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Tattoo Removal

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Tattoo: The designs created by injecting pigments beneath the skin (of clear-skinned persons) or by inflicting scars (among dark-skinned), the tattoo marks are of East Island origin; Maori, *ta*, to scar; Tahitian *tatu*, pricking.

The Oxford English Dictionary emphasizes what every dermatologist, tattoo artist, and amateur tattooer knows: the marks or designs implanted into the skin are *permanent*.

Whether the pigment is injected by a physician performing cosmetic surgery with the best sterile technique or by a professional tattoo artist using an aseptic technique, or by a teenager or bored prisoner using little to no sterile technique, most tattoos fortunately do not become infected. Although several infections have been transmitted by tattoo needles, including hepatitis, tuberculosis, leprosy and even syphilis—and probably AIDS as well—it is a great testimony to the reparative and protective nature of our skins that infections and other complications are actually quite rare.

It is also a tribute to our skin that most pigment injected or inserted into our dermis stays there—permanently!

Some pigment may be transported to adjacent lymph nodes and may present a problem to a pathologist searching for metastatic melanoma in an enlarged node. Pigment also spreads out horizontally with years, so that old tattoos become blurred and bluer and less black because of the Tyndall effect.

Because the tattoo is permanent, the man or woman contemplating getting a tattoo is advised to be absolutely certain of

the subject (i.e., name of husband, wife or lover, pornographic subject, and so on) and that he or she wants to keep that "body art" forever (Fig. 1).

People and associations do change, and tattoo removal is often requested of the dermatologist or surgeon.

REASONS FOR TATTOO REMOVAL

Dermatologists, plastic surgeons, and tattoo artists surveyed at the World of Tattoo Exhibit in San Francisco, Los Angeles, Toronto, New Orleans, and Honolulu between December 1978 and March 1980 cited the following as the most common reasons for having a tattoo removed:

Personal, Social, and Cultural Reasons

1. Personal changes—divorce, separation, and change of lovers and friends.
2. Inability to obtain employment because of a tattooed body part.
3. Easy identification by law officers, recognizing stigmata.
4. Self shame and a desire to disassociate themselves from the atmosphere of a prison or other group such as a motorcycle club.
5. Recognition by police officers who may identify a prisoner or ex-prisoner as one who can be persuaded to be an informant.
6. Removal of the stigmata of World War II Nazi concentration camp identification tattoos.

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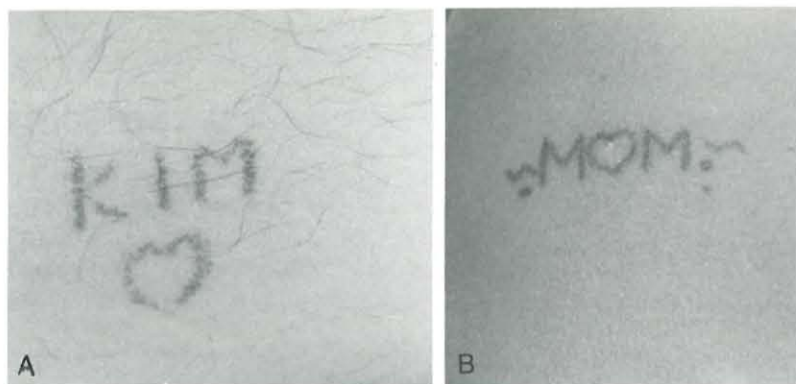


Figure 1. A and B, Clinical appearance of typical small amateur tattoos.

Medical Reasons

1. Allergic reactions in a tattoo, usually a photosensitive reaction in the red pigment.
2. Elimination of chronic infections in a tattoo, such as tuberculosis.
3. Removal of a neoplasm that develops in a tattoo (a rare occurrence).

