

Psychosocial impact

PART

III



Patient reported facial
scar assessment:
directions for
the professional

CHAPTER 5

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Abstract

Background: The face is central to our identity and provides our most expressive means of communication. Currently, the role of facial scarring in relation to self-esteem is unclear and the value of self-reported scar assessment is insufficiently understood. The aim of this study was twofold: (1) to assess the extent of agreement between patients' ratings and observers' ratings of facial scar characteristics; and (2) to examine if patients' and observers' scar characteristics ratings, or the differences, are associated with the patients' self-esteem.

Methods: A prospective study was conducted including patients with facial burns. Patients completed the Patient and Observer Scar Assessment Scale (POSAS) and the Rosenberg Self-Esteem Scale 3 months post-burn.

Results: Ninety-four subjects were included, 76 (81%) men and mean percentage TBSA burned was 12.4 (SD 10.4; range 1–50). Subject's and observer's assessment were significantly positively correlated and were identical in 53% of the cases. Subjects' assessments and discrepancy scores on the scar characteristic surface roughness were associated with self-esteem in multiple regression analysis.

Conclusions: The majority of the patients scored the quality of facial scars in a similar way as the professionals. Furthermore, facial scarring appeared only moderately associated with self-esteem. However, our study suggests that using both patients' and professionals' scar assessments provides more useful information regarding the patients' well-being relative to focussing on the separate assessments only. In particular a discrepancy between the patients' and professionals' view on surface roughness might be an early indication of psychological difficulties and a call for further clinical attention.

Background

The face is a central aspect of identity and one of our most expressive means of communication. These and other functions can be compromised as a result of a facial burn, which subsequently may relate to negative self-perceptions^[1]. Burns generally have a high prevalence of head and neck involvement^[2], presumably because that area is more exposed compared to body regions usually covered with clothes, such as the trunk or the legs. Prevalence rates of facial involvement vary internationally between 6% and 60%^[3-5]. A recent study showed that almost half of the patients admitted to Dutch burn centres had facial burns^[6], and thus were at risk for visible scars. Additionally, one in five patients needed facial surgery, indicating a deep burn, and one in twenty patients needed reconstructive facial surgery^[6]. Despite sophisticated techniques in surgery and reconstructive surgery, operative treatment has not yet established healing without scars.

In recent years, the focus on patient reported outcomes (PRO) has increased in various health related domains. PROs are self-reports that provide insight in how patients perceive (aspects of) their health. It was recently recommended that self-reports of scar evaluations should be integrated in clinical assessments, based on findings that patient-rated scar severity was directly related to psychological distress whereas observer-rated scar severity was unrelated to psychological distress^[7]. However, as to why this is the case is poorly understood, hindering the interpretability and clinical decision-making based on the patient's perspective. A first requisite to better understand why both assessments differ in their relationship to psychological distress is to compare the patients' and observers' assessment. The differences between both perspectives in relation to psychological distress found in a prior study^[7] may suggest that in general both do not agree. However, because previous studies used different scar assessment tools for patients and professionals, no comparison could be made between the two perspectives.

Alternatively, it is conceivable that only a subgroup of patients deviates from the professional's view in their scar evaluation. For instance, patients who highly value their personal appearance may have difficulties accepting the scars. A prior study showed that importance of appearance predicted body image dissatisfaction^[8]. Additionally, a 'good outcome' to the professional may not be seen as a good outcome by the patient as patients and professionals may use different frameworks in their scar evaluation. Likely, professionals use their clinical experience in previous patients as a reference, whereas patients might be more influenced by personal factors, such as reference to their appearance before the burn event, and their perceptions of social functioning^[9]. It is therefore important to recognise the differences and to increase insight into the meaning of these differences; a substantial discrepancy might be an indication of psychological distress.

In this perspective, an outcome measure of particular interest might be self-esteem as it has been related to a variety of psychological problems such as depression^[10,11] and anxiety^[11]. Self-esteem can be defined as one's overall sense of worthiness as a person^[12] or as the attitude a person has to oneself^[13] and is regarded as a relatively stable trait over time^[14]. This stability was confirmed in several studies^[13,15,16], although a study in cosmetic surgery in both visible and non-visible areas found a small but significant increase between pre-surgery and post-surgery self-esteem^[17], indicating the potency of change. In the burns literature the relationship between facial scars and the patient's well-being is still subject of debate. Only moderate relationships have been shown between burn severity measures (e.g. percentage TBSA burned, number of burn-related surgeries and scar visibility) and several social and emotional variables^[18]. Nevertheless, self-esteem may have value in detecting patients with psychological difficulties in relation to facial scarring and may be relevant when investigating the agreement among self-reports and professionals assessment of facial scarring.

