Laser Scar Revision: Comparison Study of 585-nm Pulsed Dye Laser With and Without Intralesional Corticosteroids

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BACKGROUND. **Hypertrophic scars affect 1.5% to 4.5% of the general population and remain notoriously difficult to eradicate because of the high recurrence rates and the incidence of side effects associated with treatment. Pulsed dye laser (PDL) treatment and intralesional corticosteroids have individually been reported to be effective in reducing hypertrophic scar bulk and symptoms.**

OBJECTIVE. **To determine whether combination PDL and intralesional corticosteroid treatment produces better hypertrophic scar improvement than PDL treatment alone.**

METHODS. **Bilateral hypertrophic inframammary scars in 22 females were randomly assigned to receive treatment with 585-nm PDL alone or in combination with intralesional corticosteroid. Clinical evaluations and scar pliability scores were determined before each of the two treatment sessions and 6 weeks after the final treatment. Histologic evaluation of skin biopsies obtained before and after treatment was performed in four patients.**

RESULTS. **All scars showed clinical improvement with increased pliability and decreased symptoms (pruritus) after each of the two treatments. Clinical improvement scores were not significantly better with the concomitant use of corticosteroids. Side effects were limited to mild purpura and transient hyperpigmentation. Decreased sclerosis was seen in scars after PDL treatment (with or without concomitant corticosteroids).**

CONCLUSIONS. **Treatment of hypertrophic inframammary scars with 585-nm PDL irradiation alone effected substantial clinical and histologic improvement. The adjunctive use of intralesional corticosteroids did not significantly enhance clinical outcome except in those scars that were most symptomatic.**

T. ALSTER, MD HAS INDICATED NO SIGNIFICANT INTEREST WITH COMMERCIAL SUPPORTERS.

ALTHOUGH DELIBERATELY induced scars have been assigned a positive symbolic and aesthetic value in many cultures, in Westernized societies, scars are interpreted as stigmata left by disease processes, accidental injury, or surgical interventions and serve as reminders of the vulnerability and fragility of the body and the contingency of life. Aesthetic disfigurement from scarring is known to be psychologically debilitating, decreasing the quality of life and overall productivity in affected patients. Although rarely posing a health risk, hypertrophic scars are often associated with symptomatic complaints, including pruritus and dysesthesia.

Hypertrophic scars are firm, raised, and erythematous and, by definition, remain within the boundaries of the original wound.[1] Histologically, they are characterized by thick hyalanized collagen bundles consisting of fibroblasts and fibrocytes arranged in nodules. Multiple microvessels occluded by numerous endothelial cells are often present.[2] Hypertrophic scars result from overzealous collagen synthesis coupled with limited collagenolysis (caused by decreased collagenase expression) during the remodeling phase of wound healing.[3–6] Hypertrophic scars typically occur within the first 6 to 8 weeks after re-epithelialization. They then undergo a rapid growth spurt that can continue for several months with gradual maturation over the ensuing year. Some of these scars will gradually regress over time, whereas others may continue to enlarge and become permanent.

A wide variety of treatments have been advocated for hypertrophic scars, including topical and intralesional corticosteroids, interferon, surgical excision and/or grafting, cryosurgery, radiation, pressure therapy, retinoic acid, and silicone gel sheeting. Unfortunately, their high recurrence rates, as well as significant side effects such as dyspigmentation and atrophy, have limited the usefulness of many of these modalities.[1,7]

Lasers also initially had variable success in treating these scars. The cutaneous wave argon, Nd:YAG, and CO_2 lasers were first used with encouraging results, but subsequent reports failed to confirm their long-

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term treatment efficacy.[8–18] Over the past decade, however, the vascular-specific 585-nm pulsed dye laser (PDL) has been shown to provide long-standing improvement of hypertrophic scars and keloids, as evidenced by significant reduction of scar erythema, height, symptoms, and rigidity.[19–30]

More recently, investigators have examined the PDL's potential as a means for preventing hypertrophic scar formation in surgical incisions during the initial stages of wound healing.[31] Along the same lines, adjunctive use of intralesional corticosteroids may not only improve pruritus caused by interruption of the inflammatory response mechanism (as occurs with its use after surgical excision)[32] but could lead to fewer sessions being necessary to effect the clinical response desired.

