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Psychological outcomes following surgical excision of facial skin cancers

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Funding

None

Conflict of Interest Disclosure

None

What is already known about this topic?

- Facial disfigurement can cause high levels of anxiety, depression and social isolation.
- This does not always correlate with the severity of the disfigurement or disease process.

What does this study add?

- Patients with facial skin cancers experience impaired quality of life with respect to social, emotional and aesthetic concerns.
- Female and younger people are more vulnerable to these concerns.
- Surgical excision improves quality of life, particularly in patients with squamous cell carcinomas, despite visible scarring.

Abstract

Background

Patients undergoing surgery for basal and early squamous cell carcinomas are rarely offered formal support due to low mortality of malignancies. Nonetheless 80% of non-melanoma skin cancers occur in the head/neck region, rendering both the malignancy and subsequent surgical scar clearly visible. The study objective was to quantify the social/emotional impact of facial skin malignancies on patients pre- and post-surgery and to identify vulnerable groups who may benefit from increased support.

Methods

53 patients with facial skin malignancies were prospectively evaluated before and three months after surgery using the Skin Cancer Index (SCI); a 15-item, validated, disease-specific quality-of-life (QOL) assessment tool with emotion, social and appearance subscales. Higher scores reflect improvements in QOL.

Results

Surgical excision of the malignancy led to a significant increase in SCI (p<0.001). Increasing age was associated with greater post-surgery QOL, controlling for baseline scores (p=0.037). Other clinical/demographical variables were not significantly associated with SCI scores in most models; however, patients with squamous cell carcinomas reported greater improvements that those with basal cell carcinomas. Women had lower baseline scores, but showed greater improvement in the emotional and appearance subscales. Men showed greater improvement in the social subscale. Pre-operative SCI scores were generally better predictors of post-operative scores than demographic or clinical factors.

Conclusions

Lower pre-operative SCI scores confirm the presence of anxiety among patients with cutaneous facial malignancies. Surgical excision improves social, emotional and cosmetic

wellbeing, particularly in patients with squamous cell carcinomas. Female and younger patients appear most vulnerable to QOL anxieties pre-operatively.

Key Words

Facial skin cancer; Disfigurement; Quality of life; Skin Cancer Index

Level III – Evidence obtained from cohort study

Introduction

The majority of skin cancers occur on exposed, and therefore visible, skin; most commonly in the head and neck [1]. As a consequence both the skin cancer and the scars following surgical excision can be difficult to conceal. Facial disfigurement, either arising from a malignancy, its surgical treatment or from traumatic or congenital causes, is widely recognised to be a great source of distress [2,3]. Patients with disfiguring conditions in general experience high levels of anxiety, depression and social isolation and will benefit from information, support and counselling [4].

While a considerable amount of research exists exploring the psychological impact of many disfiguring conditions, the literature has overlooked the common, often perceived as minor, cutaneous malignancies [5]. The majority of these are non-melanoma skin cancers: most commonly basal cell carcinomas (BCCs), which have a relatively low morbidity and propensity to metastasize [6], and are generally considered to have little impact on quality of life [7,8]. Furthermore, as these are small and slow-growing tumours, complete surgical excision can often be achieved without leaving an extensive cosmetic or functional defect. However, it would be an oversimplification to assume that this would automatically result in less anxiety and a lower impact on quality of life, particularly given the propensity for lesions to occur on conspicuous body sites. Certainly previous work on disfigurement has failed to demonstrate any relationship between size or severity of disfigurement and resulting psychological distress [9].

One-stop, rapid access skin cancer clinics are increasingly the norm in UK practice, allowing more rigid compliance with current guidelines on surgical and specialist referral waiting times [10]. The introduction of such clinics will undoubtedly result in increased early detection and treatment of life-threatening malignancies. However, the efficiency of the process risks overlooking emotional concerns, particularly those that are not directly cancer or mortality

related, in patients thought to have low-risk disease [11]. In these patients, social, emotional and body-image issues may be a greater cause of concern than the cancer itself.

This study aims to look specifically at the social, emotional and aesthetic impact of a facial skin cancer in this large but overlooked group of patients. A clearer understanding of whether elevated levels of anxiety and distress exist within this group, or in certain subgroups, is necessary if adequate support for vulnerable patients is to be provided.

