Evidence-based and clinical views on acute wound healing and scar formation
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Do patients’ and caregivers’ perceptions of donor site scar quality change over time? 
A follow-up study

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Chapter 9

Abstract

Background
The Patient and Observer Scar Assessment Scale (POSAS) involves patients and caregivers to judge scars. Clinical changes in scar perception during scar maturation is poorly investigated, especially in donor site scars (DSS). We investigated patients’ and caregivers’ satisfaction regarding the quality of the DSS and explored possible changes in time.

Methods
Patients after split-skin grafting (n=64) and their caregivers (n=9) evaluated the scars twice using the POSAS, while unaware of each other’s judgment. The first assessment was done three months after complete healing, the second at least six months later.

Results
At the first and second assessment most POSAS-items received low scores, meaning high satisfaction. Nevertheless, the patients’ second judgments of the POSAS-items ‘colour’ (effect size 0.28; P-value=0.001; Wilcoxon test) and ‘total patient scale score’ (effect size 0.19; P-value=0.032) were significantly lower than the first ones. For caregivers, all second judgments of the POSAS-items, with the exception of thickness and pliability, were significantly lower than the first ones. Medium effect sizes were seen for total observer scar scale (0.46), vascularity (0.42), overall satisfaction (0.34) and pigmentation (0.30).

Conclusion
Patients’ and caregivers’ satisfaction regarding scar quality of donor sites is high and improves slightly throughout the scar maturation period.
Introduction

Wound care regimens usually pay little attention to the cosmetic outcome of wound healing, whereas for patients scarring is often their greatest concern. If these scars are located in visible areas, they may have a psychological impact and could affect their quality of life.\textsuperscript{1,2} Scars may cause persistent discomfort; both cosmetically and physically (e.g. colour or itching). A survey in the United States showed that 91\% of patients would value even small improvements in scarring.\textsuperscript{3} Therefore, the patients’ perception of the quality of their scars has to be taken into account when informing the patient to avoid unrealistic expectations about treatment outcomes.

Caregivers tend to neglect cosmetic scar quality when informing their patients, possibly because the long-term effect of interventions to improve scars is not supported by a large amount of sound evidence. In addition, scar quality is often assessed before the scar has fully matured\textsuperscript{4-7}, while scar maturation is known to take at least 12 months.\textsuperscript{8,9} Another problem is that patients and caregivers value the scar quality differently during its maturation.\textsuperscript{10-12}

To determine the clinical changes of scars in time, a reproducible and valid rating scale is essential. Although none of the scar assessment scales available really stands out or is generally accepted, one of them has been validated, i.e. the Patient and Observer Scar Assessment Scale (POSAS). This scale is unique in that it takes the opinion of the patient into account. The POSAS consists of two scales: the Patient Scar Assessment Scale and the Observer Scar Assessment Scale.\textsuperscript{13,14} Furthermore, it includes all recommended scar measurements items, namely colour, thickness, relief, pliability, surface area.\textsuperscript{15}

Previous research showed better scar quality scores after a longer follow-up period using the POSAS.\textsuperscript{11,12} Overall, patients were more satisfied about burn and linear scars after cleft lip surgery if scar assessment was done after a longer time interval.\textsuperscript{11,12} In burn scars, caregivers were more satisfied with the outcome compared to patients.\textsuperscript{11} The opposite was found in scars after cleft lip surgery whereas patients were more satisfied.\textsuperscript{12} For donor site scars (DSSs) it remains unclear if the perceptions of the scar assessed by caregivers and patients show better outcomes in the long term. These scars are different from others, whilst these linear-shaped scars are acutely created to cover other defects. As a result, patients have to accept this second scar, which could lead to more negative emotions in association with this scar.

Therefore, the aim of our study was to investigate the patients’ and caregivers’ perceptions as to the quality of DSSs and to explore the possible changes in time. We tested the
following hypothesis: patients and caregivers are significantly less satisfied about the quality of the DSS after three months than later in time.

