

Review of Scar Assessment Scales

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Scars that occur during wound healing can cause several cosmetic and functional problems and can exhibit various clinical features. From a therapeutic point of view, if scarring is severe, surgical removal is considered. However, if it is not severe, non-invasive methods, such as laser treatment, are given priority. It is important to select the ideal scar assessment method for the appropriate treatment of skin scars. To aid in this endeavor, we reviewed the following methods of scar assessment: The Vancouver Scar Scale (VSS), Modified Vancouver Scar Scale (mVSS), Seattle Scale, Mapping Assessment of Scars and Photographs (MAPS), Hamilton Scale, Manchester Scale, Patient and Observer Scar Assessment Scale (POSAS), Stony Brook Scar Evaluation Scale (SBSES), University of North Carolina "4P" Scar Scale (UNC4P), Visual Analog Scale (VAS), and the Dermatology Life Quality Index (DLQI). The objective of this study was to summarize and evaluate the various scar assessment methods that are commonly used in clinical practice.

Key words

Assessment; Scale; Scar; Review

INTRODUCTION

Scars appear due to imbalances between the anabolic and catabolic phases of the process of filling defects in the epidermis and dermis. They are also seen in deep-seated regions, caused by skin damage and replacement with abnormal connective tissue. Scars can be caused by trauma, including burns and injuries, inflammatory skin disorders, and surgery.¹ Scars are one of the most common illnesses that affect a patient cosmetically. This can not only affect the quality of life of patients, but also cause financial and mental health problems. Surgical and non-surgical treatments are available for scar management. Various laser treatments have recently gained traction as non-surgical alternatives. Various treatments, such as cryotherapy and bleomycin injection therapy, are used in combination to treat these lesions.^{2,3}

In general, scars have a shape similar to that of the surrounding tissue because of a secondary process in which the wound site shrinks due to the condensation of surrounding cells over time. This allows scars to be classified into immature and mature scars. However, scars are generally classified into depressed, atrophic, or elevated scars depending on their morphology (classification by contour). Although this classification is important for determining the correct treatment for scars, it is equally important to choose an appropriate scar assessment method to evaluate the course and effectiveness of the treatment process itself. Scar assessment scales that are currently used include the Vancouver Scar Scale (VSS), Visual Analog Scale (VAS), Patient and Observer Scar Assessment Scale (POSAS), Manchester Scar Scale (MSS), and the Stony Brook Scar Evaluation Scale (SBSES). However, to date, there is no gold standard in the evaluation of scars. The most important reason for this is that most current scar assessment methods focus on the cosmetic features or problems associated with scars. There is reduced consideration of the functional problems and psychological sequelae that the patient might encounter. It can be said that a simple evaluation method is actually ideal to consider all the aspects of the scar as a whole. Hence, this review summarizes various scar assessment methods that are currently used in clinical practice.

VANCOUVER SCAR SCALE

The VSS was the first validated scar scale to be widely used in clinical scar assessment, as early as 1990. It is one of the most frequently used scales till date.⁴ The VSS evaluates four indicators: vascularity, pigmentation, pli-

ability, and height. It has a score ranging from 0-13 (Table 1). The VSS set a precedent for systematic scar assessment by collecting subjective assessments and using a semiquantitative approach. However, this method has multiple limitations. According to some studies, the VSS has insufficient efficacy and reliability, especially if the scar is large or irregular. It does not include an assessment of subjective symptoms, such as pain, itching, functional sequelae, or the psychological sequelae of scars. To aid in better understanding, the measured results are shown in Fig. 1.

MODIFIED VANCOUVER SCAR SCALE

Owing to the limitations mentioned above, some modifications to the VSS have been suggested in literature. An important change presented by Nedelec et al. is the addition of pain and itchiness as indicators (Table 2).⁵ Forbes-Duchart et al. have confirmed that VSS shows reduced reliability among evaluators when assessing scars in patients with various skin pigmentations. Therefore, they proposed the use of light, medium, and dark modifiers when evaluating patients with different skin tones.⁶ These changes are expected to offer slight advantages over the existing VSS. However, a systematic review by Tyack et al.⁷ did not report any improvements in validity, reliability, or sensitivity. In addition, subjective indicators other than pain and itch are not covered by either the VSS or modified VSS.

