The Taylor Hyperpigmentation Scale: A New Visual Assessment Tool for the Evaluation of Skin Color and Pigmentation

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The Taylor Hyperpigmentation Scale is a new visual scale developed to provide an inexpensive and convenient method to assess skin color and monitor the improvement of hyperpigmentation following therapy. The tool consists of 15 uniquely colored plastic cards spanning the full range of skin hues and is applicable to individuals with Fitzpatrick skin types I to VI. Each card contains 10 bands of increasingly darker gradations of skin hue that represent progressive levels of hyperpigmentation. This article describes the ongoing development of the Taylor Hyperpigmentation Scale and reports the results of a recent validation study of the use of this newly developed chart in individuals with skin of color. In the study, skin color and an area of hyperpigmentation in 30 subjects of white, African American, Asian, or Hispanic ancestry (approximately 5 from each of the 6 skin types) were evaluated by 10 investigators. The results of the study revealed significant variation among intraindividual and interindividual ratings by investigators of skin hue (P<.0001) and hyperpigmentation (P=.0008); however, most investigators rated the scale as useful and easy to use, and 60% stated they would use it in clinical practice to document the response of hyperpigmentation to therapeutic agents. A heuristic evaluation of the results of this study provided insight into essential considerations for the continued effort to develop a useful and simple scale for assessing skin color and pigmentation.

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Obtaining objective evaluations of color and skin pigmentation is imperative for physicians diagnosing and treating patients with hyperpigmentary disorders.[1-3] An effective, properly used tool for assessing hyperpigmentation can improve a physician's ability to evaluate patients; such a tool can facilitate the diagnosis of the condition and help monitor changes in the condition due to the progression of the disorder or the effectiveness of therapy. The tool also could help educate patients, promote treatment adherence, coordinate patient and physician assessments, and allow patients to visualize their improvement. However, the measurement of skin color presents a challenge due to the numerous factors that influence the perception of skin color.[4]

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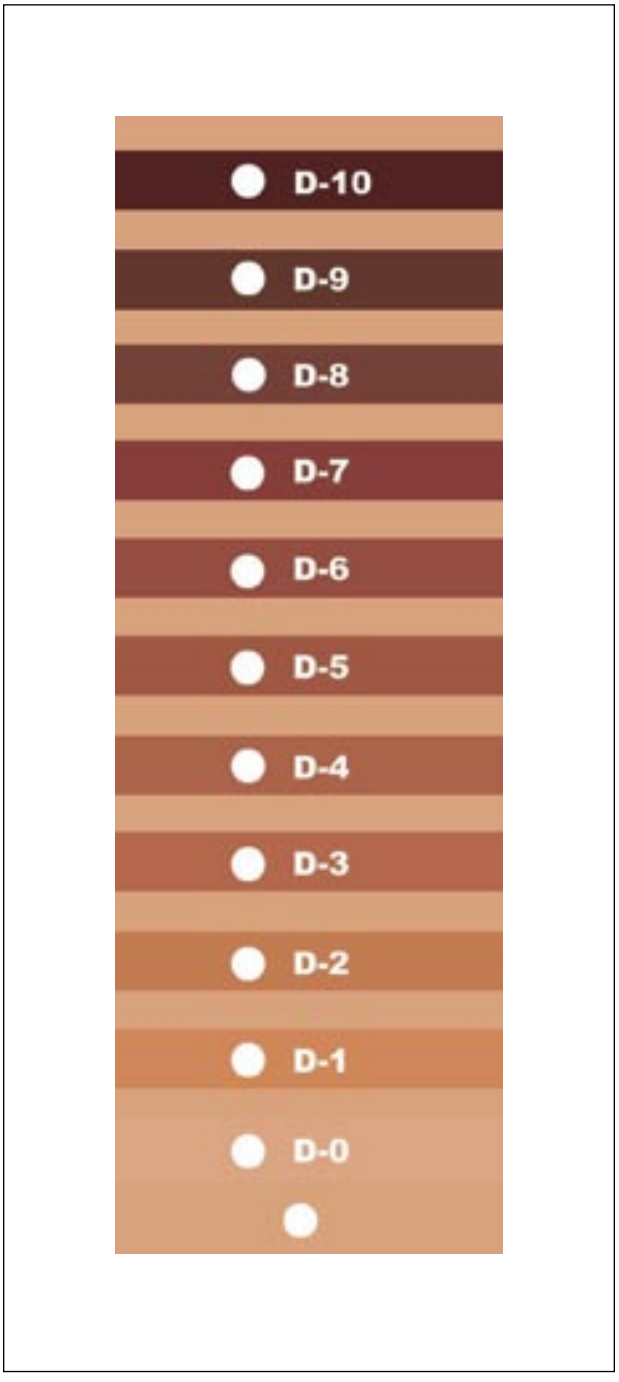
Several noninvasive tools for the assessment of hyperpigmentation exist. Commercially available instruments include scanning reflectance spectrophotometers,[3-5] tristimulus reflectance colorimeters,[6-15] and narrowband reflectance spectrophotometers.[6-7,15-19] These tools have demonstrated the ability to produce reliable and reproducible results; however, routine use of these instruments in most clinical and in some research settings may be limited due to their costly and time-consuming nature. Technical deficiencies associated with these instruments include difficulties in assessing the pattern or distribution of an affected area and accurately evaluating areas of hyperpigmentation that are smaller than the opening of the instrument probe head.[3,20]



One of the 15 skin hue cards in the Taylor Hyperpigmentation Scale.

