

Factors influencing final rendering in areola tattoo reconstruction: a statistical analysis

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Abstract. *Background and aim:* Reconstruction of the nipple-areola complex announces the end of breast reconstruction process, sometimes difficult to live for the patient, and significantly improves the perception of body image. In literature there are no studies addressing the possible influencing factors of the final rendering of areola reconstruction with tattoo. The aim of the present study was to evaluate all the factors which could influence the yield and the final result of the nipple areola complex pigmentation. *Methods:* 97 patients who underwent areolar tattooing between January 2018 and February 2020 were retrospectively reviewed. Breast reconstruction timing and personal history, as well as surgical details were recorded. *Results:* Mean age was 52 years old (range 29-71), almost the totality of cases was women including even 2 men (one with Poland syndrome and one post mastectomy). 27 patients needed bilateral tattooing. 22 had history of adjuvant radiotherapy, 16 received neoadjuvant chemotherapy and 4 adjuvant chemotherapy. In the logistic regression analysis, radiotherapy resulted a risk factor for retattooing ($p < 0.05$) while the autologous breast reconstruction resulted a protective factor for retattooing. Neo- and adjuvant chemotherapy were not statistically significant. *Conclusions:* Tissue thickness, sex, reconstructive technique and history of radiotherapy could influence the final result in areola reconstruction with tattoo, and must be taken into account to obtain the best result, knowing when the pigmentation has to be repeated. (www.actabiomedica.it)

Key words: NAC reconstruction, areola reconstruction, areola tattoo, breast reconstruction, radiotherapy

Introduction

Reconstruction of the nipple-areola complex (NAC) is an essential step in breast reconstruction. It announces the end of the reconstruction process, which is often long and sometimes difficult to live for the patient and significantly improves the perception of body image (1). NAC reconstruction may be viewed as the “cherry on top” of the breast reconstruction. In previous studies the overall satisfaction with NAC reconstruction were 72-88%, which reflects the relevance and the expectancy of patients about this last step of the reconstruction (2,3). In the last three decades, techniques for NAC reconstruction have evolved,

advanced and reviewed (4,5). Surgical ones pose disadvantages such areola necrosis, loss of nipple projection, depression or local necrosis and temporary leave from professional activities. Therefore, these factors could discourage patients from complete the breast reconstruction (6).

Tattooing is one of the preferred techniques for areola reconstruction, since it is a simple, quick and safe procedure with a high satisfaction rate (1) and it does not feature donor site morbidity (7). Despite in literature final outcome and patients' satisfaction with this technique are widely described, there are no studies addressing the possible influencing factors of the final rendering of areola reconstruction with tattoo.

The aim of our study was to evaluate all the factors which could influence the yield and the final result of the NAC pigmentation.

Patients and methods

Records of 97 patients who underwent areolar tattooing at the Department of Plastic and Reconstructive Surgery of Policlinico of Modena (Italy) between January 2018 and February 2020 were retrospectively reviewed. We considered the breast reconstruction timing and type, history of a secondary breast procedure or other operations, history of neo or adjuvant therapies, timing between the end of radiotherapy and NAC reconstruction, type of NAC reconstruction (with or without nipple reconstruction), result of tattooing and number of tattooing procedures needed to obtain a good result. The patient was evaluated and marked in the upright position: if she already had the nipple, with the use of a circle template, we draw a circle of the same diameter of the contralateral, otherwise we marked the principal landmarks (the sternal notch, midline, and the midclavicular line) and with the use of an electrocardiographic lead we decided the final position of the NAC. An informed consent was obtained. After fifteen minutes of anesthetic ointment (Lidocaine 2,5% and Prilocaine 2,5%, EMLA) application with occlusive dressing, it was possible to start the tattooing procedure. Only few patients required local anesthesia. No prophylactic antibiotics were used. The One Need permanent makeup device system (Campomats Srl, Carpi, Italy) with sterile prepackaged 9 or 11-magnum needle cartridges and pigments (NPM International, Israel) was used for tattooing. During color preparation, when the contralateral areola was present, a color matching was performed. Otherwise, a color for both areolas was decided in accordance with the patient's phototype. After color preparation, tattooing was started from the outside border of the areola moving in circles the needles, alternating clockwise and anticlockwise. The movement was repeated until the amount of pigments deposited was uniform. If the nipple was not present, it was created with light and dark contrast. Finally, a light beige pigment was used with a 1 needle to make Montgomery glands sparsely distributed over the areola.

