

CASE REPORT

Hypertrophic Scars After Therapy with CO₂ Laser for Treatment of Multiple Cutaneous Neurofibromas

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BACKGROUND. CO₂ laser surgery is a treatment modality for cutaneous neurofibromas.

OBJECTIVE. Hypertrophic and atrophic scars can result from treatment with CO₂ laser surgery. We present a case of cutaneous neurofibromatosis that developed hypertrophic scars postoperatively.

METHODS. Continuous wave CO₂ laser surgery therapy was applied to the patient.

RESULTS. Hypertrophic scars developed 2 months after therapy.

CONCLUSION. With a preliminary test treatment the patient is able to see the expected result.

VON RECKLINGHAUSEN neurofibromatosis, also known as neurofibromatosis 1 (McK 162200), is a disease with skin tumors derived from peripheral nerves. Von Recklinghausen neurofibromatosis is an inherited neuroectodermal abnormality characterized by the presence of multiple neurofibromas, six or more café au lait macules (larger than 15 mm postpuberty), axillary freckles, hypertrophic and cystic bone lesions, and Lisch nodules in the iris. The mode of inheritance is autosomal dominant on gene 17q11.2. This gene is responsible for the production of the tumor suppressor neurofibromin. With a prevalence of 1 in 2500 births, it is one of the most prevalent genetic defects.¹

Because of the psychological impact of the disease, treatment to remove the neurofibromas which stigmatize the patient is often requested.^{2,3} CO₂ laser vaporization is a simple procedure that quickly removes the tumor with minimal postoperative discomfort and acceptable cosmetic results.^{3,4}

Case Report

A 54-year-old woman with neurofibromatosis 1 presented with multiple café au lait macules and many fibromas. Some of the other clinical symptoms of Von Recklinghausen neurofibromatosis were also present: axillary freckles and Lisch nodules in the iris. She had

no health problems or neurologic abnormalities at that moment. Several excisions of fibromas had already been performed under local anesthesia. This time she was seen in our department for CO₂ treatment of newly developed neurofibromas.

The neurofibromas were treated with continuous wave CO₂ laser, 20 W on defocused mode for the sessile form and 10 W when excising the pedunculated form. Under general anesthesia about 100 lesions were treated on face, arms, neck, and collar. After the laser therapy, chlorohexidine 1% creme was applied to the skin and instructions were given to avoid sunlight.

The wounds healed by second intention in 3 weeks time. Two months later the face, neck, and collar had recovered well. However, several hypertrophic and atrophic scars persisted on the arm, mostly on the hand (Figure 1).

A 3 mm biopsy was performed on the left hand. Histopathology showed an epidermis of normal thickness. In the dermis, scar tissue formation was visible, characterized by parallel lying fibroblasts and collagen. In the depth, a remainder of the neurofibroma was still present.

The patient was treated with 13-*cis*-retinoid 80 mg/day. After 4 months of therapy an improvement of the scars occurred. There was almost no erythema left and the scars were flattened. Smooth depigmented scars remained.

Discussion

The classic pattern of anatomic distribution of neurofibromas is predominance on the trunk, as well as head and neck involvement, with decreasing incidence of lesions as one proceeds peripherally. The involve-

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Figure 1. Hypertrophic scars 2 months after laser therapy.

ment of the hand, especially the palm, is quite uncommon. Traditional surgical procedures are as variable as the modes of presentation of the disease. Most commonly, repeated excisions of tumor involving the orbit, eyelids, cheeks, ears, lips, nose, and mouth are performed, followed by appropriate reconstruction such as skin graft, rhytidectomy, blepharoplasty, tarsorrhaphy, or fascia sling. Frequently a secondary reconstruction is necessary.⁵

Very small fibromas cannot be treated by conventional surgery, as they usually present in large numbers: the enormous amount of time required makes it impossible to treat all the tumors. By contrast, laser can perform this task quickly and without bleeding, since the coagulating capability of the laser light beam seals blood vessels up to about 0.5 mm in size immediately. For this reason CO₂ laser has been developed during the last 10–15 years and has become a standard treatment for neurofibromas of the skin.² Its advantages include high patient satisfaction with rapid, staged removal of thousands of neurofibromas, minimal morbidity, and enhanced appearance. Healing is complete in 6 weeks or less.⁴

Our patient was in good health and had not reported any previous abnormal scarring or keloid formation even after earlier excisions. In port-wine stains, hypertrophic scars are described after treatment with CO₂ laser, argon laser, and even with flashlamp-pumped pulsed dye laser surgery, although treatment is effective in most instances.^{6–8}

