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Original Article

Tattoo Removal using Surgical Techniques: Experience with 350 Cases

Samira Sharma[1], Kavita Kumari[2], Reena Makhni[3]

[1]Assistant Professor and Head, Department of Plastic Surgery, Government Medical College, Amritsar, Punjab, India, [2]Assistant Professor, Department of Blood Transfusion, Government Medical College, Amritsar, Punjab, India, [3]Associate Professor, Department of Anaesthesia, Government Medical College, Amritsar, Punjab, India

Abstract

Introduction: There has been an exponential increase in the number of young adults seeking tattoo removal in recent years. The main reason is a prohibition of any form of tattoo in recruitment of army, paramilitary force, police, and other jobs. Most studies done on tattoo removal are either on laser removal or have established results of only one particular surgical method of tattoo removal. However, almost all known surgical methods of tattoo removal have been performed in the present study.

Aims and Objectives: The aim is to study the clinical outcome of various surgical methods of tattoo removal to search for an ideal one.

Materials and Methods: A study was conducted in 350 patients. Tattoo removal was done with surgical methods. The various surgical techniques used were excision and primary closure, serial excision, tangential split thickness excision, tangential excision with dermal over grafting, and excision with grafting. The factors which determined the choice of procedure were size, site, shape, depth of tattoo, skin laxity, and presence of complication of tattooing or previously attempted tattoo removal. Patients were followed for 3 months.

Results: Excision and primary closure were done in 26 tattoos. Serial excision in 9, split thickness tangential excision in 2, tangential excision with dermal over grafting in 179, and excision with grafting in 134 tattoos were done. Scar stretching, minimal color changes, and hypertrophy were seen after tattoo removal. Post-operative marginal hypertrophy was seen lesser in tangential excision with dermal over grafting (60%) than in excision with grafting (75%) though it could be managed conservatively. Patient satisfaction levels were well achieved.

Conclusion: All procedures resulted in complete tattoo removal, and each had its own application and limitations. It was difficult to label one procedure superior to the other.

Key words: Dermal over grafting, Serial excision, Tangential excision

INTRODUCTION

The problem of tattoo removal is not new. Bromberg suggested that tattooing is frequently a sign of emotional immaturity.[1] The term tattoo is derived from "tattau," a Tahitian word which translates essentially "to mark" and is a process of implantation of permanent pigment granules in the skin.[2] Although tattooing is an ancient practice, there has been a dramatic increase in recent times among teenagers and young adults, as a cosmetic and decorative body art form. A tattoo is a permanent reminder of a temporary feeling.[3] Many people eventually want to get rid of their tattoos because of emotional reasons, change of religious faith, as a requirement for jobs and careers and as a result of complications of tattooing.

All methods of tattoo removal involve some element of tissue destruction of the skin to ablate the pigment design.[4] The approach to remove tattoos may be divided into two categories.

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Corresponding Author: Dr. Kavita Kumari, Department of Blood Transfusion, Government Medical College, Amritsar – 143 001, Punjab, India. Phone: +91-9876055376. E-mail: drjpattri@gmail.com

Non-surgical Methods

These utilize local application of chemical and physical agents. Salabrasion,[5] trichloroacetic acid application,[6] cryosurgery, and electrosurgery[7] have been used. However, depth control and scarring due to deep dermal injuries are the problems with these methods. Laser removal of tattoos has also gained a lot of popularity, and excellent results have been claimed.[8,9]

Surgical Methods

Various surgical techniques to remove tattoos are excision and primary closure, serial excision,[10] split thickness tangential excision,[4] derma abrasion,[11] and tangential excision with dermal over grafting and excision with grafting.[12] Derma abrasion is time-consuming and pigment removal may be irregular requiring repetitions followed by scarring in case of deep dermal involvement of pigment.[4]

Most studies conducted on tattoo removal have established only one method of tattoo removal, and of late, laser removal has become a popular trend. No author in the past has included all surgical methods of tattoo removal in his study. In the present study instead of restricting to one or two methods, almost all surgical methods have been used. The aim was to study clinical outcome and find the most ideal surgical method of tattoo removal.

MATERIALS AND METHODS

A prospective study was conducted on 350 tattoos removed between January 2012 and December 2017 at the Department of Plastic Surgery, Guru Nanak Dev Hospital, attached with Government Medical College, Amritsar. The small-to–moderate-sized tattoos which were not crossing the neutral lines of limbs and neck were included in the study.