TATTOO REMOVAL METHODS

Review of Past Methods

Parry in his classic 1933 book listed all the methods "scientifically tested and approved by chemists, physicians and surgeons."⁴⁵ He warned that "these methods are not to be used by the tattooed themselves, or by tattoo masters, but by physicians and surgeons only."⁴⁵

1. The French process—tannic acid and silver nitrate
2. Salicylic acid
3. Monochloroacetic acid or trichloroacetic acid
4. Carboic acid (phenol)
5. Sulfuric acid (15 grains to 1 oz of water)
6. Nitric acid (concentrated)
7. Zinc chloride
8. Mercuric chloride
9. Cantharides plaster (Spanish Fly). Add vinegar to increase action or open the blister formed by the Spanish Fly and add a weak zinc chloride solution.
10. Glycerol of papoid (or glycerol of caroid). A powerful organic digestant. It digests the tissue in question.
11. Zonite, a solution of sodium hypochloride, approximately twice as strong as Dakin's solution

12. Electrolysis—similar to hair removal by electricity, feasible only on small tattooed designs
13. Surgery—cut out mechanically, raise the flap, cut skin, scrape off the pigment from the bottom of the skin
14. Surgery—use a grattage (a little steel scrubbing brush). Apply hydrogen peroxide.
15. Use cutaneous trephine (a surgical instrument resembling a carpenter's hollow tool)
16. When a design is superficial, use dry ice (CO₂ snow). It will freeze the skin and turn it grey; then the skin may be removed with tweezers.
17. Prolonged thin design: simple excision
18. For larger designs: excision with grafting

Since Parry's review, a few more modern surgical methods have emerged, including cryosurgery and laser therapy, to be reviewed later in this article.

Tattoo Removal Methods Today

Home do-it-yourself methods such as salabrasion and "picking it out" or curettage are also performed by physicians with fair-to-good results and will be discussed later.

Some do-it-yourself methods not usually performed by dermatologists include cautery with cigarettes, hot coat-hangers, and scalding with steam!

Tattoo Removal Methods by Tattoo Artists

Tattoo artists, for legal and other reasons, usually prefer not to remove tattoos and in

many states are actually prohibited by law from removing them. One of the most common removal methods used by tattoo artists is the Variot or French method.

Other tattoo artists' methods include over-tattooing or re-tattooing—an attempt to lighten a dark tattoo by using lighter pigments. Tattooing with white zinc oxide or pink pigments is usually not very successful because of surrounding skin color changes with sun exposure and aging.

Artistic dermatologists and plastic surgeons over the years have devised new techniques and modifications of old methods to remove tattoos. Some common techniques are surgical and include:

1. Punch removal, with or without sutures—ideal for small tattoos.
2. Simple excision with primary closure for small tattoos. For larger tattoos, staging or removal in segments is usually recommended. Excision and grafting can also be combined.
3. Dermatome removal with or without grafting.
4. Abrasion with sandpaper, wire brush using diamond fraises, dermabrasion with or without grafting, and salabrasion (salt).

Other techniques use chemical means. Practically every caustic chemical known to man has been employed to remove tattoos. Included in this list are phenol, nitric acid, tannic acid, sulfuric acid, liquid ammonia, silver nitrate, and salicylic acid.

One of the most effective chemical methods is the Variot or French method using tannic acid, silver nitrate, and dermabrasion or tattooing as modified by Penoff.⁴⁶

Physical methods to remove tattoos are also used, including:

1. Cold using Freon spray, CO₂ snow or solid CO₂, and liquid nitrogen by cotton-tipped applicator, copper applicators, or cryospray units.
2. Heat by electrocautery with or without curettage, ultraviolet light to produce an intense erythema with subsequent peeling and removal of some tattoo pigment.
3. Lasers, usually employing argon or carbon dioxide lasers.

Counter-tattooing and re-tattooing also

have their uses. Some physicians tattoo white opaque pigment into a tattoo in an attempt to lighten it. One may use the Conway tattoo attachment for the dermabrasion equipment, a standard electric tattooing machine, or one of the newer types of medical tattoo units.⁵⁴

The choice of removal technique depends on many factors including size, duration, location, and who applied the tattoo. The professional tattoo artist usually puts the pigmentation in at the same level in the dermis, making it easier and more effective for removal, whereas the do-it-yourself tattooer varies the levels significantly.

REMOVAL TECHNIQUES

Excision and Closure

Small tattoos may simply be removed with a punch or excised and sutured. Unfortunately, even small tattoos, because of tension or location, may tend to spread the incision lines, leaving an unacceptable result. Staples may also be employed instead of sutures.

