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Review Article

A Comprehensive Review of the Acne Grading Scale in 2023

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ABSTRACT

Acne is a common skin inflammatory condition that can significantly affect the patient's quality of life. Therefore, accurate assessment scales are very important for treatment and management of acne vulgaris. This review article issues a comprehensive review of various acne severity assessment scales. In this text, the authors review the acne grading scales, such as the Pillsbury scale, Cook's acne grading scale, Leeds acne grading system, Global Acne Grading System, and investigator's global assessment, etc. And we delve into the characteristics, advantages, limitations, and applicability of these scales. The acne grading scale to be developed in the future should be objective, accurate, comprehensive, easy to use, and applicable in a variety of clinics and research settings. Current technologies, such as artificial intelligence, could potentially contribute to the development of ideal acne grading scales that meet unmet needs.

Keywords: Acne; Assessment; Grading; Scale; Severity

INTRODUCTION

Acne vulgaris is a polymorphic skin disease with various clinical phenotypes (e.g., papules, pustules, nodules, cysts, scarring, and psychological sequelae)[1]. Adolescence, the period when acne first occurs, is a period of socialization, developmental issues with body image, and sexual maturation, which can affect emotional health, self-esteem, and quality of life. Acne persists beyond the teenage years and is associated with psychosocial disturbances, such as embarrassment, anxiety, and depression[2]. The severity of acne can be difficult to assess because it fluctuates spontaneously, and the distribution of lesions might be inconsistent. This makes it difficult for dermatologists to determine the optimal treatment course. Therefore, the measurement and grading of acne severity are recognized as challenges impeding high quality research[1,3]. In a Cochrane review of the efficacy and safety of minocycline in acne vulgaris, the authors concluded that the efficacy of minocycline was not be reliable because of the poor methodological quality of the clinical trial and inconsistent methods of outcome measuring[3]. In the present paper, we provide a review of the scales and tools for measuring the acne severity that have been reported and used in trials, and discuss the methods to increase the accuracy and convenience of acne severity assessment.

APPROACHES TO THE ASSESSMENT OF ACNE SEVERITY

Acne severity can be assessed using three broad approaches, namely global acne severity grading, acne lesion counting, and

Table 1. Advantages and disadvantages of acne severity assessment tools and their categorization of assessment method

Assessment tools	Advantages	Disadvantages
Global acne severity grading	Simple and quick to use over serial clinic visits	Subjective assessment
	Estimates the full extent of involvement	Multiple variables (including variability between assessors)
	Evaluates the range of aspects pertinent to severity (i.e., number, type and size of lesions, and presence and coverage of inflammation, erythema and seborrhea)	Less sensitive to change
	Allows the clinician to observe the dominant lesions	Too simplistic to provide useful insight
	Pillsbury et al.[7], James and Tisserland[8], Frank[9*], Plewig[10*], Christiansen et al.[11*], Cook et al.[12†], Burke and Cunliffe[13‡], Samuelson[14†], Sung et al.[15‡], U.S. Food and Drug Administration[16], Tan et al.[17], Hayashi et al.[18‡], Spanish Acne Severity Scale[19†]	
Acne lesion counting	Precise, objective and highly discriminative	Time consuming – not practical in the clinic
	Quantifies the types of lesion present	Intrusive for the patient/ subject
	Distinguishes small effects in therapeutic response	Dependent on external variables such as assessor's visual acuity, skin quality, and office lighting
	Allows examination of morphogenesis and evolution of individual lesions	Counting requires specialist knowledge and training to administer
	Can provide continuous data for statistically analysis	Does not capture various clinical aspects of symptoms including concentration, distribution and size of lesions, or skin redness
	Witkowski and Simons[20], Frank[9*], Plewig[10*], Christiansen et al.[11*], Burke and Cunliffe[13‡], Michaelson et al.[21], Lucky et al.[22], Sung et al.[15‡], Hayashi et al.[18‡]	
Multimodal digital imaging	Permanent record of acne severity	Difficulty with standardization
	Allows reliable recoding of change with time	Requires expensive equipment
		Does not adequately detect small, noninflamed lesions
		Two-dimensional images only – no account of palpation or lesion depth
	Lucchina et al.[23], Phillips et al.[24]	