Even if the physician global assessment is a subjective evaluation and has inherent problems with interindividual variability, visual assessment, such as the physician global assessment, remains a common method for evaluating skin pigmentation because of its ease and feasibility. Therefore, a need exists for a simple and reliable tool for the evaluation of hyperpigmentation.

The Taylor Hyperpigmentation Scale is a new visual scale for the evaluation of all skin types. This tool has been developed to provide an inexpensive and convenient method to assess hyperpigmentation and measure improvement in hyperpigmentation following therapy. The tool enables an evaluation to be completed in minutes and can be used by clinicians in an office, clinical, or research setting. Unlike the Pantone® Color System, a standard reference for selecting and matching paint colors, the range of choices in the scale focuses on common skin hues and levels of hyperpigmentation.

The objective of this study was 2-fold: (1) to validate the use of this newly developed chart in a clinical setting and in subjects representing each of the 6 skin types; and (2) to evaluate the ease and the likelihood of use of the scale. Using the Taylor Hyperpigmentation Scale, 10 investigators evaluated an area of hyperpigmentation in 30 subjects (approximately 5 from each skin type).

Methods

Study Design–Men and women at least 18 years of age who had at least one active area of hyperpigmentation were enrolled in the study. To be included in the study, the area of hyperpigmentation was required to be visible on the face, neck, trunk, arms, or legs, and not be located on the genitals, breasts, or buttocks. Approximately 5 subjects from each of the 6 Fitzpatrick skin types were accepted for enrollment.

Subjects meeting the inclusion and exclusion criteria were screened by 2 investigators to determine their skin phototype. Ten investigators at the Skin of Color Center at St. Luke's-Roosevelt Hospital Center observed the same area of cutaneous hyperpigmentation for 30 enrolled subjects and then independently selected the single rating

Demographic Parameters

Characteristics	N=30
Gender, n (%)	
Male	2 (6.7)
Female	28 (93.3)
Age, y	
Mean±SD	37.5±11.9
Range	24–70
Fitzpatrick skin type, n (%)	
I	4 (13.3)
II	5 (16.7)
III	4 (13.3)
IV	6 (20.0)
V	5 (16.7)
VI	6 (20.0)

on the Taylor Hyperpigmentation Scale that best matched the observed hyperpigmentation using the following procedure: First, each investigator matched each subject's skin color to 1 of the 15 laminated skin hue cards in the scale. Once the investigators identified the appropriate skin hue, the hyperpigmentation value (scaled 1–10) that best matched the subject's affected area of hyperpigmentation was selected from 1 of the 10 color gradations on the corresponding skin hue card.

Each investigator reevaluated the area of hyperpigmentation, with a brief time interval between assessments. Viewing conditions were consistent for all evaluations. No photographs of the subjects were taken. There was minimal risk of adverse events due to the observational nature of the study.

Hyperpigmentation Scale–The Taylor Hyperpigmentation Scale consists of a set of 15 laminated plastic cards, each representing a unique skin hue (ranging from A0–J). These 15 skin hue choices span the full range of skin types (I–VI). Each card contains 10 bands of increasingly darker gradations of the skin hue (Figure). To facilitate the assessment, the scale was designed with a circular aperture in each hyperpigmentation band through which the skin can be viewed and thus compared with the scale. Although the scale is suitable for all skin types, the range of skin hue and pigmentation choices makes the tool particularly useful for individuals with skin of color, including those of African American, Asian, and Hispanic ancestry.

The procedure for evaluating a subject using this new scale is straightforward. First, the investigator matches the subject's skin color to 1 of the 15 laminated skin hue cards in the scale. Once the appropriate skin hue is identified, the hyperpigmentation value (scaled 1–10) that best matches the affected area of hyperpigmentation is selected from the 10 gradations on the corresponding skin hue card. The values for skin hue and hyperpigmentation (eg, D9) are then recorded and may be monitored to evaluate the progression of the pigmentation or the effectiveness of therapy.

Statistics—Variability between the 2 investigator ratings for each subject (intraindividual variability) was assessed using an analysis of variance (ANOVA) carried out on all individual ratings of skin hue and hyperpigmentation. A second ANOVA was performed on the mean values of the 2 investigator ratings to assess the heterogeneity among the investigators (interindividual variability). All analyses were performed on both the numerical transformation of the skin hues (ranging from A0=1 to J=15) and the hyperpigmentation ratings (scaled 1–10). The statistical models were exploratory. Significant threshold was declared at a 5% 2-sided level (95% CI), and missing data were not imputed. Residuals from both analyses were examined for the identification of any correlations and/or outlier observations. In addition, investigators were asked to complete a 5-question feedback form to assess the usefulness and design of the Taylor Hyperpigmentation Scale.