Patients and Methods

This was a prospective study of 53 patients presenting to a combined (dermatology/plastic surgery) skin cancer clinic with a cutaneous malignancy located the head and neck region. All patients with a malignancy that required surgical excision were invited to participate. The data were collected between August 2008 and October 2010. Ethical approval for the project was granted by the Leeds East Research and Ethics Committee and the study has been perfomed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Patients were recruited at first presentation, during which they were seen by a consultant plastic surgeon (GS) and informed of their provisional diagnosis and surgical management plan. Following this they received verbal and written information about the study and informed consent was obtained from all patients agreeing to participate. Patients with major cognitive impairment and poor comprehension of spoken English were excluded.

Patients were interviewed by two of the study authors (JC and LG) using structured questionnaires to obtain basic demographic and clinical data. Patient interviews were conducted on 2 occasions: at initial presentation and at routine, post-operative follow up approximately 3 months after surgery. Demographic data included details on age, sex, ethnic background, marital status, children and level of education (determined by whether or not patients had received a college or university education). A measure of social isolation

was also derived, determined by whether the patient lived alone or with a partner or other family members. Clinical variables recorded included the type and location of the malignancy, method of surgical reconstruction employed, scar size and post-operative complications. Histological diagnosis was categorised as basal cell carcinoma (BCC), squamous cell carcinoma (SCC), malignant melanoma (MM) or Other (comprising lesions clinically diagnosed as malignancies subsequently found to be histologically benign). The scar size of each patient was categorised according to the length of the longest dimension, with categories corresponding to scars of length <10mm, 11-30mm, 31-50mm and >50mm. Quality of life (QOL) variables were assessed using the Skin Cancer Index (SCI) [12]. The SCI is a recently developed, 15-item, validated, disease specific quality of life instrument. It assesses 3 distinct subscales which impact on QOL: emotional, social and appearance. Standardised scores range from 0-100, with higher scores reflecting a better QOL. The SCI has been shown to be both sensitive and responsive in the assessment of QOL in patients with facial skin cancer [13].

This methodology utilised in this report extends that of a previous analysis of the data set [14] by extending the set of candidate predictor variables considered and by the derivation of both simple and multiple linear analysis of covariance (ANCOVA) models, in which the effects of predictor variables on total SCI scores and emotional, social and appearance sub-scale scores were assessed. Assessments of variable significance were obtained after correction for baseline imbalances, eliminating any effects of regression to the mean.

Statistical Analysis

A power analysis was conducted to determine an adequate sample size. Assuming similar data variability to that found by Rhee et al [13], a minimum sample size of 32 was calculated to be required to detect a gain in standardised SCI score of 9 points under standard levels of power and significance.

Mean SCI scores with standard deviations were calculated for total SCI and individual SCI subscales at the pre- and post- operative time points, and for the change between pre- and post-operative scores. The significance of the effect of surgery on all patients on total SCI and individual sub-scales was assessed. Mean scores were also obtained for sub-sets of patients distinguished by clinical and demographic variables.

The effect of clinical and demographic variables was analysed using ANCOVA models, considering total and SCI subscale post-surgery scores as outcome measures. Each variable was considered individually alongside pre-surgery scores, with variables found to be significant then carried forward into multiple ANCOVA models.

Descriptive statistics were calculated for other recorded clinical and demographic variables; however, due to the limited size of the data set, these were not included in the ANCOVA models.

Results

62 patients agreed to participate in the study; 8 of whom failed to complete follow-up questionnaires, and 1 of whom died before the study was complete; resulting in a total of 53 complete sets of data for final statistical analysis. Of these 29 (55%) were men and 24 (45%) were women. No ethnic minorities were represented in the sample. The majority of patients fell in to the older age categories; with 37 (70%) patients aged 66 years or above, 13 (25%) of patients aged between 46 and 65 and only three patients below 45 years of age. Table 1 gives further details of the demographic characteristics of the patient cohort.

