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Original Article

Subjective scar assessment scales in orthopaedic surgery and determinants of patient satisfaction: A systematic review of the literature

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ABSTRACT

Purpose: Scar assessment tools can be utilized during the post-operative period to monitor scar progress. The primary aim of this systematic review was to evaluate current subjective scar assessment scales utilized in orthopaedic surgery. The secondary aim was to identify determinants of patients' satisfaction with their scars and evaluate current measurement scales.

Methods: The preferred reporting items for systematic reviews and meta-analyses checklist was followed. Electronic databases, currently registered studies, conference proceedings and the reference lists of included studies were searched. There were no constraints based on language or publication status. A narrative synthesis provided a description and evaluation of scales utilized in orthopaedic surgery. Determinants of patient satisfaction were identified along with the scales used to measure satisfaction.

Results: A total of 6059 records were screened in the initial search. Twenty-six articles satisfied the inclusion criteria, assessing 7130 patients. In the literature, six validated subjective scar scales were identified, including the Vancouver scar scale, patient and observer scar assessment scale, Manchester scar scale, Stony Brook scar evaluation scale, visual analogue scale, and Hollander wound evaluation scale. Studies utilizing these scales to evaluate scars following orthopaedic procedures did so successfully. These were total hip arthroplasty, total knee arthroplasty and limb reconstruction. The scales demonstrated satisfactory validity. Functional outcomes such as restoration of movement ranked among patients' highest concerns. Scar cosmesis was found to be amongst patients' lowest priorities.

Conclusions: Subjective scar assessment scales identified in the literature were not designed specifically for orthopaedic surgery. However, these were able to appropriately assess scars in the studies identified in this review. Current evidence suggests the effect of scar cosmesis on patient satisfaction with orthopaedic procedures is limited.

1. Introduction

A scar is defined as "a macroscopic disturbance of the normal structure and function of the skin architecture, resulting from the end product of a healed wound".[1] Scars are aesthetically unpleasant for patients, causing anxiety, depression, and disruption of daily activities.[2] Objective scar assessment tools can be used to assess scar features such as colour, thickness, relief, pliability, and surface area.[3] Subjective tools provide a qualitative measurement by a patient or clinician.[4] These scales can be used to assess scars at different time points during the post-operative period to monitor their progress.

Previous reviews of objective and subjective scar assessment tools have not been specific to orthopaedic surgery.[3,4] Scars resulting from orthopaedic procedures differ to those in other specialties. Orthopaedic surgery leads to notable tissue trauma, with severe scarring as a result.[5] Scarring on the surface of joints can limit range of motion. Restriction of movement is less applicable in other specialties concerning tissues with low mobility (e.g. abdominal surgery). Additionally, mature scar strength is 80% of intact skin, making it susceptible to dehiscence if loaded prematurely.[6] Scar visibility, which is related to psychological distress, varies according to position. Scars covered by clothing are not

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visible but may lead to more distress than visible ones, since visible scars may allow patients to develop coping strategies.[7]

The primary aim of this systematic review was to evaluate current subjective scar assessment tools utilized in orthopaedic surgery. Objective scar assessment tools were excluded, since these do not evaluate scar cosmesis.[8] Patient satisfaction with scar cosmesis following surgery may determine choice of surgical approach. For instance, laparoscopic surgery is often preferred to open surgery due to patient satisfaction associated with a minimally invasive approach.[9] Knowledge of determinants of patient satisfaction following orthopaedic surgery could therefore influence choice of surgical approach. The secondary aim of this systematic review was to identify determinants of patients' satisfaction with their scars and evaluate the scales used to measure it.

2. Methods

We aimed to evaluate current subjective scar assessment scales used in orthopaedic surgery with a preferred reporting items for systematic reviews and meta-analyses (PRISMA) compliant search.[10] The secondary aim was to identify determinants of patients' satisfaction with their scars and evaluate scales that measure this parameter.

2.1. Study eligibility

All studies utilizing subjective scar scales to evaluate scar cosmesis, measuring patients' satisfaction with their scars, and reporting determinants of patients' satisfaction were included. Papers not reporting original data such as literature or systematic reviews, and articles for which the full text was not available were excluded. Animal studies, studies utilizing objective scar assessment tools only, and those not concerning orthopaedic surgery were also excluded. There were no constraints based on language or publication status.