Small tattoos (Fig. 2) or part of larger tattoos may, of course, be carefully excised. Larger tattoos may be excised in stages, removing the center, then the sides at a later date. Unfortunately, patients with tattoos

Table 1. *Techniques Used Most Often by Physicians to Remove Tattoos*

Excision
With closure
Tangential
Punch
Dermabrasion
Deep
Superficial
French method
Toothbrush
Curettage following
Lasers
Argon
Carbon dioxide
Ultraviolet
Others
Salabrasion
Other methods
Grafting
Cryosurgery
Mohs' surgery

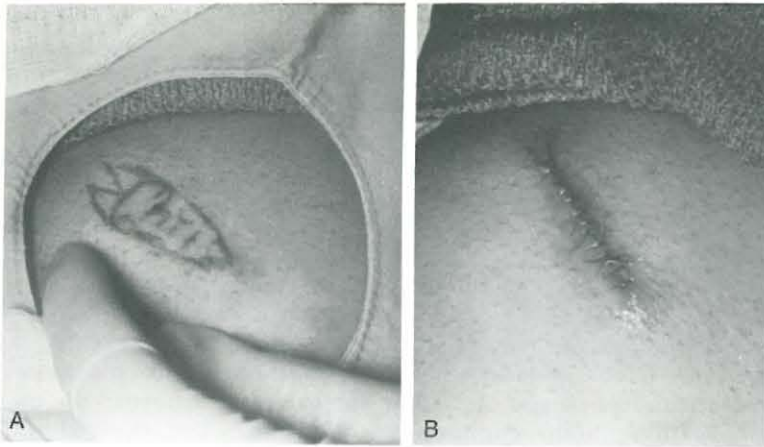


Figure 2. A, Planned excision of a small tattoo using M-plasty to shorten the length of the incision. B, Immediate result of excision.

frequently fail to return for follow-up and excision of the residual tattoo.

Tattoos in selected locations or larger tattoos may require a Z-plasty procedure.

A standard instrument tray consisting of scalpel, scissors, forceps, needle and suture material, local anesthetic, and syringe is used. The tattoo outline usually does not have to be marked with a dye, since sometimes the dye and the tattoo may become indistinguishable. Merely marking off the ends of the incision mark to guide the scalpel is sufficient. After local anesthesia, the tattoo is removed with scalpel and scissors. Minimal bleeding is usually controlled with an electrocautery. The wound is closed in two layers. The first layer is a deep dermal or subcuticular stitch just approximating the deeper layers of the dermis. This brings the skin edges with better approximation, so there is minimal tension on skin sutures. The second layer is then closed with an over-and-over continuous suture with a knot on each end.

Split-Thickness Tangential Excision

This method is particularly useful for a professional tattoo because of the uniform depth of the tattoo pigment. Infiltration of local anesthetic is carefully done to elevate the tattoo pattern. A Brown or Davol oscillating dermatome, set at approximately 0.15 of an inch, is used to remove the elevated tattoo by tangential excision, similar to the process of removing a split-thickness skin graft. The wound created by this tangential excision is managed in a manner similar to a donor site for a graft. A fine

mesh cotton gauze is placed over the wound and cut to conform with the wound. A slightly occlusive wet dressing is then applied and removed the following day. Healing is primarily the result of epithelialization, and spontaneous separation of the gauze occurs in 7 to 10 days.

Dermabrasion

Dermabrasion has been one of the most popular methods for tattoo removal performed by dermatologists. Because of their experience gained in acne scar removal with dermabrading units, most dermatologists prefer dermabrasion. The term "dermabrasion" was first coined by Blau. Dr. Blau perfected the dermabrading wheel used for both acne scarring and tattoo removal. Dermabrasions may also be done with a toothbrush or hand brush, especially helpful for the immediate removal of traumatic tattoos (Fig. 3).

Standard Dermabrasion Procedures

The standard dermabrasion technique as described by Bunke and Conway¹⁴ and Chai¹⁷ attempts to remove as much of the tattoo pigment as possible (Fig. 4). Because of the deep abrasion, this procedure is often rather bloody. Skin pigment and blood splattering during the procedure requires protective operating garments and face shields. Sterile technique is not necessary; merely a clean operating room and office routines are sufficient.