*The acne lesions were counted and graded according to the results; †The severity of acne was evaluated on grading scale anchored to photographic standards or reference photographs; ‡Global Acne Grading System using acne lesion counting and reference photographs.

multimodal digital imaging[1]. Global severity grading is a universal acne assessment method that compares a patient's presentation with text descriptions or photographs. Some commented that the photographic assessment provides an easier to use and more accurate system than previous text-based assessments[4]. Acne lesion counting is typically performed on-site by tallying the number of different lesion types. Multimodal digital imaging is a method for evaluating the lesion types, extent of erythema, and pigmentary changes using photographic equipment. It utilizes purpose-built technology or various devices such as ultraviolet A lamps, fluorescent light, polarizers, and a digital camera. The advantages and disadvantages of this approach for assessing acne severity, as well as the assessment method of the acne grading system that will be discussed, are summarized in **Table 1**[1,5]. Thus, acne lesion counting is used in clinical trials, and global acne severity grading is used in offices and clinical settings because of these characteristics[6].

WHAT AN ACNE GRADING SCALE SHOULD HAVE

The evaluation of the acne severity is very important for determining the efficacy of treatment; however, it continues to be a challenge for dermatologists because there is currently no universally acceptable grading scale. Therefore, these factors negatively impact acne researches. The ideal grading scale for acne should be simple, accurate, reproducible, and less time consuming, and, if possible, capable of documentation for future verification and reflect subjective standards such as psychosocial factors[6]. To establish the core domains of an ideal acne global grading scale (AGGS), the online Delphi process identified the specific criteria and functionalities that should be included. These selected scales are comprised of essential clinical elements and functions[25,26] as outlined in **Table 2**. When assessing English-language AGGSs using these criteria, the current Food and Drug Administration (FDA) scale, as well as earlier scales such as those presented by Allen and Smith[27], Cook et al.[12], Tan, et al.[17], and Dréno et al.[4], can provide a framework for developing ideal scales. The authors also explained that integrating these scales would facilitate the development of a new standard scale.

THE HISTORY OF ACNE GRADING SCALES

Acne vulgaris has existed throughout human history, and the use of a grading scale for acne can be found in the office notes of Carmen Thomas from Philadelphia in the 1930s. The evaluation of acne severity gained momentum in the early 1950s with introduction of tetracycline, resulting in a need for a useful tool to evaluate new agents for acne vulgaris[28,29].

In 1956, Pillsbury et al.[7] first published the acne grading system for the first time in dermatology textbooks, which included

Table 2. Essential components and features for ideal acne global grading scale

	Category	Subcategory
Clinical components	Primary lesions (inflammatory and noninflammatory)	Evaluated separately
	Quantity of lesions	Lesion counting
		Numeric range
	Sites of involvement	Chest
		Back
		Neck
		Shoulders
	Extent of involvement	Proportion descriptors
Features	Clinimetric properties	Validity
		Reproducibility
		Discriminatory capacity
		Responsivity
	Efficiency (ease of use)	For clinicians
		For researchers
		For nursing staff
		Easy to teach
	Categorization of severity	Descriptive text
		Photographic examples
		Both text and photographs
	Acceptance	By researchers
		By clinicians
		By regulators

the type and number of lesions, dominant lesions, and extent of involvement, and was classified into four grades. In 1958, James and Tisserland[8] proposed an alternative acne grading system; however, there were minimal modifications, mainly related to variations in acne grading based on the extent of skin involvement. Witkowski and Simons[20] were the first to count acne lesions after Carmen Thomas. Once it was confirmed that the number of lesions on the left side was equal to that on right side, they counted the lesions on only one side of the face to save time. In 1971, Frank[9] created a numeric grading system based on the type of lesions on the face, chest, and back. He classified them into 0–4 or 0–10, and provided a table to record the results. Plewig[10] introduced numeric grading in their textbooks and they classified acne into comedonal(whiteheads and blackheads) and inflammatory acne (papules and pustules) in 1975. They counted the number of each lesions and assigned grades based on the number of each lesion (e.g. grade 1, <10; grade II, 10–25 or 10–20; grade III, 25–50 or 20–30; grade IV, >50 or >30). Michaelson et al.[21] proposed an acne grading system for acne that counts the number of lesions on the face, chest, and back, and assigns different scores to each lesion type (e.g. comedones [0.5], papules [1.0], pustules [2.0], infiltrates [3.0], and cysts [4.0]). The total score was then calculated by multiplying the number of lesions by the score for each lesion type, and representing the acne severity. This grading system is a simple and easy-to-use but it is not accurate as an acne severity assessment because it combines non-parametric data (score of each lesion type) and parametric data (numbers of lesions).