Results

Study Population—Thirty subjects from each of the 6 skin types were enrolled (Table). All patients were of either white, African American, Asian, or Hispanic ancestry. All subjects completed the entire evaluation.

Intraindividual Investigator Ratings—ANOVA was performed on all ratings for skin hue and hyperpigmentation to gain insight into the intraindividual variability between the 2 investigator ratings for each subject. This analysis demonstrated significant variability between intraindividual ratings for both skin hue and hyperpigmentation ($P<.0001$ for both). The variability of investigator intraindividual hyperpigmentation

ratings was more common at very light (A2–B) and very dark (H1–J) skin hues.

Interindividual Investigator Ratings—ANOVA also was further performed on the mean values of the 2 investigator ratings of skin hue and hyperpigmentation. The goal of this analysis was to evaluate the heterogeneity of the Taylor Hyperpigmentation Scale ratings among the investigators. There was significant variability among investigators for ratings of both skin hue ($P<.0001$) and hyperpigmentation ($P=.0008$). Investigator differences were more marked when evaluating skin hues (Fisher value, 15.2) relative to hyperpigmentation (Fisher value, 3.3). The variability among all investigator hyperpigmentation ratings was higher for darker skin hues (H–J). The reasons given by investigators for inconsistencies in ratings included an inadequate allocation of time and insufficient concentration for the assessment of skin hue and hyperpigmentation values.

Questionnaire—After the study, each of the 10 investigators completed a 5-question evaluation assessing the overall usefulness and design of the Taylor Hyperpigmentation Scale. On a scale of 1 to 10 (1=poor, 10=excellent), the mean grade for usefulness and ease of use of the scale as judged by the investigators was 6.33 and 6.60, respectively. Although only one investigator (10%) used an objective measure of hyperpigmentation in clinical practice, 6 investigators (60%) stated they would use the scale in clinical practice to document the response of hyperpigmentation to therapeutic agents. Five investigators (50%) thought the size of the aperture in the scale should remain the same, and 5 investigators (50%) thought a larger hole would be useful. Regarding the number of available skin hues and hyperpigmentation choices from which to select, 7 investigators (70%) thought additional skin hues would be helpful; 5 (55.6%) out of 9 investigators thought that the number of choices to evaluate dyspigmentation was adequate.

Comment

In community practice, as well as in clinical trials, the ability to accurately and reproducibly evaluate the color of normal and hyperpigmented skin is critical to the diagnosis and subsequent monitoring of an affected area.[1-3,20] The Taylor Hyperpigmentation Scale was developed to address the need for an easy-to-use, quick, and reliable alternative to assessing hyperpigmentation. The aim of this study was to validate this new visual assessment tool in individuals with skin of color.

The results of the study revealed significant intraindividual and interindividual variations among investigator ratings for skin hue ($P<.0001$) and hyperpigmentation ($P=.0008$). There was more heterogeneity in the investigator ratings of skin hue relative to hyperpigmentation, which reflects the large natural variability of skin hues that may not be adequately captured in the current set of 15 laminated cards. When the investigators were asked their opinion on the number of choices of skin hues, 70% (7/10) thought there were too few choices. Conversely, a criticism of the scale may be that there are too many choices for skin hue and therefore a large variability in ratings is inevitable. Clearly, a balance must be met between the accuracy of the assessment and the practical limitations that prevent representation of every possible skin hue in such a tool.

Despite the variability noted in this study, the Taylor Hyperpigmentation Scale still may be a reliable and straightforward method to assess hyperpigmentation for investigators and clinicians who become comfortable with the tool. Although the tool requires additional modifications to improve reproducibility, it was considered useful and easy to use by investigators. The instrument required minimal training to use and provided assessments of both skin hue and level of hyperpigmentation. One may speculate that the scale can be beneficial if the same clinician used the scale on a given patient from one visit to the next.

Comments from participating investigators and the results of a heuristic evaluation of this study have provided insight into several essential considerations for making a proper evaluation with the Taylor Hyperpigmentation Scale. First, although only a few minutes are needed to make an assessment, it is important to allocate adequate time for careful selection of the skin hue and hyperpigmentation values because the same observer can make different selections at different times. Second, when assessing the lightest and darkest skin hues, additional care must be taken because intraindividual and interindividual variability was higher for patients with these skin hues. Lastly, as with any visual assessment of skin color, adequate control for the type and intensity of ambient light is essential.

In summary, a new visual scale for use in physicians' offices or research settings has been developed to provide an inexpensive and convenient method to quantify hyperpigmentation. The range of skin hue and pigmentation choices in the Taylor Hyperpigmentation Scale makes the tool particularly useful in evaluating individuals

with skin of color, but it is suitable for all common skin types. Despite the variability in ratings observed in this validation study, most investigators considered the scale useful and easy to use. Six (60%) investigators stated they would use the scale in clinical practice to document the response of hyperpigmentation to therapeutic agents. The assessment of pigmentation continues to be an important challenge for clinicians in dermatology; therefore, efforts to develop a useful scale for this assessment should continue.

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