TATTOO

The Invaluable Compendium for Dermatologists

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Foreword

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All our patients from whom we have learnt

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FOREWORD

When Professor Shashikumar from the Mandya Institute of Medical Sciences, Mandya, Karnataka, India contacted me to write this foreword for this book titled *Tattoo—The Invaluable Compendium for Dermatologists*, I must admit that my knowledge and vision of tattooing in India were the ones of a French Epinal imprint, traditionalist and naïve—a roadside tattoo artist in the middle of a village in rural and remote areas of India, tattooing dozens of young girls and women, who would develop years later inoculation leprosy or tuberculosis on their tattoos.

But no, modern tattooing is global, irrespective of age, gender, social classes, religion or continents. Nowadays, Indian physicians have to face the same issues regarding tattooing as we do in Western countries—tattoo infection, ink allergies, amateur backyard tattooists or tattoo removal requests.

For this first-ever book on tattoos in India, Professor Shashikumar did a real tour de force. From epidemiology to tattoo-removal techniques, the book covers all the fields of permanent and temporary tattooing in India with updated data and it is abundantly illustrated with original clinical and histopathological photographs from Indian collections.

Needless to say that this book will be of an invaluable help not only for any Indian dermatologist or resident in dermatology, but also for general practitioners, infectious specialists dealing with issues related to tattooing. It may be of interest for Indian tattooists to improve their work. For Western physicians, this book is an invitation to discover the specificities and faces of Indian tattooing.

Paris, April 22nd, 2017

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PREFACE

Think Before You Ink!

Tattooing is a very old practice, which involves insertion of ink pigment of the desired color into the dermis. It is practiced worldwide, across all cultures and is becoming increasingly common in India. Furthermore, it is becoming more prevalent among rural youngsters of India due to increased enthusiasm towards newer fashion trends exposing to increased risks and complications associated with it. There is a paucity of literature on tattoo except for a few case reports and case series.

Since there is no book published from India on tattoos, so we are presenting for our readers the first-ever book on this topic. It covers history of tattoo, types of tattooing, psychosocial aspects and uses of tattooing in details. The authors have tried to cover tattoo complications and its management, and various modalities for the removal of tattoo, including lasers in details. Few chapters on safe tattoo alternative and regulations on tattoo have been covered extensively.

Most of the complications associated with tattooing or tattoo removal have been described with relevant photographs. Also, various tips and tricks of laser tattoo removal have been described in a simple and comprehensive way.

We hope this book will be a valuable reference for the researchers, health professionals, and policy experts, and a useful resource for all those who have interest in tattoos.

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Chapter 8

Other Methods of Tattoo Removal

R Raghunatha Reddy, Shilpa K

INTRODUCTION

Tattooing is an invasive procedure in which coloring pigments are introduced into the skin permanently by multiple punctures. Tattoos can be decorative, accidental or sometimes therapeutic. Tattooing has been practiced since ages in different countries and cultures for various reasons. In recent times the number of people seeking tattoos has raised rapidly. A study in United States has shown that 25% of the population aged between 18 years and 50 years have a tattoo.[1,2] Another study has shown these decorative markings are sometimes obtained impulsively, before the age of 18 years or while under the influence of alcohol or recreational drugs,[3] and many eventually regret their decision. With increase in number of patients seeking tattoos, there is also increasing in number of people opting for tattoo removal.

REASON FOR TATTOO REMOVAL

Patients seek tattoo removal for varied reasons:

- Complications arising out of tattoo procedures (Box 8.1), the prevalence of which is approximately 2% to 3%[4]
- Some patients may report feelings of embarrassment, low self-esteem, and stigmatization associated with their tattoos, and may seek removal
- When done under the influence of alcohol or substance abuse, may regret later and seek removal
- In some professions and organizations, like in defense, tattoos are not acceptable.
- Tattoos are forbidden in certain religions
- Due to social beliefs and customs.

Box 8.1: Complications in tattoo procedures.