In summary, although PROs are highly valued, including in scar assessments, it is insufficiently understood what information self-assessment produces and to what extent patients and observers agree on scar assessments. Furthermore, clinical practice and decision-making might benefit from a better understanding of underlying causes explaining a discrepancy between patient and observer evaluations. With the introduction of the POSAS^[19] (<http://www.POSAS.org>), a scar assessment instrument is available for both self-assessment and observer assessment, allowing to compare the extent to which patients and observers agree on scar qualities. Additionally, this instrument enables the identification of specific scar characteristics that may be more troublesome than others from the patient's point of view. Therefore, the aim of this study was twofold: (1) to assess the extent of agreement between patients' ratings and observers' ratings of facial scar characteristics; and (2) to examine if patients' and observers' scar characteristics ratings, or the differences, are associated with the patients' self-esteem.

Methods

Participants

This study included patients from a larger multicentre study. The clinical outcomes were previously published^[20] and follow-up treatment was performed according to standard clinical practice. Patients admitted to one of the three Dutch burn centres were enrolled in the study between March 2006 and January 2009. Patients were eligible if they had facial burns (including neck) and were ≥ 18 years. Patients were excluded if they were unable to provide informed consent, for instance due to cognitive impairment or because they had poor Dutch proficiency.

Procedure

Patient and burn characteristics were collected from medical files and participants completed follow-up measures at 3 months post-burn. All patients provided informed consent, and the medical ethical board of the Maastad hospital (Rotterdam, the Netherlands) approved the study (TWOR 2005/25).

Measures

Scar quality

The Patient and Observer Scar Assessment Scale (POSAS) was used to assess the scar quality of facial burn scars. The scale has been found reliable and valid^[21], and enables both patient and observers to assess the same scar on six different scar characteristics, with an overlap of four characteristics. The patient assesses the scar on pain, pruritus, colour, thickness, surface roughness and pliability. The observer assesses the scar on vascularity, pigmentation, thickness, relief, pliability and surface area. Both use a numerical 10-point scale in which 1 represents a scar comparable with 'normal skin' whereas 10 represents the 'worst scar imaginable'. Both the patient and the observer independently assess the same scar, which is the scar judged by the patient as being the most severe^[19]. The observer assessment was performed by an experienced and trained observer, either a physician, nurse or researcher.

Self-esteem

The Rosenberg Self-Esteem Scale (RSES)^[22] was used to assess the patient's self-esteem. This questionnaire involves 10 items and is scored on a 4-point Likert scale with responses ranging from strongly agree to strongly disagree. Five statements are positively, and five are negatively worded. Scores of the negatively worded statements are reversed. The sum of scores ranges from 10 to 40. A higher score indicates a higher self-esteem.

Data analysis

Only participants who completed questionnaires on scar quality and self-esteem 3 months post-burn were selected for this study. Comparison analyses were used to assess whether included participants were different from participants who did not complete the questionnaires. Continuous variables were assessed using two-tailed independent t-tests and categorical variables with chi-squared statistics. Differences between the patients' and the observers' scores on the scar characteristics were calculated by subtracting the observer's ratings from the patient's ratings, resulting in discrepancy scores. Consequently, a positive discrepancy score represents patients that score their scar more severe compared to the observer, whereas a negative discrepancy score represents patients that score their scar less severe compared to the observer. A discrepancy score of zero represents an identical patient and observer score for the same scar characteristic. An average score for the observers colour assessments, including 'vascularity' and 'pigmentation', was used to compare with the patients colour

assessments. Kendall's tau coefficient was used to assess the correlation between the patient's and the observer's assessment. In addition, descriptive statistics were used to assess the level of agreement on scar characteristic assessments between patients and observers. Multiple regression analyses were used to examine patients' and observers' ratings association with the patients' self-esteem and results were presented as standardised regression coefficients. One model included only the scar characteristics, whereas a second model also included the percentage total body surface area (TBSA) burned and the patient characteristics gender and age. We used the R^2 statistic to provide information on the proportion of variance explained by the model. Data were analysed using PASW (Predictive Analytics SoftWare) Statistics 18.0 (IBM, New York City) and Mplus (version 6.1)^[23].