At the end of the procedure a moist dressing was applied and the patients could remove it after 12-24

hours and they were allowed to take a shower. The patient was educated to apply moisturizing cream once a day for 3-4 weeks.

After two months it was evaluated the result of the tattoo and if necessary a retattooing could be performed.

We analyzed the covariates with a logistic regression analysis to identify the risk factors which could increase the risk of retattooing of the NAC or the ones which could ensure a good result after one procedure. Statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, Ny, USA). P-values ≤ 0.05 were considered statistically significant.

Results

A total of 97 patients were included, the mean age was 52 years old (range 29-71), almost the totality of cases was women including even 2 men (one with Poland syndrome and one post mastectomy) (Figure 1).

27 patients needed bilateral tattooing (Figure 2).

22 had history of adjuvant radiotherapy (18 patients had previously received radiation therapy to the reconstructed area and 4 received it after reconstruction), 16 received neoadjuvant chemotherapy and 4 adjuvant chemotherapy. In Table 1 demographic characteristics are described.

15 patients had breast reconstruction with flaps (10 DIEP, 4 pedicled latissimus dorsi and 1 TRAM) and the other 82 patients with a prosthetic reconstruction (12 with direct to implant and the others 70 with two stage reconstruction with expander and prostheses) (Table 2).

In 40 cases autologous fat grafting was used after the reconstruction.

NAC reconstruction was performed in 81 cases using the CV flap and tattoo and in 16 cases tattoo-only technique. The main reasons for performing the tattoo-only technique were reluctance of the patient to undergo another operation, thin and/or tight breast skin in patients with implant-based reconstruction, radiotherapy after implant-based reconstruction, mastectomy scar across the central portion of the breast mound, and flat nipple on the contralateral side (Figure 3).

The mean interval between the nipple reconstruction and tattooing was 20 months (with an interval



Figure 1. A preoperative photographs of a 52-year-old man who had history of mastectomy for left breast cancer. B Postoperative photographs after tattoo-only nipple areola complex reconstruction. In this case the procedure had to be repeated six times.

