Tattooing of the nipple-areola complex: review of outcome in 40 patients

K. El-Ali*, M. Dalal, C.C. Kat

West Midlands Regional Unit for Burns, Plastic and Reconstructive Surgery, Selly Oak Hospital, Birmingham, UK

Received 8 October 2004; accepted 24 January 2006

Summary  Reconstruction of a pigmented nipple-areola complex (NAC) is one of the final steps in rehabilitating patients following mastectomy. We report the results of 40 consecutive patients who had NAC tattooing done by the same surgeon. Assessments were made both subjectively using a questionnaire, and objectively by using a computer software programme (Adobe Photoshop) to analyse the colour of the NACs.

Follow up ranged between six and 24 months (mean 14 months). One patient suffered an infection, and was the only one to need repeat tattooing in our series. Thirty-seven patients (92%) reported some colour fading which ranged between 5% and 80% (mean 32%). A grade of good or very good was given by 33 patients (85%) for colour match, by 36 patients (90%) for overall satisfaction, and by 34 patients (85%) for enhancement in body image. An analysis of the colours of the tattooed and unoperated NACs by the software programme showed that they were similar to a value that ranged from 78% to 97% (mean 91%).

Tattooing is a simple and safe procedure, and despite some colour asymmetry it still has a high satisfaction rate. It significantly improves patient's perception of body image. An objective assessment of tattooing using a computer software programme can be a useful tool in reviewing the outcome.

Video clips (1–5) are included with the paper for demonstration of the tattooing technique (re-arranged from the video presented with the paper at BAPS).

© 2006 The British Association of Plastic Surgeons. Published by Elsevier Ltd. All rights reserved.
Creating a pigmented nipple-areola complex (NAC) is the final step in breast reconstruction following a mastectomy. Regardless of the nipple reconstruction technique, tattooing has been advocated as the preferred modality to provide colour and so to give a more realistic appearance to the reconstruction.1–3

In this study our aim was to assess the outcome of tattooing, both subjectively using a questionnaire and objectively using a computer software programme to analyse the colour of the NAC; another objective was to ascertain the value of this technique in enhancing patients’ perception of body image.

Materials and methods

From January 2001 to December 2002, all our patients who had NAC tattooing as part of their breast reconstruction were contacted to participate in this study. There were no exclusion criteria. As part of our care pathway, nipple reconstruction was done initially using a modified CV flap and this was followed four to six months later by NAC tattooing. All tattooing was performed by the same surgeon.

Patients were invited to specially arranged clinics and given questionnaires to evaluate the outcome. They were directed to use a numerical scale of 1–10, with 1 as the worst outcome and 10 as the best possible outcome (1 = bad, 5 = fair, 6.9 = good, and 7 = very good). The questions focused mainly on colour fading, colour match between the tattooed and normal NAC, overall satisfaction with the procedure, and the impact on perception of body image. To understand this impact better, patients were also asked about the effect of their breast and nipple reconstruction on their body image.

Standardised digital photographs were taken of each patient at the Medical Illustration department (under same lighting conditions and using the same digital camera, NIKON D100); all files were then saved as jpeg format (file sizes around 500 kb) and analysed using the same computer and monitor (Sony PCG-GRX316MP). These photographs were used for the objective assessment by analysing the colour of the NAC using Adobe Photoshop® Elements computer programme. This software is made by Adobe Systems Incorporated (345 Park Avenue, San Jose, California 95110, USA).

We assessed colour intensity using the histogram feature of the software. Considering that colour intensity reflects hue, saturation and brightness of the original colour, this was a simple and easily reproducible way for the purpose of this study. For each patient, we opened the frontal view picture (where both breasts are seen) and selected the tattooed nipple-areola as one segment using the Lasso Tool (L). From the toolbar we then choose Image and from the drop menu Histogram. By default this provides a graph and some statistical data including the mean (which represents the average colour intensity value for the selected part from the picture, which in this case is the tattooed nipple-areola). We repeated the same for the normal nipple-areola (in the same picture) and measured its mean of colour intensity.

From that we calculated the difference between the two means in percentage terms as an indication of colour asymmetry between the tattooed and normal nipple-areola (for example a difference of 15% between the two means indicated a colour asymmetry of 15% between the two nipple-areolas). Three independent observers considered a colour difference of 10% or less as mild asymmetry, between 10% and 20% as moderate, and more than 20% as significant asymmetry. Accordingly, results for all patients were then grouped into these three groups (colour difference of 0–10%, >10–20%, and >20%) with the percentage referring to the level of difference between the two means of colour intensity as explained above.