2.2. Search strategy and data extraction

The following electronic databases were searched via OVID from their inception to 10/04/2022, using a preferred reporting items for systematic reviews and meta-analyses compliant search strategy: Medline, Embase, Global Health, MIDIRS, PsycARTICLES and APA PsycInfo. Unpublished grey literature and currently registered studies were reviewed using the databases ISRCTN registry, the UK National Research Register Archive, the National Institute for Health Research Portfolio, OpenSIGLE (System for Information on Grey Literature in Europe) and the WHO International Clinical Trials Registry Platform. Conference proceedings from the British Trauma Society, British Orthopaedic Foot and Ankle Society, and British Orthopaedic Association were searched. The reference lists of included studies were also searched.

Database search was conducted independently by the first and second authors to obtain a list of eligible studies (by applying prespecified eligibility criteria). Searches were conducted twice for quality assurance. The first search was conducted on 20/09/2021. The search was repeated on 10/04/2022. The following search strategy was implemented: Surg* OR Operat* OR Procedure, AND Tool* OR Scale*, AND Trauma OR Orthopedic* OR Orthopaedic*, AND Cosmesis OR Cosmetic* OR Appearance, AND Scar* Deduplicate.

Data were extracted by the first and second authors. Scales utilized to assess scar cosmesis and patient satisfaction were identified and evaluated. Determinants of patient satisfaction and tools used to measure satisfaction were also identified. The studies' findings when utilizing different scar assessment scales were summarized and presented.

2.3. Methodological appraisal

Level of evidence and risk of bias of included studies were evaluated independently by the first and second authors. The level of evidence of the studies presented was determined with the March 2009 Oxford Centre for Evidence-Based Medicine: Levels of Evidence.[11] The Cochrane Collaboration's risk of bias tool was used to assess risk of bias in randomized controlled trials (RCTs).[12] The Institute of Health Economics case series studies quality appraisal checklist was used to determine the quality of case series.[13]

3. Results

A total of 6059 records were screened in the initial search with 149 potentially eligible articles identified (Fig. 1). One hundred twenty-three articles were excluded on the bases of the prespecified exclusion criteria. A total of 26 studies, assessing 7130 patients, were reviewed. A narrative synthesis was performed given the heterogenous and qualitative nature of the data. The lack of numerical data prevented quantitative pooled analysis. The narrative synthesis involved a brief description of the scale in question, its advantages and disadvantages, and the identification of determinants of patient satisfaction.

3.1. Study quality assessment

The studies included in this review revealed methodological limitations. The findings of the study quality assessment are presented in Table 1.[8,14–33,35–39] Of the 26 studies included, only nine carried a low risk of bias, with the rest exhibiting some cocnerns or a high risk.[14–22] Only seven were RCTs in design[17,19,23–27] Of these, only Livesey et al.,[23] Alvarez-Pinzon et al.[17] and Khan et al.[19] clearly described their randomization process and concealed the allocation. Menkowitz et al.[24] and Kundra et al.[27] did not clarify whether patients or assessors were blinded, whereas Yuenyongviwat et al.[25] could not blind the patients from the closure methods, nor could blind the assessor for the Hollander evaluation score. However, the assessor for the patient satisfaction score was blinded. Accordingly, assessor bias could have impacted on the result of these three studies. Duncan et al.[26] did not describe the randomization process.

All studies with RCT designs reported all outcomes as initially planned. Kundra et al.[27] randomized 100 patients, but only received 70 responses. They attempted to contact non-responders, but no further responses were received. Livesey et al.[23] randomized 90 patients, 12 of whom were lost to follow-up due to cancellation or non-attendance. Of Menkowitz's 41 randomized patients, two were lost of follow-up and one withdrew due to a cardiac arrest not related to the procedure. Alvarez-Pinzon et al.[17] reported three of the 50 patients who were randomized were lost of follow-up. Khan et al.[19] and Yuenyongviwat et al.[25] reported no loss of follow-up. In addition, five of the seven studies with RCT designs had sample sizes based on power calculations.[17,19,23–25] Kundra et al.[27] and Duncan et al.[26] did not perform this exercise.

Of the 19 case series included in this review, only four were conducted prospectively.[8,18,21,28] The rest involved a retrospective review of patient records, or the assessment of photographs of scars. In conclusion, the retrospective nature of the majority of the studies in this review, low level of evidence, and concerns regarding their risk of bias hinder the quality.