Infections

- Bacterial:
  - Tetanus, impetigo
  - Skin infection (Methicillin-resistant *Staphylococcus aureus*)
  - Endocarditis
  - Tuberculosis cutis
  - Syphilis
  - Chancroid
  - Sepsis
- Viral:
  - Verruca vulgaris
  - Molluscum contagiosum
  - Human immunodeficiency virus
  - Hepatitis B and C
- Fungal:
  - Superficial and deep fungal infections

Koebnerization

- Psoriasis
- Lichen planus
- Sarcoidosis pyoderma gangrenosum
- Chronic lupus erythematosus
- Vitiligo

Reactions to pigment particles

- Lichenoid reactions
- Granulomatous reactions
- Pseudolymphomatous reaction
- Pseudoepitheliomatous hyperplasia

MILESTONES IN THE HISTORY OF TATTOO REMOVAL TECHNIQUES[5]

Tattoo removal techniques are in practice from pre-historic era. Until 50 years ago, chemical and mechanical methods remained the mainstay of tattoo removal.

In 543 AD, Greek physician Aetius first described the process called "salabrasion", which involves abrading the skin followed by application of salts or other chemicals.[6]

Dermabrasion, in which a wire brush or diamond fraise was used to abrade the skin to remove tattoo pigment within and tattoo itself.

Various other products like trichloroacetic acid and abrasive devices were in use, although their effectiveness and safety were questionable. Use of such non-selective destructive modalities resulted in partial or complete tattoo removal along with risk of scarring and depigmentation.[7]

Simple surgical excision of the skin containing the tattoo has also been an option for a long time. Though it removed the tattoo, it always left a linear scar. Surgical excision followed by skin grafting was another such technique.

In 1960, Maiman created the first laser using a synthetic ruby crystal.[8] Within 3 years, Goldman demonstrated the ability of laser light to selectively destroy chromophore targets in the skin.[9]

In 1967, Goldman and others described successful tattoo removal by both the Q-switched (QS) ruby laser and the QS Nd:YAG (neodymium-doped yttrium aluminum garnet).[10,11] However, the lack of a thorough understanding of the physics at work combined with unpredictable clinical outcomes caused QS lasers to fall out of favor.[12] In the late 1960s and 1970s, continuous lasers such as the carbon dioxide and argon-ion lasers became the treatment of choice for tattoo removal.[13,14]

Then, in the early 1980s, Anderson and Parrish described their groundbreaking theory of selective photothermolysis, in which QS lasers could be used to destroy pigment targets in the skin selectively.[15,16]

LIMITATIONS OF LASER TATTOO REMOVAL

Though the use of lasers is the most popular therapeutic modality with the best aesthetic results, it has certain limitations which include:

- There may be lack of availability and access to LASER
- Requires multiple sittings and removal may take months
- Certain colors like red and yellow are resistant
- Removal may be incomplete and may leave a ghost images
- Over all treatment is expensive
- In special circumstances, like the name tattoos which needs to be removed completely for various reasons. LASERS may not be able to do that and hence the need for complete removal by surgical methods despite the fact that they produce scar.

SURGICAL TECHNIQUES FOR TATTOO REMOVAL

These techniques are “mechanical” which include salabrasion, dermabrasion, and surgical excision with primary closure or followed by grafting. Though the first method is currently abandoned, dermabrasion in combination with other technique is done less frequently.

Excision

Punch Excision

Small circular tattoos commonly found on forehead, chin, and forearm can be excised using skin biopsy punches.