Histologically the majority of lesions (62%) were BCCs. Only ten patients in total had a histological diagnosis other than BCC or SCC. These were coded as missing values for the analysis, which hence assessed the significance of histological diagnosis based on a comparison of those diagnosed as BCC and those diagnosed as SCC only. Lesions were

distributed across all regions of the face, most commonly on the nose (32%) and cheeks (17%). Reconstruction following excision was by primary closure (28%), skin graft (53%) or local flap (19%). Complete clinical characteristics are illustrated in Table 2.

Following surgery there was a significant improvement both in the total SCI score and in each of the individual subscale scores (Table 3). Total SCI score improved by 12.4 points following surgery ($p<0.001$). Emotional SCI score improved by 11.0 points ($p<0.001$). Social SCI score improved by 10.2 points ($p=0.007$). Appearance SCI score improved by 16.5 points ($p<0.001$).

Improvements in SCI scores following surgery were observed in almost all sub-groups of patients (Table 4). The greatest contrast was found in the histological subgroup: patients with SCCs exhibited an improvement in total SCI score over 3 times greater than the corresponding improvement shown by patients with BCCs. SCC patients also improved more than BCC patients on all three sub-scales: particularly on the social sub-scale. Patients living alone exhibited greater improvement on all scales than those living with a partner. Patients who had not experienced post-operative complications also exhibited greater improvement on all scales than those who had experienced post-operative complications.

Males improved more than females on total scores and on the social subscale, whereas females improved more than males on the emotional and appearance subscales. Patients with no post-16 education improved more than those with post-16 education on the social and appearance sub-scales, while patients with post-16 education improved more on the emotional subscale. The change in improvement scores with increasing scar length did not follow a distinct pattern.

Analysis of the ANCOVA models using total change scores found histology to be significantly associated with change scores ($F_{(1,40)}=4.48$, $p=0.041$). Although change scores in males and females were similar, gender was also found to be significantly associated with total change scores ($F_{(1,50)}=4.95$, $p=0.031$) after correcting for the large baseline imbalance

between males and females on the emotional and appearance sub-scales. Age was also found to be significant ($F_{(1,50)}$=6.57, p=0.013), with an increase in post-intervention score of 1 point being associated with about 3 years of increasing age. Social isolation, scar length, educational level and whether post-operative complications experienced did not show statistically significant effects in relation to total SCI score (Table 5).

Analysis of the ANCOVA models using sub-scale scores as the outcome measures revealed some differences in patterns of variable significance (Table 5). Age alone was found to be statistically significantly associated with emotional SCI score ($F_{(1,50)}$=7.33, p=0.009), with increasing age associated with increasing emotional SCI score post-surgery; and gender alone was found to be significantly associated with appearance SCI score ($F_{(1,50)}$=4.20, p=0.046), with males scoring significantly higher than females post-surgery. No factors or covariates were found to be significantly associated with the social SCI score.

In all models of both the total and sub-scale scores, the pre-intervention score was found to be a statistically significant predictor of the post-operative score

Hence the variables of age, gender and histology were carried forward for inclusion in a series of multiple ANCOVA models. Main effects models only were considered as the number of patients in all sub-groups was insufficient to facilitate consideration of interactions.

Compared with the univariate models (Table 5), the multiple ANCOVA model revealed some differences in the significance of variables when other variables were controlled for (Table 6). Age was found to be significantly associated with total scores ($F_{(1,38)}$=4.65, p=0.037) and emotional scores ($F_{(1,38)}$=5.35, p=0.026), controlling for histology and gender. The direction of association was unaltered, with increasing age being associated with increasing post-surgery emotional SCI score. Models considering social scores or appearance scores as the outcome measure did not find any of the variables to be significant. In all models the effect of the pre-surgery score (using the partial η^2 statistic) was substantively greater than the effect of any additional variables (Table 7).

Discussion

In the majority of patients with cutaneous malignancies, morbidity is a more important issue than mortality. Consequently, quality of life becomes a more relevant endpoint in the assessment of patient outcomes [15]. The SCI has been previously shown to be a useful instrument to measure QOL in patients with facial skin malignancies [13]. Compared with other dermatological QOL tools which have been designed principally for chronic, benign skin conditions, it captures issues specific to facial skin cancers such as scarring, disfigurement & concerns about possible recurrence, which are more relevant to this patient group. The individual subscales of emotion, social & appearance allow us to identify concerns related to self-image and social confidence as well as those directly related to cancer.