Six subjective scar assessment scales were identified in the literature. These were the Vancouver scar scale (VSS), patient and observer scar assessment scale (POSAS), Manchester scar scale

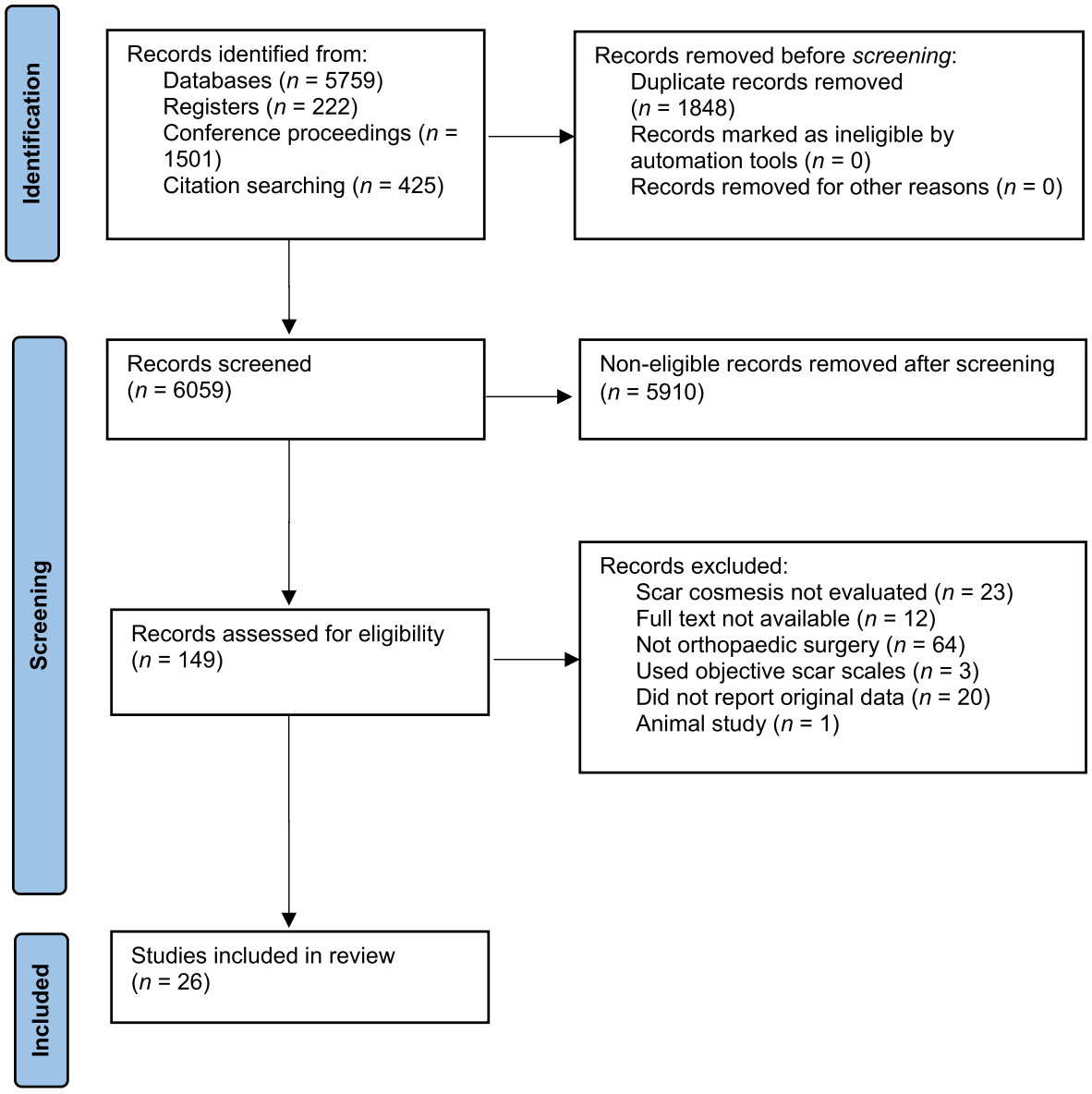

Fig. 1. PRISMA diagram depicting the study collection process.

(MSS), Stony Brook scar evaluation scale (SBSES), visual analogue scale (VAS), and Hollander wound evaluation scale (HWES) (Table 2).