In 1979, Cook et al.[12] developed a grading system that assessed the overall severity of the acne on a scale of 0–8. According to the literatures, they are thought to be the first to use photographic standards to evaluate acne severity and classify lesions based on the number of lesions, the degree of distribution, and whether they can be easily recognized. They also set up a 9-point scale for comedones, papules, and macules to improve sensitivity, and used a front surface mirror to capture both sides of the face in a single shot. The advantages of photographic standards for assessing the severity of acne include objectivity, time efficiency, intra- and inter-grader consistency and documentation; however, they have some limitations that make it difficult to determine depth, detect small lesions and erythema, and maintain consistent settings (e.g. lighting)[30].

Burke and Cunliffe[13] presented the Leeds technique, which ranges from 0 (no acne whatsoever) to 10 (the most severe acne) on the face, back and chest. The face included the chin and neck anterior to the sternocleidomastoid muscles, and the chest in men was from the waist upwards, whereas in women only the skin between the breasts and above the bra was included. However, the Leeds technique divides grades 0 to 2 into seven levels, and grade 1.5 to 10 into 0.5-point divisions, resulting in a total of 26 grading scales. The Leeds technique's uses of black and white photographs and its complex grading system can makes it difficult to accurately assess the severity of acne. Subsequently, the Leeds technique was revised in 1998 to improve its accuracy, reliability, and applicability in clinical trials. The revised technique not only had a simple 12-step facial acne grading system, but also included photographic standards for back and chest acne, with color photos. In addition, the revised technique includes a separate scoring system for patients with predominantly non-inflamed lesions[31].

In 1996, Lucky et al.[22] developed a method to evaluate the reliability of acne lesion counting by dividing the face into five segments, excluding the nose. This method involves identifying the type of acne lesion (open comedones, closed comedones, papules, pustules, and nodules), and measuring the total number of the lesions. This study showed that the trained raters had a higher overall reliability, and that the use of a facial template could increase reliability because the number of lesions was less variable. The Global Acne Grading System (GAGS) was first developed in 1997[32]. The GAGS divides the face (forehead, each cheek, nose, and chin), chest, and back into six areas, and the severity in each zone is then assessed on a scale of 0 to 4 (0, no lesions; 1, comedones; 2, papules; 3, pustules; and 4, nodules). The total score for all six zones is then calculated, and the acne severity is classified as either mild (1–18), moderate (19–30), severe (31–38), or very severe (>39). It is a simple, accurate, reproducible, and less variable between and within raters and does not require the

lesion counting. However, the GAGS has some limitations. It might underestimate the severity of acne in patients with many lesions confined to one or two locations and it could be difficult to use in patients with severe acne. In 1999, six French dermatologists introduced ECLA, an acne grading system that can be easily used in the clinical practice and takes approximately about 2 minutes. ECLA showed excellent reliability in terms of intra- and interobserver variability. However, pre-training is recommended before applying ECLA in clinical studies[33]. **Table 3** summarizes the grading scales that have been introduced thus far apart from the acne grading scales.

In 2004, the Korean Acne Grading System (KAGS) was developed by a group of dermatologists at five major university hospitals in South Korea. The KAGS classifies acne into six grades based on both standard photographs and ranges of lesion counts (e.g. papules and nodules)[15]. The KAGS reflects the characteristics of acne in Koreans and uses both standard photographs and the ranges of lesion counts to minimize the subjective judgement of the rater. It is a simple and easy-to-use system that can be easily applied in the clinical settings.