Table 1. Vancouver Scar Scale (VSS)

Scar characteristics	Score
Vascularity	
Normal	0
Pink	1
Red	2
Purple	3
Pigmentation	
Normal	0
Hypopigmentation	1
Hyperpigmentation	2
Pliability	
Normal	0
Supple	1
Yielding	2
Firm	3
Ropes	4
Contracture	5
Height	
Flat	0
< 2 mm	1
2-5 mm	2
> 5 mm	3
Total score	13

Example 1



	Vascularity	Pigmentation	Pliability	Height	Total
VSS	2	2	2	2	8

POSAS Vascularity	Pigmentation	Thickness	Relief	Pliability	Total	
OSAS*	2	4	3	2	3	14

POSAS	Pain	Itching	Color	Stiff	Thick	Irregular	Total
PSAS**	1	3	3	4	4	2	17

Example 2



	Vascularity	Pigmentation	Pliability	Height	Total
VSS	2	1	2	1	6

POSAS Vascularity	Pigmentation	Thickness	Relief	Pliability	Total	
OSAS*	1	2	2	4	2	11

POSAS	Pain	Itching	Color	Stiff	Thick	Irregular	Total
PSAS**	2	3	2	2	2	4	15

Example 3



	Vascularity	Pigmentation	Pliability	Height	Total
VSS	2	2	3	2	9

POSAS Vascularity	Pigmentation	Thickness	Relief	Pliability	Total	
OSAS*	3	4	5	2	4	18

POSAS	Pain	Itching	Color	Stiff	Thick	Irregular	Total
PSAS**	3	4	4	4	4	2	21

Fig. 1. Scars assessed using the Vancouver Scar Scale, POSAS. *Observer Scar Assessment Scale; **Patient Scar Assessment Scale.

Table 2. Modified Vancouver Scar Scale (mVSS)

Scar characterstic	Score
Vascularity	
Normal	0
Pink	1
Red	2
Purple	3
Pigmentation	
Normal	0
Hypopigmentation	1
Mixed	2
Hyperpigmentation	3
Pliability	
Normal	0
Supple	1
Yielding	2
Firm	3
Ropes	4
Contracture	5
Height	
Flat	0
< 2 mm	1
2-5 mm	2
> 5 mm	3
Pain	
None	0
Occasional	1
Requiring medication	2
Pruritus	
None	0
Occasional	1
Requiring medication	2
Total score	16

SEATTLE SCALE

Yeong et al. have suggested 24 standardized color photographs to assess the surface, thickness, border height, and color differences between scars and normal skin to derive a more consistent score.⁸ The scale increases in severity from -1 to 4, with 0 indicating a normal score. The Seattle Scale did improve reliability between evaluators. However, by design, it allows negative values for certain metrics, such as hypopigmentation and atrophy. Although these negative values help to distinguish between different scar types, they lead to an "improved" overall score, which, in turn, can lead to a misinterpretation of the degree of scarring. Owing to these limitations and the lack of evaluation of subjective symptoms, the Seattle Scale is not widely used.

MAPS (MAPPING ASSESSMENT OF SCARS AND PHOTOGRAPHS)

In 2005, Masters et al. optimized the scar assessment scale described by Young et al. by adding a localization technique consisting of matching assessments of scars and photographs (MAPS) to depict the overall appearance of scars rather than specific spots.⁹ Long-term follow-up observations of several months became possible through photographs. Reliability between evaluators showed a high concordance rate (0.55-0.81) when measuring bor-

der, height, thickness, and color of scars. However, it seemed to be relatively low (0.25-0.40) when evaluating the surface.

HAMILTON SCALE

The Hamilton scale is a scar assessment scale developed in 1998. It uses relatively little-known photographs.¹⁰ The observer evaluates several indicators, including surface irregularity, thickness, color, and vascularity, using photographs alone. The advantage of this scale is that it is highly reliable, even when used by novice observers. Despite its high reliability, the Hamilton scale can potentially distort the observer's interpretation because it relies on photographs rather than actual scars for evaluation. Moreover, similar to previously described scales, the Hamilton scale also lacks a component dealing with the assessment of subjective symptoms.

MANCHESTER SCAR SCALE

Beausang et al. introduced the MSS in 1998 to quantitatively assess scars based on clinical, photographic, and histological features.¹¹ After evaluating independent scar characteristics including color, contour, radiation, texture, and distortion, the total score proportional to scar severity is derived in combination with a VAS. Although the MSS is suitable for assessing linear scars, it has been criticized for its lack of description of symptoms.