3.2. The VSS

Seventy-three patients with burn scars were assessed by three occupational therapists. Statistical analysis for interrater validity revealed a statistically significant agreement between observers for each parameter. These include skin pigmentation, vascularity, pliability and height (Table 3). The scope of each component is relatively small (e.g., pigmentation is measured in a 0–2 scale). A wide range would allow for a greater subjective description of the scar at the expense of interrater validity.[29] The inter-rater reliability improved with increased familiarity of the scale.

Sullivan et al.[29] recommended a three-to four-month trial before implementing this scale in clinical practice. Livesey et al.[23] used the VSS to evaluate cosmetic appearance of scars following total hip arthroplasty (THA). They found no difference in cosmetic outcomes when closing skin with staples or adhesive. Karlen et al.[30] utilized it to evaluate scars following lower limb reconstruction, and they recruited 25 patients who received femoral or tibial lengthening to reduce limb discrepancy and improve mobility. The mean Vancouver score for the femoral lengthening group was 4.5, and 1.2 for the tibial lengthening group. However, satisfaction with scars was higher in the femoral lengthening group than the tibial lengthening group, despite the former leading to a higher mean score in the VSS. Karlen et al.[30] attributed this discrepancy to clothing being able to cover thigh scars more easily.

3.3. The POSAS

The POSAS was developed by Draaijers et al.[31] in 2004 for the assessment of burn scars (Table 4). Menkowitz et al.[24] used the POSAS to evaluate scar cosmesis following closure of total knee arthroplasty (TKA) incisions with zip or staples. The former consisted of two polyurethane strips attached at either side of the incisions. Closure was achieved with interconnecting nylon straps,

Table 1
Level of evidence and risk of bias of studies included in this review.

Study	Level of evidence	Risk of bias
Singer et al.[8]	4	Some concerns
Lenzi et al.[14]	4	Low
Petis et al.[15]	4	Low
Beausang et al.[16]	4	Low
Alvarez-Pinzon et al.[17]	2b	Low
Hollander et al.[18]	4	Low
Khan et al.[19]	1b	Low
Soldado et al.[20]	4	Low
Tai et al.[21]	4	Low
Bridwell et al.[22]	4	Low
Livesey et al.[23]	1b	Some concerns
Menkowitz et al.[24]	2b	High
Yuenyongviwat et al.[25]	2b	Some concerns
Duncan et al.[26]	2b	Some concerns
Kundra et al.[27]	2b	High
Sundaram et al.[28]	4	High
Sullivan et al.[29]	4	Some concerns
Karlen et al.[30]	4	Some concerns
Draaijers et al.[31]	4	Some concerns
Wilson et al.[32]	4	Some concerns
Ojima et al.[33]	4	Some concerns
Quinn et al.[35]	4	Some concerns
Durani et al.[36]	4	Some concerns
Jia et al.[37]	4	Some concerns
Afolayan et al.[38]	4	Some concerns
Moran et al.[39]	4	Some concerns

enabling adjustable closure tension. At three weeks post-operatively, the POSAS favoured zip for appearance, pain, itching, colour, thickness, stiffness, irregularity, vascularity, relief, pigmentation, pliability, surface area, and overall observer opinion. However, there was no statistically significant difference in overall subject opinion when closing the skin with zip or staples. At six weeks, the POSAS favoured zip only for colour, stiffness, thickness, pigmentation, vascularity, relief, pliability, surface area, and overall observer opinion. The difference between zip and staple closure in terms of appearance, pain, itching and irregularity were no longer statistically significant at six weeks.

Wilson et al.[32] examined perception of surgical scars after direct anterior approach (DAA) or posterior approach (PA) for THA. Seventy-five DAA and 75 PA for THA patients underwent scar assessment using the POSAS. All wounds were closed with subcuticular running closure and secured with skin adhesive glue. Scars were graded closer to normal skin more often for DAA patients than for PA patients on the POSAS patient-reported scale. More irregularities were recorded for DAA scars than PA scars on the POSAS observer scale. Wilson's results are contradicted by Petis et al.,[15] who also compared cosmetic outcomes following a DAA or PA to THA. The scars were graded closer to normal skin more often for PA patients than DAA patients. Age was not predictive of overall scar opinion on this scale.