The purpose of this study was to determine whether the combination of 585-nm PDL and intralesional corticosteroid treatment is more advantageous in the amelioration of hypertrophic scars than PDL irradiation alone.

Methods

Twenty-two females (ages 21–45, mean age of 38 years, skin phototypes I–IV) with bilateral, symmetric hypertrophic breast reduction (inframammary) scars were included in the study. Scars had been present for 4 to 72 months (mean duration of 18.5 months). Patients were excluded if any scar treatments had been obtained within 6 months of study entry. Scars were randomly assigned to receive 585-nm PDL (Sclerolaser; Candela Laser Corp., Wayland, MA) alone or combined with triamcinolone acetonide (Kenalog; Bristol-Myers Squibb, Princeton, NJ) injected immediately after laser irradiation. Each patient had one inframammary scar treated with the PDL alone and the contralateral scar treated with combination PDL and corticosteroids. All laser treatments and steroid injections were performed by the investigator (T.S.A.) at 6-week time intervals. Two treatments were delivered to each scar using either PDL alone or PDL followed immediately by 10- to 20-mg intralesional triamcinolone. Fluences ranging 4.5 to 5.5 J/cm^2 (average of 5.0 J/cm^2) were applied to the length of each scar using nonoverlapping 10-mm collimated spots with concomitant cryogenic cooling (30 ms) and a laser pulse duration of 1.5 ms.

Photographic documentation and clinical evaluations were made before each treatment and 6 weeks after the second (final) treatment by two independent assessors blinded to the study protocol using a standard quartile grading scale (0 = $<$25%, 1 = 25% to 50%, 2 = 51% to 75%, and 3 = $>$75% improvement). Pliability scores (0 = normal, 1 = supple, 2 = yielding, 3 = firm, and 4 = banding) and symptom scores (0 = none, 1 = mild itch/burn, 2 = moderate itch/burn, and 3 = severe itch/burn) were also recorded.

Scar biopsies were obtained before and after treatment in four patients. Histologic evaluations were made by a board-certified dermatopathologist who was also blinded to the study protocol.

Results

All scars (N = 44) showed clinical improvement after each of the two treatments (Figures 1A–C and 2A–C). Clinical improvement scores averaged 1.45 and 1.58 at 6 weeks after one PDL treatment (N = 22) and PDL/steroid combination (N = 22), respectively. Six weeks after the second treatment, scores were 2.42 and 2.50 for PDL alone (N = 22) versus PDL/steroid combination (N = 22), respectively (Figure 3).

Scar pliability scores and symptoms also improved after each treatment session. Average pliability scores were reduced by 50% after two sessions with either the PDL treatment alone or combination PDL/steroid treatment (Figure 4). Symptom scores dropped by 50% after PDL treatment and by 70% when concomitant intralesional corticosteroids were used (Figure 5).

Side effects were limited to mild purpura (average duration of 4.5 days), transient mild hyperpigmentation (four patients, average duration of 5 to 6 weeks), and intraoperative pain (mild for PDL alone and moderate for PDL/steroid combination).

Histologic examination of tissue biopsies revealed dense coarse dermal sclerosis in all pretreatment scars. After PDL irradiation, a decrease in the number of fibroblasts was seen, and collagen fibers appeared looser and less coarse. The addition of corticosteroids did not change the histologic appearance of treated scars (compared with laser alone). In addition, no significant changes in tissue mast cell numbers were seen after treatment.

Discussion

Treatment of hypertrophic inframammary scars with 585-nm PDL irradiation effected significant clinical and histologic improvement in all study patients. Although the mechanism of action by which PDL irradiation improves these proliferative scars remains unknown, but suggested theories include laser-induced tissue hypoxia from decreased microvascular perfusion leading to neocollagenesis,[21] collagen fiber heating

