



Skin typing: Fitzpatrick grading and others

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Abstract Skin phototyping refers to a skin classification scheme based on how the skin responds to sun exposure. The Fitzpatrick classification is the most widely accepted method of skin phototyping, based on a person's tendency to sunburn and ability to tan. Apart from estimating the initial therapeutic dose of UV light, skin phototyping is also useful in predicting the risk of photodamage and skin cancer and the outcome of esthetic procedures. Techniques to type the skin objectively have been developed to address the deficiencies associated with the subjective Fitzpatrick classification. Some skin typing systems have been proposed specifically to predict the response of skin to cosmetic procedures such as chemical peeling and laser resurfacing. We discuss the concept of skin type and its relation to skin color, as well as critically appraising the various available methods of skin typing.

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Introduction

There has been an increasing interest in classifying the skin based on its response to an inciting event, be it UV light, cosmetic procedure, or skin injury. Skin typing has several practical considerations in the field of photodermatology and procedural dermatology. Skin phototyping specifically refers to the classification of skin according to its UV sensitivity. Until the 1960s, a simple clinical assessment of skin color was used to determine the skin phototype, which was later demonstrated to be fallacious. In 1975 Fitzpatrick proposed a classification system based on an individual's ethnicity and susceptibility to sunburn and tan in non-Hispanic white population for calculating the initial dose of phototherapy.^{1,2} Since then, several modifications of the Fitzpatrick classification, as well as new ways of skin typing, have emerged, which can be used depending on the intended purpose.³ This review

discusses the idea of skin typing, its relation with skin color and ethnicity, and different methods of skin typing.

Skin color and skin phototypes

Skin color can be constitutive or facultative. Constitutive skin color refers to the genetically determined levels, types, and distribution of epidermal melanin, which is not influenced by exogenous or endogenous factors. Facultative skin color refers to an increased epidermal melanin content as a result of environmental (such as sunlight) or hormonal factors.⁴ Skin phototype and skin color may appear similar at the outset but are fundamentally different. Skin color, be it black, brown, or white (Figure 1), is determined by several pigments such as melanin, hemoglobin (oxy or deoxy), bilirubin, and carotenoids; however, only melanin offers protection from UV light. Other factors also participate in skin photoprotection.⁵ It is understandable that skin phototypes do not always exhibit a linear correlation with skin color, especially in dark-skinned individuals.^{6,7}

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Fig. 1 Skin color diversity (Residents and research scholars, Department of Dermatology and Venereology, All India Institute of Medical Sciences, New Delhi, India).

Skin sun sensitivity is not a function of skin color alone

The content and type of epidermal melanin is one of the prime determinants of skin color. Melanin can be broadly classified into two types: darker eumelanin and lighter pheomelanin. Eumelanin exerts a better photoprotective effect than pheomelanin. Eumelanin, characteristic of darkly pigmented individuals, is a good filter against UV light and is a free radical scavenger as well.^{8,9} Pheomelanin is predominantly present in fair-skinned people, is a less effective UV filter and acts as an endogenous photosensitizer by generating superoxide anions.^{9–11} Apart from melanin itself, there are certain colorless intermediate products in the melanogenesis pathway that have a protective effect. For example, 5,6-dihydroxyindole, an intermediate in the melanin synthesis pathway, has an inhibitory effect on lipid peroxidation and protects keratinocytes against UV-induced apoptosis.¹² In addition to melanin, other biochemical factors that do not influence the skin color, such as cutaneous antioxidant enzymes, DNA repair systems and mechanisms responsible for extracellular matrix homeostasis, and control of inflammatory effects, also participate in skin photoprotection.⁵

Skin phototyping

Fitzpatrick classification system

Thomas B. Fitzpatrick (1919–2004), long-time professor of dermatology at Harvard Medical School, first classified skin types I to III based on his outdoor sunscreen study in Australia in 1972. The skin sun reactivity of the fair Australian population was categorized as the following:

- I: those who sunburn easily and do not tan at all
- II: those who sunburn easily and tan with difficulty
- III: those who sunburn moderately, have immediate pigment darkening, and tan moderately with 60 minutes of midday sun exposure^{13,14}