The Investigator Global Assessment (IGA) scale is a measure of acne severity that has been used in clinical trials and controlled experimental studies since it was approval by the US FDA in 2005 (**Table 4**). The IGA scale is scored by a dermatologist or other healthcare professional who observes and evaluates the skin of a patient. It is one of the most widely used scales for assessing the severity of acne, and it is a reliable and easy-to-apply scale[16,36]. However, the term "severe" can be interpreted differently by practicing dermatologists. Therefore, a more refined system that classifies acne severity into moderately severe, severe, and very severe, tailored to additional potential first-line treatment options is required. In addition, nodules can have different treatment selections depending on their size (e.g. approximately 1 cm); therefore, it may be necessary to consider this factor.

Tan et al.[17] developed the comprehensive acne severity scales (CASS), 6-point scale, by modifying a preexisting facial acne scale, the IGA, to include truncal acne. Spearman correlation was significant between Leeds and CASS grades for the face (0.823), chest (0.854), and back (0.872), respectively (p<0.001), and the CASS is believed to be a reliable measure of acne treatment response.

In 2008, Hayashi et al.[18] conducted a study to develop a new scale to assess acne severity. Their purpose was to compare the global severity classifications by consulting a dermatologist with the photograph-based classifications provided by three expert dermatologists. Researchers found a high degree of agreement between the two groups of dermatologists. They also found that papules and pustules had the highest multiple regression coefficient values, followed by nodules and cysts; therefore, they decided to limit the grading system to papules and pustules because they believed that this would provide a more accurate and reliable assessment of acne severity. In the Hayashi criteria, lesion count was used to classify severity, and the number of inflammatory lesions located on the half of the face was evaluated as mild (0–5), moderate (6–20), severe (21–50), or very severe (>50). Counting the number of inflammatory eruptions may be useful for analyzing precise changes, and their criteria allow the counting to be converted into a global estimation. However, comedones, which are not included here, need to be evaluated by number or other criteria.

The Global Evaluation Acne (GEA) scale was reported in 2011 as a scale used to create and validate a reproducible acne assessment scale suitable for use in France and Europe[4]. A study conducted on adult patients with acne showed good agreement between clinical photographs and patient-based assessments

Table 3. Other acne grading system

Scale	Features of the grading method
Christiansen et al.[11] (1976)	Lesion counting done in a test area and grade with a 6-point scale 4 to −1
Allen and Smith[27] (1982)	0–8 Grades for overall facial severity and comedones (both with text descriptions)
Gibson et al.[34] (1984)	0–8 Grades with text descriptions; separate 0–8 grades for non-inflammatory acne
Samuelson[14] (1985)	0–9 Grades of facial acne severity with text descriptions and photographs
Pochi et al.[35] (1991)	Inflammatory acne grade (mild, moderate, severe, and very severe) depending on global evaluation of lesions and their complications
Lucchina et al.[23] (1994)	Assessment of comedonal acne based on 4-point scale using fluorescent photography
Phillips et al.[24] (1997)	Enhanced visualization of inflammatory acne using polarized light photography

Table 4. Investigator Global Assessment Scale (IGA) by US FDA

Grade	Clinical description
0	Clear skin with no inflammatory or noninflammatory lesions
1	Almost clear; rare noninflammatory lesions with more than one small inflammatory lesion
2	Mild severity; greater than grade 1; some noninflammatory lesions with no more than a few inflammatory lesions (papules/pustules only, no nodular lesions)
3	Moderate severity; greater than grade 2; up to many noninflammatory lesions and may have some inflammatory lesions, but no more than one small nodular lesion
4	Severe; greater than grade 3; up to many noninflammatory and inflammatory lesions, but no more than a few nodular lesions

IGA: Investigator Global Assessment, FDA: Food and Drug Administration.

