Enhancing the Care and Treatment of Skin of Color, Part 1: The Broad Scope of Pigmentary Disorders

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Scientific research and technologies related to skin pigmentation and dyschromias, which are often key skin concerns for patients of color, have led to recent developments in skin care and treatment. Differences and similarities between skin of color and white skin and current issues in the treatment of ethnic skin are reviewed. Recent research findings, such as the elucidation of the protease-activated receptor 2 (PAR-2) pathway and its role in pigmentation, and areas for further investigation, such as the pathogenesis of pseudofolliculitis barbae (PFB), also are discussed. Awareness of this information within the wider community of dermatologists, primary healthcare providers, and the media will help to accomplish the objective of stimulating new prospective research.

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New Horizons in Dermatology

People of color in the United States represent a wide range of ethnic groups, including African Americans, Asians, Hispanics, Native Americans, and Pacific Islanders. The US Census Bureau reports that by 2050, approximately 50% of the US population will be composed of citizens with skin of color.[1] Skin of color is commonly defined as Fitzpatrick skin phototypes IV to VI.[2] It should be noted that the Fitzpatrick scale describes the response of different skin types to UV light rather than the actual color of the skin.

Despite the size and continuing growth of the skin of color population, most research related to the structure, function, and treatment of skin has been conducted in white subjects. Early data suggest that despite many similarities, there are differences between skin of color and white skin, as well as different susceptibilities to skin conditions. Although data from some of these seminal studies are conflicting or are based on small populations, they form an essential foundation for continuing research.[3-7]

New technologies, such as diffuse reflectance spectroscopy (DRS), have permitted a greater understanding of the contribution of different pigments to skin color.[8] Recent research, such as the elucidation of the protease-activated receptor 2 (PAR-2) pathway and its role in the regulation of pigmentation, has augmented our understanding of the interaction of the keratinocyte-melanocyte unit. This understanding may have an impact on the treatment of pigmentation disorders common in skin of color.[9] Advanced research and emerging technologies undoubtedly will provide increasing opportunities to deliver enhanced skin care, therapies, and products to this growing segment of the US population.

Ethnic Differences in Melanin Physiology

The most visible difference between skin of color and white skin is the epidermal melanin content.

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Melanosomes in the skin of individuals of African descent are large and singly dispersed in keratinocytes, whereas in white and Asian skin, the melanosomes are aggregated within a surrounding membrane.[3,4] The epidermal melanin unit of skin of color contains more melanin and may undergo slower degradation compared with other groups.[5] Although increased melanin offers significant photoprotection for deeply pigmented skin compared with white skin, the potential for an exaggerated response by melanocytes to cutaneous trauma or inflammation can lead to a higher incidence of pigmentary disorders in skin of color.[5,6]

Skin pigmentation in response to UV irradiation traditionally has been attributed to melanin; however, advances in biomedical optics have permitted a more detailed understanding of the contribution of other chromophores.[8] Objective quantitative evaluation of skin color reactions traditionally has used reflectance spectroscopy, either tristimulus reflectance colorimeters (Photovolt ColorWalk or the Minolta chromameter) or narrowband reflectance spectrophotometers (DermaSpectrophotometer, the Erythema meter, or the Mexameter®). However, it is reported that with both methods, what is clinically perceived as erythema and pigmentation does not correlate linearly with the calculated indices.[10] DRS is a technology that uses reflected visible light to determine concentrations of melanin, oxyhemoglobin, and deoxyhemoglobin, which are contributors to skin color. Using DRS, it is possible to distinguish between the vascular and the melanin components that contribute to erythema and pigmentation. It recently has been suggested that blood stasis, specifically the pooling of deoxyhemoglobin, can be confused with melanin pigmentation.[8] Hence, skin darkening does not depend only on the concentration of melanin but is affected strongly by the concentration of deoxyhemoglobin in the superficial venous plexus. Future studies using DRS will be needed to separate the visual contributions of vascular and pigmentary reactions in inflammatory conditions, especially in more deeply pigmented skin where erythema may be more difficult to visualize at the macro level in contrast with melanin pigmentation.