Results

The patient and the burn characteristics of the participants who completed both the POSAS and the RSES ($n = 94$) and those who had incomplete files ($n = 38$) are summarised in **Table 1**. Analyses comparing included participants to excluded participants did not show significant differences. Differences in gender, age, inhalation injury, surgical treatment and percentage TBSA burned were clearly not significant ($p > .10$). For one variable, a significant level of $p < .10$ was found: compared with those who completed all assessments, the drop-outs showed a tendency to have less facial surgery ($p = .07$). The included participants had a mean age of 39.7 years (SD 13.6; range 18–66) and 81% were men. The participants suffered from minor to moderate burns, mean percentage TBSA burned was 12.4 (SD 10.4; range 1–50), and the mean RSES score was 32.6 (SD 5.5; range 19–40).

Table 1: Patient- and burn-characteristics of included and excluded patients and the comparison between both groups ($n=132$).

	Included ($n = 94$)	Excluded ($n = 38$)	p -Value
Gender; male (%)	76 (80.9)	33 (86.8)	.411
Age; mean (SD; range)	39.7 (13.6; 18-66)	41.3 (15.1; 19-66)	.545
Inhalation injury (%)	24 (25.5)	8 (21.1)	.587
Surgery (%)	46 (48.9)	13 (34.2)	.123
Facial surgery (%)	14 (14.9)	1 (2.6)	.066 ^a
% TBSA burned; mean (SD; IQR)	12.4 (10.4; 5-17)	11.7 (13.9; 4-12)	.754
% TBSA full thickness burned; mean (SD; IQR)	2.9 (5.2; 0-4)	3.1 (6.2; 0-4.8)	.889

SD, Standard Deviation; TBSA, total body surface area; IQR, interquartile range
^a Fisher's exact is used because expected frequencies < 5

Table 2 presents the mean POSAS scores with SD and interquartile range (IQR) at 3 months post-burn. All scores (mean, variances) were lower for the observer scar assessment scores compared to the patient scores on equal or comparable characteristics. Both patient and observer mean scores were in the bottom third of all possible scores, closer to the rating

Table 2: Mean patient and observer scar assessment scores on scar characteristics and the correlation between patient and observer scores (n=94).

	Patient scores Mean (SD; IQR)	Observer scores Mean (SD; IQR)	Kendall's tau
Colour/pigmentation	3.29 (2.30; 1-5)	2.11 (1.30; 1-3) ^b	0.325 ^{b*}
Colour/vascularity	3.29 (2.30; 1-5)	2.60 (1.77; 1-3)	0.320*
Colour/combination ^d	3.29 (2.30; 1-5)	2.33 (1.18; 1.5-3) ^b	0.395 ^{b*}
Thickness	2.06 (2.03; 1-2)	1.38 (.87; 1-1)	0.565*
Surface roughness	1.92 (1.78; 1-2) ^a	1.32 (.95; 1-1)	0.603 ^{a*}
Pliability	2.24 (2.16; 1-3)	1.58 (1.40; 1-2) ^a	0.604 ^{a*}
Overall opinion	2.33 (2.13; 1-3) ^a	2.06 (1.15; 1-3)	0.444 ^{a*}
Surface area		1.15 (.50; 1-1) ^c	
Pain	1.46 (1.22; 1-1)		
Itch/Pruritus	1.67 (1.58; 1-1)		

^a 1 missing.^b 2 missing.^c 41 missing.^d combination = sum of observer scores on vascularity and pigmentation divided by two.

* p < 0.01

'normal skin' than the rating 'worst scar imaginable', indicating relatively minor facial scars. Kendall's tau statistics showed that patient and observer scar assessments were significantly positively correlated for all comparable scar characteristics. The strength of this correlation was moderate (>0.3) for colour and strong (>0.5) for the other scar characteristics.