PATIENT AND OBSERVER SCAR ASSESSMENT SCALE

The introduction of the POSAS in 2004 marked a turning point in scar assessment using scales.¹² POSAS is the first scale that considers both the patient's and evaluator's perspectives. In addition to assessing the physical properties of scars (e.g., vascularization, pigmentation, thickness, relief, and pliability), POSAS allows patients to score scar-related pain and pruritus using a 10 point scoring system (Table 3). Although subjective symptoms are considered, they are limited to only pain and pruritus; functional defects and possible psychological effects are not assessed. In 2005, a modified version of POSAS was introduced which added a subjective assessment of the effects of scarring on daily life activities. To aid in better understanding, the parameters measured are listed in Fig. 1.

Table 3. The Patient and Observer Scar Assessment Scale (POSAS)

Observer Scar Assessment Scale	Score*
Vascularity	1-10
Pigmentation [†]	1-10
Thickness	1-10
Relief	1-10
Pliability	1-10
Total score Observer Scar scale	5-50
Patient Scar Assessment Scale 1	Score**
Is the scar painful?	1-10
Is the scar itching?	1-10
Patient Scar Assessment Scale 2	Score***
Is the color of the scar different?	1-10
Is the scar more stiff?	1-10
Is the thickness of the scar different?	1-10
Is the scar irregular?	1-10
Total score Patient Scar Scale	6-60

*1, Normal skin; 10, Worst scar imaginable; **1, No complaints; 10, Worst imaginable; ***1, Normal skin; 10, Very different; [†]categorized to hypopigmentation, mixed, or hyperpigmentation.

STONY BROOK SCAR EVALUATION SCALE

The Stony Brook Scar Evaluation Scale (SBSES) was developed by Singer et al. in 2007. It is based on five scar indicators: width, elevation or depression, color, suture or staple marks, and overall appearance.¹³ Each indicator is assigned a score between 0 and 5 points. These scores are totaled to obtain the final score. SBSES has demonstrated consistent reliability between evaluators, ranging from 0.73 to 0.85. However, it failed to include subjective indicators in its assessment of scars.

UNIVERSITY OF NORTH CAROLINA "4P" SCAR SCALE

The University of North Carolina "4P" Scar Scale (UNC4P) was developed to broaden the range of existing scar scales and qualitative assessments.¹⁴ The "4Ps" of UNC4P include pain, paresthesia, pruritus, and pliability. It evaluates scars using a score ranging from 0-12. UNC4P emphasizes the importance of subjective evaluations. However, the scale is not designed for independent use. In a study comparing scar characteristics before and after laser peeling by Hultman et al., UNC4P was only used as a supplement to the pre-existing VSS. Moreover, the reliability of UNC4P has not yet to be verified.

Table 4. Summary of scar assessment scales (1)

Scar evaluation method	Score range	Evaluation item	Disadvantages	Advantage	Major indication
Vancouver Scar Scale (VSS)	0 (best) – 13 (worst)	Vascular distribution, thickness, flexibility, pigmentation	It does not include the degree of subjective awareness of the patient. It is difficult to apply pigmentation indicators to large, non-uniform scars. Do not assess evaluator-dependent errors, pain, or swells. Subjective symptoms other than itching and pain are not included. Negative(-) measurements tend to be evaluated as rather to improve scarring.	Often used in the study of burn treatment results	Burn scar
Modified VSS (Nedelec et al. ⁵⁾ Seattle Scale	0 (best) → 16 (worst) -4 → 16 (worst)	VSS evaluation item + background, pain Homogeneity, thickness, boundaries, pigmentation		Including patient subjective symptoms Since it is evaluated using photographic materials, it is easy to evaluate and highly responsive. Hypopigmentation and atrophy can be measured negatively(-). Improved reliability than Seattle Scale	Burn scar When evaluating scars with photos
Matching Assessment of Scars and Photographs (MAPS) Hamiltons Scale	-5 (best) – 20 (best) 0 (best) → 14 (worst)	Seattle Scale endpoint + color Homogeneity, thickness, color, blood vessel distribution	Same as Seattle Scale Limited because it is evaluated with photographic materials. It does not include the patient's subjective symptoms. Emphasis and evaluation of each item are optional	Since it is evaluated using photographic materials, it is easy to evaluate and highly responsive. Applicable to various scars, includes physical measurements as well as clinical importance endpoints Focus on the severity of scars from the perspective of a doctor or patient	When evaluating scars with photos Various scars including postoperative scar
Manchester Scar Scale (MSS) Patient and Observer Scar Assessment Scale (POSAS)	5 (best) – 18 (worse) 5 (worst) – 50 (best)	VAS endpoint + scar color, skin texture, scar texture, relationship with surrounding skin, border, size, number VSS evaluation item + surface area, pain, bare skin, color, thickness, hardness	Subjective symptoms other than itching and pain are not included. Scar assessment results may differ from patient perceptions and concerns It is evaluated only as a photograph and does not include the patient's condition. Not suitable for long-term evaluation	Useful for evaluation of scars accompanied by contracture Useful for evaluation of suture scar	
The Stony Brook Scar Evaluation Scale (SBSES)	0 (worst) – 5 (best)	VAS evaluation item + width, thickness, color, presence or absence of suture marks	Original use restrictions (additional use for VSS) Reliability has not been evaluated.	Indicator developed for short-term assessment of repaired burns Focus on the patient's subjective symptoms	
University of North Carolina "4p" Scar Scale (UNC4P)	0 (best) – 12 (best)	Pain, Paresthesias, Pruritus, Pliability			Useful for evaluation of scars accompanied by subjective symptoms

