Ablative Fractional Resurfacing for Involved Hemangioma Residuum

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Background: Given the natural tendency for 15% to 40% of infantile hemangiomas to spontaneously involute over time, much debate surrounds the issue of treatment. Until recently, effective therapies to improve the appearance of residual textural skin changes in these patients were lacking. We suggest the use of ablative fractional resurfacing for the treatment of textural skin changes resulting from involuted hemangiomas.

Observations: All patients treated with an ablative fractional carbon dioxide laser experienced considerable flattening of the fibrofatty residual tissue, with at least 50% to 75% improvement in color, texture, and overall appearance.

Conclusion: While additional future studies are needed, we believe that ablative fractional resurfacing should be considered for the treatment of textural skin changes associated with involuted infantile hemangiomas.


EMANGIOMAS ARE BENIGN vascular tumors that are present in approximately 13% of infants at birth and up to 5% to 10% of children by the age of 1 year.1-4 Much debate has centered on whether to treat hemangiomas given their natural tendency to spontaneously involute over time. Without intervention, approximately 15% to 40% of hemangiomas will involute, with resultant textural changes of the skin.5,6 Until recently, effective therapies to improve the appearance of these residual skin changes have been lacking.

The typical progression of hemangiomas includes a proliferative growth phase followed by gradual spontaneous involution.7 During the proliferative phase, which may last up to 12 months of age, hemangiomas undergo rapid growth. The involutional phase typically begins between 12 and 18 months, and it is estimated that complete involution of hemangiomas occurs at a rate of 10% per year.8 Accordingly, 50% of hemangiomas involute by the age of 5 years, 70% by the age of 7 years, and so on. However, multiple studies have shown that not all hemangiomas resolve completely.9,10 Many hemangiomas partially involute, leaving behind residual telangiectasia, epidermal atrophy, or redundant fibrofatty tissue.

Lasers have proved to be a valuable tool in treating hemangioma residuum. In the early 1990s, the pulsed dye laser (PDL) was shown to effectively treat telangiectasia and erythema.11 However, it has not been found to be efficacious in treating the epidermal atrophy and the fibrofatty residual that are seen with some involuted hemangiomas. Ablative lasers, including the carbon dioxide (CO2) laser and the erbium: YAG laser, are effective in the treatment of scars, photodamaged skin, rhytides, and dyschromia. They require prolonged recovery periods, however, and are associated with the potential for infection, scarring, and permanent dyspigmentation, making them a less than ideal treatment for hemangioma residuum. The risk for adverse effects with ablative lasers is greater in children who have fewer appendageal structures (in particular on nonfacial anatomical locations), which are necessary for repopulating the ablated tissue.12 Nonablative laser penetration is confined to the upper portion of the dermis, with minimal adverse effects and downtime. Compared with ablative lasers, nonablative lasers are limited in their depth of penetration; therefore, these lasers cannot produce substantial remodeling of the dermis compared with ablative lasers.

Unlike ablative laser resurfacing, which vaporizes and heats tissue in layers, fractional photothermolysis creates distinct columns of thermal injury in the epidermis and dermis, which are referred to as
Microthermal zones are surrounded by healthy, uninjured tissue, which allows rapid healing and minimal adverse effects. Improvement in the appearance of a residual hemangioma has been reported with a nonablative fractionated 1440-nm erbium-doped fiber laser. A newer 30-W ablative fractional CO2 laser combines the efficacy of ablative CO2 lasers with the safety profile of a fractional photothermolysis system. The laser delivers microthermal zones, partially vaporizing the skin and creating a surrounding cylindrical zone of coagulation. This treatment, referred to as ablative fractional resurfacing (AFR), stimulates the production of new collagen and the proliferation of myoblasts in the dermis. Subsequent tissue remodeling occurs, resulting in a reduction in tissue laxity and epidermal atrophy and an overall improvement in the appearance of the hemangioma residuum. In this case series, we propose the use of AFR for the treatment of textural skin changes resulting from involuted hemangiomas.

REPORT OF CASES

CASE 1

A 5-day old girl who was born without any lesions developed hemangiomas of the left and right preauricular cheek area as well as in the beard distribution. The lesions grew rapidly for the next 3 months and tapered off for the following 3 months. At the time of initial evaluation, the patient was 6 months old and had already undergone 1 PDL treatment for ulcerations and multiple courses of intralesional and oral prednisone. On physical examination, she was noted to have erythematous telangiectatic plaques measuring approximately 15.0 × 18.0 cm (Figure 1A). She was treated 23 times with a 595-nm PDL (Vbeam; Syneron/Candela) over the course of 5 years to reduce erythema and telangiectases. A pulse duration of 3.0 ms, spot sizes ranging from 7 to 12 mm, and fluences of 7.5 to 12.5 J/cm² were used while the patient was under general anesthesia. Subsequently, also with the patient under general anesthesia, AFR (Fraxel Re:pair; Solta Medical Inc) was used to treat the fibrofatty residuum and the epidermal atrophy. She has undergone 13 treatments, with settings ranging from 25 to 40 mJ and total 0.5 to 10 kJ, with a 15-mm tip and 30% to 40% coverage, over the course of 3½ years (Figure 1B).