Table 3 presents the proportion of patients that score their scar more severe, identical or less severe compared to the observers' score. Patient and observer scar assessment scores were identical in approximately 70% of the scores for the scar characteristics thickness, surface roughness and pliability, whereas the percentage of agreement for colour (pigmentation and vascularity) was 30%. For all scar characteristics together, the patient and the observer scores were identical in 53% of the ratings and another 17% differed only one point on a 10-point-scale, indicating a fair level of agreement between patients' and observers' scar assessment. The patients scored their scar more severe (higher POSAS score) compared to observers in approximately 25% of the scores for the scar characteristics thickness, surface roughness and pliability, whereas this percentage was twice as high (50%) for colour. On average, these patients scored their scar 2.7 points more severe compared to the observers,

Table 3: Frequency of patients that score their scar more severe, identical or less severe compared to the observer score on five scar characteristics (n = 94).

	More severe n (%); $\bar{\Delta}$	Identical n (%)	Less severe n (%); $\bar{\Delta}$
Colour/pigmentation ^a	50 (54.3); 2.7	26 (28.3)	16 (17.4); -1.6
Colour/vascularity	43 (45.7); 2.5	29 (30.9)	22 (23.4); -1.9
Thickness	24 (25.5); 3.0	65 (69.1)	5 (5.3); -1.6
Surface roughness ^a	24 (25.6); 2.7	65 (69.9)	4 (4.3); -2.0
Pliability ^a	27 (29.0); 2.8	60 (64.5)	6 (6.5); -2.5

 $\bar{\Delta}$: mean difference between patient and observer score; (patient score minus observer score).^aMissing: colour/pigmentation (2); surface roughness (1); pliability (1).

indicating a substantial discrepancy in scar assessment in this group. Patients scored their scar less severe (lower POSAS score) compared to observers in approximately 5% of the scores for the scar characteristics thickness, surface roughness and pliability; this percentage was higher (approximately 20%) for the scar characteristic colour. On average, these patients scored their scar 1.9 points less severe compared to the observers.

Table 4 presents the results on the relationship between the scar characteristics and self-esteem. Model 1 included only scar characteristics to obtain insight in the single associations between facial scar characteristic scores from both the observer's and the patient's point of view and self-esteem. Additionally, the discrepancy scores on facial scar characteristics were investigated in relation to self-esteem. No significant associations were found between the observers' scar characteristics scores and self-esteem, whereas a significant association was found between the self-reported scar characteristic surface roughness and self-esteem. A significant association was also found between the discrepancy scores of surface roughness and self-esteem, and a trend was found for pliability ($p = 0.053$). These findings indicate that a more severe patient scar score on surface roughness and pliability compared to the observer score was associated with lower self-esteem.

Table 4: Associations between patients' self-esteem (RSES) and patient, observer and discrepancy scores on facial scar assessment: results of multiple regression analyses.

	Observer scar assessment n=91		Patient scar assessment n=93		Discrepancy scar assessment P-O n=90	
	β (SE)	p -Value	β (SE)	p -Value	β (SE)	p -Value
Model 1: scar characteristics						
Colour	-0.13 (0.12)	0.26	0.02 (0.15)	0.88	0.004 (0.11)	0.97
Thickness	-0.01 (0.11)	0.95	0.26 (0.21)	0.21	0.20 (0.15)	0.20
Surface roughness	0.09 (0.11)	0.39	-0.31 (0.16)	0.05	-0.31 (0.12)	0.01
Pliability	-0.01 (0.08)	0.93	-0.24 (0.20)	0.25	-0.21 (0.11)	0.05
R ²	1.5		9.9		11.9	
Model 2: scar and patient characteristics						
Gender	-0.13 (0.10)	0.22	-0.13 (0.11)	0.26	-0.13 (0.11)	0.23
Age	0.22 (0.09)	0.01	0.16 (0.08)	0.05	0.13 (0.09)	0.14
% TBSA burned	-0.26 (0.11)	0.02	-0.15 (0.09)	0.09	-0.14 (0.09)	0.12
Colour	-0.14 (0.12)	0.23	0.04 (0.16)	0.81	0.004 (0.11)	0.97
Thickness	0.04 (0.10)	0.71	0.23 (0.22)	0.30	0.15 (0.16)	0.34
Surface roughness	0.20 (0.11)	0.06	-0.22 (0.16)	0.17	-0.25 (0.12)	0.03
Pliability	-0.04 (0.08)	0.65	-0.25 (0.20)	0.21	-0.18 (0.12)	0.13
R ²	10.5		14.7		16.0	

Bold values indicate statistical significance.