Table 3
The Vancouver scar scale.[4]

Parameter	Scar characteristic	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
	Banding	4
	Contracture	5
Height	Flat	0
	< 2 mm	1
	2–5 mm	2
	> 5 mm	3

Table 2
A comparison of subjective scar assessment tools.

Scar scale	Scoring system	Parameters assessed	Advantages	Disadvantages
VSS	0 (best) to 13 (worst)	Skin pigmentation, vascularity, pliability and height	Ease of use	Does not indicate the absolute severity of the pathologic condition of a burn scar
POSAS	Observer scale: 5 (best) to 50 (worst) Patient scale: 6 (best) to 60 (worst)	Observer scale: vascularization, pigmentation, thickness, relief and pliability Patient scale: scar pain, pruritus, colour, stiffness, thickness and regularity	Takes patients' perspectives into account, use of a numeric scale with multiple values	Parameters assessed in patient scale may not represent the concerns of every patient
MSS	5 (best) to 28 (worst)	Scar colour, contour, distortion, texture. Matte or shiny appearance, VAS	Takes multiple cosmetic parameters into account	The high weight of the VAS reduces the impact that specific scar parameters have on the overall score
SBSES	0 (worst) to 5 (best)	Width, height, colour, presence of hatch marks or suture marks and overall appearance	Ease of use (composed of 5 unequivocal items), fast completion	Takes “overall appearance” into account, which is less specific than the other parameters assessed in the SBSES
HWES	0 (best) to 6 (worst)	Step-off borders, contour, margin separation, edge inversion, distortion of surrounding tissues and overall scar appearance	Ease of use, fast completion. Provides technical feedback to practitioner on the quality of their wound repair	The presence or absence of distortion of surrounding tissues has poor interobserver reliability and occurs infrequently. Not suitable for long-term assessment of scars.[8]
VAS	0 cm −10 cm	Different parameters are assigned to each end of the scale	Ease of use	Not standardised, difficult to interpret results.[30]

VSS: Vancouver scar scale; POSAS: patient and observer scar assessment scale; MSS: Manchester scar scale; SBSES: Stony Brook scar evaluation scale; VAS: visual analogue scale; HWES: Hollander wound evaluation scale.

Table 4
The patient and observer scar assessment scale.[31]

Observer scar assessment scale	
Parameter	1 (normal skin) to 10 (worst scar imaginable)
Vascularization	1–10
Pigmentation	1–10
Thickness	1–10
Relief	1–10
Pliability	1–10
Total observer score	5–50
Patient scar assessment scale	
Parameter	
Is the scar painful?	1 (no complaints) to 10 (worst imaginable)
Is the scar itching?	1 (no complaints) to 10 (worst imaginable)
Is the colour of the scar different?	1 (as normal skin) to 10 (very different)
Is the scar more stiff?	1 (as normal skin) to 10 (very different)
Is the thickness of the scar different?	1 (as normal skin) to 10 (very different)
Is the scar irregular	1 (as normal skin) to 10 (very different)
Total patient score	6 to 60

3.4. The MSS

As opposed to the VSS and POSAS, the MSS does not break down colour into components such as redness and pigmentation. Instead, it compares scar colour to that of surrounding skin to increase its ease of use (Table 5). Beausang et al.[16] found a high correlation between histologic scar assessment scores and clinical assessment scores obtained with the MSS. Ojima et al.[33] used the MSS to evaluate scars resulting from TKA after having performed longitudinal or transverse incisions. The latter led to lower MSS scores. Mean scar width and sensory disturbance were also smaller in the transverse incision group than the longitudinal group.

Sundaram et al.[28] performed TKA using a medial parapatellar incision and trivector arthrotomy in 91 patients. They also carried out this procedure using a midline incision and medial parapatellar arthrotomy in 76 patients. Resulting scar cosmesis was compared between two groups using the MSS, and the difference was not statistically significant.

3.5. The SBSES

The SBSES was created by Singer et al.[8] of assessing scars following traumatic lacerations (Table 6). Singer also utilized a 100-mm VAS, and marked from worst to best scar to evaluate scars following traumatic lacerations previously assessed by the SBSES.