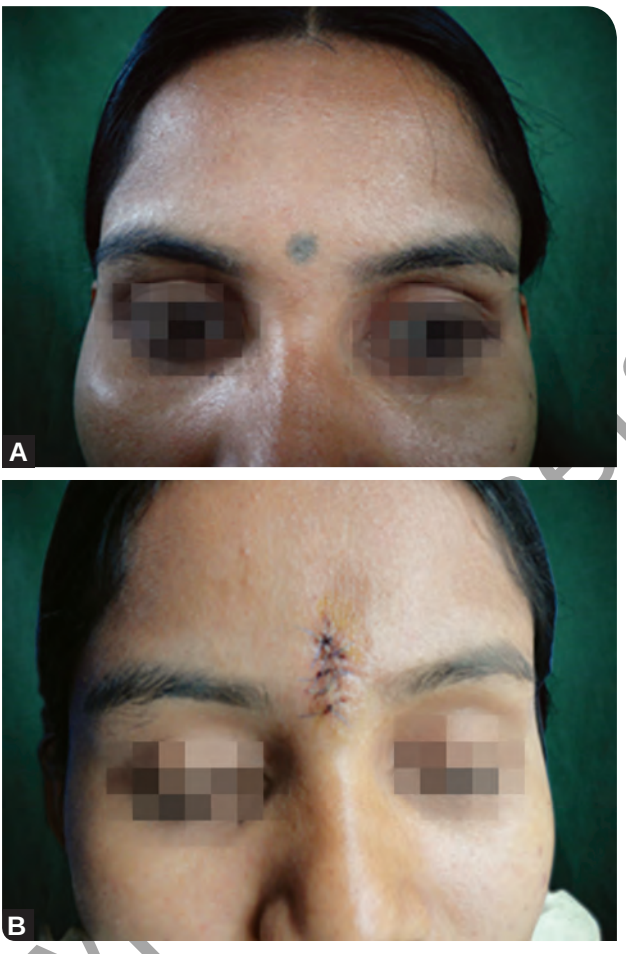
Procedure: After preparing the parts, the skin is stretched perpendicular to the direction of relaxed skin tension line (RSTL), an appropriate sized punch which can completely remove the tattoo is kept perpendicular to skin, and with slow twisting back and forth movements it is advanced till the subcutis (where we get a giveaway feel). The tissue is then held with forceps and cut at the base. This technique often allows the wound to rest along RSTL and wound closed with appropriate suture material of the size 5-0 or 6-0 depending on the size (Figs. 8.1A and B). Wound dressed followed by suture removal on 5th to 7th day depending on the site.

Precautions: Tattoos of up to 4 mm size can be removed with punch excision. Closure of punch excision above 4 mm in size often cause dog ear, thus causing less than optimal cosmesis compared to small ellipse.[17] Using larger punches (>6 mm) can result in dog ear formation which require further correction resulting in lengthier scar. In such circumstances, elliptical excision will be a better option in such condition or alternately the defect may be closed with full-thickness skin grafting of 1 mm larger size donor skin harvested from postauricular area.

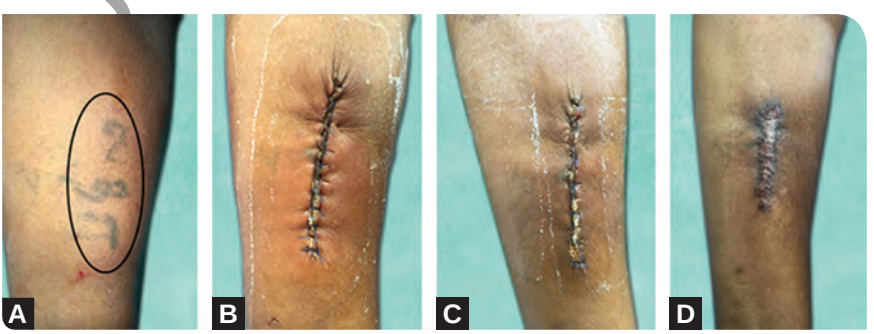
Elliptical Excision

The elliptical (fusiform) excision is a basic tool of cutaneous surgery due to ease of construction in the ensuing suture line along the RSTLs with good aesthetic outcomes. Elliptical variations are easily designed and can be adapted to many situations.[18] Linear tattoos along RSTL commonly found on forearm and neck can be excised with simple elliptical excision and closure.