The results of this study indicate that surgical excision improves QOL in patients with facial skin cancers. This improvement was seen across all subscales individually as well as in the total score. The distress experienced by many people with suspicious skin lesions, despite the relatively indolent behaviour of their tumours, is illustrated by consistently lower pre-operative SCI scores. In other malignancies the early period surrounding diagnosis is widely recognised to be the most stressful [16,17]. Indeed current guidelines for the management of cutaneous SCCs emphasise the importance of patient access to psychological support at the time of diagnosis [18]. In our own practice we should consider devoting as much time, pre-operatively to our patients' psychosocial issues as we currently do to their biomedical ones.

Histological diagnosis of SCC was predictive of a greater improvement in QOL following surgery compared with a diagnosis of BCC. This may reflect informal counselling regarding disease severity which would make surgical removal, irrespective of post operative appearance, more desirable for the more aggressive SCCs. The gender imbalance in the

SCC group (predominantly male) compared with the more balanced BCC group may confer some bias to this finding.

Differences seen among other variables that did not achieve consistent statistical significance across all scales also raise interesting issues. Female patients are consistently reported as suffering greater anxiety and poorer QOL than males using a number of different assessment tools [11,19,20]. Consistent with previous research using the SCI [13], our results also indicate that female patients have lower QOL scores both pre- and post-operatively and across all subscales, particularly in appearance (Table 4). The higher baseline scores of male patients would normally be expected to lead to smaller improvements following surgery than for females, due to the effect of regression to the mean, in which baseline values are negatively correlated with change scores. Scrutiny of the subscales illustrates that this is not always the case and suggests that the sexes may differ in what influences their post-operative improvement in QOL. Females showed greater improvement in the emotional and the appearance score following surgery: however, in the social score males improved more than females. It is interesting to consider whether these gender differences reflect the subtle differences to QOL that facial malignancies confer on different sexes, affecting men more in a social context and women in an emotional and cosmetic one.

Previous work on cutaneous malignancies has suggested that scar length has relatively little impact on pre and postoperative distress [21]. In this study the impact of scar size on SCI was somewhat conflicting. Improvement in total SCI score following surgery was predictably lowest in patients with larger (31-50mm) scars, and in the appearance subscale, the SCI for these patients actually deteriorated following surgery (Table 4). Conversely those with the very largest scar (>50mm) actually reported a greater improvement in SCI, in all scales other than social, compared with all other groups. This group was represented by only 6 patients and therefore one must be cautious in drawing any conclusions from the data. Three of these patients had wounds that were closed with cervico-facial flaps which, although the

scars are long, are cosmetically well concealed. Furthermore 3 patients had a histological diagnosis of melanoma. The poorer prognosis in these cases is likely to make surgical excision, irrespective of scaring, more desirable.

In our cohort, the youngest patients recorded low pre- and post-operative SCI scores with increasing age resulting in greater improvements in QOL following surgery. Again this finding supports previous research on skin cancer patients [21]. Interestingly we have identified that the improvement in older patients was principally due to the effect of surgery on the emotional and appearance subscales. The questions asked in the emotional subscale are the only ones in the SCI that address the issues of cancer severity, spread and recurrence. It is possible these indirect references to mortality are considered in more depth by older patients resulting in a greater improvement in score following surgical cure. While the positive impact of improved appearance in older patients may reflect better scarring observed in aging skin [22], this finding also challenges widely held beliefs that appearance is predominantly a concern of the young [23].

Only three patients were aged less than 45 years in this study, reflecting the propensity for cutaneous malignancies to occur in older patients. Although this prohibits meaningful analysis of this sub-group, it is interesting to note that these patients (all female) recorded low SCI scores throughout which actually deteriorated post-operatively.

Patients living alone had lower pre-operative and broadly similar post-operative SCI scores across all domains and hence showed a greater overall improvement following surgery, most notably in appearance (Table 4). The lower pre-operative SCI scores seen in the socially isolated are probably indicative of poorer access to regular emotional support. The greater improvement in QOL following surgery in these patients is more interesting and perhaps reflects the positive social impact a series of hospital visits can have on this subgroup, even in the absence of formal psychosocial input.