Table 5
The Manchester scar scale.[22]

Parameter	Scar characteristic	Score
Colour (compared to surrounding skin)	Perfect	1
	Slight mismatch	2
	Obvious mismatch	3
	Gross mismatch	4
Matte or shiny	Matte	1
	Shiny	2
Contour	Flush with surrounding skin	1
	Slightly proud/indented	2
	Hypertrophic	3
	Keloid	4
Distortion	None	1
	Mild	2
	Moderate	3
	Severe	4
Texture	Normal	1
	Just palpable	2
	Firm	3
	Hard	4
Visual analogue scale	0 (excellent) to 10 (poor)	

Resulting scores from each scale were compared. There was a statistically significant correlation between the VAS and SBSES scores. Interobserver agreement was noted when using the SBSES. Singer excluded the presence or absence of distortion of surrounding tissues from the SBSES due to its poor interobserver reliability and infrequent occurrence. Petis et al.[15] used the SBSES to evaluate scars following THA. They compared the outcomes when following a DAA or a PA, and found no difference of scar width, height, colour, presence of hatch marks and overall scar appearance between both approaches ($p > 0.05$). Alvarez-Pinzon et al.[17] evaluated the use of a ring retractor in DAA for THA scars. Forty-seven patients undergoing THA were randomized to surgery with ($n = 23$) or without ($n = 24$) ring retractor. The SBSES and MSS were used to assess cosmesis. No difference in cosmesis scores were noted between both groups at all points during follow-up, except for two weeks post-operatively, when MSS scores were superior in the group receiving a ring retractor.

3.6. The HWES

The HWES was developed by Hollander et al.[18] to evaluate scars due to traumatic wounds (Table 7). Hollander et al.[18] found this scale had substantial interobserver concordance for description, infection and overall cosmetic appearance of traumatic wounds. The HWES considers 'step-off' borders, but wound edges even out over time, and are rarely seen in the long term.[15] Overall satisfactory/unsatisfactory appearance is included despite its moderate interobserver reliability, as it allows the observer to downgrade the scar if one of the other items in the HWES is deficient.[18]

Livesey et al.[23] used the HWES to evaluate cosmetic appearance of scars following THA, and compared cosmetic outcomes following closure of incisions with staples or adhesive. They found all scars scored highly on the HWES. Seventy-one (92%) of all scars were optimal (with a score of 3), but six (8%) were considered sub-optimal with a score of 2. No statistically significant difference was found for the scores between both groups at three months.

Khan et al.[19] performed a RCT comparing skin closure with 2-octylcyanoacrylate, subcuticular suture, or staples following 102 THAs and 85 TKAs. No statistically significant difference in HWES score was found among the three methods of skin closure at six weeks for neither THA nor TKA.

Yuenyongviwat et al.[25] randomized 70 patients undergoing TKA into two groups. Thirty-four patients had the upper half of the wound closed with skin staples, and the lower half with simple interrupted nylon suture. The opposite was performed on the remaining 36. This yielded 70 nylon-stitched wounds and 70 skin

Table 6
The Stony Brook scar evaluation scale.[8]

Parameter	Scar characteristic	Score
Width	>2 mm	0
	≤2 mm	1
Height	Elevated or depressed	0
	Flat	1
Colour	Darker than surrounding skin	0
	Same colour or lighter than surrounding skin	1
Hatch marks or suture marks	Present	0
	Absent	1
Overall appearance	Poor	0
	Good	1

stapled-wounds for analysis. Difference in the HWES score between both closure methods was not statistically significant.

3.7. The VAS

The VAS is typically used in clinical practice to quantify pain.[34] Quinn et al.[35] developed a VAS to assess cosmetic results of healed lacerations. This demonstrated good interobserver and intraobserver agreement. The reliability and validity of the VAS was verified by Duncan et al.[26] As opposed to the previous scales outlined, the VAS is not a standardised scale. The parameters assessed vary between studies.

3.8. Scales measuring patient satisfaction

Few scales measuring patient satisfaction with their scars were identified in the literature. The patient component of the POSAS considers perception of the scar, but does not directly measure satisfaction. Durani et al.[36] constructed a 39-item scale to assess patients' perceptions of their scars. They created the patient scar assessment questionnaire. This consisted of five subscales concerning appearance, symptoms, consciousness, and satisfaction with appearance and symptoms. It was designed by analysing scars following a large variety of procedures, including head and neck naevi excision, scar revision surgery, varicose vein removal and cardiothoracic surgery.