Technique. A small area of the tattoo is

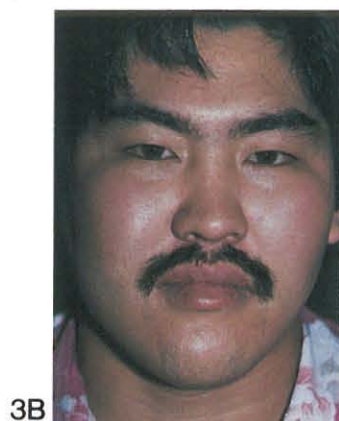


Figure 3. A, Preoperative appearance of traumatic tattoos on the face. B, Appearance 15 years following brush dermabrasion.

Figure 5. Intraoperative view of laser surgery showing smoke evacuator tube removing noxious smoke and odors.

Figure 6. A, Immediate postoperative appearance of tattoo site following laser treatment. B, Postinflammatory hyperpigmentation of treatment site following laser surgery.

Figure 7. A, Clinical appearance of tattoo test treatment site 2 months after test. B, Appearance of treatment site 9 months after completion of laser treatment, showing residual pigment. C, Final appearance of treatment site 1 year after completion of treatment.

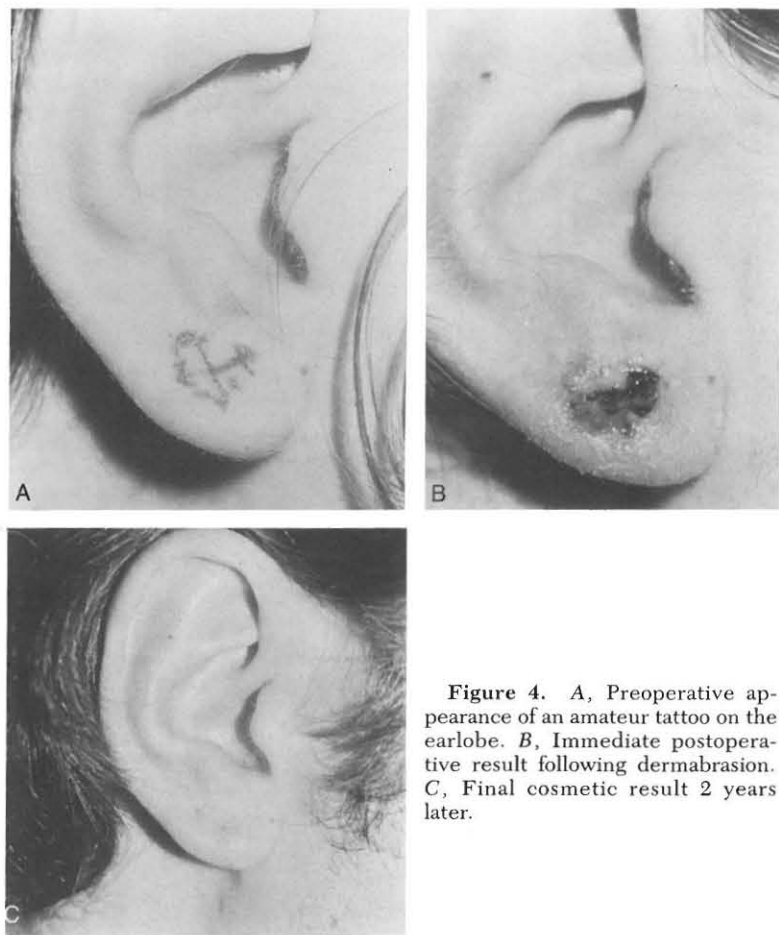


Figure 4. A, Preoperative appearance of an amateur tattoo on the earlobe. B, Immediate postoperative result following dermabrasion. C, Final cosmetic result 2 years later.

exposed using 4×4 inch gauze pads. This area is then frozen with a Frigiderm or similar spray or a liquid nitrogen cryospray unit. Because wire brushes tend to get caught in the gauze and adjacent drape material, most dermabraders prefer using diamond fraises and the standard Conway dermabrasion unit. Smaller, more powerful and more adjustable units are also available today. The frozen area is then scraped off by dermabrasion, and Adaptic or Vigilon dressing is applied immediately after the dermabrasion. The dressing is removed a day or two later. Serum, epidermal cells, and tattoo pigment will come out with the dressing.