CASE 2

Patient 2 was noted to have hemangiomas in the right parotid region, lower lip, tongue, and left preauricular area as early as 6 weeks. She had bleeding and ulceration of the lower lip at the age of 3½ months, requiring hospitalization. Before presenting for evaluation at our center at the age of 4 years, she had undergone 3 excisional procedures. On physical examination, she was noted to have a 4.0 × 3.0-cm slightly atrophic, telangiectatic, thin plaque on the right preauricular cheek area and a 3.0 × 2.0-cm hypertrophic, erythematous plaque involving the lower vermilion and cutaneous lip area. She was treated 4 times under general anesthesia with a 595-nm PDL (Vbeam; Syneron/Candela) to reduce erythema and telangiectases. Settings included pulse durations of 0.45 to 1.5 ms, with a spot size of 10 mm and fluences of 8 to 9 J/cm². Under general anesthesia, she subsequently had 3 treatments of AFR (Fraxel Re:pair; Solta Medical Inc), with settings of 20 mJ and total 0.29 to 2 kJ, with a 15-mm tip and 20% to 30% coverage to reduce the fibrofatty residuum and epidermal atrophy.

CASE 3

The hemangioma of our third patient first appeared as a minute red macule above the medial aspect of her left eyebrow at 2 weeks of age. The lesion, which was then
diagnosed as a hemangioma, rapidly enlarged over the following 3 months before stabilizing in size. No treatment was received, and the lesion involuted gradually, with the erythema resolving by the age of 8 years. Substantial fibrofatty residuum remained at the site of the hemangioma, which prompted the patient’s mother to seek further treatment. The patient presented with a 1.0-cm-diameter, skin-colored, elevated rubbery nodule on her left lower medial forehead area, just above her eyebrow, 2 weeks after her 10th birthday. Under general anesthesia, the patient has received 5 AFR treatments (Fraxel Re:pair; Solta Medical Inc) over 19 months, with settings ranging from 30 to 40 mJ and total 7.5 to 8 kJ, with a 12- to 15-mm tip and 30% to 40% coverage, as well as 3 treatments with a 595-nm PDL (Vbeam; Syneron/Candela) pulse durations of 0.45 to 1.5 ms, 7- to 12-mm spot sizes, and energies of 6 to 11.5 J/cm². These treatments have resulted in considerable flattening of the fibrofatty residual.

CASE 4

Patient 4 developed a left submental pinpoint red papule 2 days after birth that rapidly enlarged over the following 8 months. No medical or surgical treatment was administered. The hemangioma remained stable in size until the age of 4 years, at which time the lesion began to gradually involute. At the age of 13 years, she presented for consultation with a 4.0-cm, atrophic, yellow-brown plaque in the left submental area. She has received 2 AFR treatments (Fraxel Re:pair; Solta Medical Inc), with settings of 40 mJ and total 10 kJ, with a 15-mm tip and 40% coverage, resulting in improvement in skin texture and a reduction in skin redundancy. She and her mother noted a “tremendous improvement.”

CASE 5

Patient 5 was born with a hemangioma involving his left cheek and orbit that was treated during its proliferative phase with prednisone and laser therapy at the age of 2 months by an outside physician in the Dominican Republic (Figure 2A). At 4 years old, he presented with an involuted hemangioma with residuum, including multiple atrophic scars and diffuse hyperpigmentation of the left cheek, measuring 60 cm² (Figure 2B). Over a 1 year period, he was treated 3 times under general anesthesia with AFR (Fraxel Re:pair; Solta Medical Inc), with settings ranging from 25 to 40 mJ and total 0.4 to 1.0 kJ, with a 15-mm tip and 40% coverage. These treatments resulted in exceptional improvement in texture and color (Figure 2C).

RESULTS

All 5 patients tolerated the procedure well, with no incidence of infection, scarring, or pigmentary alteration. Immediate, transient posttreatment oozing and crusting were reported to resolve within 2 to 3 days. Post-treatment adverse effects included moderate erythema and edema, with pinpoint petechiae that resolved by days 5 through 7. Independent assessments were performed by 3 blinded physicians who were not involved in the treatment. Baseline and follow-up photographs were evaluated for improvement in color, texture, and overall cosmetic appearance according to a 4-point scale (1, 0%-25%; 2, 25%-50%; 3, 50%-75%; and 4, 75%-100%) after a series of AFR treatments. All patients were found to have at least 50% to 75% improvement, and 2 patients had 75% to 100% improvement in the degree of atrophy, topographical abnormalities, and pigmentary
Infantile hemangiomas are vascular tumors that develop in the newborn period, grow rapidly, and then gradually involute. Understanding the progression of these lesions, many parents and physicians choose to observe rather than treat hemangiomas. Unfortunately, the involutional process is often imperfect, and patients may be left with residual skin changes such as telangiectases, atrophic wrinkling, yellow or brown discoloration, and fibrofatty redundancy of the skin. Hemangiomas treated with surgical excision, intralesional or systemic medications, or PDL can also be left with posttreatment residuum. The PDL has been used to treat residual telangiectases and erythema; however, effective treatments to target the disfiguring textural skin changes associated with involuted hemangiomas are lacking.

