

ORIGINAL ARTICLE

Introduction of dermatome shaving as first line treatment of chronic tattoo reactions

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Abstract

Background/aims: Chronic tattoo reactions requiring treatment have increased. Laser removal is not ideal for removal of allergic reactions. Surgical removal of culprit pigment situated in the outer dermis by dermatome shaving is rational and need to be revisited. **Materials/methods:** Fifty four tattoos with chronic reactions in 50 patients were treated with dermatome shaving. Tattoos with red/red nuances dominated the material. In total, 52 operations were performed in infiltration and 2 in general anaesthesia. Shaving was performed to the level in the dermis free of tattoo pigment as assessed visually by the surgeon. **Results:** Operative complications were few. Healing occurred over weeks as normal for this procedure. On a rating scale from 0 to 4, 4 as most severe, the patient's severity rating of symptoms in their tattoo declined from 3.2 pre-operatively to 1.0, 0.8 and 0.7 after 3, 6 and 12 months, respectively. Burden of operation was rated low. Patient satisfaction was high. **Discussion/conclusion:** Dermatome shaving is efficient and with few complications, and is proposed as first line treatment of chronic tattoo reactions. Shaving of such reactions apparently has been neglected during enthusiastic introduction of laser approaches, which in the treatment of allergic tattoo reactions may be relatively contra indicated and of special risk.

Keywords

Allergic tattoo reactions, red tattoos, surgical removal of tattoos

History

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Introduction

The current tattoo trend with presently about 100 million Europeans carrying tattoos is paralleled with an increased number of chronic tattoo reactions in need of efficient treatment (1,2). The reactions are elicited by culprit pigment residing in the dermis making the tattoo permanently colourful. Until now treatments have included topical corticosteroids, antihistamines and laser surgery as intuitive first line treatments used on physicians discretion. Such treatment modalities have not been documented when applied to chronic tattoo reactions, which are inflamed and often allergic in nature. Lasers, especially Q-switched lasers, are universally used for removal of non-reacting tattoos, which the individual for personal reasons regrets. The outcome of cosmetic laser removal is variable and may be excellent depending on a number of factors including the colour being treated (3–7). Laser removal also has known complications such as hyper- and hypo-pigmentation, and scarring. Non-ablative lasers do not remove the pigment but make it colourless. Concerns have been raised that laser induced photo chemical reactions of the pigment may produce new and harmful chemicals including Carcinogenic–Mutagenic–Reproduction (CMR) toxic substances and new allergens (8–10). Furthermore, lasers decolorize dermal pigment near the surface but not in the deep dermis and thus are not logic to use in chronic tattoo reactions, which often are

thickened due to inflammation and allergic in nature, which requires complete or nearly complete eradication of all pigment to solve the problem efficiently. Surgical full-thickness excision of reacting tattoos would be logic, however, excision is only applicable to tattoo reactions of limited size and located in selected anatomical sites (11). Thus, there is a need for a treatment modality which can offer radical removal of the culprit pigment of tattoo reactions and which can be practised in many clinics. Dermabrasion and dermatome shaving have over the years been sporadically practiced for treatment, but not systematically used, and documented since the introduction in 1976 (12–15). Dermatome shaving is a promising candidate treatment because this surgery can be used under infiltration anaesthesia and performed sequentially to the desired dept in the dermis under the pigment and reach normal dermis as guided directly by surgeon's eye leaving a wound bed, which can reconstitute spontaneously. Dermatome shaving can be applied to larger tattoo reactions and is altogether an innovative approach in the treatment of chronic tattoo reactions, which often are surprisingly cumbersome with itching and reduced quality of life (16). In this study, we present results of dermatome shaving including measurement of patient's satisfaction studied in a larger series of consecutively operated patients.

Materials and methods

Patients included in this study were referred to the Wound Healing Center from the “Tattoo Clinic” of Bispebjerg University Hospital, Department of Dermatology. Patients suffered from chronic tattoo reactions, i.e. abnormal signs and

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symptoms in their tattoos such as swelling, redness, scaling and hyperkeratosis associated with itching and pain for more than 3 months and beyond normal healing. They requested efficient treatment. Patients had often tried treatments such as local corticoids, antihistamines, antibiotics and some even laser therapy without success. Treatment had been instituted by the patient's general practitioners or dermatologists before referral to the "Tattoo Clinic". Patients were included consecutively and formatted as a production control study. Punch biopsies were taken pre-operatively for routine pathology to assess the depth of the pigment in the dermis and to exclude skin diseases, which might complicate operation. Before operation the patients were informed about potential risk of the shave operation and the expected sequels with hypo- and hyper-pigmentation and the risk of abnormal scar formation. Tables 3 and 4 illustrate typical complications after shaving procedure. Operations were done after written and oral information to the patient, who should consent.