Post-operative complications did not appear to have a significant impact on quality of life following surgery. This may reflect the fact that the complications seen were generally minor with a short term impact (for example superficial infection requiring antibiotics) but with no long term consequences. Our finding that educational level is not related to post-operative outcomes is consistent with previous studies [13].

In all models, the strongest predictor of post-surgery SCI score is pre-surgery score, with models of the emotional and appearance sub-scale scores in particular indicating relatively strong effects of pre-surgery scores in comparison to the effects of other factors. This finding may put into context the significant effects of demographic and clinical variables which have been observed in several models. If we wish to identify patients vulnerable to psychosocial concerns pre-operatively our results would indicate that, rather than making assumptions based on age, gender etc, more valuable information may be obtained by routine use of the SCI within the clinic setting. Selecting patients who score below a given threshold in this manner could allow more targeted allocation of limited resources, such as psychological support.

This study was not without limitations. The busy clinical environment in which the study was carried out prevented the use of a more generic and widely used psychological tool, such as the Hospital Anxiety and Depression Scale or the Derriford Appearance Scale, for comparison with the SCI. Although the results clearly indicate an improvement in overall QOL and in the three subscales of emotion, social and appearance following surgery, the findings of the multivariate analysis need to be interpreted with caution. The small size of some of the patient groups limit the usefulness of the data and a larger study is needed to support the results presented here. Finally, the results represent patients from a single geographic location with little ethnic diversity.

Overall, surgical removal of facial skin cancers does improve quality of life despite the physical intervention, resultant scarring and need for multiple hospital visits. Significant

improvement in QOL following what is, for most, a minor procedure may reflect the reassurance experienced by the knowledge a lesion has been completely removed [24]. Non-surgical therapeutic options continue to emerge as effective treatments for many skin cancers [25]. A comparison of the impact on QOL of these alternative treatment modalities may provide a valuable outcome measure when assessing patient preferences for operative and non-operative techniques.

The results have identified that patients with a histological diagnosis of SCC as well as female, younger and socially isolated people, are most vulnerable to quality of life anxieties concerning their malignancy pre-operatively. Although all groups improved following surgery, the relatively low scores persist among younger and female patients. The variability in scores in our sample presents a challenge in designing appropriate support strategies as does the high patient turnover setting in which we work. Nonetheless, simple, inexpensive measures such as provision of self help leaflets have been successful in helping patients deal with anxiety related to facial disfigurement [26]. Offering ready access to support organisations, the presence of a psychological specialist as part of the MDT and engaging friends and relatives with the support process are additional options [19]. These may be appropriate interventions within the time constraints of a rapid access skin cancer clinic. Further research is now needed to determine whether the vulnerable groups we have identified benefit from the introduction of such strategies.

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Table Legends

Table 1: Demographic characteristics of the patient cohort.

Table 2: Clinical characteristics of the patient cohort.

Table 3: Pre-and post operative mean (SD) SCI total and sub-scale scores and assessment of effect of surgery.

Table 4: Pre-and post operative mean (SD) SCI total and sub-scale scores partitioned by demographic and clinical factors.

Table 5: Significance of factors and covariates (ANCOVA models): total SCI post-surgery scale scores and sub-scale scores.

Table 6: Significance of factors and covariates (multiple ANCOVA models): total post-surgery SCI scale scores and sub-scale scores.

Table 7: Effect sizes for factors and covariates (multiple ANCOVA models).

Tables

Table 1: Demographic characteristics of patient cohort

Variable	n	Percentage
Total number of patients	53	
Sex		
Male	29	55
Female	24	45
Age, median (range)	69 (28-90)	
66 and over	37	70
46-65	13	24
45 and under	3	6
Partner at home		
Yes	33	62
No	20	38
Children		
Yes (at home)	45 (10)	85 (22)
No	8	15
Level of Education		
School to age 15	25	47
School/vocational >15	22	42
University degree	6	11

