## Tattoo Removal Using the Ruby Laser

DECORATIVE TATTOOS have almost certainly existed since prehistoric times. Because social customs and individual preferences change, patients frequently seek information concerning the removal of these marks. Despite having a large number of techniques to choose from including salabrasion, chemical scarification, dermabrasion, infrared coagulation, split-thickness tangential excision, cryosurgery, excisional surgery, and ablation using the argon and carbon dioxide lasers, there has been no ideal form of treatment available. Furthermore, many of these techniques shared the common problems of incomplete pigment removal, considerable postoperative wound care, prolonged healing, permanent hypopigmentation, textural changes, and scarring. As a result, newer techniques have been eagerly awaited that might allow a more satisfactory management of patients with tattoos.

With the recent Food and Drug Administration approval of the ruby laser, the wait for an ideal form of treating tattoos may finally be over. Developed in the early 1960s, the ruby laser was the first functional laser system. Despite early publication regarding its use in the treatment of decorative tattoos, it was not until 1983 that reports reappeared describing the beneficial effects of ruby laser therapy. It now appears from several published large series of patients that this technique offers some distinct advantages over alternative forms of therapy for tattoos. The most important benefit is the ability to remove tattoos without scarring. This apparently is possible because the high-intensity red light produced by the ruby laser is selectively absorbed by the blue and black carbon particles found in amateur and professional tattoos. In addition, the energy is emitted to the pigmented tissues without damaging the surrounding normal skin. This concept, known as selective photothermolysis, has also been recently employed with a dye laser for the treatment of port-wine stain birthmarks in infants and young children without scarring. Additional benefits include minimal postoperative care and rapid healing.

This technique does have some limitations. Presumably because of differences in the size of pigment particles and variable energy absorption by the metals used to produce tattoo colors, all patients do not respond uniformly to ruby laser therapy. In general, blue and black tattoos respond the best, but even yellow, green, and red will usually fade with multiple treatments, which are performed at five- to six-week intervals. Typically, more treatments will be required for professional tattoos than for amateur tattoos, but an accurate prediction cannot be made for the ultimate response or the number of treatments that will be required. Anesthesia may be needed in about 50% of patients, especially when the tattoos are on sensitive areas such as the fingers, breast, or face. Despite these problems, the benefits resulting from this technique are substantial. It should be considered for patients with tattoos in anatomic locations that are susceptible to poor healing or for those who are seeking the best cosmetic result possible.

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## Skin Cancer and Sunscreens

NONMELANOMA SKIN CANCERS, basal cell carcinomas, and squamous cell carcinomas are by far the most common cancers that occur in the United States each year. They make up 30% to 40% of all malignant growths. The incidence of nonmelanoma skin cancers has been increasing progressively in the past several decades.

Malignant melanoma, the third most common skin cancer, accounted for 3% of all reported cancers in the US in 1990, and it was estimated that there would be 32,000 new patients with melanomas and that 6,200 persons would die because of this cancer in 1991. The melanoma incidence has been increasing at an alarming rate for at least the past four decades.

The role of the sun in inducing nonmelanoma skin cancers is well established. There is also epidemiologic and experimental evidence indicating that sun exposure most likely stimulates melanoma formation.

The avoidance of sun damage should be the mainstay of a preventive medicine approach to limiting all three of these skin cancers. The use of sun blocks and sunscreens is probably useful in preventing chronic sun damage. Sun blocks reflect and scatter the offending rays. They provide excellent protective coats but are usually cosmetically unacceptable.

In contrast, sunscreens absorb the injurious rays and can be applied in cosmetically acceptable invisible films. They are labeled with a sun-protective factor (SPF) number that represents the hours of exposure to the midday sun required to induce a minimal erythema dose (MED) through the sunscreen divided by the MED without the sunscreen in place. This is a measure of UVB protection. Everyone who is going to be in the sun should wear a sunscreen with a SPF of at least 15.

UVB rays make up the primary action spectrum for the sunburn erythema, chronic sun damage, and skin cancer. Although recent studies indicate that UVA radiation can also cause a delayed erythema in human skin, it requires much more energy. A person could receive 15 or more UVB-induced MEDs in a summer's day but only get 2 to 4 UVA-induced MEDs in that same day.

In humans, UVA augments the acute sunburn effects of UVB. In experimental models, UVA acts additively with UVB-induced cancer formation, and, with large enough amounts, UVA can by itself induce cancers. It would therefore seem prudent to protect against UVA as well as UVB damage.

Recent advances have included increased SPF, UVA protection, and substantivity (water resistance). Sunscreens with SPF values as high as 50 are available. In one study, it was shown that a sunscreen with an SPF of 29 prevented the UVB damage that 15 MEDs induced through a sunscreen with an SPF of 15. A potential drawback is that the increased concentration of chemicals might lead to increased contact irritancy and allergic sensitization. UVA protection has been accomplished by increasing the percentage of certain molecules, such as the benzophenones, or by adding certain specific UVA-absorbing compounds, such as butyl-methoxy-dibenzoylmethane (Parsol 1789). Micronized particles or melanin may be incorporated to increase UVA protection.

The third advance has been in products that resist being removed by swimming, perspiring, or even by rubbing. It is still a good idea to reapply a sunscreen after swimming or