Nodules*	Papules/pustules†	Comedones‡									
Many	Covered	----	Less severe		Less severe	Severe			Very severe				Very severe
Many	None	----	Moderate to less severe		Moderate to less severe	Less severe			Severe				Very severe
Some	----	----											
Few	Many	----	Moderate		Moderate	Moderate to less severe			Less severe				Severe
1	Some	----	Mild to moderate		Mild to moderate	Moderate			Moderate to less severe				Less severe
None	Few	----	Mild+§		Mild+§	Mild to moderate			Moderate				Moderate to less severe
None	None	Many; Covered	Mild+§		Mild+§	Mild+§			Mild to moderate				Moderate
None	None	Few; Some	Almost clear		Mild	Mild			Mild to moderate				Moderate
None	None	None	Clear		Almost clear	Mild			Mild to moderate				Moderate
Inflammation			None	----	None	Mild/ Moderate	None	Mild/ Moderate	Severe	Severe	Mild/ Moderate		Severe
Scars			----	None	None	None	Mild /Moderate; Severe	Mild/ Moderate	None	Mild /Moderate	Severe		Severe
Postinflammatory hyperpigmentation			None	None	Yes	Yes	Yes	----	Yes	----	----		----

Fig. 1. Proposed 9-point multidimensional acne global grading system.
Primary lesions and secondary changes can be encoded into a score by first counting lesions (nodules, papules/pustules, and comedones), choosing the highest corresponding row, and then selecting the degree of secondary changes (and choosing the correct combination). The dashed lines indicate any possible entry (i.e, the final severity is independent of that specific feature/variable).
Scars and inflammation should be categorized as none, mild/moderate, or severe. And post-inflammatory refers to any post-inflammatory color change (eg. focal color changes and/or diffuse erythema not associated with primary acne lesion activity, hyperpigmentation, redness, dryness, or color change due to treatment) and should be marked Yes.
*For nodule, few; 2 to 3, some; 4 to 6, and many; more than 6; †For papules/pustules, few; 1 to 3, some; 4 to 8, and many; more than 8; ‡For comedones, few; 1 to 3, some; 4 to 12, many; more than 12; §Mild +, differentiation of severe comedonal acne.

(reliability >0.8), leading to the conclusion that the GEA scale is a validated scale that can be used in clinical research and outpatient settings. It can also be valuable for acne management and treatment decisions.

The Spanish Acne Severity Scale (EGAE), validated in 2013, is a visual photonumeric scale that uses the extent of inflammation, type of lesions, number and size of lesions, and associated erythema to assess the severity of acne[19]. When comparing acne on the face, chest, and back to the Leeds Revised Acne Grading System (LRAGS), the EAGE scale showed high correlation. 95.6% (confidence interval [CI], 92.9%–97.5%) of dermatologists who used the EGAE scale found it easy-to-use, and the time required was found to be less 3 minutes in 75% of cases. The EGAE scale has demonstrated feasibility, high interobserver reliability, concurrent validity, and sensitivity for detecting treatment effects, making it a valuable tool for clinical trials.

In recent years, a new acne grading system has been developed that considers both primary lesions (e.g., comedones, papules, pustules, and nodules) and secondary changes (e.g., inflammation, scarring, and postinflammatory hyperpigmentation)[37]. Six pediatric dermatologists analyzed the images of 150 patients with acne to develop a novel 2-dimensional grading system that assessed the severity of acne based on visual image features, and the system was validated by six clinicians using the new set of 40 images. The proposed grading system is presented in **Fig. 1** and the system is more comprehensive than the IGA scale because it considers both primary lesions and secondary changes. This makes it a more useful tool for clinical care and clinical trials.

GRADING SCALE FOR TRUNCAL ACNE

Acne is a common skin condition that can affects the face, chest, and back. Facial acne is the most common type of acne, but

truncal acne can also be severe and has a significant impact on quality of life. Several different tools that can be used to assess the severity of facial acne; however, there is a lack of data on the truncal acne severity. An expert group (GEA) published a review of truncal acne data, and reported six tools[38]. The first tool was proposed by Pillsbury et al.[7] in 1956, and the Leeds technique, which was revised in 1998, scored truncal acne using 8 grades[31]. In 1999, the GEA group proposed the ECLA scale, which assessed the severity of both truncal and facial acne[34]. Tan et al.[17,39] proposed a comprehensive severity scale for truncal acne in 2007 and the Physician Global Assessment score in 2019. In addition, Del Rosso et al.[40] used a numeric range of lesions according to each primary lesion type to explain the severity of truncal acne. The approval of trifarotene for the treatment of moderate truncal acne by the FDA in 2019 sparked a renewed interest in truncal and its management[41].