Planning and procedure: An ideal ellipse is the one in which the length and width ratio is 3:1 and the angle between the two limbs is 30°. However slight modification can be done according to the size and site of tattoos. After drawing an ellipse, incision line is put over the pre-marked lines. Then the tattooed skin is dissected at the level of mid-dermis and excised. After excision proper undermining has to be done on both sides and wound has to be closed in two layers with buried intradermal and percutaneous sutures to reduce tension on suture line. Compression dressing has to be put and patient should be advised to avoid vigorous movements or weight lifting in the operated area. Suture removal done from 7th (face) to 10th day (forearms) depending on the site (Figs. 8.2A to D).



Figs. 8.1A and B: (A) A circular tattoo on forehead; (B) After punch excision and closure.



Figs. 8.2A to D: (A) Tattoo on forearm with elliptical excision planned; (B) Immediately after excision and primary closure, note the tension in the wound; (C) On the third day, minimal gaping; (D) A bad linear scar after a month with poor results.

Precautions: A linear tattoo of width up to 2 to 3 cm depending on the laxity of skin can be excised and closed primarily. A wider tattoo may require serial excision in two to three sittings. Primary closure of wider tattoos may result in excess tension on suture line, wound gaping and a bad scar. Proper undermining and wound closure in layers reduces the tension along suture line. The most important point during skin closure is to keep wound sutured edges slightly everted in order to overcome the spreading of scar which is inevitable to occur in due course of time. Wound edge eversion improves with time.

S-plasty

S-plasty is a modification of elliptical excision in which an S-shaped curvilinear incision instead of a straight line incision is made to reduce tension and improve healing in areas where the skin is loose.

Planning and procedure: The planning is similar to elliptical excision; however, the edges of an elliptical excision are modified in the shape of letter "S" which realigns along RSTL of extremities. Further procedure like excision, undermining, and wound closure is similar to elliptical excision and closure. However, line of closure will be S-shaped rather than linear closure of elliptical closure, which may help to break the monotony associated with linear straight line scar (Figs. 8.3A and B).

Advantage: This technique further reduces tension on suture line. It also prevents dog ear formation and thus reduces the length of the scar line.[19] It is suitable for linear tattoos of forearm.

Serial Excision

Serial or staged skin excision is a time-honored technique that was first described by Morestin in 1915 and later, independently, by Sinstrunk in 1926. A wider tattoo which cannot be removed completely with either elliptical or S-plasty can be removed with serial excision.

Principle: The principle relies on the fact that there is "creep" (relaxation) of the tensioned skin over time. This relaxation is initially "mechanical" due to uncoiling of elastin fibers and reorientation of collagen fibers in the direction of the strain, and later is followed by "biological" creep due to remodeling of the skin. This biological creep allows the skin once more to undergo "mechanical" creep.[20]

Planning and procedure: In serial excision technique, a part of tattoo either in the center or edge is removed in the first stage as in elliptical or S-shaped excision technique described above in Figures 8.1A and B. The remaining part of the tattoo will be excised after 6–10 weeks. In this way the entire tattoo can be removed in 2–4 surgical sessions (Figs. 8.4A to F).

Figs. 8.3A and B: (A) Tattoo on forearm with planned S-shaped excision; (B) Wound closed with S-shaped suture line, immediate postoperative period.