Older resurfacing technologies, such as the CO2 laser or the erbium:YAG laser, carry substantial risk of infection, scarring, and permanent pigmentary alteration, along with prolonged downtime, complications that make these technologies less than ideal choice for treating hemangioma residuum. Ablative fractional resurfacing represents a major advance in laser resurfacing. Its proven efficacy in the treatment of rhytides, acne, atrophic scarring, and melasma led us to postulate that substantial improvement could be achieved in the treatment of hemangioma residuum. The clinical improvement achieved in this case series is secondary to excess tissue volume reduction by means of ablation as well as textural changes induced by remodeling over time by means of neocollagenesis. The clinical improvement achieved in this case series is secondary to excess tissue volume reduction by means of ablation as well as textural changes induced by remodeling over time by means of neocollagenesis.

As demonstrated in this case series, AFR can safely and effectively improve the epidermal atrophy, fibrofatty residual, and overall appearance of hemangioma residuum. The fractional CO2 technology allows quick recovery and is of particular importance in children, who possess fewer pilosebaceous units that act as reservoirs for epidermal replacement. As documented, there were no adverse effects, including delayed hypopigmentation, as can occur with fully ablative procedures. With appropriate candidates, procedure technique, and parameters specific to each case, there is seemingly a low risk for delayed hypopigmentation, which has been well documented by Hunzeker et al.

The long period of time over which these laser treatments were administered makes it difficult, in the absence of internal controls, to discern whether the clinical improvement was solely a result of the laser treatments, as the role of natural involution cannot be adequately assessed. Larger studies with extended follow-up are needed to further examine the benefits of treatment; however, at the present time, we believe that AFR should be considered for the treatment of textural skin changes associated with involuted infantile hemangiomas.

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Atomic Bomb Lexicon

With the dropping of 2 atomic bombs on Japan in 1945, a whole new terminology developed to describe the resulting devastation. This article lists some of the terms that are relevant to dermatology. It is intended to serve as a remembrance for the victims of Hiroshima and Nagasaki. It is also a reminder of what can happen, even to 1 organ system, should mankind foolishly unleash upon itself another nuclear weapon.

Flash burns are injuries that are caused by exposure to thermal radiation. When the atomic bombs exploded, there was an intense flash of light that spread over Hiroshima and Nagasaki, causing burns.1 Some persons who were close to the hypocenter were incinerated, leaving behind only their shadows imprinted on the ground. Of the 90,000 to 166,000 persons who were killed in Hiroshima and the 60,000 to 80,000 persons who were killed in Nagasaki, approximately 20% to 30% died of burns.2

The distinctive features of flash burns were as follows:

1. The burns occurred on skin areas that faced the explosion.
2. The burns often formed patterns on the skin that corresponded to the darker portions of garments, which burned more because of increased light absorption.
3. The burns often healed with disfiguring keloid formation.

Fifteen percent to 20% of the atomic bomb victims died of radiation sickness, now termed acute radiation syndrome. Their symptoms included nausea, vomiting, headache, low blood cell counts that resulted in infections, and petechiae.

Hair loss, especially on the crown of the head, was a striking finding, along with skin necrosis.

Acute radiation syndrome comprises 4 subsyndromes that result when the body is exposed to a high dose of deep, penetrating, ionizing radiation: (1) hematopoietic, (2) gastrointestinal, (3) neurovascular, and (4) cutaneous.3 These subsyndromes occur in 4 phases, which can vary in timing, severity, and prognosis, depending on the degree of radiation exposure. The phases for the cutaneous radiation syndrome are:

1. Prodromal. The features include erythema, pruritus, and edema. This stage lasts 1 to 2 days.
2. Latent. No injury is evident for a variable time.
3. Manifest illness. The features include erythema, edema, dry or moist desquamation, necrosis, and epilation. This stage occurs days to weeks after exposure.
4. Possible chronic or late effects and recovery. The features include fibrosis, telangiectasia, atrophy, and skin cancer. This stage occurs months to years after exposure.

This article concludes with the words of hope that are inscribed on the Isaiah Wall that stands across from the United Nations. The Biblical verse captures humanity’s age-old dream for a better future, when countries will resolve their differences at conference tables and not on battlefields. No longer will mankind need the lexicons of war. Instead, we will share pruning hooks. Nation shall not lift up sword against nation. Neither shall they learn war any more. (Isaiah 2:4)

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REFERENCES


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