Later in 1975, the need for skin typing developed due to difficulty in choosing the optimal initial dose of UVA for the then newly developed photochemotherapy for psoriasis in patients with white skin.² Genetic predisposition, response of skin to sunlight, and tanning habits were taken into account while determining the skin phototype (Table 1)¹³; however, even patients with a dark skin phenotype (brown or black hair with brown eyes) would develop severe phototoxic reaction with UVA 4 to 6 J/cm². Phenotypic traits such as hair and eye color could not be relied on to decide a white-skinned individual's response to UV light, and a classification system based on a brief personal interview regarding the patient's history of sunburn and tanning was developed. A working classification was devised based on the patient's response to the first unprotected sun exposure for about 45 to 60 minutes at noon in an early Boston summer: "How painful is your sunburn (i.e., intensity of erythema, edema, and discomfort) after 24 hours?" and "How much tan will you develop in a week?" Four groups (skin phototypes I–IV) among white-skinned participants were identified based on response to these two questions, and their phenotypic characteristics were broadly characterized.¹ Later, phototypes V (brown skin) and VI (black skin) were added, based on the skin color rather than the sun reactivity, to give shape to the Fitzpatrick skin phototyping classification as we know it today (Table 2).^{1,15,16}

Criticisms of Fitzpatrick skin phototyping

Although easy to use and so widely accepted that it has come to be synonymous with skin typing, Fitzpatrick skin phototyping classification has certain limitations. The main criticisms pertain to its subjective nature and a lack of consistent correlation with a minimal erythema dose, the primary purpose for which it was developed.

Over the years, the personal interview of the patients by health care professionals has been replaced by two questions with self-reporting of burning and tanning. Several variables can influence the Fitzpatrick skin phototyping results depending on who assesses the response (patient or physician), method of assessing the response (personal interview or self-reported), and variation in question wording. Because the Fitzpatrick questionnaire has been adapted for use in different settings, phrasing of the questions has varied widely.

Phrasing the question differently can modify its perception and elicit different responses for the same question by the same person.¹⁷ A study of dermatologist-determined skin phototype was more accurate than patient self-reported phototype in a population with skin of color.¹⁸ A substantial proportion (40%–60%) of participants are unable to choose a phototype based on the limited response options available.^{18,19} Many times, the

Table 1 Fitzpatrick questionnaire for skin phototyping based on genetic predisposition, reaction to sun exposure, and tanning habits

Score	0	1	2	3	4
Genetic predisposition					
What is the color of your eyes?	Light blue, gray, or green	Blue, gray, or green	Blue	Dark brown	Brownish black
What is the natural color of your hair?	Sandy red	Blonde	Chestnut/dark blonde	Dark brown	Black
What is the color of your skin in the nonexposed areas?	Reddish	Very pale	Pale with beige tint	Light brown	Dark brown
Do you have freckles in the nonexposed areas?	Many	Several	Few	Incidental	None
Reaction to sun exposure					
What happens when you stay in the sun too long?	Painful redness, blistering, peeling	Blistering followed by peeling	Burns sometimes followed by peeling	Rare burns	Never had burns
To what degree do you turn brown?	Hardly or not at all	Light color tan	Reasonable tan	Tan very easily	Turn dark brown quickly
Do you turn brown within several hours after sun exposure?	Never	Seldom	Sometimes	Often	Always
How does your face react to the sun?	Very sensitive	Sensitive	Normal	Very resistant	Never had a problem
Tanning habits					
When did you last expose the body to sun (or artificial sunlamp/tanning cream)?	More than 3 months ago	2-3 months ago	1-2 months ago	Less than month ago	Less than 2 weeks ago
Did you expose the area to be treated to the sun?	Never	Hardly ever	Sometimes	Often	Always

Scores and corresponding skin phototypes: 0-7: I, 8-16: II, 17-25: III, 26-30: IV, >30: V or VI.

respondents end up selecting a phototype fitting with only one of the two responses: either sunburn or tan.^{19,20} Respondents find it easier if the questionnaire has separate answers for sunburn and tan instead of a single combined answer. Such a questionnaire has also been found to correlate better with spectrophotometric analysis.²¹ Doubts have additionally been raised on whether the respondents consider single or multiple sun exposures while answering these questions and if the Fitzpatrick skin typing classification correlates with constitutive or facultative skin color.²²