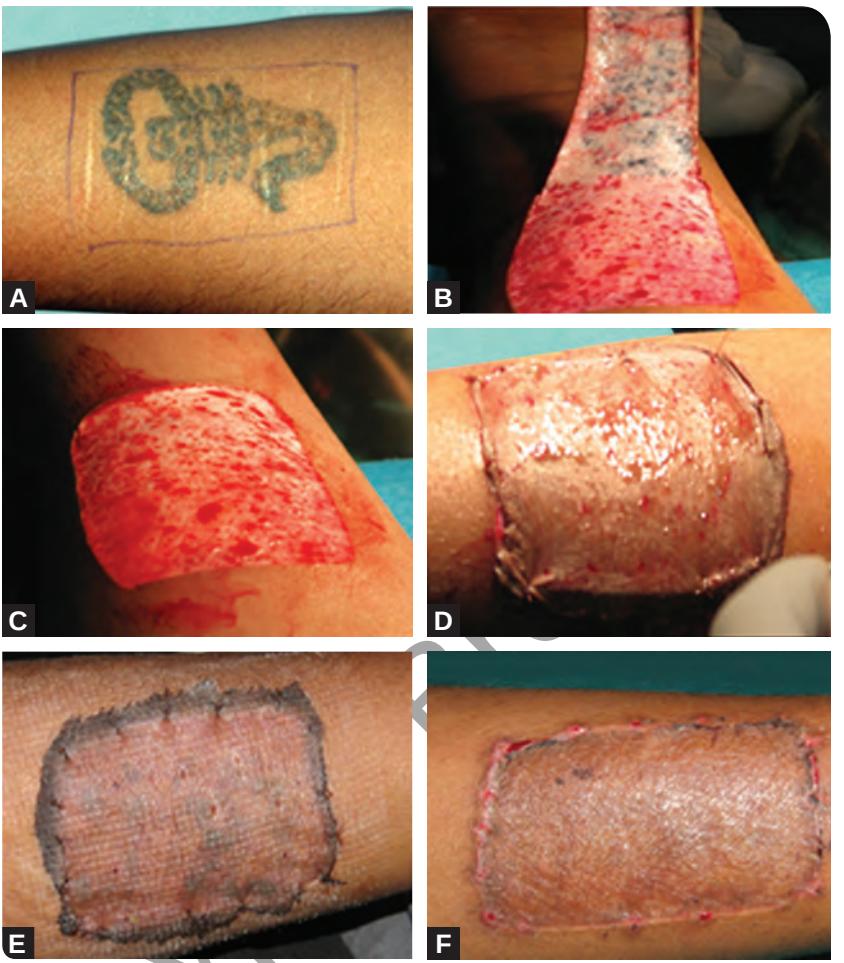
Advantage of serial excision is that the resultant scar can be made to orient along RSTL for a better cosmetic outcome. Tension on the wound edges and thus ensuing bad scar can be avoided. Bigger tattoos may require 2–3 sittings.

Excision followed by Split-thickness Skin Graft

Excision followed by split-thickness skin grafting is a simple means of tattoo removal with very acceptable cosmetic results.

Figs. 8.4A to F: (A) A wide tattoo on forearm; (B) Partial excision in the center; (C) Immediately after first excision; (D) Linear scar along with remnant of tattoo after first stage of excision; (E) Second-stage excision after 12 weeks with complete tattoo removal; and (D) Complete removal with a linear hypertrophic scar.

Procedure and planning: Procedure is done under local anesthesia. Tattooed skin is excised at the level of upper dermis or mid-dermis depending on the level of pigment in the dermis, so that the tattoo pigments are completely removed. Donor area is usually the covered areas like upper thigh or buttocks. After anaesthetizing the part, partial or split-thickness skin graft is harvested using Humby's knife or dermatomes. Skin is stretched by giving traction. Humby's knife is introduced at 45° to skin surface. After reaching the desired depth, Humby's knife is kept parallel to skin and with to and fro movement knife is advanced to get the desired length of the graft. The size of the graft should be kept 10% more than the defect to compensate for the elastic recoil and shrinking of graft. The obtained graft is then placed over the defect. Graft is secured with suture or staples followed by pressure dressing (Figs. 8.5A to F).



Figs. 8.5A to F: (A) A wide tattoo in forearm; (B) Tattooed area being removed with dissection of skin in the mid-dermis level; (C) Complete removal of tattooed skin; (D) Placing split-thickness graft; (E) Graft secured with suture; and (F) Complete take up of graft with good aesthetic outcome within 6 weeks.

The technique has several advantages: (1) ensures complete removal of tattoo pigments; (2) scar formation is negligible; (3) the procedure may be carried out rapidly, is inexpensive for patients and conserves time for physicians, since it is one-stage procedure compared to serial partial excision.