Hypertrophic scar formation occurring during the first 3–4 months after CO₂ laser therapy of neurofibromas has been mentioned in the literature.² It remains an uncommon complication after CO₂ laser therapy. In neurofibromas, depigmented, flat, circular, and depressed scars are seen.^{2,4} Instead of a complication of treatment, CO₂ laser therapy is frequently suggested as an effective treatment for hypertrophic scars.⁹

Suggested causes for scar formation after treatment are localized infection, trauma within 24 hours, overlap of adjacent test pulses, the location, and higher pulse level.^{6,7,10} In our case the scars were only present on the underarm and hand. Thermal trauma could be an explanation.¹¹ Another explanation could be the characteristics of the neurofibroma itself. Neurofibromas are complex mixtures of Schwann cells, fibroblasts, perineural cells, vascular endothelium, and mast cells.¹² Interactions of these cells during trauma and wound healing might produce scars. In our patient the anatomic site, in combination with the wound depth, was probably the cause of hypertrophic scarring, as she had no problems on the face, neck, and collar after the same treatment. Extremities take significantly longer to heal as compared to the face and there is a greater risk of hypertrophic scar formation.¹³

Isotretinoin, a synthetic isomer of tretinoin (vitamin A acid), has an anti-inflammatory and antineoplastic activity. Tretinoin can induce hypertrophic scar formation. Nonetheless, it seems to work in many cases, an apparent contradiction. In the literature there are indications that retinoids can produce a reduction of fibroblast proliferation and collagen synthesis. Also, topical vitamin A has been shown to be effective in the treatment of hypertrophic scars.^{10,14} Although there is no evidence, we believe that treatment with 13-*cis*-retinoid might reduce or inhibit further fibroblast proliferation. Our patient responded to the treatment, but it is doubtful whether the effect is due to the drug or to spontaneous resolution of the hypertrophic scar.

The cosmetic disfigurement is the most important issue in the decision to treat cutaneous symptoms of neurofibromatosis. Treating patients with extensive neurofibromas with CO₂ laser is still the best choice. However, it is strongly advised that a test treatment be performed to judge the effectiveness of the procedure and whether the developed scar is an acceptable trade-off.

References

1. Riccardi VM. Neurofibromatosis: phenotype, natural history, and pathogenesis, 2nd ed. Baltimore: Johns Hopkins University Press, 1992.
2. Katalinic D. Laser surgery of neurofibromatosis 1. *J Clin Laser Med Surg* 1992;10:185–92.
3. Roenigk RK, Ratz JL. CO₂ laser treatment of cutaneous neurofibromas. *J Dermatol Surg Oncol* 1987;13:187–90.
4. Becker DW Jr. Use of the carbon dioxide laser in treating multiple cutaneous neurofibromas. *Ann Plast Surg* 1991;26:582–6.
5. Bromley GS, Sherman JE, Goulian D Jr. Neurofibromatosis—distribution of lesions and surgical treatment. *Ann Plast Surg* 1982;8:272–6.
6. Tan OT, Carney JM, Margolis R, et al. The histologic responses of port-wine stains treated by argon, carbon dioxide, and tunable dye laser. *Arch Dermatol* 1986;122:1016–22.
7. Swinehart JM. Hypertrophic scarring resulting from flashlamp-pumped pulsed dye laser surgery. *J Am Acad Dermatol* 1991;25:845–6.

8. Gaston DA, Clark DP. Facial hypertrophic scarring from pulsed dye laser. *Dermatol Surg* 1998;24:523-5.
9. Nowak KC, McCormack M, Koch RJ. The effect of superpulsed carbon dioxide laser energy on keloid and normal dermal fibroblast secretion of growth factors: a serumfree study. *Plast Reconstr Surg* 2000;105:1973-8.
10. Urioste SS, Arndt KA, Dover JS. Keloids and hypertrophic scars: review of treatment strategies. *Semin Cutan Med Surg* 1999;18:159-71.
11. Rendon-Pellerano MI, Lentini J, Eaglstein WE, Kirsner RS, Hanft K, Pardo RJ. Laser resurfacing: usual and unusual complications. *Dermatol Surg* 1999;25:360-67.
12. Riccardi VM. of mass and men: neurofibromas and histogenesis. *Arch Dermatol* 2000;136:1257-8.
13. Jimenez G, Spencer JM. Erbium:YAG laser resurfacing of the hands, arms, and neck. *Dermatol Surg* 1999;25:831-5.
14. Klingman AM. The growing importance of topical retinoids in clinical dermatology: a retrospective and prospective analysis. *J Am Acad Dermatol* 1998;39:S2-7.