Annales de chirurgie plastique esthétique (2016) xxx, xxx—xxx

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com

GENERAL REVIEW

# Dealing with tattoos in plastic surgery. Tattoo removal

## *Autour du tatouage en chirurgie plastique. Détatouage*

**N. Malca*, L. Boulart, W. Noel, A. de Runz, M. Chaouat, M. Mimoun, D. Boccara**

*Plastic, reconstructive, aesthetic surgery unit, hôpital Saint-Louis, 1, avenue Claude-Vellefaux, 75010 Paris, France*

Received 25 July 2016; accepted 14 September 2016

**KEYWORDS**
Tattoo;
Tattoo removal;
Surgery;
Laser;
Scar

**MOTS CLÉS**
Tatouage ;
Détatouage ;
Chirurgie ;Laser ;
Cicatrice

**Summary** Not only has tattooing been socially performed for thousands of years, but it has also been part and parcel of medical practice since antiquity. In our day and age, plastic surgeons are ever more frequently compelled to deal with tattooing — and with tattoo removal procedures, as well. While the process itself may appear harmless, it is not without risk and necessitates use of suitable tools and management by expert hands.


**Résumé** Le tatouage est une pratique sociétale parmi les plus anciennes au monde et intégrée à la sphère médicale depuis l'antiquité. Les chirurgiens plasticiens sont de plus en plus confrontés au tatouage mais aussi à son retrait. Même si cette pratique est anodine en apparence, tatouage et détatouage ne sont pas dénués de risque et nécessitent d'être pris en charge par des mains expertes.


* Corresponding author.
*E-mail address:* nathaniel.malca@gmail.com (N. Malca).

http://dx.doi.org/10.1016/j.anplas.2016.09.005
0294-1260/

Please cite this article in press as: Malca N, et al. Dealing with tattoos in plastic surgery. Tattoo removal. Ann Chir Plast Esthet (2016), http://dx.doi.org/10.1016/j.anplas.2016.09.005

## Introduction

In parallel with the resurgent popularity of tattooing, requests for tattoo removal have been steadily increasing; this is the case for a number of psychosocial reasons: making a break with a tumultuous past, responding to professional exigencies or enduring a romantic ''split''. Over the upcoming years, one can expect at least 5 to 10 million tattooed individuals to wish to have their tattoos removed [1,2].

Tattooing consists in implanting exogenous pigments under the epidermis at various degrees of depth so as to produce coloration. Dermograph needles cross the papillary and/or reticular dermis at a depth approximating 1 to 2 mm. The tattoo pigments are placed in the macrophages; subsequent to scarring, they remain inert [3—6] (Figs. 1 and 2).

## Tattoo removal techniques

### Historical background

Different techniques have existed since antiquity [7]: the salt abrasion process dates back to the 6th century and remained in use as late as the 1990s [8]. In 1888, Variot developed a new chemical destruction technique [2] involving injection in the dermis of tannic acid and leading to dry necrosis of the tattoo; its implementation was later discontinued due to the extensive resulting keloid scars and hypopigmentation it provoked. In the early 20th century, Lacassagne was the first to propose a dermal abrasion procedure using emery cloth [9]. As for Dubreuilh, he carried out unsuccessful attempts with X-rays prior to publishing details on his new, so-called decortication technique in 1909, at a time when direct suture for large-scale tattoos was not possible [10], and it yielded controlled wound healing or a skin graft taken from the limbs [11]. Diversified procedures of chemical destruction using potassium bioxalate, zinc chloride and vesicatory ammoniac also saw the light of day, provoking superficial burns and hideous scars.

### Thermal tattoo removal techniques

The 1970s were marked by the emergence of selective photothermolysis through which laser is enabled to destroy the pigment. Whether or not laser is chosen depends on the color of the pigment corresponding to the therapeutic target. When it is, sufficient knowledge of the inks comprising the tattoos is essential to selection of the wave length most amenable to absorption. Several studies have underscored the wide variety of chemical components to be found in tattoos; some of them have specific colors, and the black and dark inks are the easiest to eliminate. In addition to acquisition of the right wave length, pulse time is of prime importance. Indeed, with nanosecond pulsed lasers only a limited part of laser energy is transformed into an effective photoacoustic effect, especially when the target is minuscule. One consequence of this principle is that small-sized pigmented masses are resistant targets (Fig. 2). Clear, polychrome or compact tattoos are particularly difficult to remove, and some forms of permanent makeup contain non-mineral pigments that change colors on contact with laser [12—16].

Even though some of the thermal procedures outlined above have revolutionized treatment of exceedingly large-scale tattoos, they have continued to present several short-

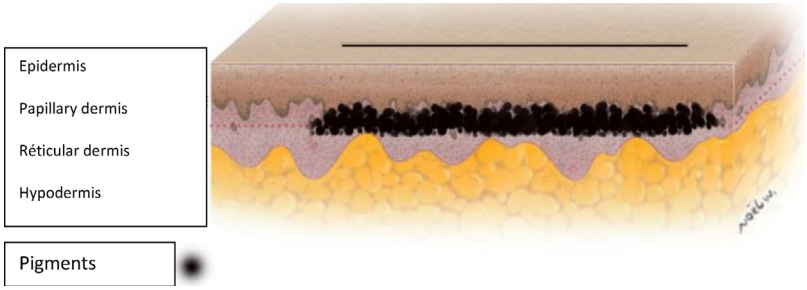


**Figure 1** Homogenous distribution of the pigments in the dermis on a tattoo created by a professional.

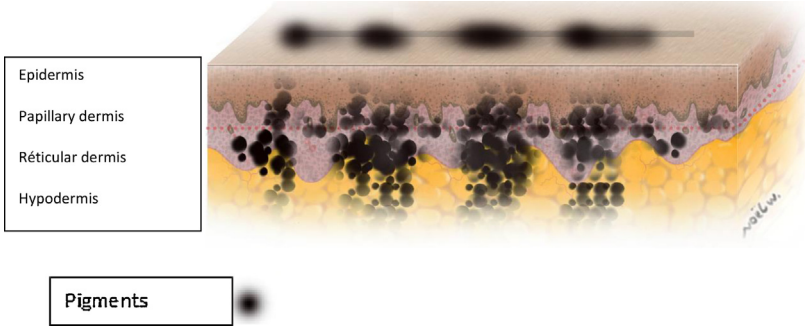


**Figure 2** Localization of the pigments created by an amateur. It is necessary that the pigment be deposited at exactly the right depth. If it is positioned too superficially, the color will fade; if it is positioned too deeply, it will appear bluish due to Tyndall effect.

Please cite this article in press as: Malca N, et al. Dealing with tattoos in plastic surgery. Tattoo removal. Ann Chir Plast Esthet (2016), http://dx.doi.org/10.1016/j.anplas.2016.09.005