Operations included in the study were conducted from November 2009 until June 2013. Dermatome shaving was not used in our clinic before November 2009, thus, during the period the surgical technique used for this special indication developed from new and experimental into a routine treatment used as first line treatment of such cases. One Senior Surgeon (BJ) did all operations. He routinely does dermatome shaving on other indications.

The setting of surgery was a one day out-patient procedure. Infiltration anesthesia with mepivacain, hydrocholrid (carbocaine[®], 1% with no adrenaline) was used in all cases except two in which the patients were operated under general anesthesia. Operations were conducted in a standard operation theater under sterile conditions. Operations were not supported by pre- or post-operative antibiotics or sedatives.

For dermatome shaving, the preferred instrument was the Watson knife supplemented with the Zimmer pneumatic instrument for larger lesions and the Da Silva knife or a curved shave biopsy blade trade named "Miltex Bioblade[®]" (Miltex, Plainsboro, NJ). The lesional skin was shaved in thin slices ranging from 0.25 mm to 1 mm with thick slices cut initially if the lesion was elevated over the surrounding skin. The surgery was individualized and also depended on anatomical site. A case is illustrated in Figure 1. The depth of shaving was guided by visual examination for tattoo pigments in slices removed from the dermis and pigment remnant in the wound bed. The procedure was continued until whitish collagen tissue devoid of any visual pigment was obtained in the entire field of the reaction. The depth of shaving typically reached the mid-dermis level, however, if indicated due to pigment remnants the level might come close to the interface to subcutis. Shave level was as superficial in the dermis as ever possible. Shaving was limited to the affected area of the tattoo and the particular colour giving rise to problem. Dependent on the case and the tattoo the shave field was widened 1–3 mm into the surrounding non-lesional skin to ensure efficient removal of tattoo pigment and to smoothen the contour of the borderline zone.

Post-operative treatment consisted of absorbent bandages, preferably alginate four layers and semipermeable film, applied under long stretch compression bandage, which was removed after one week and re-applied with compression for some 2 months adjusted to individual needs, see Figure 2. Follow up and post-operative treatment was individual and performed by the "Tattoo Clinic" of the Department of Dermatology. This also included assessment of the effectiveness of the operation in improving the tattoo reaction, and the need for a second shave operation in the case of incomplete removal of tattoo pigment and significant subjective symptoms. Patients were followed for 6–12 months.



Figure 1. Shaving of a reacting tattoo with Zimmer dermatome.



Figure 2. Removal of bandage. Notice tattoo pigment diffusion into the alginate.

Occasional treatments such as corticoids and antibiotics were used. Hypertrophic scarring was treated with intralesional injection of the corticoid triamcinolone acetonide in a 10 mg/ml slow release formulation (Kenacort[®] A 10, Dermapharm AG, Hünenberg, Germany). The injected volume was individualized (Figure 3).

Clinical information originated from two sources, i.e. patient's records and a follow up questionnaire as described later. Demography of the patients, the colour and anatomical location of the problem tattoo, previous treatments and other tattoos in the patients not causing clinical problems were registered accordant with Patient's standard file. This also included registration of known skin diseases and other diseases which might influence the tattoo reaction or interfere with operation and post-operative course, and healing.

The essential part of the study based on a questionnaire was performed during May, June and September 2013 using structured telephone interview. Interviews were based on a standard questionnaire with pre-defined questions as well as open questions and invited spontaneous comments. It was composed of 20 questions concerning the treatment of the tattoo reaction. The primary end point was overall patient satisfaction with the shave operation. The telephone interviews were performed by one of the authors (MS), who is a medical doctor. An interview was scheduled with duration of 20 min.



Figure 3. Hypopigmentation after dermatome shaving in tattoo.

The systematic interview and the questionnaire addressed five topics and 20 questions. Some of the questions in topic 3 and 4 were based on an ordinal scale:

- (1) *Pre-operative clinical information on the reacting tattoo*, i.e. anatomical site and colour etc. referenced to and confirmative to patient file information.
- (2) *Treatment before the operation*, i.e. any medical treatment of the problem tattoo prior to shave operation. The interviewed were specifically asked to confirm or deny previous treatment with topical corticoids and, if taken, report the outcome.
- (3) *Symptoms*, i.e. overall severity rating of subjective symptoms before shave operation and after 3, 6 and 12 months. Ratings were “no symptoms” scored 0, “a little” scored 1, “moderate” scored 2, “severe” scored 3 and “extensive including symptoms at night” scored 4. Subsequently, open questions about the dominant specific or major symptom and additional symptoms were assessed. Symptoms were rated from 0 to 4 as described above.
- (4) *Shave operation, post-operative complications and sequels, the need for additional surgery or treatment, and overall patient satisfaction*. Patient’s overall satisfaction with the operation and the outcome of shave surgery was rated from 0 to 3 with “not satisfied” scored 0, “mildly satisfied” scored 1, “moderately satisfied” scored 2, “highly satisfied” scored 3. This was followed by specific questions about visual sequels as described below and in the patient’s spontaneous opinion. The patients were asked specifically about their evaluation about scar formation and pigment variation i.e. hypo- and hyper-pigmentation in the shaved field including cosmetic concerns, to be answered as yes or no. Objective sequels of the shave operation were only registered consistently in the patient’s files on follow-up visits if sequels were medically significant. Objective medical sequels requiring antibiotics, intralesional injection of triamcinolone acetonid or a second operation were consequently noted in the patient files, and shall be reported under results.