We tattoo the NAC in the operating theatre, under local anaesthetic infiltration using the ‘Revolution’ cosmetic tattooing machine (Spaulding and Rogers Mfg, New York, USA), and Flesh-toned pigments made by the same manufacturers. The new areola is marked in consultation with the patient as a mirror image to the other side with the patient sitting up. Colours are mixed manually and is thus tested against the normal areola. With the patient lying down, we start from the border moving slowly towards the nipple and then back again. This is repeated once more before moving to the next area. We roughly divide the areola into wedges, tattooing one wedge at a time before finishing with the nipple. Adequate pigmentation is checked by regularly wiping the areola. At the end, we add another coat all over to darken the colour further to allow for subsequent fading. An irregular border is fashioned to give a more natural look. The tattooed area is dressed with 1% chloramphenicol ointment and a nonadherent dressing.

Results

Forty (73%) of the contacted 55 patients participated in the assessment. Average age was 51 years (21–67 years), and mean follow up was 14 months.
(6–24 months). There were no significant demographic differences between patients. One patient suffered an infection, and was the only one to need repeat tattooing. There were no other complications in this group of patients. Thirty seven patients (92%) reported that the tattooed colour has faded with time to an extent which ranged from 5% to 80% (mean 32%) as compared to the original colour.

The overall colour match between the tattooed and normal NACs was rated as good [mean 6.5 (1–9)]. Twenty-three patients (57%) reported their match as very good, 10 patients (25%) as good, and seven patients (17%) as fair. The overall satisfaction with this technique was rated as very good [mean 7.5 (3–10)]. Twenty-eight patients (70%) reported their satisfaction to be very good, eight patients (20%) as good, while four patients (10%) as fair (Table 1).

The impact on enhancing body image was rated as excellent for breast reconstruction [mean 9 (7–10)], very good for nipple reconstruction [mean 7.5 (1–10)], and similarly as very good for tattooing [mean 7 (1–10)] (Table 2). Twenty-five patients (62%) considered tattooing as very good in enhancing their body image, nine patients (22%) as good, while six patients (15%) as fair (Table 1). It is worth pointing out here that the scores for breast reconstruction were significantly higher, and for this reason it was graded as excellent to appreciate the difference.

Digital photographs (Figs. 1–3) were taken for 34 out of the 40 patients (85%). Using Adobe Photoshop software, the colour similarity between normal and tattooed NACs in these pictures ranged between 78% and 97% with a mean of 91%. Twenty-four of these patients (70.5%) had a colour difference of 10% or less, eight patients (23.5%) had a difference between 10% and 20%, and two patients (6%) had a colour difference of more than 20% (Table 3).

### Discussion

Prior to the introduction of intradermal tattooing, reconstruction of a pigmented areola was achieved by using split and full thickness skin grafts from various sites of the body including labia minora,

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Summary of patients' assessment of the outcome of NAC tattooing(a) (N = 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Fair</td>
</tr>
<tr>
<td>Colour match</td>
<td>7 patients (17.5%)</td>
</tr>
<tr>
<td>Over all satisfaction</td>
<td>4 patients (10%)</td>
</tr>
<tr>
<td>Body image enhancement</td>
<td>6 patients (15%)</td>
</tr>
</tbody>
</table>

\(a\) Using numerical scale of 1–10.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Impact on the body image (using numerical scale of 1–10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction stage</td>
<td>Mean score</td>
</tr>
<tr>
<td>Breast reconstruction</td>
<td>9 (7–10)</td>
</tr>
<tr>
<td>Nipple reconstruction</td>
<td>7.5 (1–10)</td>
</tr>
<tr>
<td>Tattooing</td>
<td>7 (1–10)</td>
</tr>
</tbody>
</table>

\(^a\) This is a significantly high score, graded as excellent to appreciate the difference.

Figure 1 (a, b) — Appearance six months after tattooing of right nipple-areola; tattooing is deliberately made slightly darker to allow for fading. Both patient and Adobe programme rated colour matching as good.
inner thigh, retro-auricular skin, and the opposite normal areola.1,4,5 Many prefer not to harvest from the normal side, and this is not an option for bilateral reconstructions.5 The other donor sites mentioned are often objectionable to patients, painful, prone to break down, and the colour match obtained is frequently inappropriate or unpredictable.2,4,6 Becker7 listed many attributes of tattooing the NAC, which include lack of donor site, absence of scarring, a more predictable outcome, and the ability to create the illusion of a projecting nipple. Other authors also highlighted that it is a simple, quick, safe, effective, and easily repeatable procedure that can be performed at the dressing clinic without anaesthesia.1–3,8

In a review of 150 patients, Spear and Arias reported a 3% rate of superficial infection, and as a result they now prescribe antibiotics for 48 h.2 In our study, one patient (2%) suffered an infection which started at the site of the reconstructed nipple; it eventually needed surgical debridement and repeat nipple reconstruction and tattooing. We continue to use local chloramphenicol ointment for 3–4 days postoperatively. The fact that tattoo pigments (in a sterile form or not) have not been found to increase the risk of infections is well reported.1,8