Routine laboratory investigations were done in all patients, especially, viral markers for hepatitis B, hepatitis C, and HIV. Any person found to be HIV, HCV or HBs positive was not included in the study. Size, site, shape, and depth of tattoo skin stretchability and the presence of previous intervention or not were the deciding factors in the selection of surgical technique in a particular patient. All of these factors had to be taken into consideration.

Tattoos of the same dimensions might have to undergo different methods of removal if they were situated on different sites or even in different orientations. Similarly, tattoos of the same surface area might have to undergo different methods of removal depending on their length and breadth ratios. Tattoos which had one dimension narrow enough or those situated where the skin was easily stretched could be excised and closed primarily.

Split skin graft was required if primary closure was not possible due to large size of tattoo or inextensible skin. Such tattoos were removed by excision or tangential excision. In cases who presented with hypertrophic scarring over tattoos as a result of improper attempts of tattoo removal or complications of tattooing such as allergic reactions, tangential excision was avoided. Tangential excision was not done for tattoos where pigment was infiltrating deep in to the subcutaneous tissue or when tattoos present on the web spaces of the hand. These underwent excision with grafting. The tattoos were excised completely so that pigment was not visible at the margins of the grafted area. It was sometimes possible to deal with a large tattoo by serial excision, removing only a part of tattoo at the first operation and removing the rest after a delay of 3–6 months.

Aseptic preparation of area to be operated on was done with 10% povidone-iodine. All cases were operated under local anesthesia. The tattoos were removed with either of the following methods.

Excision and Primary Closure [Figure 1]

Twenty-six tattoos were treated by this method. The tattoo was marked and local infiltration of 0.5% Lidocaine with 1:200,000 adrenaline was done. Full-thickness skin-bearing tattoo was excised. Undercutting of skin margins was done. Tension-free wound closure was obtained in two layers using Vicryl 4-0 for subcutaneous and Ethilon 4-0 or Ethilon 5-0 subcuticular sutures as well as interrupted sutures for the skin. Wound was dressed. Post-operative interrupted sutures were removed on the 5th day and subcuticular sutures between 10 and 14 days. From the 21st post-operative day, all patients were advised coconut oil massage on scar twice a day for 2 min and silicone gel application twice a day for 3 months.

Serial Excision [Figure 2]

Nine tattoos were treated in this manner. In the first stage, a part of tattoo was removed to achieve primary closure easily. Rest of tattoo was removed after 3 months' interval, and closure, suture removal, and scar management protocol were the same as done in the previous method.

Split-Thickness Tangential Excision [Figure 3]

Two tattoos underwent split-thickness tangential excision. An intermediate split-thickness portion of the skin was excised using manual skin graft knife. Once it was ensured that total pigment removal had been achieved at the level of superficial dermis level only, the wound was dressed using Sofra-Tulle grass and Bulky Gauze dressing. The dressing was removed on the 7th post-operative day. The area was

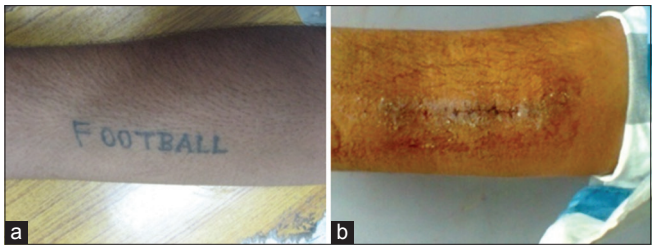

Figure 1: Excision and primary closure of tattoo. (a) Pre-operative and (b) post-operative

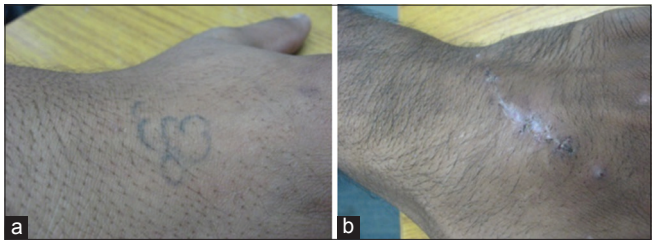

Figure 2: Serial excision (a) pre-operative and (b) post-operative

allowed to reepithelialize just like a donor skin graft area. On the 21st day, coconut oil massage and pressure garment were advised for 3 months.