Calculation of minimal erythema dose (MED) is regarded as the criterion standard to estimate the skin's UV sensitivity;

however, it is a time-consuming procedure, and the solar simulator required to determine MED is not available everywhere. The Fitzpatrick method of skin phototyping was introduced as a convenient method to circumvent the need to calculate the MED before initiating phototherapy. Interestingly, several studies suggest that the Fitzpatrick skin typing scheme is not a good substitute for MED estimation. No significant correlation of the MED with the self-reported sunburn and tan responses was found in 197 subjects in one study. The authors noted a better correlation of tanning ability with skin complexion characteristics than sunburn tendency.¹⁹ Other authors have also found a variable correlation with MED^{19,20,22,23}; however, Fitzpatrick argued that the personal history may be more reliable than self-reporting when determining the skin types.¹

Because the Fitzpatrick classification was primarily developed based on the responses in the fair-skinned white population, its validity for other ethnic populations is debatable. Individuals with ethnic skin are often classified into one Fitzpatrick phototype (usually V or VI) based on the skin color, instead of their response to sunlight. Skin of color is not completely inert to UV light, and questions relating to sunburn and tan should be included for phototypes V and VI as well.¹⁸ Asian brown skin may react differently to sunlight than to the Fitzpatrick skin types,²⁴⁻²⁷ prompting development of different skin type classification schemes for

Table 2 Fitzpatrick classification of skin phototypes based on self-reported tendency to sunburn and tan

Fitzpatrick skin phototype	Skin reaction
I	Always burn, never tan
II	Usually burn, tan less than average (with difficulty)
III	Sometimes mild burn, tan about average
IV	Rarely burn, tan more than average (with ease)
V	Brown skin
VI	Black skin

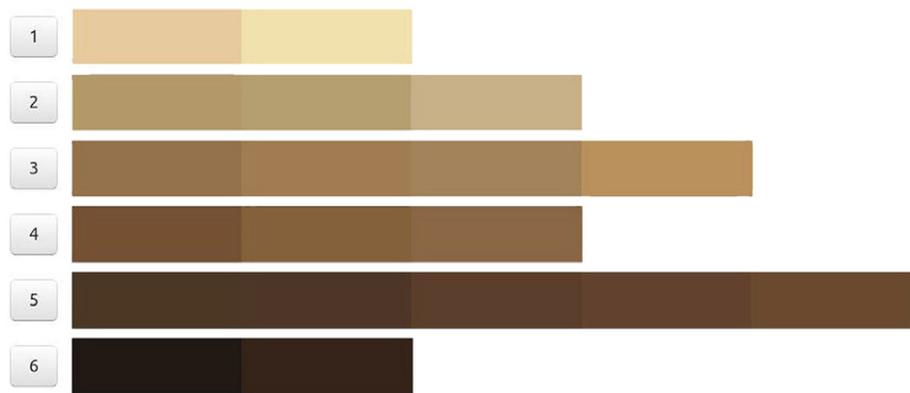


Fig. 2 Color bar survey item. The participant selected the color bar that most closely matched the skin tone on the inside part of their upper arm (With permission from Ho BK, Robinson JK. Color bar tool for skin type self-identification: a cross-sectional study. *J Am Acad Dermatol.* 2015;73:312-313).

different ethnicities. There is a separate skin typing system for the Japanese skin, which was found to correlate well with MED.²⁸ Another skin typing system relevant to people of African descent has been developed which classifies skin color, reactivity to sunlight, and association of pigmentary disorders.²⁹

We have modified the Fitzpatrick skin typing classification to make it more relevant for the Indian population. Response options for three questions on genetic disposition (eye color, hair color, and color of the unexposed skin) in the Fitzpatrick questionnaire were selected for modification. Some response options were thought to be not relevant to the majority of the Indian population, whereas others did not capture the differences in various shades of a color. A change was noted in 16% responses in the modified questionnaire compared with its original form, implying that the participants identified themselves better with the modified response options. The two questions related to tanning habits were removed as all the participants scored 0 for these questions.³⁰

Objective skin phototyping techniques

In light of criticisms of the Fitzpatrick classification, especially its subjective nature, attempts have been made to classify skin types objectively. Pigment protection factor and skin color measurement are some such methods.