The patients were asked if they found the shaving operation procedure as such was felt “a burden” rated 0–4 with “no” scored 0, “a little” scored 1, “moderate” scored 2, “severe” scored 3, “could not stand it, will never do it again” scored 4.

- (5) *Motivated for a new tattoo in the future*: The patients were asked whether they have been tattooed after the shave operation, if they planned a new tattoo or if they deliberately would abstain from getting a tattoo in the future. If yes, they were asked to specify, *i*: if it was the same anatomical site as the shaved tattoo (yes/no), *ii*: in another site (yes/no), *iii*: with the reacting colour (yes/no).

Results

The study included 50 patients, 40 women and 10 men with an average age of 35.5 years. One patient had known psoriasis, and one sarcoidosis.

In total, 54 patients had been operated with shaving during the inclusion period. Two patients were not accessible and one did not wish to participate. One presented with a hypertrophic scar in her tattoo due to intense pulsed light and laser treatments and was therefore not eligible for inclusion in the study. Thus, of 53 consecutive patients being candidates for inclusion in the study 50 participated inclusion rate 94%. Four patients had two operations in two different anatomical locations, thus, 54 operations were performed in 50 included individuals. Annual operations were 2 in 2009, 1 in 2010, 16 in 2011, 22 in 2012 and 22 in 2013. Nine patients in 2013 were not subjected to questionnaire examination due to time frames defined in the study.

Operations and anatomical site is shown in Table 1, and the distribution of colours coursing problems is shown in Table 2. Red and nuances of red made up for 93% of all operations.

Forty-four tattoos had received various medical treatments in the past such as antibiotics and topicals with topical corticoids tried in 40 cases. In 35 tattoos, the corticoids had no effect, in five little effect and in one some relief was noted. None of the patients obtained a satisfying treatment outcome of topical treatment.

The major symptoms of the chronic tattoos were itching (43 cases), pain or tenderness (5 cases), stinging (1 case), irritation (1 case) and swelling (3 cases) and recurrent abscess formation (1 case).

The patient’s overall severity rating of subjective symptoms was at the time of the interview rated to be 3.2 pre-operatively, 1.0 after 3 months, 0.8 after 6 months and 0.7 after 12 months (Figure 4).

Patient’s overall satisfaction with the operation and the outcome of shave surgery at the time of the interview, rated from 0 to 3, was concluded to have an average value of 2.6, i.e. satisfactory. This corresponds to a high satisfaction rate of 87%.

Pre- and post-operative complaints and sequels were none existent in 38 operations (70%) and complaint were mainly mild and not serious (Table 3).

Questions about visual sequels specified as scar formation and pigment variation in patients spontaneous opinion are shown in Table 4.

The patients rated the burden of the operative procedure with an average value of 0.6, i.e. minor burden registered on a rating scale from 0 to 3.

The follow up in the “Tattoo Clinic”, 9 patients were noted to have scar formation in the shave fields of a degree needing intradermal injections with triamcinolone acetonide, which in general helped the problem after 1–2 injections.

Of 50 operated patients, seven needed a second shave operation since reoccurrence of signs and symptoms had happened in parts of the tattoo. The predominant location of such reoccurrences was in the very periphery of the shaved tattoo

Table 1. Anatomical site and operations.

Anatomical site	Number	Percentage (%)
Near joint	19	35
Angle	11	20
Wrist	8	15
Dorsum pedis	4	7
Dorsum manus	0	0
Other	31	58
Forearm	7	13
Upper arm	7	13
Lower leg	11	20
Abdomen	1	2
Back	3	6
Groin	1	2
Achilles tendon	1	2
Total	54	100

Table 2. Tattoo colours and distribution.