Table 2: Clinical characteristics of the patient cohort

Variable	n	Percentage
Histology		
BCC	33	62
SCC	10	19
MM	6	11
Other	4	8
Site of lesion		
Forehead	5	9
Nose	17	32
Cheek	9	17
Chin	3	6
Lip	2	4
Nasolabial fold	3	6
Eye area	6	11
Temple	6	11
Ear	1	2
Scalp	1	2
Reconstruction type		
Primary closure	15	28
Skin graft	28	53
Local flap	10	19
Complications		
Yes	19	36
No	34	64
Co-morbidities		
Yes	39	74
No	14	26

Table 3: Pre-and post operative mean (SD) SCI total and sub-scale scores and assessment of effect of surgery

SCI scale	Pre-surgery mean (SD)	Post-surgery mean (SD)	Change mean (SD)	*p*-value
Total score	70.0 (25.3)	82.4 (18.4)	12.4 (17.4)	<0.001
Emotional score	66.6 (27.1)	77.6 (20.0)	11.0 (17.6)	<0.001
Social score	75.5 (28.3)	85.7 (23.1)	10.2 (26.3)	0.007
Appearance score	68.7 (34.3)	85.2 (23.1)	16.5 (27.7)	<0.001

Table 4: Pre-and post operative mean (SD) SCI total and sub-scale scores partitioned by demographic and clinical factors

SCI scale	Factor	Pre-surgery mean (SD)	Post-surgery mean (SD)	Change mean (SD)
Total score	**Histology**			
	BCC	74.8 (22.3)	81.9 (20.8)	7.1 (13.2)
	SCC	59.8 (31.9)	83.0 (13.4)	23.2 (23.4)
	Gender			
	Male	76.2 (24.6)	89.0 (11.3)	12.8 (15.8)
	Female	62.5 (24.5)	74.4 (22.1)	11.9 (19.5)
	Scar size			
	<10mm	62.9 (21.6)	71.7 (24.8)	8.7 (18.9)
	11-30mm	68.8 (27.0)	83.6 (17.0)	14.9 (19.6)
	31-50mm	82.7 (21.9)	87.0 (19.1)	4.3 (10.2)
	>50mm	62.5 (29.0)	81.9 (15.9)	19.4 (14.8)
	Social Isolation			
	Living alone	67.0 (26.3)	83.2 (16.6)	16.2 (17.8)
	Not living alone	71.8 (24.9)	81.9 (19.7)	10.1 (17.0)
	Procedural complications			
	No complications	69.1 (26.8)	82.7 (17.3)	13.7 (18.9)
	Complications	71.7 (22.9)	81.8 (20.7)	10.1 (14.4)
	Education			
	No post-16 education	76.6 (24.1)	88.0 (14.0)	11.5 (17.7)
	Post-16 education	65.7 (25.5)	78.0 (20.7)	12.3 917.1)
Emotional score	**Histology**			
	BCC	71.8 (25.4)	78.0 (21.0)	6.3 (13.7)
	SCC	60.4 (28.3)	76.8 (17.1)	16.4 (20.4)
	Gender			
	Male	73.9 (24.9)	83.4 (16.9)	9.5 (14.5)
	Female	57.9 (27.6)	70.7 (21.6)	12.8 (20.9)
	Scar size			
	<10mm	60.3 (27.2)	67.4 (27.0)	7.1 (6.6)
	11-30mm	61.2 (26.5)	78.3 (19.9)	11.1 (19.1)
	31-50mm	76.4 (26.1)	84.3 (17.7)	7.9 (16.7)
	>50mm	60.1 (36.1)	77.4 (16.7)	17.3 (24.2)
	Social Isolation			
	Living alone	64.5 (29.5)	78.2 (17.9)	13.7 (20.9)
	Not living alone	68.0 (25.9)	77.3 (21.5)	9.3 (15.4)
	Procedural complications			
	No complications	65.3 (28.3)	77.4 (19.1)	12.1 (19.2)