The Significance of Pigmentary Disorders

Pigmented skin frequently responds to trauma or inflammation by becoming hyperpigmented or hypopigmented. Such pigmentary abnormalities can be distressing to individuals of color. In a

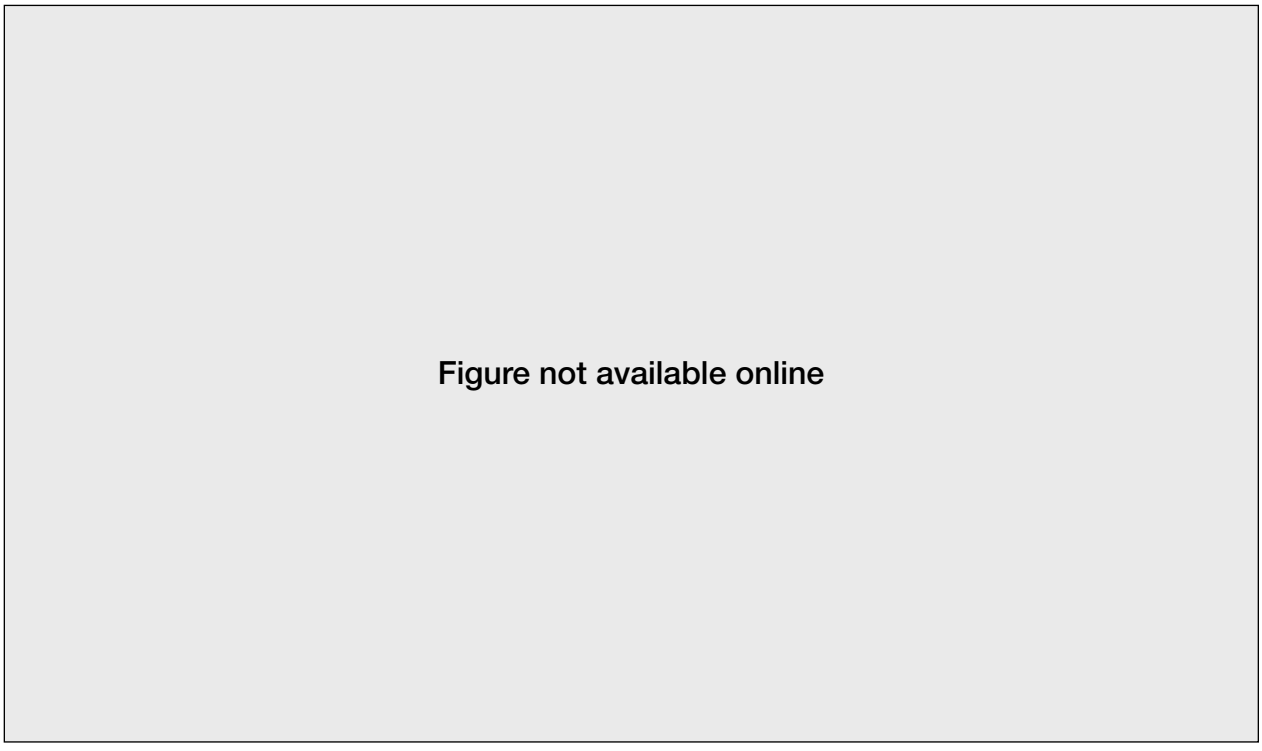

Figure 1. The protease-activated receptor 2 (PAR-2) pathway. STI indicates soybean trypsin inhibitor; SLIGRL, serine-leucine-isoleucine-glycine-arginine-leucine. Reprinted with permission from Seiberg M. Keratinocyte–melanocyte interactions during melanosome transfer. *Pigment Cell Res.* 2001;14:236-242. ©2001, Blackwell Publishing.[12]

cosmetic usage and needs survey of 100 women of color, 86% of respondents stated that hyperpigmentation or dark spots were a major concern.[11] This concern is further supported by a study of 2000 blacks by Halder et al,[7] who found that 37% of patients were concerned about pigmentation.