The disadvantages of this technique include: (1) it gives a stuck on appearance, donor area scarring or depigmentation, and (2) it also requires skill to obtain appropriate grafts.

Modification of the technique is that instead of split skin grafts the defects can also be covered with grafting of autologous and allogenic cultured epithelium after excision of tattoos.[21]

COMPLICATIONS OF SURGICAL EXCISION

Reported complications include difficulties in suturing of the skin, with risk of delayed healing, development of hypertrophic scars, keloids or anatomical distortions resulting in scars less aesthetically acceptable. Permanent scars will result and this should be explained very carefully before treatment. Scars may be red and raised for up to 3 months and then gradually improve over a year to 18 months. In a situation of wide or hypertrophic scar, the scar can be improved with fractional CO_2 laser resurfacing in multiple sittings of 5–6 times 4 weeks apart, which will improve the ensuing scar greatly for better aesthetic results.[22]

Salabrasion

Since ages physicians have tried to remove tattoos without leaving a scar. Aetius (543 AD) was the first to describe the use of salt and chemicals for the purpose.[5,23] Klovekorn (1935) described the abrasion of skin with table salt in order to remove tattoo pigment;[6,24] and Crittenden recently confirmed these results and named the process salabrasion.[25]

Procedure: The tattooed area to be treated is prepared and anesthetized. The patient is then instructed to wrap a moist 4 × 4 gauze sponge impregnated with salt around his index and middle fingers and to begin rubbing the tattoo he wishes to remove. The abrasion continues till the skin becomes "blood" red and appears like good granulation tissue. This usually takes 30–40 minutes. At this point, the treated area is covered with antibiotic ointment and a sterile dressing which is left in place for 3 days. When a dermabrador or tattoo gun is used, the skin is either superficially abraded or punctured in the desired areas and then covered with a layer of table salt. The insult to the dermis must be very superficial. At this point, when the treated area will look raw but not blood red, it is covered with a layer of salt for 4 hours.

Postoperative care: The dressing is then changed and the wound cleaned and redressed with an antibiotic ointment for an additional 3 days. This salted area separates between the 7th and 12th postoperative days. With eschar separation one may see that about half of the ink has been removed. Still more ink leaves the treated area in exudate while the skin is healing. The skin heals quickly and with virtually no scarring. A second treatment can be administered 6–8 weeks after the first. This technique is obsolete now.

Superficial Dermabrasion

Boo-Chai reported that superficial dermabrasion of tattoos creates an inflammatory response and thus promotes the "biologic removal" of

pigment through the lymphatics and the sloughing of superficial macrophages.[26] Clabaugh postulated that the pigment-laden phagocytes may become mobile and migrate to the wound surface where they are removed by daily dressing changes.[27] However, the dermabrasion is the prime stimulus for pigment effluvium from the wound; and the postoperative application of gentian violet 2% (Figs. 8.6A to D), triamcinolone acetonide 0.1% lotion, hydrogen peroxide solution 3%, and daily dressing changes in any combination do not significantly increase the amount of pigment removed. Tattoos treated postoperatively without any topical medication responded with pigment loss equal to those treated by any of several other combinations.[28] Trichloroacetic acid is a chemical cauterant that coagulates the proteins of the skin and has been utilized for therapeutic treatment of dermatological conditions.[1] It has also been proposed as a tattoo removal agent.[29,30] However, as the concentration increases, the depth of dermal damage also increases.

CONCLUSION

In LASER era also, surgery still remains as an alternative method of tattoos removal. It remains the first-line choice for small tattoos localized on areas

Figs. 8.6A to D: (A) Tattoo on the chest; (B) Immediately after superficial dermabrasion; (C) Everyday dressing with paraffin dressings; (D) After healing with slight hyperpigmentation.

of appropriate laxity. Postoperative scar is all the more discreet and aesthetically pleasing when planned and executed well on an area of significant laxity. Surgery ensures complete excision of the tattoo in one surgical time for smaller tattoos and for wider tattoos a complete excision requires two operative times with a higher risk of vicious scars.

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