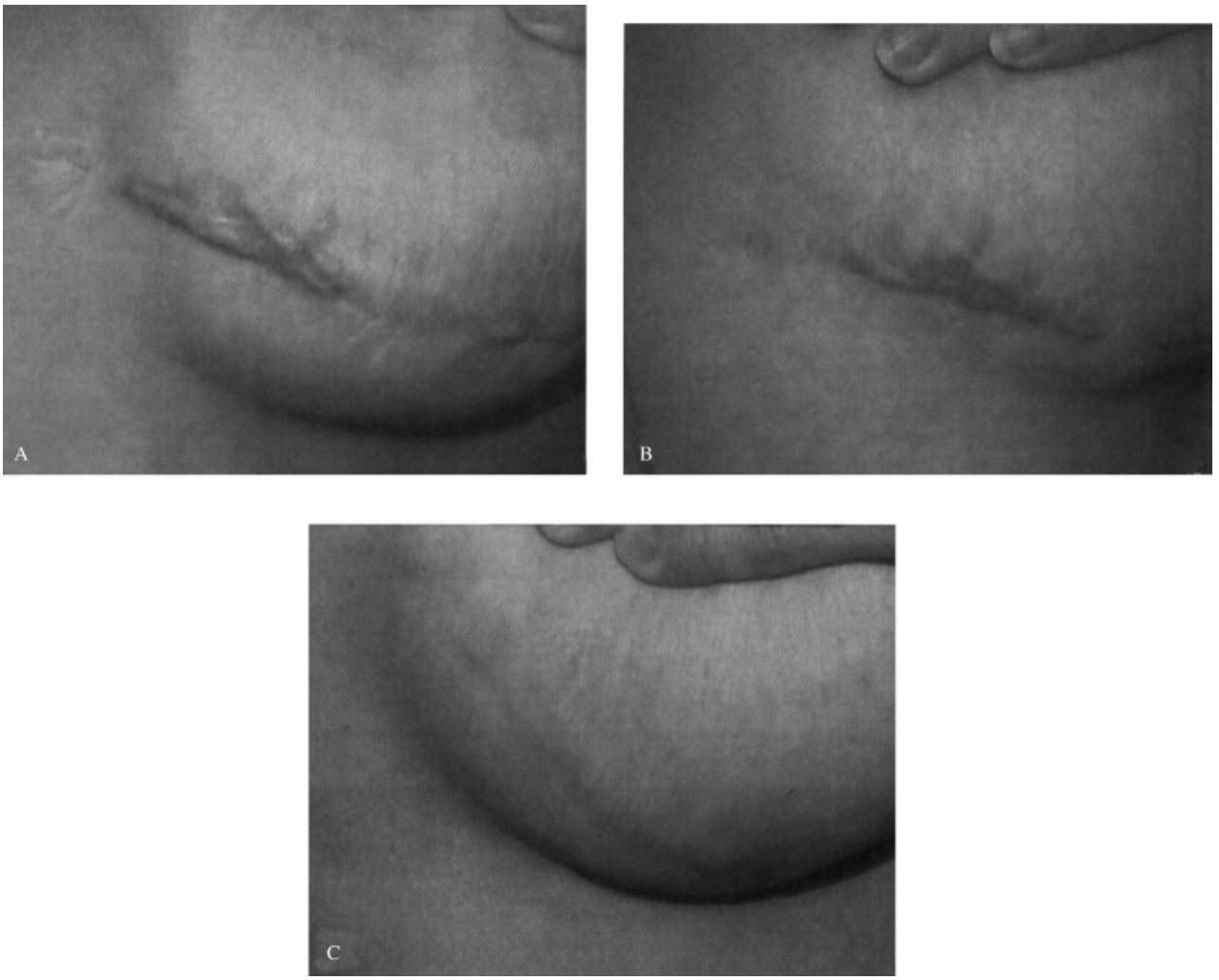

Figure 1. (A) Inframammary scar before treatment. (B) Six weeks after one PDL treatment. (C) Six weeks after second PDL treatment.

with dissociation of disulfide bonds and subsequent collagen fiber realignment, and release of histamine or other factors that influence fibroblast activity.[23] The 585-nm wavelength has been shown to be the most capable of effecting decreased hypertrophic scar growth (compared with 590, 595, and 600 nm), presumably because of its increased vascular specificity.[33]