A Potential New Therapy for Pigmentary Disorders

Potential new therapies for pigmentary disorders are being studied. One novel mechanism for maintaining normal skin tone and possibly preventing dyschromias may reside in the elucidation of the PAR-2 pathway (Figure 1). PAR-2 is a receptor expressed on keratinocytes but not on melanocytes and thus may regulate pigmentation via keratinocyte-melanocyte interactions. PAR-2 activation is involved in cell growth, differentiation, and inflammatory processes.[13] Two soy proteins, soybean trypsin inhibitor and Bowman-Birk inhibitor, have been shown to regulate the PAR-2 pathway and partially inhibit pigmentation.[13] In vitro studies have demonstrated that treatment with these soy proteins can reduce UV-induced pigment deposition by reducing keratinocyte phagocytosis of melanin from melanocytes.[14]

Pierard and colleagues[15] studied the effect of stabilized whole soy extracts in white women with a variety of hyperpigmentation disorders. A greater than 25% improvement in hyperpigmentation was noted and was most evident in solar lentigines and melasma. Additional studies involving individuals with skin of color will be needed.

Postinflammatory Hyperpigmentation and Acne

Postinflammatory hyperpigmentation (PIH) is most prevalent in Fitzpatrick skin types IV to VI.[16] PIH appears as a hyperpigmented macule or patch at the site of previous inflammation. Causes of PIH include cutaneous diseases such as acne, melasma, lichen planus, contact irritant dermatitis, allergic dermatitis, and atopic dermatitis. Exogenous causes of PIH include sunlight, surgery, cosmetic procedures, and other types of mechanical trauma to the skin. PIH in black skin is generally attributed to the labile responses of melanocytes to cutaneous stimulation.[17] A variety of mediators, including arachidonic acid metabolites, may play a role in the etiology of PIH.[18] There are several diseases in which there are known differences between skin of color and white skin, including acne vulgaris. Although there are likely to be no fundamental differences among skin types with regard to the pathogenesis or the effectiveness and treatment of acne, there are important differences in clinical presentation, histologic appearance, and sequelae.[19] Physicians should be aware of these differences because they impact acne treatment protocols.

In contrast with comedonal acne in white skin, which is defined as noninflammatory, comedone biopsy specimens from black subjects showed significant inflammation with infiltrates of polymorphonuclear leukocytes. Papular and pustular lesions displayed inflammatory infiltrates that extended beyond the actual acne lesion.[20] Inflammation in these comedonal lesions, as well as the marked inflammation present in inflammatory lesions, may explain the propensity for individuals of color to develop PIH as a sequela of acne.[21] The Skin of Color Center in New York City conducted a survey of 313 patients of color with acne vulgaris. More than 50% of respondents had PIH that lasted an average of 4 months, which often was longer than the actual acne lesions lasted; the PIH was noted to be psychologically and cosmetically disturbing to the patients.[21] PIH is frequently the presenting complaint of individuals of color with acne, many of whom request a lightening agent to treat the dark marks (Figure 2). These patients find that the dark marks are more distressing than the acne lesions. It is important to be aware of the impact of PIH on patients of color and to treat both the acne lesions and the PIH.

The recommendations of the Global Alliance to Improve Outcomes in Acne noted that acne treatment should target as many pathogenic factors as possible.[22] Hence, the mainstays of acne treatment include topical and systemic retinoids, topical and systemic antibiotics, and topical comedolytic agents. Various over-the-counter products may serve as adjunctive therapy.