Simple categorical scales have been used by Jia et al.,[37] reporting on outcomes of open reduction in infants with developmental dysplasia of the hip, and evaluated the patients' feelings towards their cosmetic appearance with a 4-item scale (very satisfied, satisfied, unsatisfied, and very unsatisfied). However, it is not clear whether this scale evaluated scar cosmesis specifically or if it considered overall cosmetic appearance.

Soldado et al.[20] employed a 4-point Likert scale to rate parents' level of satisfaction with the cosmetic appearance of their children's scar following surgery for lateral condylar fracture of the elbow (0 = not satisfied, 1 = satisfied, 2 = very satisfied, and 3 = extremely satisfied). All parents claimed to be "very satisfied" with their children's scar.

In addition, Livesey et al.[23] reported that patients used a 5-point Likert scale to rate scar appearance compared to expected appearance following THA (1 = much better than expected, 2 = better than expected, 3 = as expected, 4 = worse than expected, and 5 = much worse than expected). Skin closure with adhesive or staples were compared. There was no statistically significant difference in patient rating of the actual versus expected appearance of the wound. Livesey et al.[23] also utilized a VAS to measure patient satisfaction with scars following THA. Patients completed a 100 mm VAS for satisfaction with their scar (0 = extreme dissatisfaction, 100 = complete satisfaction). There was no statistically significant difference in patient satisfaction between both groups.

Kundra et al.[27] used a linear VAS to assess patient satisfaction (0 = not satisfied, 100 = fully satisfied) in patients undergoing elective hand and wrist surgery. They compared cosmetic outcomes following skin closure using either absorbable or non-absorbable sutures. There was no statistically significant difference between two groups in terms of patient satisfaction.

Yuenyongviwat et al.[25] compared patient satisfaction with cosmetic appearance of wounds following TKA with nylon sutures or skin staples. They utilized a 10-point verbal numeric rating scale (0 = least satisfied, 10 = most satisfied), and found no statistically significant difference in patient satisfaction between both closure methods.

Table 7
The Hollander wound evaluation scale.[26]

Scar attribute	Scar characteristic	Score
Step-off borders	Absent	0
	Present	1
Contour irregularities	Absent	0
	Present	1
Margin separation	Absent	0
	Present	1
Edge inversion	Absent	0
	Present	1
Excessive distortion of surrounding tissue	Absent	0
	Present	1
Overall appearance	Satisfactory	0
	Unsatisfactory	1

3.9. Factors determining patient satisfaction with scars

Tai et al.[21] investigated pre-operative patient expectations for hallux valgus surgery in 153 patients. Improved walking was the most important expectation, followed by reduced pain and ability to wear shoes. Improved appearance (straighter toe) was the 10th most important expectation out of the 19 included in the questionnaire distributed to patients. However, this finding pertains to bunion surgery only, and scar cosmesis was not included in their questionnaire. Afolayan et al.[38] contacted 125 patients who had hallux valgus surgery, with an 84% response rate. Of these, 30% experienced scar sensitivity following surgery. Despite this being a concern, 100% of patients would have the surgery again.

Bridwell et al.[22] recruited 91 sets of patients and their parents, and asked them to complete questionnaires regarding the patients' upcoming scoliosis surgery. The greatest concern expressed by patients and their parents was neurologic deficit. Location and appearance of the scar was the lowest concern (the sixth out of all six concerns in the questionnaire). The main reason for having surgery was to reduce future pain and disability. Eighty-two patients and their parents provided answers regarding their preferred location of the scar. The majority preferred a posteriorly placed scar

(52.44% of parents and 48.78% of patients) over an anteriorly placed scar (31.71% of parents and 36.59% of patients). There were 15.85% of parents and 14.63% of patients had no difference in preference. Incision length, location and ability to conceal with clothes were among the reasons for having a scar preference.

Moran et al.[39] explored the main concerns of 205 patients undergoing THA/TKA. These were graded on a scale of 1 (not concerned) to 4 (very concerned). The greatest concern was cancellation of surgery (mean 2.66), whereas concerns regarding scar problems were amongst the lowest (mean 1.21). Alvarez-Pinzon et al.[17] evaluated the use of a ring retractor in DAA THA scars. They asked patients to rank outcomes according to their importance (1 = most important, 5 = least important). Lack of hip pain was the most important outcome (mean 1.2), whereas scar cosmesis was the least important outcome (mean 3.9).