Methods

Patients

Adult patients with DSSs who had participated in multicentre randomized clinical trial regarding donor site treatment (REMBRANDT trial; www.trialregister.nl; NTR1849) were approached. We selected patients who lived within a reasonable travel distance (< 1 hour) of the Academic Medical Center in the Netherlands. The prerequisites to contribute to this study were the presence of a DSS that had completely healed for at least six months, and a completed baseline POSAS assessment three months after complete healing.

POSAS

To rate the quality of their DSS, patients used the Patient Scar Assessment Scale, i.e. the patients’ part of the POSAS, which contains the following six items: pain, itching, colour, pliability, thickness, and relief. The caregivers’ part of the POSAS (i.e. the OSAS) contains the following six items: vascularity, pigmentation, pliability, thickness, relief, and surface area. All items were scored on a 10-point scale, ranging from one (best possible outcome) to ten (worst possible outcome), and results in a ‘total score’, which can add up to a maximum of 60 points.

In addition, patients as well as caregivers assessed their overall satisfaction with the cosmetic appearance of the scar, also on a scale of one to ten, corresponding with the worst imaginable scar.

Measurements

Both groups evaluated the scars twice, using the POSAS, at outpatient visits. The first scar assessment was done three months after complete healing of the donor site, the second at least six months after complete closure. We chose the six-month threshold, because developments in scar quality should be visible approximately six to seven months after the skin harvest. Complete wound healing was defined as re-epithelialization of the total wound surface, i.e., without any remaining scabs.

The first scar assessment was done by six caregivers and the second by three caregivers. These caregivers were specialized wound care nurses, surgical nurses, and researchers.
with a clinical background. Caregivers and patients were unaware of each other's judgment in both assessments.

**Ethical considerations**

The local medical ethics committee waived the need for approval of this study. Willingness to participate was implied when the patients gave written consent for their participating in the REMBRANDT trial.

**Data-analysis**

Patients’ baseline data comprised age, sex, indication for SSG, location of the donor site, time elapsed since the skin harvest, and skin type by using the Fitzpatrick skin classification.\(^\text{17}\)

We used the Wilcoxon Signed Rank Test to compare the changes in the POSAS scores between the two assessments. Additionally, we calculated the effect size of a difference found by dividing the Z-value of the Wilcoxon test by the square root of number of observations. We considered an effect size above 0.5 as a ‘large effect’, between 0.3 and 0.5 as a ‘medium effect’, between 0.1 and 0.3 a ‘small effect’, and anything below 0.1 ‘trivial’.\(^\text{18}\) Generally, this means that the larger the effect size, the greater the change in scar quality.

Given the various time intervals between both time points, we could further analyse the relationship between the patients’ and caregivers’ overall satisfaction and the age of the scar. The scores of overall satisfaction, measured at the second time-point were plotted to determine its association. If linear, we planned to perform a general linear model.

**Results**

We studied 64 patients, who filled out the POSAS at both time points. Most of them were men (67%), with a mean age of 60.1 years (SD 15.8, range 23 to 90). The first scar assessment for all patients was three months after complete wound healing. The second assessment of the scar was carried out after at least six months, with a mean of 20.3 months (SD 5.6, range 6 to 32) after complete wound healing. The majority of indications for split-skin grafting were acute or traumatic wounds (n = 44; 68.6%). The DSSs were mostly located on the thigh (n = 62; 96.6%) (Table 1).

Caregivers classified the majority of the patients (50%) as having skin type II according to Fitzpatrick (white skin; blond or red hear; blue, green or hazel eyes) (Table 1).
Patients’ perception of DSS over time

Table 2 shows the patients’ perceptions of the DSS quality at both time points. Two examples of scar appearance are showed in Figures 1 and 2. At the first time point most of the POSAS-items received a low score (range 1 to 6), suggesting that patients were already satisfied with their scar at an early stage (see Table 2). Nevertheless, at the second time point, a further significant reduction was found for the POSAS-items ‘colour’ (P-value = 0.001) and ‘total patient scale score’ (P-value = 0.032). This indicates patients had become more satisfied with the quality of the scar for these two items later in time. These changes represented a small effect size for colour (0.28) and total patient scale score (0.19). The other items showed no significant differences in patients’ perception between both time points.