If the outlines of the tattoo are followed too closely, the post-dermabrasion result is not as good. Blending of the entire tattoo or perhaps spraying the entire area at a later date with liquid nitrogen may improve the cosmetic result.

Superficial Dermabrasion Technique

The superficial dermabrasion method was described by Clabaugh.¹⁸ This technique does not attempt to remove all of the tattoo pigment, but in many cases, this is accomplished by natural desquamation and re-epithelialization. Clabaugh originally described 75 tattoo removals but has done hundreds of others. Most tattoos removed by the superficial dermabrasion technique require several procedures.

Technique. After the tattoo site is prepared, a small area is frozen with a refrigerant such as Frigiderm. The area is then very superficially dermabraded. Only epidermis and parts of the papillary dermis are abraded. As soon as the tattoo pigment appears in the skin scrapings, the dermabrasion should stop. After bleeding is stopped, the abraded site is painted with a 2 per cent gentian violet solution, and an Adaptic or

Vigilon dressing is applied and covered with gauze and tape. After the dressing is removed, an outline of the tattoo can be readily seen on the Adaptic or Vigilon.

Dermabrasion Combined with Tannic Acid and Silver Nitrate (The French Method)

Penoff modified the Variot, or French removal, technique performed by some tattoo artists and physicians.⁴⁶ Variot removed tattoos by linear incisions, scratches, or punctures, followed by applications of tannic acid and silver nitrate solutions. Penoff usually irritates the epidermis by making a grid with crisscross abrasions, using a standard dermabrading unit or a tattoo instrument. The tannic acid solution and silver nitrate cause a flexible, leathery scar that desquamates much of the tattoo pigment. This is especially effective for large tattoos.

Salabrasion

The Greek physician Aetius in 543 A.D. first used table salt for the removal of tattoos. His technique consisted of applying an irritating substance to the tattoo for several days, after which table salt was rubbed into the tattoo site.

In 1935, Klovekorn revived this method and rubbed salt in daily until the skin became red.³⁹ Crittenden first employed the term "salabrasion" in 1971.²¹ Manchester reviewed the subject and reported on more than 50 tattooed patients in 1973 and 1974.⁴³

Koerber and Price correlated the clinical and histological results of salabrasions of tattoos in Palo Alto, California.⁴⁰ Their study consisted of 26 tattoos treated by salabrasion, with the salt being left on the abraded surface from 0 to 24 hours. Catterall routinely performs up to three procedures per tattoo and feels he gets an improved result over the single abrasion procedure.¹⁵

Any hair is shaved and skin cleansed with a povidone-iodine solution. Patients usually require no local anesthetic. The tattoo is rubbed with slightly moistened sterile gauze dipped in the salt until the skin surface is removed and a uniform glistening erosion is present.

Additional salt may then be applied to the abraded area and left on for varying pe-

riods of time. Sauer (personal communication) and Price⁴⁷ feel the best results in most cases are obtained by removing the salt immediately after salabrasion. Treated areas may be permitted to dry uncovered or dressed with an antibiotic ointment and occlusive dressing or Adaptic or Vigilon gauze.

Salabrasions may be performed with fine table salt, but most salabradors prefer a coarse type of salt such as Hawaiian crude or Kosher salt.

Cryosurgery

Cryosurgery using Freon, carbon dioxide (dry ice), liquid oxygen, or liquid nitrogen has also been used to remove tattoos. Most cryosurgeons, including Zacarian⁵⁶ and Goldstein,²⁹⁻³³ have abandoned it because of poor general results. For small and recently applied tattoos, cryosurgery with liquid nitrogen might be recommended.

Grafting

Some physicians do prefer grafting of tattoos, depending on size and location. Gupta performed basic animal and clinical studies with grafted tattoos. Most surgeons do not remove tattoos by grafting today, however, because of other faster, less expensive, and cosmetically better techniques.