Pigment protection factor

Pigment protection factor (PPF) has been proposed as an objective measurement of skin phototype. PPF is measured by diffuse remittance spectroscopy with a dedicated instrument, Optimize Scientific 555 (Chromo-Light, Espergaerde, Denmark), and takes only a few seconds. It is calculated as the UV dose in terms of standard erythema dose (100 J/m^2 at 298 nm) to provoke just perceptible erythema after a single exposure, that is, how many standard erythema doses are required to reach 1 MED.

The question on the tendency to sunburn in the Fitzpatrick classification relates to MED. The minimal melanogenesis dose refers to the minimal UV dose required to produce just perceptible pigmentation after 7 days, which can be equated to the question on “ability to tan.”²² Another group compared PPF and the Fitzpatrick skin typing system, using the MED and minimal melanogenesis dose (on back and buttock) as the references. PPF was found to correlate better with MED as well as minimal melanogenesis dose on back and buttocks. Between the two sites, correlation of Fitzpatrick classification was better with buttocks (constitutive skin color) than back (facultative skin color), whereas PPF correlated to a similar extent with both sites. Further analysis revealed that only MED is predictive of Fitzpatrick skin types compared with PPF, which correlated with both MED and minimal melanogenesis dose. The authors concluded that PPF is a better and more reliable measure of sun sensitivity (both sunburn and tan), and unlike the Fitzpatrick system, it can be used in people with dark skin as well.³¹

Skin color measurement

Skin ethnicity and phenotypic traits such as skin, eye, and hair color have been shown to influence Fitzpatrick skin phototype in white persons^{32–34} but not in other ethnicities with darker skin.^{25,35–38} Techniques such as spectrophotometry³⁹ or colorimetric analysis^{6,38,40} have been used to evaluate the skin phototypes. A group has demonstrated that the constitutive skin color measurement from an easily accessible site such as the upper volar arm using a reflectance spectrophotometer differentiated between each of the six Fitzpatrick’s skin types and had a good agreement with the clinician-assessed skin phototypes.³⁹ The narrowband reflectance spectrophotometer provides results in terms of melanin index and erythema index. Of these, only melanin index has been shown to correlate, to some extent, with Fitzpatrick phototypes^{30,41,42}; however, the use of such instruments is largely limited to research settings owing to their high cost and cumbersome use.

There is a simple and economic color bar tool, where the person is asked to choose the color that most closely matches the skin tone on the upper inside of their upper arm (Figure 2). This color bar was found to have a linear correlation with melanin index in an ethnically diverse group.⁴³ Similarly, visual color scales (cartoon faces, color cards) have been used to determine skin phototypes in Danish schoolchildren (aged 6-19 years). The visual color scales were found to be superior to question-based (skin color, response to sun exposure) skin phototype self-assessment, using spectrophotometric analysis as the reference.⁴⁴

Other skin typing systems

Although the Fitzpatrick classification of skin phototyping has been shown to correlate with the risk of skin cancers,⁴⁵⁻⁴⁸ it does not quantitate the risk of skin cancer; further, it has been suggested that the Fitzpatrick skin classification has limited utility in predicting the risk of postinflammatory hyperpigmentation after cosmetic procedures.³ A few skin typing systems have been proposed specifically to meet these unmet needs and are discussed below.

Skin cancer phototypes

A group has modified the Fitzpatrick questionnaire to estimate the risk of photo-induced skin cancers: response to the two questions was kept separate and skin types V and VI were excluded, as these are not based on response to sun exposure. The skin cancer phototypes were categorized into 4 classes based on the responses to the questions on ability to tan and tendency to burn and were found to correlate well with objectively measured pigment protection factor. The skin cancer risk showed a linear correlation with skin cancer phototypes, with odds ratio of 5.35, 4.58, 2.59, and 1 for phototypes I, II, III, and IV, respectively.⁴⁹

Skin classification for cosmetic procedures

Cosmetic procedures, such as chemical peeling and lasers, can be complicated by postinflammatory pigmentary alterations, scarring, and keloid formation. There are skin classification scales that attempt to predict the risk of such complications. Combining the racial and genetic backgrounds of the patients to their skin complexion, may give a better idea of a patient's risk of postoperative complications and outcome.