Caregivers’ perception of DSS over time

Table 3 shows the caregivers’ perceptions of the DSS at both time points. Again, at the first time point most of the OSAS items received a low score (range 1 to 4). At the second time point, all items were significantly lower, with the exception of thickness and pliability. Effect sizes were medium for total observer scar scale (0.46), vascularity (0.42),
Table 2. Patients’ perceptions of donor site scar

<table>
<thead>
<tr>
<th>Patients</th>
<th>Pain</th>
<th>Itching</th>
<th>Color</th>
<th>Pliability</th>
<th>Thickness</th>
<th>Relief</th>
<th>Overall opinion</th>
<th>Total POSAS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (IQR)</td>
<td>64</td>
<td>64</td>
<td>63</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Time point 1</td>
<td>1 (1-1)</td>
<td>1 (1-1)</td>
<td>4 (2-6)</td>
<td>1 (1-1)</td>
<td>1 (1-1)</td>
<td>1 (1-1)</td>
<td>3 (1-4)</td>
<td>13 (10-16)</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>64</td>
<td>64</td>
<td>63</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Time point 2</td>
<td>1 (1-1)</td>
<td>1 (1-1)</td>
<td>2 (1-5)</td>
<td>1 (1-1)</td>
<td>1 (1-1)</td>
<td>1 (1-1)</td>
<td>2 (1-4)</td>
<td>9 (8-16)</td>
</tr>
<tr>
<td>P-value</td>
<td>0.131</td>
<td>0.175</td>
<td>0.001*</td>
<td>0.469</td>
<td>0.347</td>
<td>0.843</td>
<td>0.441</td>
<td>0.032*</td>
</tr>
<tr>
<td>Z-score</td>
<td>-1.511</td>
<td>-1.356</td>
<td>-3.179</td>
<td>-0.723</td>
<td>-0.941</td>
<td>-0.198</td>
<td>-0.771</td>
<td>-2.146</td>
</tr>
<tr>
<td>Effect size</td>
<td>0.13</td>
<td>0.12</td>
<td>0.28</td>
<td>0.06</td>
<td>0.08</td>
<td>0.02</td>
<td>0.06</td>
<td>0.19</td>
</tr>
</tbody>
</table>

An effect size above 0.5 was considered as a ‘large effect,’ between 0.3 and 0.5 as a ‘medium effect,’ between 0.1 and 0.3 a ‘small effect,’ and anything below 0.1 ‘trivial.’ * IQR: interquartile range; POSAS: Patient and Observer Scar Assessment Scale.

Figure 1. Difference in scar appearance over time (3 and 13 months after split-skin grafting)

For this patient the total POSAS scores were 42 (out of 60) at time point 1 and 32 at time point 2.
Table 3. Caregivers’ perception of donor site scar

<table>
<thead>
<tr>
<th>Vascularity</th>
<th>Pigmentation</th>
<th>Thickness</th>
<th>Relief</th>
<th>Pliability</th>
<th>Surface</th>
<th>Overall opinion</th>
<th>Total POSAS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (IQR)</td>
<td>2 (2-3)</td>
<td>3 (2-4)</td>
<td>1 (1-1)</td>
<td>1 (1-2)</td>
<td>1 (1-2)</td>
<td>2.5 (2-4)</td>
<td>13 (10-16.75)</td>
</tr>
<tr>
<td>Time point 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>1 (1-2)</td>
<td>2 (2-3)</td>
<td>1 (1-1)</td>
<td>1 (1-1)</td>
<td>1 (1-2)</td>
<td>1 (1-1)</td>
<td>2 (1-3)</td>
</tr>
<tr>
<td>Time point 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P-value: 0.000* 0.001* 0.106 0.011* 0.636 0.020* 0.000* 0.000*
Z-score: -4.741 -3.480 -1.616 -2.554 -0.473 -2.333 -3.851 -5.169
Effect size: 0.42 0.30 0.14 0.22 0.04 0.21 0.34 0.46

An effect size above 0.5 was considered as a ‘large effect’, between 0.3 and 0.5 as a ‘medium effect’, between 0.1 and 0.3 a ‘small effect’, and anything below 0.1 ‘trivial’.  
* IQR: interquartile range; POSAS: Patient and Observer Scar Assessment Scale.

