the superficial dermis, avoiding atrophy of the treated skin.

Two patients in our study experienced hyperpigmentation of the treated skin. Because of the retrospective design of the study, long-term follow-up photographs were not available to evaluate these patients' improvement over time. Most nonablative laser treatment-induced hyperpigmentation is transient, resolving within 6 months. There is a high likelihood that the hyperpigmentation that these two patients experienced would have cleared over several months, as has been reported in other studies using PDL to treat hemangiomas.[15]

The risks of PDL are less than those associated with systemic medical management or intralesional therapy for eyelid hemangiomas. Oral corticosteroids are effective in decreasing the size of hemangiomas, but potential side effects include adrenal suppression, growth delay, irritability, and gastritis.[5,26] Oral corticosteroid therapy also requires delaying the recommended immunization schedule, placing the incompletely immunized infant at risk for infection. Propranolol was recently reported for the treatment of severe and disfiguring hemangiomas, but it can cause bradycardia and hypotension.[27] Intralesional corticosteroid therapy carries a risk of atrophy and depigmentation of treated skin, adrenal suppression, failure to thrive, and retinal artery occlusion leading to blindness.[5,28] Meanwhile, intralesional interferon 2-α is reserved for sight-threatening hemangiomas refractory to oral corticosteroids because of its associated 20% incidence of the development of spastic diplegia.[29] All of these therapies are effective in decreasing the size of hemangiomas, but because of their side-effect profiles, they are primarily indicated in cases of vision-threatening hemangiomas and should not be employed as first-line therapy for proliferating superficial periocular hemangiomas.

Ultimately, treatment must be tailored to fit the hemangioma. Early treatment of superficial eyelid hemangiomas with PDL reduces the lesion size, shortens the duration of the proliferative growth phase, and expedites resolution of the hemangioma. PDL should be considered as an alternative to "active nonintervention" in the treatment of superficial eyelid hemangiomas because of the lower risk of textural change to the skin and the potential to

mitigate psychosocial stresses associated with facial hemangiomas. The decision to "actively" not intervene should be a decision made by the infant's parents after a complete discussion of available treatment options with their consulting physician. We encourage prospective studies comparing PDL with observation for the treatment of superficial hemangiomas of the eyelid as well as other sites on the face, but we feel there is sufficient evidence to support PDL as an effective and safe therapeutic option in the management of superficial infantile hemangiomas of the eyelid.

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