Tangential Excision and Dermal Over Grafting [Figure 4]

One hundred seventy-nine tattoos were included in this group. Multiple tangential excisions of skin bearing tattoo were done with manual skin graft knife (Humby's knife handle with Down's skin grafting blade) up to the depth where the pigment was completely removed. Deep dermis level had to be reached mostly to achieve full clearance of the pigment. In some cases, a few small specks of pigment were seen which were scooped out with 11 no surgical blade.

Donor area (thigh of patient) was dressed with non-adherent padded dressing. The graft was applied to recipient area after achieving homeostasis with epinephrine gauze. The graft was secured with minimal sutures or staplers. Tie overdressing was done. Splint was given where the recipient area was on hand dorsum or very near to wrist joint on the forearm.

Recipient area was dressed after 8 days. Donor area usually healed in 14–21 days. Grafts usually settled in 15–20 days. Patients were instructed about graft care such as massage with coconut oil, pressure garment, and avoidance of sun exposure.

Excision and Grafting [Figure 5]

One hundred thirty-four tattoos were included in this group. Excision was done with 15 no surgical blade ensuring complete removal of the tattoo. The rest of the procedure and post-operative protocol was similar to the

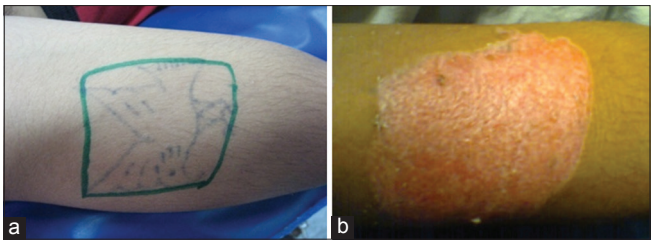

Figure 3: Tangential split skin excision without skin grafting. (a) Pre-operative and (b) post-operative, complete pigment removal was achieved

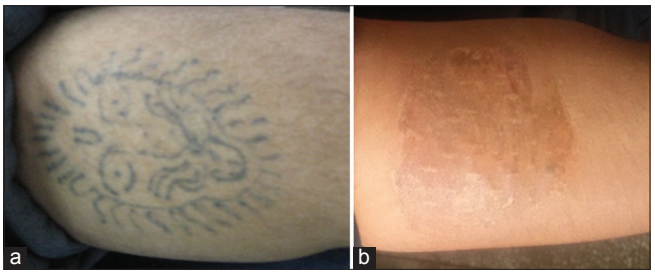

Figure 4: Tangential excision with dermal over grafting of tattoos. (a) Pre-operative and (b) post-operative

previous procedure. All patients were discharged on the same day. All patients were followed for a minimum of 3 months.

Patients were assessed for pigmentation, vascularity, pliability, and height through physical examinations on scar after 3 months of surgery by applying Vancouver Scar Scale (VSS).[13]

Pigmentation
0=Normal color
1=Hypopigmentation
2=Hyperpigmentation
Vascularity
0=Normal
1=Pink (slight increase in blood supply)
2=Red (significant increase in blood supply)
3=Purple (excessive local blood supply)
Pliability
0=Normal
1=Supple (flexible with minimal resistance)
2=Yielding (giving way to pressure offering moderate resistance)
3=Firm (solid/inflexible unit, not easily moved, resistant to manual pressure)
4=Banding (rope-like tissue that blanches with extension of scar does not limit a range of motion)
5=Contracture (permanent shortening of scar-producing deformity or distortion limit range of motion)
Height
1=Normal
2<2 mm
3≥2 mm and <5 mm
4≥5 mm

Vancouver scar scale

After 3 months, patients were asked to select one of five responses which were very satisfied, satisfied, neutral, unsatisfied, and very unsatisfied.[14]

RESULTS

In our study, we found that tattoos were more prevalent in males (325 cases, i.e., 93%) than in females (25 cases, i.e., 7%). The age of patients ranged between 18 and 26 years, and the average age is 19.5 years. Size of tattoos ranged from 3 cm × 1 cm to 15 cm × 7 cm.

One hundred ninety tattoos were on the upper arm (54%), 108 on the forearm (30.9%), 48 on the dorsum of hand (14%), and 4 on the neck (1.1%).