Of importance in the treatment of acne in skin of color is the treatment and possible prevention of PIH. Although an early and aggressive approach to acne treatment is required to prevent later hyperpigmentation and scarring in skin of color, the treatment must be balanced with the understanding that many agents can be drying and/or irritating.[19] Vigorous cleansing and overzealous use of topical medications may lead to a potential worsening of PIH. Also, patients may choose cleansers that are too drying or scrubs that are too harsh. Hence, irritant contact dermatitis in this setting is common and can result in further PIH. Topical therapies and skin care

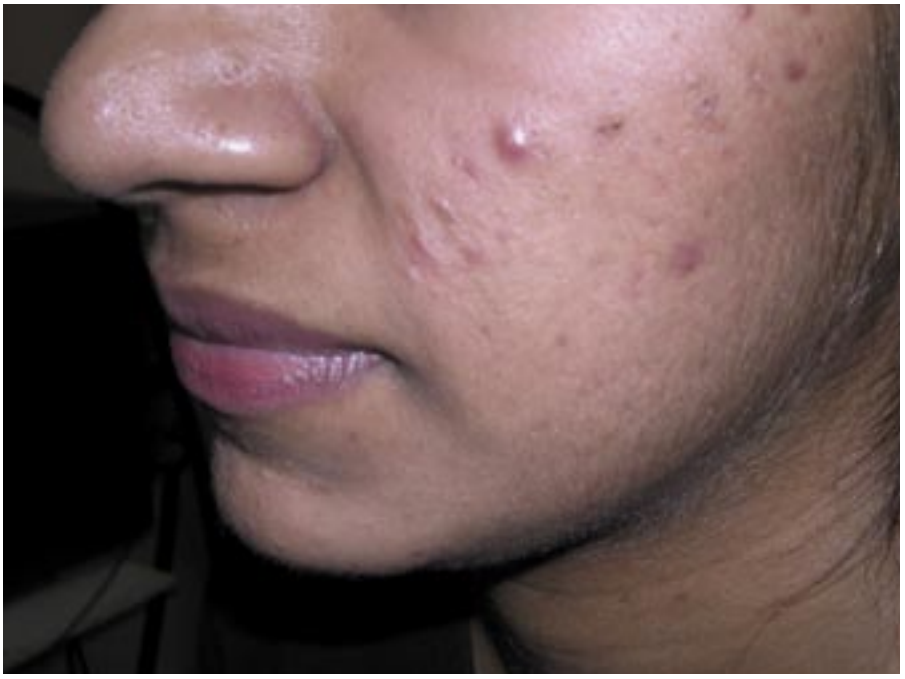

Figure 2. Acne hyperpigmented macules present frequently in skin of color. (Photograph courtesy of Susan C. Taylor, MD, Society Hill Dermatology, Philadelphia, Pa.)

products must be selected with consideration to skin sensitivity, skin type (dry or oily), and seasonal influences.

Topical retinoids, which target several of the pathogenic factors in acne, should be used early in the treatment of acne patients, including those with skin of color. Tretinoin (all-*trans*-retinoic acid), for example, has been shown to normalize follicular hyperkeratinization and to have a beneficial effect on PIH.[23] Third-generation retinoids (eg, tazarotene) or retinoid analogues (eg, adapalene) that are formulated in a cream base have been shown to be less irritating and to have a beneficial effect on PIH.[21,24,25] Many patients will require hydroquinone or other skin-lightening agents in addition to retinoids to treat PIH. One may speculate that the anti-inflammatory properties of oral antibiotics may impact PIH due to acne in skin of color. Benzoyl peroxide at low concentrations and in cream or lotion formulations adds nonspecific antimicrobial activity.[22]

Sah et al[26] demonstrated a topical acne treatment consisting of salicylic acid, retinol, and soy that improved PIH due to acne in patients with skin of color.

It is important for dermatologists to inquire about skin care regimens and cosmetic product use in patients of color because cultural practices related to skin and hair care often can lead to product-induced exacerbation of acne. For example, pomade applied to the hair and scalp may cause comedonal and papular acne of the forehead and temples. Successful treatment of acne in patients of color requires balancing the need for early and aggressive treatment to prevent and reduce inflammatory lesions that could lead to PIH, with the need to minimize iatrogenic irritation that could result in PIH.