In Model 2, percentage TBSA burned, age and gender were included to control for a possible association of these variables on self-esteem. With regard to the observer's scores, this model showed significant associations between both age and percentage TBSA burned and self-esteem, indicating that younger people and those with more severe burns had a lower self-esteem. None of the scar characteristics were found statistically significant. Similarly,

the patient's self-report scores showed an association for age and a trend for percentage TBSA burned with self-esteem. The finding that surface roughness was no longer statistically significantly related to self-esteem indicates that age and percentage TBSA burned are associated with self-esteem to a greater extent, relative to the self-reported facial scar characteristic surface roughness. Finally, the discrepancy scores indicated that a larger discrepancy on surface roughness was associated with lower self-esteem. In contrast to the analyses with professionals' and patients' scores, the discrepancy overruled the effects of age and percentage TBSA burned. This finding indicates that a more severe patient scar score on surface roughness compared to the observer score was associated with self-esteem to a greater extent, relative to age and percentage TBSA burned. Although the explained proportions of variance were modest, Model 2 including the discrepancy scores explained the largest part, that is 16.0%.

Discussion

To our knowledge, the present study is the first study that examined the level of agreement between patient's and observer's scar assessment, and investigated the association between scar evaluations from several points of view, that is the patient, the professional and the discrepancy between both, in relation to self-esteem. Interestingly, the majority of the patients (70%) evaluated the individual scar characteristics identical or similar (plus or minus one point) compared to the professional's evaluation. Only a minority evaluated the scar characteristics less severe than the professional, whereas 26– 54% scored the individual scar characteristics more severe. The finding that there was a significant correlation between patients' and observers' scores, and that on average 70% of the patients had identical or similar scores relative to the professional indicates that the majority of patients are well able to evaluate their scar. This finding contrasts with results from a previous study that reported no significant correlations between patients' and professionals' scar ratings^[7]. Of notice, the patients and the professionals in that study used different instruments for scar assessment, likely explaining these different outcomes. The current study used one validated scar assessment tool that was developed for both patient and observer assessment, yielding more meaningful outcomes when comparing both perspectives.

Despite the large overlap in scores from the patients' and professionals' perspective, a group of patients scored some scar characteristics more severe than the observer. When using these discrepancy scores in the multiple regression analysis, higher discrepancy scores on surface roughness showed to be significantly associated with a lower self-esteem. This association remained significant when controlled for age, gender and percentage TBSA burned. Although causal pathways could not be established in this study, this finding suggests that overestimating the scar characteristic surface roughness relative to the professional may

be an indicator of psychological difficulties. A possible explanation for why particularly surface roughness was associated with self-esteem may be that this scar characteristic is the most visible abnormality and therefore the most bothersome aspect of facial scarring. It is conceivable that surface roughness affects social comfort, which has been found to correlate with body esteem in burn survivors^[18]. Other scar characteristics might be less noticeable, a thick scar for instance can still be smooth and colour differences occur also in the general population. In addition, a difference in colour can more easily be camouflaged with make-up. The scar characteristic pliability is generally not visible, although it can cause a visible disturbance in facial expression during social interaction. Although more research is needed, early identification of a discrepancy between the patient's and the professional's assessment may provide an opportunity to open a discussion with the patient, provide appropriate interventions and prevent further patient distress or dissatisfaction. Although speculative, these patients may benefit less from surgical interventions alone to improve satisfaction with appearance aspects as most scars cannot be removed.

This study also supports other studies, such as a study that found no association between observer-rated scar severity and psychological distress^[7] or a study that found an association between larger burns and high body image dissatisfaction^[24]. Furthermore, the finding that the statistically significant effect of self-reported facial scarring on self-esteem was overruled by the percentage TBSA burned and age may indicate that facial scarring appears only moderately associated with self-esteem, although it should be noted that the facial scars in this study were relatively mild. The finding that percentage TBSA burned was relatively stronger associated with self-esteem was supported by a study that compared body-esteem of paediatric burn survivors with an age-matched comparison group without burns. That study found a small significant negative relationship between burn scar severity and body-esteem^[25]. Because scar severity comprised number of surgeries and number of scarred body parts, one may argue that these characteristics also reflect burn severity and therefore support the current findings. However, it should be noted there was a difference in outcomes, that is body-esteem instead of self-esteem. Although body-esteem is a component of self-esteem, a change in one component does not necessarily change the overall self-esteem. Probably, most people compensate the effects of facial disfigurements by giving more emphasis to other qualities involved in self-esteem^[13]. As a result, the overall self-esteem can remain stable while the different components (e.g. body-esteem or social self-esteem) vary. In patients that highly value their appearance, the face in particular, this compensation of effects may not occur, possibly resulting in a lower self-esteem.