The most common indication for tattoo removal was recruitment in army, paramilitary, and police force (302 cases, 86%), followed by emotional reasons such as divorces and breakups (23 cases, 7%), complications of tattooing (14 cases, 4%), and other jobs and careers (11 cases, 3%). Complications of tattooing which needed tattoo removal were in the form of allergic reaction to pigments.

One hundred twenty-seven (36%) cases were those where some intervention was already done by the patients themselves or by ignorant medical practitioners in the form of chemical application or cauterization leading to incomplete tattoo removal and hypertrophied scars bearing tattoo pigments [Figure 6]. Of these, two patients had themselves shaved off their tattoos with the knife leading to partial tattoo removal and presented with non-healing raw areas still bearing tattoo impressions [Figure 7]. One patient presented with infection with frank pus discharge after application of some chemical on tattoo [Figure 8]. He was operated on after infection got settled with conservative treatment. Seven patients of these 127 could be managed with excision and primary closure [Figure 9] and one with tangential excision and dermal over grafting and rest underwent excision and grafting.

Excision and primary closure were possible only in a few patients because only linear tattoos could be managed by this method.

Serial excision was a staged procedure. Some scar stretching was seen in all patients who underwent serial excision [Figure 10]. This procedure obviated the need of skin grafting and was suitable for neck and hand dorsum.

Tangential split-thickness excision was possible only in two cases where penetration of pigment was found to be limited to superficial dermis only. Soon we left this method for the fear of scarring and incomplete pigment removal.

In 102 (60%) cases, who underwent tangential excision and dermal over grafting, marginal hypertrophy was seen [Figure 11].

In patients who underwent excision and grafting, 100 patients (75%) developed marginal hypertrophy [Figure 12] which was managed with coconut oil massage and pressure garment wearing. Hyperpigmentation was seen in all patients who underwent skin grafting, but it

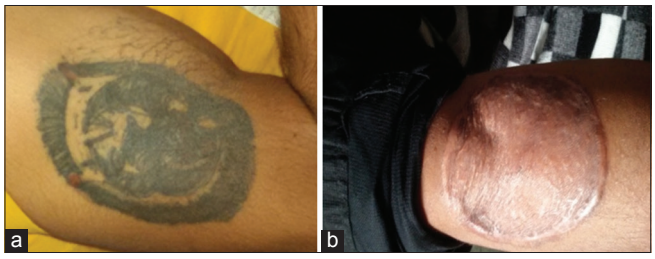

Figure 5: Excision and grafting of tattoo. (a) Pre-operative and (b) Post-operative

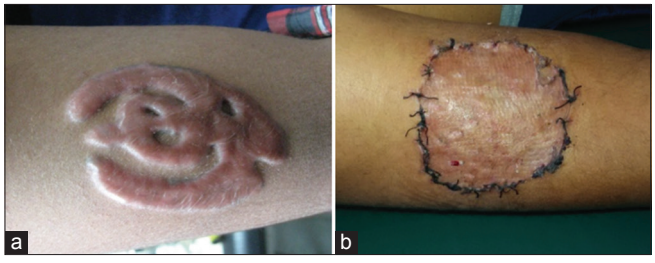

Figure 6: Partially removed tattoo with hypertrophy underwent excision and grafting. (a) Pre-operative, (b) Post-operative

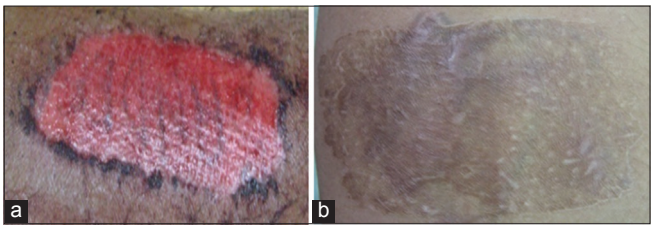

Figure 7: Tangential excision and dermal over grafting of a self-attempted tattoo removal by shaving leading to incomplete removal and raw area showing tattoo impressions. (a) Pre-operative, (b) post-operative

Figure 8: Excision and grafting in a tattoo where chemical application led to ulceration and infection. (a) pre-operative and (b) post-operative