Lancer ethnicity scale. Lancer ethnicity scale includes racial or ancestral (parents and grandparents) background in addition to Fitzpatrick skin phototypes to determine the best approach for patients planned for laser resurfacing procedures.⁵⁰

Fanous skin classification. Fanous skin classification takes into account the ancestral origin of the patient, in addition to the skin color, to predict the suitability, risk, and expected postprocedure result.⁵¹

Goldman world classification scale. This classification scale also considers the ancestry and Fitzpatrick phototype

and additionally asks the patients about their tendency to develop postinflammatory hyperpigmentation.⁵²

Taylor hyperpigmentation scale. The Taylor hyperpigmentation scale is a visual hyperpigmentation scale consisting of 15 color plastic cards spanning the full range of skin hues. Each card has 10 bands of progressively darker gradations of skin hues representing progressively increasing severities of hyperpigmentation. Despite significant intra- and interrater variability in results, it has been proposed as a simple method of monitoring improvement in hyperpigmentation after treatment.⁵³

Roberts skin type classification system. The Roberts skin type classification is a 4-part system for predicting the skin's response to injury after esthetic procedures. It can be used for people with diverse skin color. It takes into account four elements:

- Fitzpatrick skin phototype (I-VI)
- Glogau photoaging scale (GI-GIV)⁵⁴
- Roberts hyperpigmentation scale (H0-HVI)
- Roberts scarring scale (S0-SV).

To determine the Roberts skin type, the clinician reviews the ancestral and clinical history, pigmentation and scarring background, skin examination, and, if required, assessment of the

Table 3 Roberts skin type classification system

Fitzpatrick skin phototypes (FZ)

Type I white skin, always burns, never tans

Type II white skin, always burns, minimal tan

Type III white skin, burns minimally, tans moderately and gradually

Type IV light brown skin, burns minimally, tans well

Type V brown skin, rarely burns, tans deeply

Type VI dark brown/black skin, never burns, tans deeply

Roberts hyperpigmentation scale (H)

Type H0 hypopigmentation

Type HI minimal and transient (1 y) hyperpigmentation

Type HII minimal and permanent (>1 y) hyperpigmentation

Type HIII moderate and transient (1 y) hyperpigmentation

Type HIV moderate and permanent (>1 y) hyperpigmentation

Type HV severe and transient (1 y) hyperpigmentation

Type HVI severe and permanent (>1 y) hyperpigmentation

Glogau scale (G)

Type GI no wrinkles, early photoaging

Type GII wrinkles in motion, early to moderate photoaging

Type GIII wrinkles at rest, advanced photoaging

Type GIV only wrinkles, severe photoaging

Roberts scarring scale (S)

Type S0 atrophy

Type SI none

Type SII macule

Type SIII plaque within scar boundaries

Type SIV keloid

Type SV keloidal nodule

Expressed as FZ*n*, H*n*, G*n*, S*n*, where *n* denotes the score for each scale.

test site reactions to place the patient's features into the 4 scales (Table 3). Roberts skin type classification can be used to determine the most optimum treatment plan and counsel the patients regarding postprocedure complications.^{3,55}

Conclusions

There is much more to classifying skin than just looking at its color. Genetic background and ethnicity play an important role, and there may be several other less understood factors that influence the response of skin to various stimuli. Several methods of skin typing have been proposed; however, none of them is perfect or all-inclusive.

The Fitzpatrick skin phototyping system is perhaps the most widely used method of skin typing, based on a person's self-reported tendency to sunburn and tan. Objective methods of skin typing, such as pigment protection factor or skin color measurement, have been developed that better reflect the skin's sun sensitivity and should be used if available. Skin classification scales to predict the outcome of cosmetic procedures, such as laser resurfacing and chemical peeling, have also been proposed in recent years. Dermatologists should choose the appropriate skin typing method depending on the patient's ethnicity and intended use. With increasing racial diversity the world over, skin typing tools will assume greater importance in the future.

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