Colour fading is well recognised as inevitable by most authors,1,2,7–10 as well as by tattoo artists.11 It therefore was no surprise that 37 (92%) of our patients reported some colour fading. Early fading was blamed on technical errors where the pigments were placed superficially in the epidermis.

| Table 3 Objective assessment of NAC colour asymmetrya (N = 34) |
|---------------------------|---------------------------|---------------------------|
| Colour differenceb        | Colour asymmetry          | Number of patients         |
| 0–10%                     | Mild                      | 24 patients (70.5%)        |
| >10–20%                   | Moderate                  | 8 patients (23.5%)         |
| >20%                      | Significant               | 2 patients (6%)            |

a Using the Adobe Photoshop elements programme.
b Measured as the difference (in percentage terms) between the means of colour intensity of the tattooed and normal nipple-areolas.
that is then lost through desquamation. Excessive dermal trauma and tearing (by blunt needle for example) can lead to skin slough with early total loss of the tattoo. Long term fading is a natural biological process related to the healing and maturing of the tattoo. To account for this fading, most authors make the initial tattoo a little darker. Eskenazi indicated that one gradually becomes familiar with the necessary over correction. In our study the average colour fading was 32% (5–80%), and from this we recommend that the initial tattoo to be one-third darker than the normal side. This is based on observations only, and an individual’s experience may supersede these estimations.

Colour fading is the main reason for repeat tattooing. The reported incidence varies from 10% to 40%. Spear and Arias indicated that because fading is a normal process, patients may require one or more touch-up tattoos over months or years. This is a view shared by many authors. So far none of our patients (apart from the one who suffered an infection) needed or demanded repeat tattooing, but we accept we may need to repeat the tattoo in the future.

Colour mismatch is a challenge in tattooing, and rates of 20% and 43% have been reported in the literature. In our study, the overall colour match was rated as good; thirty three patients (82%) considered their colour match to be good or very good while seven patients (17%) considered it as fair (Table 1). Henseler et al. attributed this occurrence to an error in matching the colour of the existing NAC due to inexperience, lack of time, and artificial lights in the theatre. They recommended matching the colours in daylight using a Munsell colour chart.

Fading also contributes to colour mismatch, and part of the dilemma is that selecting a much darker colour can lead to a long or persistent hyperpigmentation. Masser et al. recommended standardised mixtures of pigments suspended in a gel to imitate natural skin colour and translucency. Bhatty and Berry noted that results improve quickly with practice and Eskenazi noted a similar experience. Spear and Arias accept that a perfect match is probably an unrealistic goal, but a good match that pleases a significant portion of patients is a reasonable and attainable goal.

Patient satisfaction with NAC tattooing has been reported to be high. In one study 84% of tattoos were rated as satisfactory and 86% of patients were willing to repeat the procedure. Likewise, 36 of our patients (90%) rated their overall satisfaction to be good or very good (Table 1). We noted that three out of the seven patients who were not particularly satisfied with their colour match still reported a good overall experience with tattooing. This high satisfaction has been largely attributed to tattooing being fast and easy with minimal morbidity. The patients in this study were actively involved in choosing the position and colour of the NAC to be tattooed, and this has been shown to enhance patient acceptance and compliance.

Thirty-four patients (85%) considered tattooing had a good or very good impact on enhancing their body image, while six of the seven patients who were unsatisfied with their match indicated that it had little effect (Table 1). To put this into perspective, enhancement of body image by nipple reconstruction was also rated as very good, and by breast reconstruction as excellent (Table 2). Interestingly tattooing had about the same impact on body image as nipple reconstruction (mean of impact for nipple reconstruction and tattooing was 7.5 and 7, respectively). Tattooing the NAC comes at the end of a long and difficult rehabilitation for these patients to complete their reconstruction, and signals the return to ‘normality’. It was highlighted by our patients that tattooing significantly enhances this feeling of being almost ‘normal’ again, and gives an additional boost to the body image.

Assessment of tattooing has been done subjectively, usually by the operator and occasionally through questionnaires. In this study, we introduced an objective assessment by using an established computer software programme to analyse the colour of NAC. It was quite interesting to find that this objective assessment can differ from subjective assessments by patients (Figs. 1–3). The technique is simple and easily reproducible, and eliminates observer and patient biases. It can be a useful tool to review and compare results, or to document and follow colour changes to better understand the fading process.

Tattooing is a simple and safe procedure that can effectively improve the final appearance of NAC reconstruction. It has a very high satisfaction rate and significantly enhances patient’s perception of body image. An exact colour match remains a challenge. The use of computer software for objective assessment of the outcome can be a very useful tool in reviewing and comparing results. This may also help us better understand the fading process.

Acknowledgement

We would like to thank the staff of the burns and plastic surgery dressing clinic, and the Medical
Illustration department at Selly Oak Hospital, Birmingham, for their help and support during this study.

References