In 2022, the Truncal Acne Severity Scale (TRASS) was introduced as a new method for assessing the severity of truncal acne[42]. The TRASS is based on three subscores: severity based on disease and family history, acne severity, and impact on the patient's quality of life. By combining these three subscores, the TRASS seems to provide a comprehensive evaluation that integrates clinical severity and a patient-centered approach. This is a valid and reliable tool for dermatologists and other healthcare providers to treat truncal acne. The TRASS is expected to help tailor treatment strategies to the individual patient's needs and monitor the patient's progress over time.

DISCUSSION

Acne is a common skin disease that affects 9.4% of the world's population, and its burden is steadily increasing in almost all countries. We must clearly understand the burden of acne for more effective interventions to manage and accurately grade acne to confirm the efficacy of these interventions[43]. Therefore, it is important to understand the acne grading scales that have been reported to date to address these issues and closer to the development of a reliable gold standard tool. We reviewed the various acne grading scales described in the main text, and a comprehensive summary of representative acne grading scales can be found in **Table 5**.

A systematic review of 24 acne grading scales published to date found that the GEA, LRAGS, and EGAE scored relatively high on the quality criteria of assessment tools, including psychometric properties (validity, inter- and intra-rater reliability, and sensitivity to change) and suitability for research and evaluation[1]. When analyzing the trend of the acne grading assessment method from 2000 to 2019, it was found that the use of grading methods increased over time compared to lesion counting[44]. Among the grading methods, the IGA was the most widely used, and the LRAGS showed a decreasing trend in use after 2010. This is likely because IGA has been widely recommended as an evaluation indicator in clinical trials by the US FDA since 2005, and is actually the most commonly used indicator in North America[36,44]. In terms of study design, the application of lesion counting significantly increased in controlled experimental studies. Lesion counting is more commonly used in studies with fewer than 100 patients, possibly because it is time consuming and required training to implement it[44].

Training in assessing acne severity is as important as the scale used to assess acne severity[36,45]. A study conducted in Canada found that dermatologists had high reliability in the assessment of acne lesion counts, even without training, with an intraclass correlation coefficient (ICC) of 0.75 or higher[46]. However, the ICC for the global assessment increased from 0.61 to 0.77 after training, suggesting that the reliability of the global assessment maybe surprisingly low. The training process improved the reliability of non-inflammatory lesion counts and increased the proportion of evaluators with good reliability in all outcome measurements.

Acne grading scales are diverse and heterogenous, and have been applied differently depending on the era, region, design of trials, and technology. These factors demonstrate that the current methods for assessing acne severity have limitations and suggest the importance of developing a core outcome measure[44]. The current acne grading systems are subjective, and the clinicians may assign different grades based on their experience and visual acuity, lighting conditions in the examination room, and the patient's skin type. In addition, they tend to assess only inflammatory lesions, and do not evaluate post-inflammatory hyperpigmentation and scarring to measure severity. They also don't include the grading system related to patient quality of life, self-esteem, and mental health, which are important in many skin conditions.

The acne scales to be developed for future research and clinical use should be the tools that can be used by both experts and non-experts interested in this research field. Such acne scales for research purposes should prioritize the assessment tools that are suitable for community-based and clinical trial settings, taking these factors in the future[1]. In addition, computational assessments based on deep convolutional neural networks will have advantages over traditional methods. A study applying convolution neural network to acne severity in South Korea reported an accuracy of 86.7% when analyzed into three categories (mild, moderate and severe) based on KAGS, suggesting that it can be used to evaluate acne severity[47]. Recently, AcneGrader based on deep learning was proposed, and this model, which constitutes new features of the training data after learning multiple-based models and pruning redundant models, reported an accuracy of 85.82%, which is higher than existing studies, when classifying