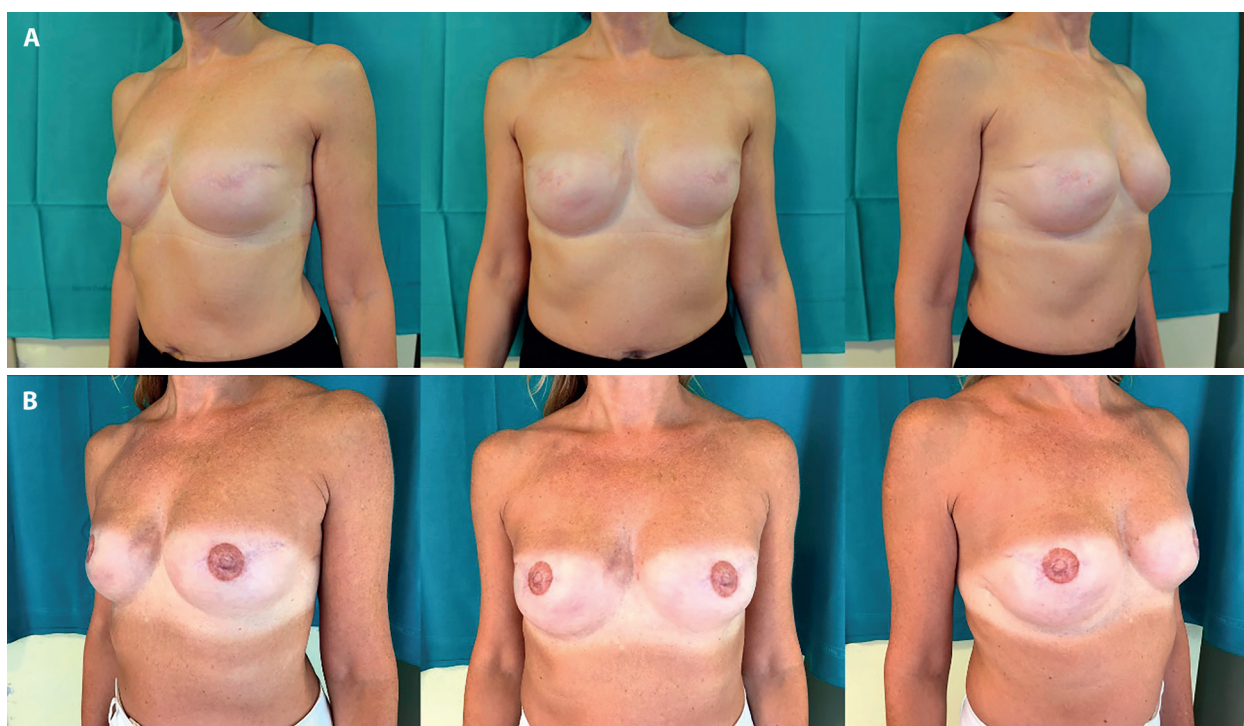


Figure 2. A preoperative photographs of a 57-year old woman who had history of bilateral skin-sparing mastectomy, followed by immediate reconstruction with expander and then silicone implants. She had no history of neo or adjuvant therapies. She had the nipple reconstruction with C-V flap and four years later she underwent areola reconstruction with tattoo. B Postoperative photographs two months after areola reconstruction with tattoo.

Table 1. Patient demographics.

Variable Total patients (n= 97)	No. of patients (%)	Risk of ri-pigmentation	Relative risk 95% C.I.
Sex			
Female	95 (98%)	21	
Male	2 (2%)	2	
Mean age, years (range)	52 (29-71)		
Comorbidities			
Hypertension	6 (6%)		
Diabetes	2 (2%)		
Smoke	6 (6%)		
Hypothyroidism	13 (13%)		
BMI>30	4 (4%)		
Others (es. fibromyalgia, sarcoidosis)	38 (39%)		
Radiotherapy			
No RT	77	21(21/77) 0,28	Ref
Received previously	18 (18%)	2 (2/18) 0,1	0,28/0,1= 2,8
Received after reconstruction	4 (4%)	0 (0/4) 0	

BMI: body mass index; CT: chemotherapy; RT: radiotherapy.

Table 2. Breast reconstruction details.

Variable Total patients (n=97)	No. of patients (%)	Risk of ri-pigmentation	Relative risk 95% C.I.
Breast reconstruction timing			
Immediate	88 (91%)	22 (22/88) 0,25	Ref
Delayed	7 (7%)	0 (0/7) 0	
No reconstruction	2 (2%)	1 (1/2) 0,5	*
Breast reconstruction type			
Flap	15 (15%)	1 (1/15) 0,07	0,26/0,07=3,7
DIEP	10 (10%)		
Pedicled latissimus dorsi	4 (4%)		
TRAM	1 (1%)		
Implant	80 (82%)	21 (21/80) 0,26	Ref
Direct to implant	12 (12%)		
Two stages (Expander-prosthesis)	68 (70%)		
Breast reconstruction type			
Unilateral	70 (72%)	18 (18/70) 0,26	Ref
Bilateral	27 (28%)	5 (5/27) 0,19	0,26/0,19=1,37

TRAM: transverse rectus abdominis myocutaneous; DIEP: deep inferior epigastric perforator.

between 3 and 80 months). The 76% of patients required only one round of pigmentation but the men needed retattooing (one of them six times), the irradiated skin was tougher to be pigmented and these patients needed more than one retattooing (at least two) and the skin of the flaps was simpler to be pigmented (Table 3).

The reported complications were: one worsening of lymphedema the days after the procedure, ten

nipple flattening, one partial muscular exposure, in fifteen cases it was difficult to obtain a good pigmentation of the nipple and in three cases (two of them with previous radiotherapy) the skin tended to split apart and become shiny (Table 4).

In the logistic regression analysis, radiotherapy resulted a risk factor for retattooing ($p<0.05$) while the autologous breast reconstruction resulted a protective factor for retattooing (Figures 4, 5 and 6).



Figure 3. Preoperative photographs of a 67-year-old woman who had history of bilateral skin-sparing mastectomy followed by immediate reconstruction with expander and then silicone implants. She had no history of neo or adjuvant therapies. She refused the nipple reconstruction with surgical techniques. B Postoperative photographs two months after tattoo-only nipple areola complex reconstruction.

Table 3. NAC (nipple areola complex) reconstruction details.