This study suffers from some limitations that should be noted. First, the study population comprised more men (81%), somewhat exceeding the percentage of men with facial burns in burn centre admissions (72%)^[6] and most participants had lower POSAS scores compared to an extensive Dutch observational study^[26], indicating that participants in our study had on average minor facial scarring. Although minor facial lacerations may also have significant

psychological impact^[27], effects might have been larger in more severe facial defects. Second, although the current results may be important to identify patients at risk for psychological problems in an early phase, the lack of follow-up results prevents such conclusions. In addition, the scars were not yet matured as that would take at least around 12 months^[28]. It may, nevertheless, be an early indicator of psychological difficulties that warrants further research. Third, to assess colour, the observer scored both 'pigmentation' and 'vascularity' whereas the patient scored 'colour'. We included the average score of vascularity and pigmentation to match patient's assessment on colour in our analyses. Ignoring the scar characteristic colour would increase the mean level of agreement between patients and observers from 53% to 68%. Despite these limitations, the relatively large and unique data set and the use of a validated patient and observer scar assessment scale enabled us to compare patient and professional scar assessment and allowed us to uncover indicators for lower self-esteem.

Conclusion and clinical implications

The overall conclusion is that the majority of patients scored the quality of facial scars in a similar way as to the professionals. Furthermore, facial scarring appeared only moderately associated with self-esteem. However, our study suggests that using both patients' and professionals' scar assessments provides more useful information regarding the patients' well-being relative to focussing on the separate assessments. In particular, a discrepancy between the patients' and professionals' view on the scar characteristic surface roughness might be an early indication of psychological difficulties and a call for further clinical attention. In that case, a more extensive interview might be beneficial in order to evaluate the patient's psychological well-being, and subsequently start the most suitable treatment.

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Conflict of interest

The authors declare that there is no conflict of interest.

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References

- 1 Rumsey N, Harcourt D. Body image and disfigurement: issues and interventions. *Body Image* 2004;1(1): 83–97.
- 2 Chien W-C, Pai L, Lin C-C, Chen H-C. Epidemiology of hospitalized burns patients in Taiwan. *Burns* 2003;29(6): 582–8.
- 3 Fraulin FOG, Illmayer SJ, Tredget EE. Assessment of cosmetic and functional results of conservative versus surgical management of facial burns. *J Burn Care Rehabil* 1996;17(1):19–29.
- 4 Kai-Yang L, Zhao-Fan X, Luo-Man Z, Yi-Tao J, Tao T, Wei W, et al. Epidemiology of pediatric burns requiring hospitalization in China: a literature review of retrospective studies. *Pediatrics* 2008;122(1):132–42.
- 5 Kara IG, Gok S, Horsanli O, Zencir M. A population-based questionnaire study on the prevalence and epidemiology of burn patients in Denizli, Turkey. *J Burn Care Res* 2008; 29(3):446–50.
- 6 Hoogewerf CJ, van Baar ME, Hop MJ, Bloemen MCT, Middelkoop E, Nieuwenhuis MK. Burns to the head and neck: epidemiology and predictors of surgery. *Burns* 2013; 39(6):1184–92.
- 7 Brown BC, Moss TP, McGrouther DA, Bayat A. Skin scar preconceptions must be challenged: importance of self-perception in skin scarring. *J Plast Reconstr Aesthet Surg* 2010; 63(6):1022–9.
- 8 Thombs BD, Notes LD, Lawrence JW, Magyar-Russell G, Bresnick MG, Fauerbach JA. From survival to socialization: a longitudinal study of body image in survivors of severe burn injury. *J Psychosom Res* 2008;64(2):206–12.
- 9 Rankin M, Borah GL. Perceived functional impact of abnormal facial appearance. *Plast Reconstr Surg* 2003;111(7):2140–6. discussion 2147–8.
- 10 Orth U, Robins RW, Roberts BW. Low self-esteem prospectively predicts depression in adolescence and young adulthood. *J Pers Soc Psychol* 2008;95(3): 695–708.
- 11 Sowislo JF, Orth U. Does low self-esteem predict depression and anxiety? A meta-analysis of longitudinal studies. *Psychol Bull* 2013;139(1):213–40.
- 12 Schmitt DP, Allik J. Simultaneous administration of the Rosenberg Self-Esteem Scale in 53 nations: exploring the universal and culture-specific features of global self-esteem. *J Pers Soc Psychol* 2005;89(4):623–42.
- 13 Levine E, Degutis L, Pruzinsky T, Shin J, Persing JA. Quality of life and facial trauma: psychological and body image effects. *Ann Plast Surg* 2005;54(5):502–10.
- 14 Trzesniewski KH, Donnellan MB, Robins RW. Stability of self-esteem across the life span. *J Pers Soc Psychol* 2003;84(1):205–20.