Pseudofolliculitis Barbae

Pseudofolliculitis barbae (PFB) is a common disorder in men and women of African American and Hispanic origin with tightly coiled hair; the condition may be exacerbated by shaving or plucking the hair. It also may occur in whites with coarse or curly hair.[27]

PFB presents as erythematous or skin-colored papules or pustules that often are hyperpigmented; it occasionally leads to the formation of keloids. Commonly occurring in the beard area, PFB also can occur in axillary or pubic areas, and on the neck, chest, or back, but rarely in the moustache area. PFB is a chronic disorder that may worsen and scar; additionally, it may develop into infection.[28] Because of its visibility, PFB may result in psychosocial distress.[27] Also, because PFB is an inflammatory process, it frequently results in PIH. One study found a 90.1% incidence of PIH in patients with PFB.[27] As in acne, PIH adds considerably to the distress of patients with PFB.

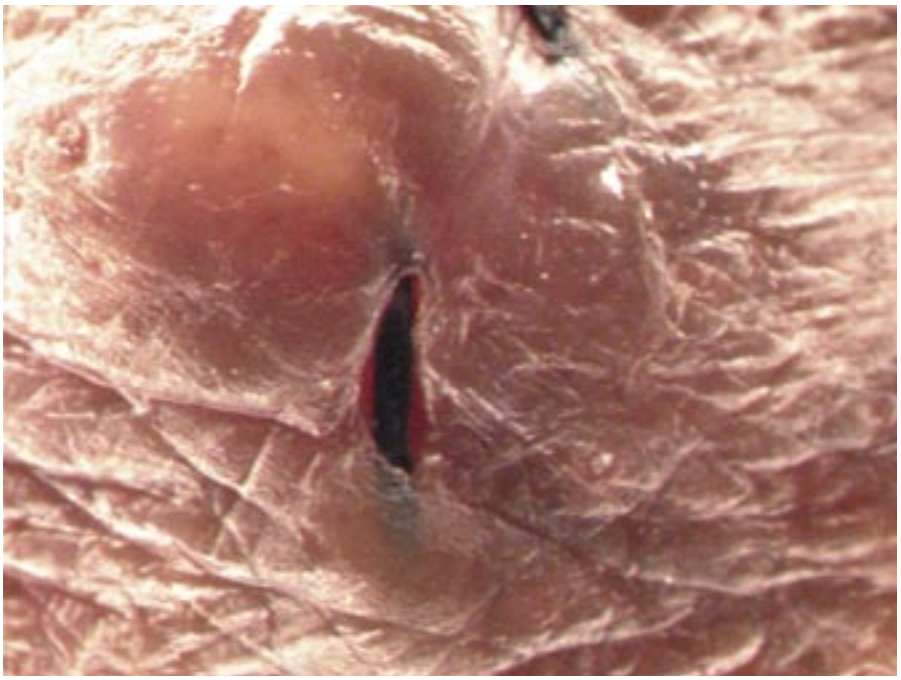

Figure 3. Extrafollicular penetration of beard hair in pseudofolliculitis barbae on the face of an African American man, resulting in an inflamed pseudofolliculitis barbae lesion at ×100 magnification. (Photograph courtesy of Johnson & Johnson Consumer Products Company. Data on file.[29])

PFB is thought to occur by 1 of 2 mechanisms. The first mechanism is extrafollicular penetration whereby coarse curly hair grows from a curved follicle and, when the hair is cut during shaving, develops a sharp edge that grows back through the skin, which causes irritation, inflammation, and a foreign-body reaction in the dermis (Figure 3).[28,29] Alternatively, transfollicular penetration occurs when the hair pierces the follicular wall and grows into the dermis.[27] Prevention and early treatment are essential in PFB to minimize the unsightly appearance and discomfort that can result, as well as to reduce the potential for PIH. No existing treatment has proven to be curative. Refraining from shaving is helpful because it allows hair to release; however, it may not be feasible for men whose occupations require shaved skin or for women. A variety of hair-releasing techniques, depilatories, and specially designed razors and clippers have been used to control the condition, as have medicated shaving creams containing colloidal oatmeal, benzoyl peroxide, or hydroxy acids such as glycolic acid. Electrolysis, though effective, generally is not feasible for large areas, requires a series of treatments, and may be technically difficult to perform on curved hair follicles.