Table 5. Comprehensive summary of acne grading systems

Acne grading system	Characteristics	Included in assessment	Evaluated body area
Pillsbury et al.[7] (1956)	First published acne grading system 4 grades with text descriptions	Dominant lesions and their extent, type, and number	Face and upper aspects of trunk
Witkowski and Simons[20] (1966)	First acne grading system to count the number of lesions	Count the lesions on only one side of the face	Face
Plewig[10] (1975)	Numeric grading scales (comedonal/inflammatory)	Count the number of each lesions and set the grade according to the number	Face
Cook et al.[12] (1979)	First acne grading system to use photographic standards Use a front surface mirror for photographs	Overall acne scale of 0-8 Add 9-point scale for comedones, papules, and macules	Face
Burke and Cunliffe[13] (1984)	Leeds technique Complex grading system Use the photographic standards (black and white photos)	Overall grading assessment of acne severity (categorize facial acne into 26 steps) Add counting system	Face and neck (anterior to the SCM muscles) Chest (waist upwards in men and between the breasts and above the bra in women)
O'Brien et al.[31] (1998)	Leeds revised acne grading system Add the photographic standards for back and chest acne with color photos Validated in 2010	Categorize facial acne (12 steps), chest (8 steps), and back acne (8 steps) Categorize non-inflamed acne (3 steps)	Face, chest and back
Lucky et al.[22] (1996)	Use the facial template (face is divided into five segment)	Count the number of each lesion type within each facial template segment	Face (excluding the nose)
Doshi et al.[32] (1997)	Global Acne Grading System (GAGS) Set factors for each location based on surface area, distribution, and density of pilosebaceous units	Multiply the score of lesion type by a factor to get a score and assess severity scale based on the score	Face, chest, and upper back
Sung et al.[15] (2004)	Korean Acne Grading System (KAGS) Use both standard photographs and lesion counts to minimize the subjective intervention of the evaluators	Classify acne into six grades based on standard photographs and lesion counts	Face
U.S. Food and Drug Administration[16] (2005)	One of the most commonly used acne severity scales Reliable and easy-to-apply scale	Approximate number of non-inflammatory lesions and inflammatory lesions such as papules, pustules, and nodules	Face
Hayashi et al.[18] (2008)	Use the photographic standards Assess severity by counting only inflammatory acne lesions (including papules and pustules, but not nodules)	Count the number of inflammatory acne located on half of the face and categorize them into 4 grading scales	Face
Puig et al.[19] (2013)	Photonumeric scale Easy-to-use and spent less time for assessing severity	Extent of inflammation, type of lesions, number and size of lesions, and associated erythema	Face, chest, and back
Bernardis et al.[37] (2020)	9-point multidimensional scale Evaluate erythema, scar, and pigmentation in addition to acne lesions	Primary changes (e.g. comedones, papules, pustules, and nodules) Secondary changes (e.g. inflammation, scarring, and postinflammatory hyperpigmentation)	Face, chest, and back
Auffret et al.[42] (2022)	TRASS (truncal acne severity scales) Based on 3 sub-scores	Disease and family history Clinical marker of acne severity (area, numbers of nodules, scars, and facial acne) Quality of life	Trunk

SCM: sternocleidomastoid.

acne into four class (mild, moderate, severe, and very severe). This model reduces the computational complexity by removing redundant models, and also reports better performance than the state-of-the-art methods[48]. In the future, artificial intelligence (AI)-based acne grading systems are likely to be particularly useful in the future for acne severity assessment, because they can objectively count the number of acne lesions, are less likely to produce inconsistent results and are time-consuming[44,49] While it is true that many studies are still needed to improve the accuracy of acne object detection, recent studies have analyzed smartphone images and evaluate acne severity using AI, and it is thought that the accuracy of acne grading be improved by considering factors other than images such as age and gender[50].

CONCLUSION

As the burden of acne is increasing worldwide, it is important to select and develop appropriate acne treatment options. Acne can have a significant impact on the quality of life; therefore,

so it must be managed properly early to minimize scarring and postinflammatory hyperpigmentation. The acne grading scale is a tool for assessing the severity of acne. However, the methods reported to date have several limitations. New acne assessment methods are needed to supplement these components and evaluate various aspects of acne severity. In addition, training healthcare providers in acne severity assessment is important, and the use of acne grading scales by well-trained raters will improve the consistency of results. Finally, we expect that continuous researches on AI-based acne grading scales currently under development will lead to an accurate, easy-to-use, and time-saving method for assessing acne severity.

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