	Complications	69.0 (25.4)	78.0 (22.2)	9.0 (14.6)
	Education			
	No post-16 education	74.7 (24.1)	84.2 (14.3)	9.5 (18.4)
	Post-16 education	61.3 (28.2)	73.0 (22.7)	11.7 (17.3)
Social score	**Histology**			
	BCC	79.2 (25.8)	83.3 (27.8)	4.1 (25.1)
	SCC	61.0 (35.1)	88.0 (13.0)	27.0 (25.6)
	Gender			
	Male	77.4 (26.7)	90.7 (18.1)	13.3 (23.5)
	Female	73.1 (30.5)	79.6 (27.1)	6.5 (29.4)
	Scar size			
	<10mm	72.5 (28.5)	76.3 (31.5)	3.8 (43.2)
	11-30mm	71.5 (29.3)	85.9 (21.3)	14.4 (25.7)
	31-50mm	84.5 (28.4)	88.5 (28.0)	4.0 (11.7)
	>50mm	77.5 (29.8)	88.3 (13.3)	10.8 (25.6)
	Social Isolation			
	Living alone	73.5 (28.4)	88.5 (20.5)	15.0 (21.0)
	Not living alone	76.7 (28.6)	83.9 (24.7)	7.3 (29.0)
	Procedural complications			
	No complications	74.6 (29.3)	88.1 (16.7)	13.5 (24.1)
	Complications	77.1 (27.0)	81.3 (31.7)	4.2 (29.6)
	Education			
	No post-16 education	80.9 (29.7)	92.4 (18.8)	11.5 (22.6)
	Post-16 education	71.9 (27.2)	80.2 (25.4)	8.3 (29.3)
Appearance score	**Histology**			
	BCC	74.5 (31.7)	84.1 (26.5)	9.6 (25.3)
	SCC	56.7 (38.8)	89.2 (14.2)	32.5 (32.7)
	Gender			
	Male	79.6 (30.6)	94.0 (10.7)	14.4 (22.6)
	Female	55.6 (34.5)	74.7 (29.3)	19.1 (33.1)
	Scar size			
	<10mm	53.1 (32.4)	73.9 (24.2)	20.8 (28.5)
	11-30mm	67.9 (36.5)	86.7 (23.7)	18.8 (28.4)
	31-50mm	94.2 (8.8)	90.8 (23.7)	-3.3 (18.5)
	>50mm	43.1 (31.4)	81.9 (22.0)	38.9 (18.0)
	Social Isolation			
	Living alone	62.1 (34.7)	86.3 (22.0)	24.2 (33.1)
	Not living alone	72.7 (34.0)	84.6 (24.1)	11.9 (23.1)
	Procedural complications			
	No complications	68.3 (36.1)	86.3 (24.5)	17.6 (27.0)
	Complications	68.9 (31.8)	83.3 (21.0)	14.5 (29.5)
	Education			

	No post-16 education	73.9 (33.6)	89.9 (18.6)	15.9 (31.1)
	Post-16 education	65.8 (35.0)	81.0 (26.1)	15.2 (23.9)

Table 5: Significance of factors and covariates (ANCOVA models): total post-surgery SCI scale scores and sub-scale scores

Factor	*p*-value in model with given outcome measure			
	Total scale score	Emotional sub-scale score	Social sub-scale score	Appearance sub-scale score
Histology	0.041	0.194	0.091	0.086
Gender	0.031	0.290	0.093	0.046
Scar category	0.320	0.494	0.687	0.495
Social Isolation	0.281	0.438	0.315	0.262
Age	0.013	0.009	0.390	0.089
Complications	0.524	0.701	0.183	0.577
Education level	0.238	0.318	0.130	0.295

Table 6: Significance of factors and covariates (multiple ANCOVA models): total post-surgery SCI scale scores and sub-scale scores

Factor	*p*-value in model with given outcome measure			
	Total scale score	Emotional sub-scale score	Social sub-scale score	Appearance sub-scale score
Histology	0.305	0.462	0.247	0.541
Gender	0.701	0.639	0.688	0.346
Age	0.037	0.026	0.579	0.117

Table 7: Effect sizes for factors and covariates (multiple ANCOVA models)

Factor	Effect size (partial η^2) in model with given outcome measure			
	Total scale score	Emotional sub-scale score	Social sub-scale score	Appearance sub-scale score
Histology	0.028	0.014	0.035	0.010
Gender	0.004	0.006	0.004	0.023
Age	0.109	0.124	0.008	0.063
Pre-surgery score	0.458	0.579	0.255	0.201