Flaps

Transplantation, or flap, procedures are an improvement over grafting methods, since adjacent skin resembles the tattooed area more than distant donor sites. As Friederich points out, "the replacement of tattoos by pedicle flaps demands a special ability and artistic skillfulness in order to avoid scars with the contours of the tattoo."

Caustics

Acids such as nitric acid are still employed occasionally for tattoo removal. Prinz obtained satisfactory results in 70 per cent of his 120 tattoo removals in 1980.⁴⁸

Vitamin A Acid

Topical vitamin A acid was suggested by Kligman in 1980. In our preliminary study

of 11 patients, we obtained very poor results with this method.

Combined Techniques

A combination of possible removal methods has been attempted. They include (1) curettage after dermabrasion,¹⁶ (2) dermabrasion followed by split-thickness graft,^{35, 36} and (3) salabrasion and dermabrasion.

Lasers

Goldman pioneered the use of lasers for tattoo removal.^{26, 27} In 1967, he reported his preliminary 3-year clinical study.

Several excellent texts deal with the use of lasers for tattoo removal.^{9, 23, 44}

The laser systems used most often today include argon, carbon dioxide, helium-neon, neodymium-YAG, ruby and tunable dye.

The use of lasers in clinical medicine and surgery is expanding at a phenomenal pace, as was evidenced at the Pacific Laser International Update held in Honolulu. More than 200 representatives from 19 foreign countries attended this multispecialty symposium. Audio tapes of the presentations are available from Sound Catchers (1451 South King Street, Honolulu, Hawaii 96814).

Early studies employing lasers to treat tattoos and other skin lesions were performed by Goldman et al.,²⁶ Laub et al.,⁴¹ and Brady et al.¹³ More recently, Apfelberg,²⁻⁷ Masher, Lash, and Laub⁴¹ at the Palo Alto Medical Foundation in California have performed additional studies with the argon laser.

Stempel,⁵⁰ Goldstein,²⁶ Saal (personal communication), Dismukes,²² and Bailin et al.¹⁰⁻¹² have had a great deal of experience with the use of the argon, CO₂, and other lasers for tattoo removal.

Technique

Argon and carbon dioxide lasers, the two most frequently used laser units today, are employed in a similar manner.

Patient education and information, just as in any cosmetic procedure, are vital. Proper patient selection is important for follow-up, as well as for patient and physician satisfaction with the procedure. Brochures and instruction sheets are very beneficial.

Local anesthesia is usually employed. A smoke evacuator (Fig. 5) is kept near the laser site to remove the odor of burned flesh—distracting to the physician and annoying to the patient. Antibiotic ointments and dressings are applied. Specific postoperative instruction sheets are given to the patient. The patient is advised to avoid direct sun exposure and to avoid activities in the sun as much as possible for at least 6 weeks. Sunscreens with a sun protective factor of 15 or higher are provided, and patients are advised to apply the sunscreen daily once the crust has desquamated. Post-inflammatory hyperpigmentation (Fig. 6) is commonly seen in Hawaii even in covered sites, perhaps because of our multiracial population and strong sunshine. Topical bleaching preparations are used to depigment the postinflammatory hyperpigmentation.

Small tattoos can be treated in one or two sessions. Larger tattoos (Fig. 7) may require two or more sessions.

Our rate of patient acceptance of the laser for tattoo removal has been excellent. They prefer the space age technology and lack of bleeding afforded by the laser.

Some controversy exists about the best laser to use for tattoo removal, but all the laser methods used today do work. In general, the same results are obtained with the carbon dioxide laser as with the argon laser, though each laser therapist has his or her preferred unit. The same adverse effects of tattoo removal using dermabrasion, salabrasion, and the other physical methods also pertain to removal by laser. Keloids frequently develop on the deltoid with laser treatments, as well as with any other tattoo removal methods at this site. The keloids can be injected with intralesional corticosteroids.

In conclusion, there is no perfect, no best method for removing tattoos. The sooner the removal procedure—no matter what technique—the better the result. Professional tattoos usually look better when removed, compared with amateur tattoos, because of uniform level of pigment deposition.

With the increasing popularity of tattoos—small and large—the cosmetic surgeon will undoubtedly be called upon to remove more and more tattoos for a wide variety of reasons. Familiarity with several methods is highly recommended.

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