Figure 9: Excision and primary closure achieved in a tattoo where attempt of tattoo removal was done by some chemical. (a) Pre-operative and (b) post-operative

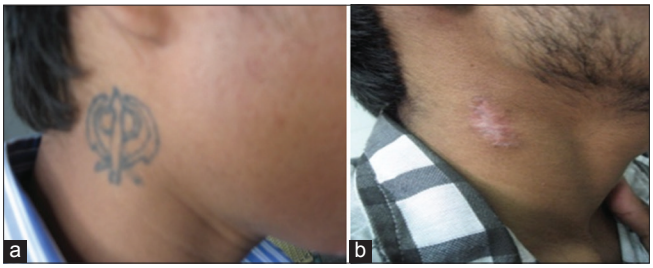

Figure 10: Serial excision of tattoo: (a) Pre-operative and (b) post-operative marked scar stretching is seen

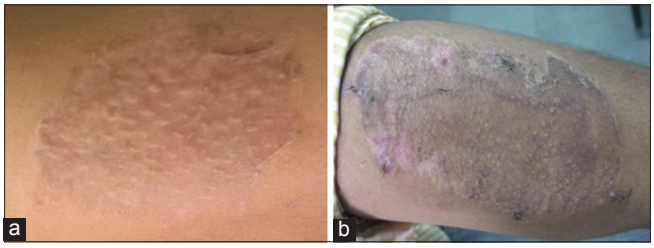

Figure 11: (a and b) Marginal hypertrophy hyperpigmentation, after tangential excision and grafting

improved with time and by avoidance of sun exposure. Operative site was healed in 10–15 days in all cases.

Donor area in all patients healed very well without any complication with 14–21 days.

In all the patients, complete pigment removal could be achieved. At the end of the follow-up of 3 months, the score of VSS ranged from 1 to 4 [Figure 13]. 172 (49%) patients were very satisfied, 150 (43%) were satisfied, and 28 (8%) were neutral [Figure 14].

DISCUSSION

No method of tattoo removal is perfect. Even the laser, though the latest in the armamentarium of tattoo removal and claim of having good results,[8,9] is itself associated with complications such as pain, pigment changes in the skin, allergic reactions, and incomplete removal of tattoo.[3]

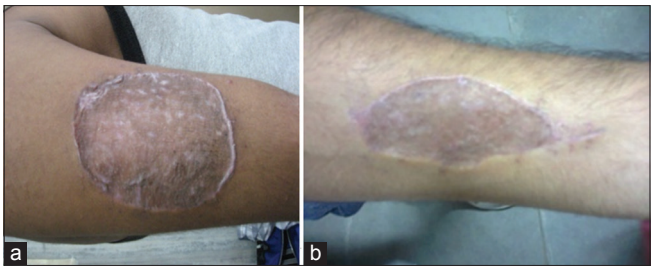

Figure 12: (a and b) Marginal hypertrophy and hyperpigmentation, after excision and grafting