- 15 Bolton MA, Pruzinsky T, Cash TF, Persing JA. Measuring outcomes in plastic surgery: body image and quality of life in abdominoplasty patients. *Plast Reconstr Surg* 2003;112(2):619–25. discussion 626–7.
- 16 Versnel SL, Duivenvoorden HJ, Passchier J, Mathijssen IM. Satisfaction with facial appearance and its determinants in adults with severe congenital facial disfigurement: a case-referent study. *J Plast Reconstr Aesthet Surg* 2010;63(10):1642–9.
- 17 von Soest T, Kvaalem IL, Roald HE, Skolleborg KC. The effects of cosmetic surgery on body image, self-esteem, and psychological problems. *J Plast Reconstr Aesthet Surg* 2009;62(10):1238–44.
- 18 Lawrence JW, Fauerbach JA, Heinberg L, Doctor M. Visible vs hidden scars and their relation to body esteem. *J Burn Care Rehabil* 2004;25(1):25–32.
- 19 Draaijers LJ, Tempelman FR, Botman YA, Tuinebreijer WE, Middelkoop E, Kreis RW, et al. The patient and observer scar assessment scale: a reliable and feasible tool for scar evaluation. *Plast Reconstr Surg* 2004;113(7):1960–5. discussion 1966–7.
- 20 Oen IM, van Baar ME, Middelkoop E, Nieuwenhuis MK. Effectiveness of cerium nitrate-silver sulfadiazine in the treatment of facial burns: a multicenter, randomized, controlled trial. *Plast Reconstr Surg* 2012;130(2):274e–83e.
- 21 van der Wal MB, Tuinebreijer WE, Bloemen MC, Verhaegen PD, Middelkoop E, van Zuijlen PP. Rasch analysis of the Patient and Observer Scar Assessment Scale (POSAS) in burn scars. *Qual Life Res* 2012;21(1):13–23.
- 22 Rosenberg M. *Society and the adolescent self-image*, Revised edn., Middletown, CT: Wesleyan University Press; 1989.
- 23 Muthén LK, Muthén BO. *Mplus user's guide*. Los Angeles, CA: Muthén & Muthén; 1998–2010.
- 24 Fauerbach JA, Heinberg LJ, Lawrence JW, Munster AM, Palombo DA, Richter D, et al. Effect of early body image dissatisfaction on subsequent psychological and physical adjustment after disfiguring injury. *Psychosom Med* 2000;62(4):576–82.
- 25 Lawrence JW, Rosenberg LE, Fauerbach JA. Comparing the body esteem of pediatric survivors of burn injury with the body esteem of an age-matched comparison group without burns. *Rehabil Psychol* 2007;52(4):370–9.
- 26 van der Wal MB, Vloemans JF, Tuinebreijer WE, van de Ven P, van Unen E, van Zuijlen PP, et al. Outcome after burns: an observational study on burn scar maturation and predictors for severe scarring. *Wound Repair Regen* 2012;20(5):676–87.
- 27 Tebble NJ, Adams R, Thomas DW, Price P. Anxiety and self-consciousness in patients with facial lacerations one week and six months later. *Br J Oral Maxillofac Surg* 2006;44(6):520–5.
- 28 Bond JS, Duncan JA, Sattar A, Boanas A, Mason T, O’Kane S, et al. Maturation of the human scar: an observational study. *Plast Reconstr Surg* 2008;121(5):1650–8.