Table 5. Summary of scar assessment scales (2)

	VSS	Modified VSS (Nedelec et al. ⁵)	Seattle scale	MAPS	Hamilton scale	MSS	POSAS	SBSES	UNC4P
Scar description									
Surface area			O				O	O	
Height/thickness/contour	O	O	O	O	O	O	O	O	
Anatomic location				O					
Erythema	O	O					O		
Pigmentation	O	O	O	O	O	O	O	O	
Subjective symptoms/cormorbidities									
Pain		O					O		O
Pruritus		O					O		O
Dysesthesia									O
Functional impairment									O
Overall appearance by patient							O		
Overall appearance by observer							O	O	

VISUAL ANALOG SCALE AND DERMATOLOGY LIFE QUALITY INDEX

Although the VAS and the Dermatology Life Quality Index (DLQI) are not designed for scar assessment, they have been widely used to assess scar severity and other skin disorders. The high prevalence of subjective symptoms, such as pruritus and pain, and the significant impact of scarring on the patient's quality of life make the use of these subjective measures in clinical evaluation important. The VAS is a scale designed to evaluate a patient's subjective pain experience quickly and easily. The patient evaluates the intensity of pain by displaying 100 mm lines on a scale from painless to the worst imaginable pain.¹⁵ Although it is not designed for scar assessment, it is commonly used for scar assessment because patients themselves can assess and attempt to quantify their subjective experience with the scars, which are not included in other scales.

The DLQI was developed in 1994 as the first dermatological assessment of quality of life.¹⁶ It evaluates factors such as pain, itch, embarrassment, social impairment, and functional impairment, through a questionnaire. The DLQI has been used in various dermatological conditions, such as psoriasis, eczema, and vitiligo, as well as scars.¹⁷

The routine use of VAS and DLQI in clinical practice, when compared with the use of other scales of scar assessment, indicates the importance of subjective indicators in supporting the holistic evaluation of a scar. The strengths and weaknesses of the various scale ranges and the parameters used to assess scarring are summarized in Tables 4 and 5.

CONCLUSION

When assessing a scar, it is important to objectively assess the shape and size of the scar, as well as the patient's subjective symptoms (itch and pain). POSAS, a modified VSS, includes patient's subjective symptoms as well as basic scar evaluation. However, the emergence and availability of various new treatments for the management of scars mean that it's not just cosmetic features, but also functional and psychological sequelae of scars that need to be considered. Therefore, a comprehensive evaluation method is required. However, to date, there has been no comprehensive measure of scar assessment that combines both the objective and subjective characteristics of scars. Nguyen et al. recently proposed the inclusion of functional impairment, infection, lymphedema, ulceration, skin cancer, scar type, and age.¹⁸

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CONFLICT OF INTEREST

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Concept and design: KL, BJK, KHY. Analysis and interpretation: JWP, YGK, SHS. Data collection: YJC, WSK, HHY, JOL, YNJ. Writing the article: JWP, YGK. Critical revision of the article: BJK, KHY. Final approval of the article: KHY. Statistical analysis: YJC, JK. Overall responsibility: KHY.

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