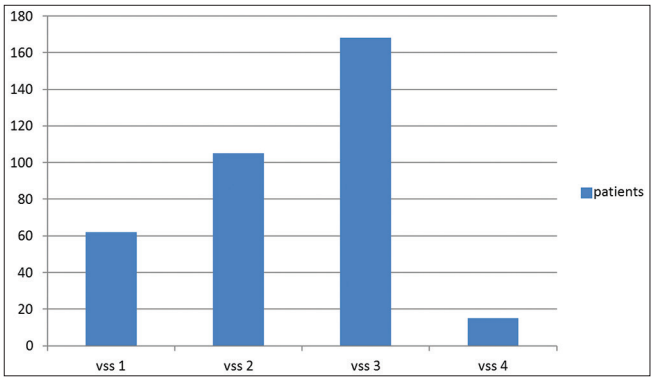

Figure 13: Vancouver scar scale score chart

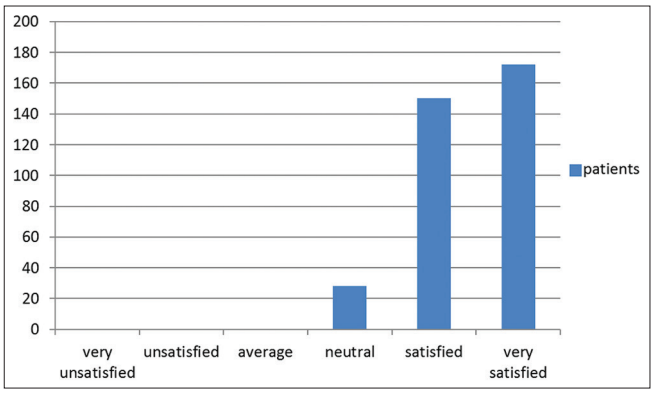

Figure 14: Patient satisfaction level chart

Of all five surgical techniques used for tattoo removal in the present study, none can be labeled as better or superior to the other, and each has its own applicability and drawbacks. Tattoos come in all sizes and shapes. There are many variables, and therefore, every method has different indication and what is important is to select a method which is the best for a particular tattoo. It is not possible to compare one method with the other.

Excision and primary closure are the best, are easy to do, and give minimal scar, but it has its limitations. The closure has to be tension free and no fix parameters can be laid for this. Tattoo of a particular size may be fit for primary closure at one site where skin is lax but may not be so at another site where the skin is not so lax.

Serial excision obviates the need for skin graft. The procedure is staged but definitely has its role where some skin laxity is present, for example, on neck and dorsum of the hand where the patchy look of skin graft is esthetically less acceptable than scar stretching which is unavoidable with this procedure (all cases had some sort of scar stretching).

Tangential excision of tattoo without skin grafting has found the least application in the present study, in two patients only. To avoid creation of a donor area of graft harvesting, some authors suggested a quick method of tangential split-thickness excision for tattoo removal, believing that it will heal like a graft donor area and some leftover pigment will come out with crust.[4,15] If tattoo pigment is penetrating into deep dermis, the skin graft has to be applied after tangential excision otherwise healing will be delayed resulting in bad scar formation.

Tangential excision of tattoo with dermal over grafting and excision of tattoo with skin grafting had to be done in most of tattoos because size and skin laxity were not limiting factors for these two procedures. All patients who underwent tangential excision with dermal over grafting could be treated with excision and grafting also.

The marginal hypertrophy seen after tangential excision with dermal over grafting was 62% as compared to 75% seen after excision and grafting. It might be due to preservation of some elements of deep dermis in the f] ormer method. The latter method was best indicated for the patients not suitable for the former method, i.e., those who presented with complications of tattooing and self-attempted tattoo removals, tattoos over web spaces where tangential excision is difficult to perform, along with scattered irregular shaped and subcutaneous tissue deep tattoos. The higher incidence of marginal hypertrophy in this group might be due to inclusion of tattoos which had already undergone interventions in the form of application of chemicals or cauterization. Further controlled studies comparing the results of these two procedures in similar tattoos may be required to label the superiority of one method over the other.

The hypertrophy responded very well to coconut oil massage, silicone gel application, and wearing of pressure garment as shown by studies in the past.[16] Avoidance of sun exposure was advised for hyperpigmentation.

Initially, we tried to follow each patient for 6 months, but we found follow-up very erratic. It was found that most of recruitment aspirants got busy in their trainings and those who got tattoos removed as a result of breakups either got new partners or were just not interested in long follow-ups; therefore, we decreased follow-up to 3 months. We assessed the final outcome of our study using VSS score and patients' satisfaction survey.[14] VSS has been accepted as a valid scale for post-surgery scar or burn scar assessment.[13] VSS ranged from 1 to 4. The patients were simply asked to select an option out of very unsatisfied, unsatisfied, neutral, satisfied, and very satisfied at the last follow-up. The aim of complete tattoo removal was achieved in all patients along with good patient satisfaction levels as 49% of patients were satisfied and 43% of patients were very satisfied.

While conducting this study, we came across five patients who were found to be hepatitis c positive (4 patients) and HIV positive (1 patient). Although we were not sure of the cause of viral infection in them, they are known complications of tattooing along with various allergic reactions, therefore, "think before you ink."[3] The trend of big tattoos is on rise, and the controlled studies comparing surgical techniques with other methods such as lasers may be required to search for an ideal method.

CONCLUSION

Each surgical technique of tattoo removal has its applications as well as limitations. One surgical method may be suitable for one type of tattoo and not so for the other; therefore, selective application is required. In the armamentarium of surgical methods of tattoo removal, all techniques are serving the purpose well and are acceptable. Surgical methods are a valid option for tattoo removal.

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