Figure 2. Differences in scar appearance over time (3 and 11 months after split-skin grafting)

For this patient the total POSAS scores were 16 (out of 60) at time point 1 and 18 at time point 2.
overall satisfaction (0.34) and pigmentation (0.3). A small effect size was found for relief (0.22) and scar surface (0.21).

When comparing caregivers’ and patients’ judgments of scar quality, they agreed at both time points as to their overall POSAS scores. Caregivers clearly consider the reduction in vascularity as symptom of scar maturation. This is commensurate with the patients’ observance of an improvement in colour.

**Relationship between patients’ and caregivers’ overall satisfaction and time**

Figures 3 and 4 show the scatter plots of the relationship between patients’ and caregivers’ overall satisfaction and time. No apparent association was found between (P)OSAS-scores and time.

**Figure 3.** Patients’ overall satisfaction about their scar

**Figure 4.** Caregivers’ overall satisfaction about the scar
Discussion

Patients’ and caregivers’ perceptions of the scar quality of donor sites after split-skin grafting change slightly during scar maturation. Apparently, scar condition and satisfaction three months after healing of the donor site wound is likely to improve slightly in the months thereafter. In this study patients and caregivers rated scar quality as high, already three months after healing of the wound, while the magnitude of the observed improvement in satisfaction over time was limited.

The small changes we observed in perception of scar quality and the non-linear relationship with time are consistent with previous studies in other scar types. Van der Wal et al. showed that burn scar quality tends to improve in due course. This improvement starts approximately six months postburn. Furthermore, Bond et al. showed that incisional scars fade after approximately seven months, but still numerous scars retain a reddish appearance after twelve months.

Although patients in our study seemed to be quite satisfied with their scar, it is hard to predict psychological distress based on the severity of disfigurement. For example, Brown et al. found that patients with non-visible scars experienced larger distress than patients with visible scars. Furthermore, Linos et al. concluded that patients with a minimal approach (i.e. smaller incision) were not more satisfied compared to patients receiving the conventional approach in thyroid and parathyroid surgery. This seems to be contradicting the results of the study by Young et al. They noted that patients are highly concerned about the scarring after routine surgery. Most of the patients included in this survey in the USA also felt that caregivers were less concerned about the appearance of the scar than themselves. These results show that scar perception is dependent upon many variables, which may have different predictive value, and are not always measurable with a standard scar assessment scale. Moreover, the minimal difference in POSAS-scores that patients consider to be relevant is unknown.

Some limitations of this study should be mentioned. First, the effect sizes we measured can be relatively large, but the clinical relevance for patients remains unclear. Therefore, the question arises if scar assessment of donor site wounds is important in clinical research. On the other hand, no change in scar quality can be disappointing for patients and a small change in effect size for some items may be more valuable than large changes in other items (e.g. the change in colour may be considerable, but relatively less important to the patient than a smaller change in pain or pigmentation). Besides, the majority of patients were middle-aged men which may not be fully representative for patients undergoing split skin grafting. Second, the scar judgments were performed...
by different caregivers in the long term. The caregivers had some, but not extensive, experience in scar assessment. This could have masked the differences. On the other hand, it is known that the inter-observer agreement of the POSAS is good, even when applied by inexperienced observers.\textsuperscript{22}

Finally, seasonal influences, such as exposure to sunlight, were not taken into account. Despite the missing evidence whether ultra violet (UV)-light has an influence on hyperpigmentation of superficial wounds, clinicians often advise their patients to protect their wounds or scars from UV-light during the first three months. In our study, the majority of the DSSs were located on the thigh, which is usually covered with clothing. Therefore, the possible effect of UV-light on scar quality seems negligible in these patients.

We conclude that patient and caregiver satisfaction as to scar quality of donor sites wounds is high throughout the scar maturation period and improves slightly over time. Assessment of scar quality using the POSAS three months after wound healing seems feasible to appreciate eventual satisfaction. Any improvement is not linearly related to time, but may take a year or two. This notion should be incorporated in the pre-surgical counselling of patients with regard to anticipated anxiety about scar appearance and time needed for scar quality improvement.
References