Colour	Number	Percentage (%)
Red	30	55
Red spectrum	20	37
Purple	9	17
Pink	5	9
Violet	3	5
Magenta	2	4
Bordeaux	1	2
Other	4	8
Black	2	4
White	1	2
Yellow	1	2
Total	54	100

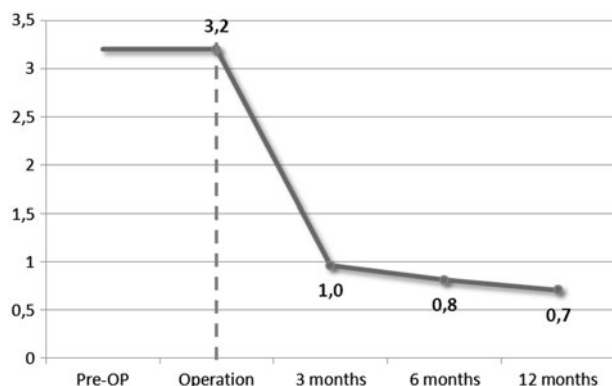


Figure 4. Patient's overall severity score (mean value) pre- and post-operatively.

adjacent to black lining and normal skin, where culprit pigment seemingly had not been removed efficiently since the shaving appeared not sufficiently deep.

At the time of the interview and after the shaving operations and patient's experience with adverse tattoo reaction, 13 patients had, nevertheless, acquired a new tattoo, 13 in another anatomical site and one also in the shave operated tattoo and 13 patients were tattooed with a colour different from the culprit colour, and one also with the same colour as the culprit ink. At the time of the interview, 29 did not plan for a tattoo in future, 21 planned a new tattoo and 4 expressed no special opinion, 24 felt scared to get another tattoo, 7 were motivated for a new tattoo in future independent of colour, 9 were motivated for a new tattoo, however, not of the culprit colour and 14 were indifferent or

Table 3. Pre- and post-operative complaints.

Pre- and post-operative complaints	Number	Percentage (%)
No complaints	38	70
Complaints	15	29
Bleeding	4	7
Infection	2	4
Prolonged healing	2	4
Pain	1	2
Cosmetic gene	1	2
Itching	1	2
Stinging	1	2
Infection and scar	1	2
Scar formation	1	2
Not specified	1	2
No answer	1	2
Total	54	101

Table 4. Visual sequels in patients' spontaneous opinion.

Scar formation and pigment variation	Number	Percentage (%)
Scar formation		
Yes	17	31
No	34	63
No answer	3	6
Pigment variation		
Yes	13	24
No	38	70
No answer	3	6

unable to conclude their aims. As mentioned, 13 actually were tattooed again despite negative past experience with tattooing, indicating shave operation.

Discussion

Patients with chronic tattoo reactions are heavily burdened with itch and discomfort, and their quality of life was shown to be affected to the same degree as known from cumbersome skin diseases such as psoriasis, eczema and pruritic skin condition (13). Discomfort from tattoo reactions is independent of affected area, and patients with a minute tattoo reaction may insist on efficient treatment and relief of their problem. We observed that topical corticoids generally failed to be efficient.

In this study, we found that dermatome shaving resulted in marked improvement of subjective symptoms as measured by severity rating, and the outcome of operation measured as patient satisfaction was rated high. Thus, dermatome shaving efficiently helped the patients. Patients did not rate the operation as a significant burden. We recommended compressive bandage whenever applicable to diminish reactive oedema in the early healing phase and in the late healing phase to prevent hypertrophic scar formation (17). Post-operative complaints were acceptable and as expected for such type of surgery. The majority of patients did not report abnormal pigmentation or scarring in the late healing phase, however, during follow up 9 of 50 patients required treatment with intradermal corticoid to control scarring.

Ideally, the shave field must be cleared from visible pigment, and this is typically achieved at the mid dermal level, however, in some cases the pigment may approach the interface to the subcutis, and the surgeon may need to compromise to minimise operative sequels. As shown in literature, pigment often stays in outer- and mid-dermis therefore shaving seems efficient as a therapeutic tool (18). Granulomatous reactions going deep in dermis towards the interface to the subcutis are unusual and such



Figure 5. Remains of isolated pigment remnants.

as may need special treatment as full thickness excision (19). The width of the shaving ideally shall include all culprit pigment and even a margin into non-tattooed skin, which may often intrude the black tattoo lining typically used to demarcate coloured tattoos. The reason for a second operation in our study typically was reoccurrence of reaction at the margin of the tattoo towards normal skin, however, as the surgeon's experience with widening of the dermatome shaving laterally the need for a second operation diminished. It shall be considered that remnant pigment in the deep dermis to some extent can become eliminated via the shave wound as may be observed directly in the dressing (Figure 2). We noted in selected cases with perfect outcome subjectively that there might remain isolated pigment remnants which had not been removed. Thus, complete removal of pigment is not obligatory (Figure 5).

Surgical treatment especially dermatome shaving, which is a universal and relatively simple and economic treatment, seems to have been neglected in the treatment of chronic tattoo reactions. Treatment options of complicated tattoo reactions apparently were over shaded by popular laser approaches during the enthusiastic development of this technique. Our results document dermatome shaving to be efficient and safe for treatment of chronic tattoo reactions, and we propose this operation is used first line.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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