Variable	No. of patients (%)	Risk of re-pigmentation	Relative risk 95% C.I.
Total patients (n=97)			
Technique of reconstruction			
Fish tail flap + tattoo	81	19 (19/81) 0,23	0,25/0,23=1,08
Tattoo only	16	4 (4/16) 0,25	Ref
Mean interval between nipple reconstruction and tattoo, in months (range)	20 (3-80)		
Number of pigmentations			
1	74 (76%)		
2	18 (19%)		
3	3 (3%)		
4	1 (1%)		
6	1 (1%)		

Table 4. Complications after tattoo procedure.

Variable	No. of patients
Total patients (n=97)	
Complications:	
Flattening of the nipple	10
Difficult pigmentation of the nipple	15
Worsening of lymphedema	1
Muscular exposure	1
Split apart of the skin	3 (2 with previous RT)

The sex was not possible to evaluate due to the different number of the two groups. Neo- and adjuvant chemotherapy were not statistically significant.

Discussion

NAC reconstruction may be seen as “the icing on the cake” of breast reconstruction and it is



Figure 4. Postoperative photographs of a 39-year-old woman with BRCA1 mutation who had history of bilateral skin-sparing mastectomy for right breast cancer and contralateral risk reducing mastectomy. She underwent to an immediate reconstruction with silicone implants and acellular dermal matrix. She had history of adjuvant radiotherapy on the right side. She underwent three sessions of autologous fat grafting. Eight years after the end of adjuvant radiotherapy, the nipple was reconstructed with C-V flap technique. Three months after the nipple reconstruction, the areola was reconstructed with tattoo. The procedure was repeated four times. Note that even after the numerous attempts, on the right side the pigmentation never reached the uniformity of the contralateral side due to the radiotherapy.



Figure 5. A preoperative photographs of a 71-year-old woman with history of bilateral skin-sparing mastectomy and previous QUART on the left side. She underwent on the right side to an immediate reconstruction with expander and then silicone implant, on the left side, due to the previous history of radiotherapy, she was reconstructed with a pedicled latissimus dorsi and silicone implant. She underwent two sessions of autologous fat grafting. The nipples were reconstructed with C-V flap technique. Six months after nipple reconstructions, the areolas were tattooed. B Postoperative photographs two months after tattoo. Note on the left side how the pigment is more uniform and brighter.