The ability to predict aberrations in the wound healing process before overt clinical symptoms become apparent and to design appropriate interventions necessitates a far more thorough understanding of the multiplicity of molecular and cellular factors that give rise to the cascade of biological events that occur during normal and abnormal wound healing than we presently have. The most recent studies continue to reveal new dimensions of the complex interactions during wound healing between angiogenic factors, inflammatory cytokines, and integrins that comprise the vast array of self-regulating interchanges between various cell populations (e.g., neutrophils, macrophages, mast cells, fibroblasts, and vascular endothelial cells).[34]

The adjunctive use of intralesional corticosteroids did not significantly enhance clinical outcome in our study except in terms of decreasing pruritus within particularly symptomatic scars. The relatively low dose of injected corticosteroid (10 to 20 mg as opposed to 20 to 40 mg) may have accounted for the limited improvement observed in the combination protocol. Higher corticosteroid concentrations could have potentially yielded better results but also would have increased the risk of unwanted side effects such as skin atrophy and telangiectasias in this delicate body location.

Conclusions

Given the emotional effects on patients suffering the consequences of excessive scar formation, the sub-

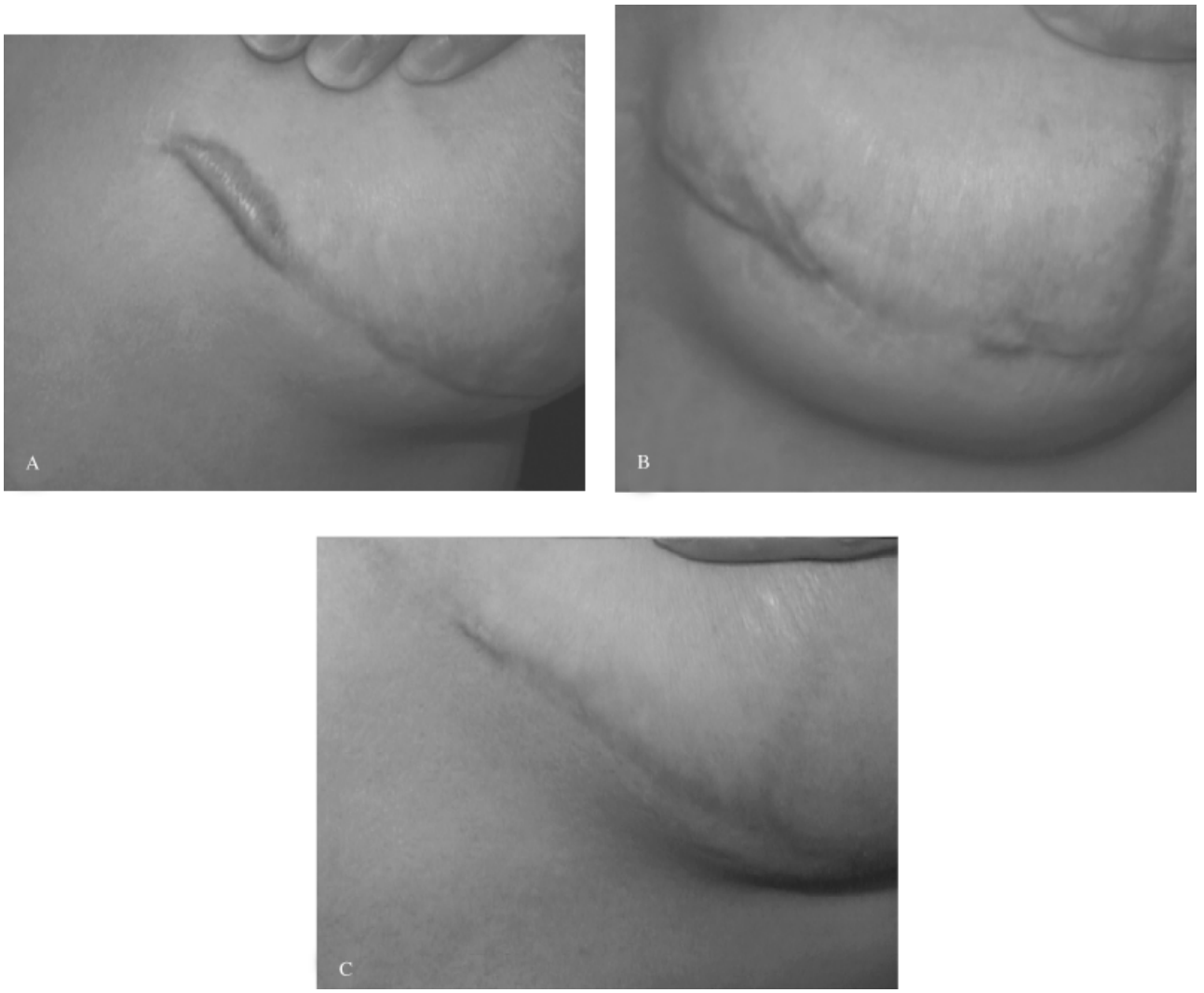

Figure 2. (A) Contralateral inframammary scar. (B) Six weeks after one combination PDL/steroid treatment. (C) Six weeks after second PDL/steroid treatment.

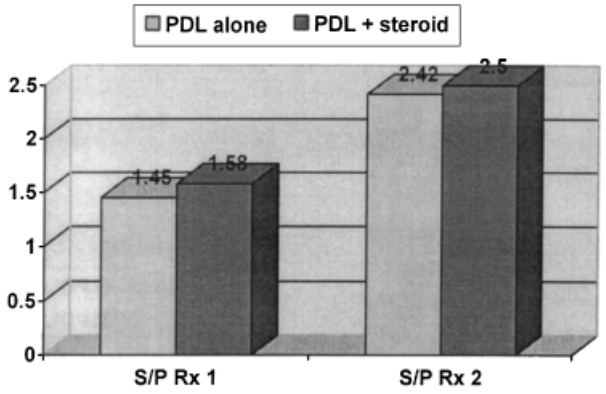

Figure 3. Clinical improvement scores. Clinical grading: 0 < 25%, 1 = 25-50%, 2 = 51-75%, 3 > 75% improvement.

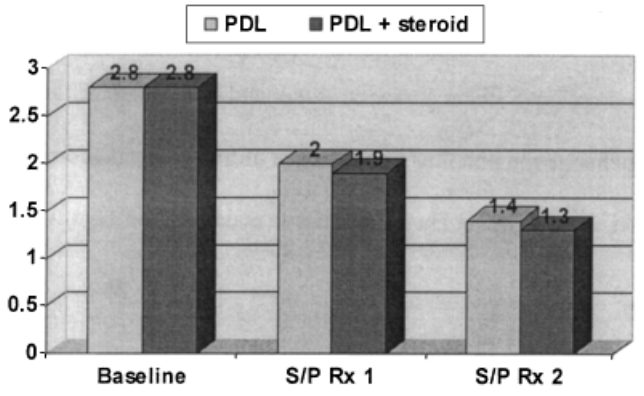

Figure 4. Scar pliability scores. Grading: 0 = normal, 1 = supple, 2 = yielding, 3 = firm, 4 = banding.

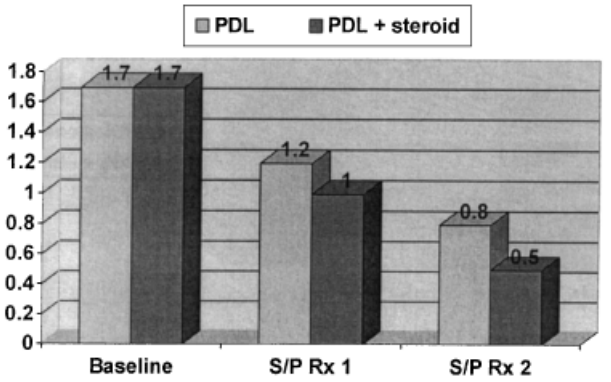

Figure 5. Symptomatic improvement. Grading: 0 = no symptoms, 1 = mild itch/burn, 2 = moderate itch/burn, 3 = severe itch/burn.

stantial improvement of hypertrophic scars seen after 585-nm PDL treatment in this study is extraordinarily gratifying. The concomitant use of intralesional corticosteroids may be warranted in those scars that are particularly symptomatic.

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