4. Discussion

Multiple subjective scar assessment scales utilized in orthopaedic surgery were identified in the literature. However, they were not created specifically for orthopaedic surgery, nor utilized in this specialty exclusively. The VSS and POSAS were designed for the assessment of burn scars. The SBSES, HWES and VAS (the latter as developed by Quinn et al.[35] in 1995) were constructed by assessing scars due to traumatic lacerations. Despite this, their validity and reliability have been verified, and they were able to successfully assess scars resulting from orthopaedic procedures, including TKA, THA and limb reconstruction. No other orthopaedic operations were identified in the literature for which the listed scar scales were used. This could be attributed to large scars resulting from these procedures (TKA, THA and limb reconstruction), compared to less invasive interventions such as arthroscopy. Large scars could have psychological effects on patients, warranting an evaluation of cosmesis. However, there are multiple operations which yield large scars, but the listed scar assessment scales were not used, such as total shoulder arthroplasty, ankle arthroplasty, open reduction and internal fixation of fractures, and total elbow arthroplasty. The scar scales evaluated in this review should be utilized in other procedures to further test their reliability.

Patient satisfaction is commonly used to measure the quality of health care. It can affect clinical outcomes, patient retention and medical malpractice claims. Patient satisfaction is also an indicator of treatment success.[40] Despite this, studies identified in this review revealed that cosmetic appearance of scars did not rank highly among patients' concerns with orthopaedic surgery outcomes.[17,21,22,39] The concordance of these studies strengthens this claim. In addition, one study found that scores in the VSS following femoral or tibial lengthening did not correlate with patient satisfaction.[30] Patients receiving femoral lengthening had higher VSS scores than those undergoing tibial lengthening. However, patient satisfaction was higher in the former. This discrepancy was attributed to clothing being able to cover thigh scars more easily.[30] This demostrates the inability of current scar scales to adequately assess patient satisfaction, which may be affected by the position of scar. However, Karlen's study is a case series of a small sample size (25 patients), which hinders the validity of its findings.[30]

The extent of the effect of scar cosmesis on patient satisfaction with orthopaedic procedures could be limited. This specialty mostly involves operating on joints, in which scars that restrict movement are more of a concern than in other procedures. In addition, patients allocate a high importance to restoration of function. This can lead to them assigning a low priority to scar cosmesis, as long as movement impairment is reduced. This is particularly relevant for TKA or THA, which are invasive operations, typically performed in elderly patients. With potentially low aesthetic expectations and high importance of function restoration, outcomes regarding satisfaction would be positive despite a large scar. This balancing act could explain scar cosmesis ranking among the lowest concerns regarding orthopaedic surgery.

Certain considerations regarding scars following orthopaedic procedures do not apply to other specialties, such as movement restriction and variable scar location and visibility. Therefore, scales specific to orthopaedic surgery measuring patient satisfaction with scars are necessary. This study identified a small number of scales that achieve this. The patient component of the POSAS does not measure level of satisfaction. The patient scar assessment questionnaire is limited to linear scars and is not specific to orthopaedic surgery. The use of simple Likert scales and the VAS exemplifies the lack of a standardized approach to assessing patient satisfaction with their scars. Understanding its determinants can aid the creation of scales measuring this parameter.

Kim et al.[41] claim that multiple factors can contribute to undesirable scars, including the patient's ethnicity, surgical technique used, post-operative infections and anatomical location of the incision. For instance, a scar on a patient's face can deeply disturbe their well-being and reduce their social role. Further research is required to validate these claims. This must come in the form of questionnaires answered by a large number of patients. The findings of such research can be utilized to create higher quality scales that measure patient satisfaction with scars following orthopaedic surgery.

The assessment of scars in orthopaedic surgery relies on scales that were not designed specifically for this specialty. However, these were able to appropriately assess scars in the studies identified in this review. The scar assessment scales included in this study must be utilized in other orthopaedic operations to further test their reliability. Current evidence suggests the effect of scar cosmesis on patient satisfaction with orthopaedic procedures is limited. This could be attributed to factors such as restored mobility and functionality carrying a higher weight than scar cosmesis.

Ethical statement

Not applicable.

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Declaration of competing interest

The authors declare that there are no conflictis interest.

Author contributions

Diego A Abelleyra Lastoria: Conceptualization, Methodology, Writing—original draft preparation, Literature search, Data extraction, Risk of bias assessment.

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Caroline B Hing: Conceptualization, Methodology, Writing—review and editing, Supervision.

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