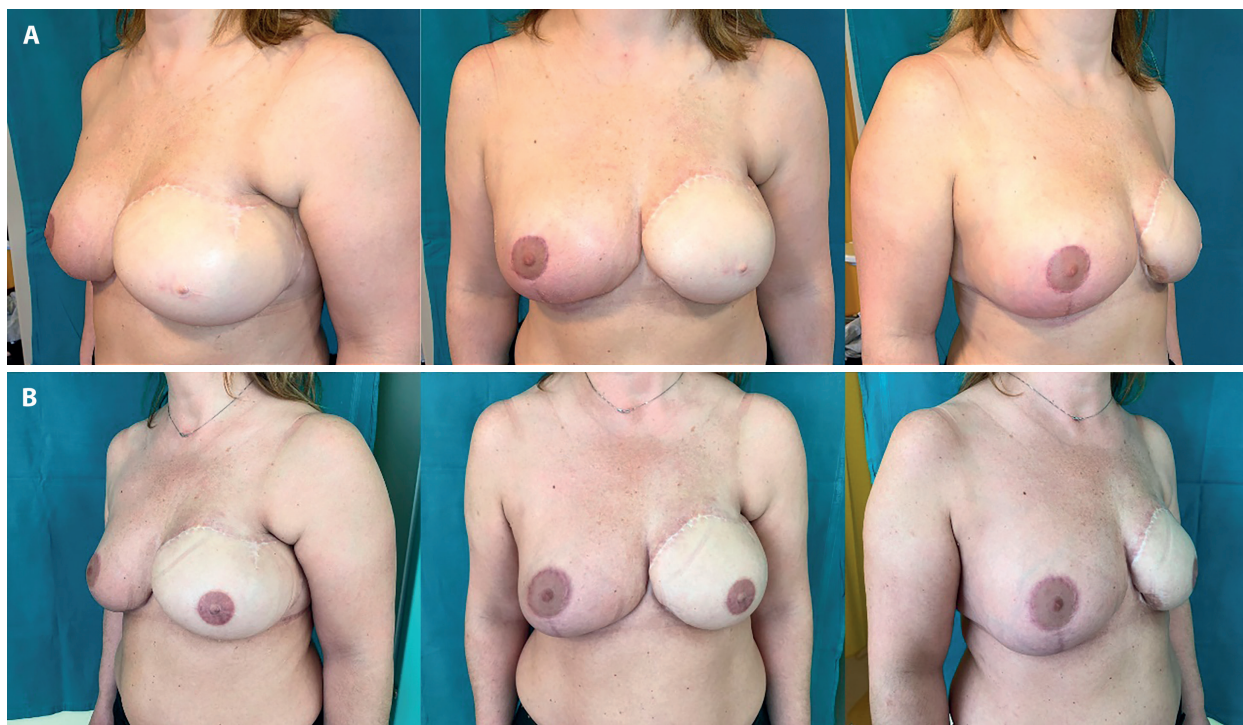


Figure 6. A preoperative photographs of a 52-year-old woman with history of left breast cancer. She underwent to left mastectomy and then to a delayed reconstruction with DIEP flap after adjuvant radiotherapy. On the right side it was performed a vertical reduction mammoplasty. On the left side the nipple was reconstructed with C-V flap. Two years after nipple reconstruction, the areola was tattooed. B Photographs two months after areola pigmentation. The color was perfectly uniform after only one procedure.

of psychological importance for many women post mastectomy, helping them in social settings, making emotionally healthy and self-confident (8). The patient satisfaction regarding NAC reconstruction, considered in other studies, is always pretty high varying from 72% to 88% as verification of how much NAC reconstruction is essential in restoring previous appearance (1).

There are many techniques described in literature for nipple reconstruction: Star, arrow, skate and C-V flaps are the most used. Our favorite choice is the C-V flap (9).

Tattooing has been introduced in 1975 (10) and it is an established technique both with and without nipple reconstruction (11). It has the great advantage of being an outpatient procedure and it guarantees the immediate return to daily activity. In our department we tattooed after the nipple reconstruction even if the pigmentation over the projected nipple could be

difficult and the scar tissue could interfere with the homogeneous pigmentation (12).

Since 2019, in Italy, the tattoo for NAC pigmentation has been inserted in the essential level of assistance and it has to be performed by healthcare professional (13).

As already known, to obtain a permanent micropigmentation it is necessary to reach the upper and mid-papillary dermis during the tattooing procedure (11). Therefore, the surgeon before tattooing should recognize the skin thickness according to the breast reconstruction technique because it is different if it is breast, abdominal or back tissue (14,15). In addition to these considerations, with our study we found out that there are components which could increase or decrease the risk of repeat the tattooing procedure. Firstly, the radiotherapy, as injurious to the dermal layer, is a risk factor; the tissue is fibrotic, stiff and less vascularized (16) so it is difficult to be pigmented. It is

important to wait at least six months after the end of radiotherapy (6) and it is mandatory to repeat the pigmentation more than once.

In contrast with this, when facing with autologous breast reconstruction, the tissue is more vascularized and thicker so it is simpler to be pigmented and almost certainly a retattooing would not be needed.

Even if not statistically comparable in our study, the men required always numerous pigmentations. It could be ascribable to the thickness of the epidermis and dermis, that is more pronounced than in women (17), but also to the necessity of a more precise result due to the bare chest men showing.

Presence of lymphedema requires particular care: the pigments in the deep dermis are absorbed by lymphatic system (18) and this procedure could lead to a worsening of lymphedema. This possible complication has to be included in the informed consent and it could be recommended to pigment in the more superficial layers even if the procedure has to be repeated.

Because of the retrospective nature of the study, we are limited in the data that we were able to collect from the medical record and constrained in the analysis that we were able to perform. Likewise, because the study was performed at a single center, it limits the generalizability of our findings.

Conclusions

Nowadays, NAC reconstruction is mandatory to conclude breast reconstruction in women but even in men. Tattoo is a reliable technique with or without nipple reconstruction. When approaching to this procedure, the surgeon has to consider the tissue thickness, the sex of the patient, the technique used for reconstruction and the presence of irradiated tissue. All these factors could influence the final result and the scheduling of the procedure if there are some risk factors which could make necessary one or more retattooing. All considered, tattoo is a safe procedure but there are some factors to take into account to obtain the best result, knowing when the pigmentation has to be repeated.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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