A variety of shaving techniques have been advocated for the treatment of PFB. Some individuals prefer to use an electric clipper because it leaves their hair a minimum length of 1 mm, which may minimize the turning in of the hairs.[27] A single-edged, foil-guarded safety razor also will prevent a close shave and decrease skin trauma. Moistening the skin with warm water before shaving, shaving with the grain, not pulling skin taut while shaving, and rinsing the blade after each stroke to prevent the razor from becoming dull are recommended maneuvers.

Laser hair removal has proven useful in reducing hair growth and slowing the development of PFB.[28] Eflornithine cream (13.9%), which inhibits ornithine decarboxylase (an enzyme that catalyzes the rate-limiting step for the follicular polyamine synthesis necessary for hair growth), has shown promise in the management of PFB.[28] Topical corticosteroids may decrease irritation and inflammation, but their long-term use on the face is not recommended. Topical retinoids or α-hydroxy acids may help reduce hyperkeratosis that may result from repeated nicking of the follicular epithelium and may promote the release of hair. The use of a new triple-combination formulation that contains a corticosteroid, tretinoin, and hydroquinone has shown some promise in the treatment of PFB and may act by decreasing inflammation, releasing trapped hairs, and lightening the hyperpigmentation.[30] Topical erythromycin or clindamycin and combinations of these agents may be useful in the management of secondary infections and inflammation in PFB. Likewise,

β-hydroxy acids such as salicylic acid may help exfoliate the outer skin.[27,28]

Conclusion

To date, research relating to skin of color has been sparse. Definitive conclusions regarding differences in skin structure and function are difficult to draw due to the paucity of well-controlled studies with sufficient numbers of subjects. Nevertheless, the studies serve as an essential background for future research.

Clearly, there are differences in epidermal melanin content; these differences lead to differences in the prevalence and type of pigmentary disorders in skin of color compared with white skin. Continuing to enhance the understanding of the pathophysiology of PIH in skin of color will aid in the development of therapies that could prevent this sequela to skin inflammation.

Learning to prevent or modulate the development of dyspigmentation arising from inflammatory conditions is a particularly pressing challenge in the treatment of acne and PFB in skin of color. Although therapies with products such as retinoids are highly effective in addressing the underlying pathophysiology of acne, their use in skin of color potentially is complicated by the risk of causing additional PIH. The combined stigmata of acne and PIH on the quality of life of people of color is such that the development of effective acne therapies specifically targeted to them will have a far-reaching effect.

PFB disproportionately affects individuals of color. It is a disorder that can be partially controlled but not cured. Its toll on psychosocial functioning is considerable. Basic research into the pathogenesis of PFB is needed. Other intriguing areas of research include male-female differences in PFB, a better understanding of how shaving affects this condition, the development of new types of razors, and new topical therapies.

The study of pigmentary disorders has begun to advance with the development of new quantitative tools such as DRS to analyze pigmentation and erythema. If early DRS analyses are corroborated, our understanding of the pathogenesis of dyschromias will be further elucidated. This may create opportunities for new therapies based on a quantification of the contributions of the vascular and melanotic components involved in pigmentary abnormalities.

As the population of people of color grows in the United States and globally, more research will need to be initiated to understand skin of color and to help design treatments and skin care products to meet the needs of people with skin of color. Achieving a more comprehensive understanding of skin of color offers exciting new opportunities for clinical practice and research in dermatology.

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