

Race-Specific and Skin of Color Dermatoscopic Characteristics of Skin Cancer: A Literature Review

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Key words: dermatoscopy, skin of color, basal cell carcinoma, squamous cell carcinoma, keratoacanthoma, Bowen's disease, melanoma, Caucasians, Hispanics, Asians, Blacks

Citation: Karampinis E, Lallas A, Lazaridou E, Errichetti E, Apalla Z. Race-Specific and Skin of Color Dermatoscopic Characteristics of Skin Cancer: A Literature Review. *Dermatol Pract Concept.* 2023;13(4)S1:e2023311S. DOI: <https://doi.org/10.5826/dpc.1304S1a311S>

Accepted: September 18, 2023; **Published:** October 2023

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Funding: None.

Competing Interests: None.

Authorship: All authors have contributed significantly to this publication.

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ABSTRACT **Introduction:** Individuals with melanin-rich skin account for the majority of the world's population. However, literature data regarding dermatoscopic characteristics of skin cancer in skin of color (SoC) are scarce. The dermatoscopic characteristics of cutaneous tumors might differ among skin types due to heterogeneity in composition and pigmentation.

Objectives: To summarize literature data on the dermatoscopic findings of skin neoplasms, according to the skin color and race.

Methods: The literature search was performed using PubMed database up to December 30, 2022 and was conducted with the use of terms referring to dermatoscopy, race (Caucasians, Hispanics, Asians, and Black/African) and skin cancer types (BCC, SCC, keratoacanthoma, Bowen's disease and melanoma).

Results: In total, 30 race-specific records were included. 9 SoC records for BCCs (2 BCC studies in Hispanics, 1 BCC study in Black individuals and 6 BCC studies in Asians), 9 SoC records for SCCs (1 SCC study in Hispanics, 1 SCC study in Black individuals and 7 SCCs in Asian population) and 8 SoC records for melanoma (2 melanoma studies in Hispanics, 1 melanoma study in Blacks and 5 melanoma studies in Asians) were compared with 4 records that involved only Caucasian population, according to their participant section as well as with studies on dermatoscopy characteristics without focusing on race origins and phototype of the patient. In Hispanics and in both fair and dark-skinned Asians, BCCs were more often pigmented or at least with pigmented structures on dermoscopy.

Squamous cell carcinoma (SCC) and keratoacanthoma were the least studied in SoC patients. Bowen's disease in SoC patients can be pigmented in a higher frequency compared to Caucasians, with glomerular vessels and a squamous surface being the most common dermatoscopic findings. The most frequent pattern of melanomas in SoC individuals were the parallel ridge pattern in palmoplantar region.

Conclusion: Based on a review of studies including Caucasians, Hispanics, Asians and Blacks /Africans, SoC patients present with more frequent and unique dermatoscopic features of skin cancers.

Introduction

Skin of Color (SoC) is a term used to define individuals with melanin-rich skin that might belong to several races, including those of Hispanic/Latino, Asian, African, Native American, Pacific Island origin, as well as mixtures of the different races [1]. In dermatology research, SoC patients seem to be neglected to some extent, since most research has been conducted in white-skin populations. The underrated education of medical students and trainees on SoC populations [2], the limited availability of images of skin diseases in SoC for educational and research purposes and the focus of artificial intelligence and machine learning on white skin, broaden the gap [3]. It has been shown that most skin cancers in individuals of SoC are diagnosed late, due to the health inequity and the lack of access to healthcare and dermatology care [2]. In the last years, SoC dermatology has attracted more attention as a result of the lack of relevant information and the subsequent difficulties the dermatologists are facing when dealing with SoC individuals. Indeed, the search of 'skin of color' term in Pubmed results in 21,324 studies, with the 5,139 (approximately 24%) of them published in the last three years (2020-2022).

Dermatoscopy is a precious tool for dermatologists, enabling an assessment of skin lesions based on patterns, structures, signs and colors and significantly facilitating the clinical diagnosis. In SoC, different color backgrounds and patterns typical of darker phototypes maybe alter the dermatoscopic aspect, as compared to white skin [4]. The combination between 'skin of colour' and 'dermatoscopy' Pubmed search results in 680 articles with limited research in the dermatoscopy of skin cancer in SoC patients.

An additional limitation is that SoC is often considered as a group, while in fact it consists of significantly heterogeneous populations in terms of skin color. Therefore, it would be more informative to describe each study population in more details. For instance, Caucasians are the not-Hispanic, white-skinned individuals of European origin, blacks are not-Hispanic individuals of African origin and Hispanics are the individuals from Mexico, Puerto Rico, Cuba, Spanish-speaking countries of Central and South America, Spanish-speaking Caribbean Island nations, and other Hispanic civilizations

The aim of our study is to investigate available data from studies on the dermatoscopic characteristics on skin cancers in SoC populations, compare them with the findings in white skin and summarize the evidence on dermatoscopic patterns and structures of common skin cancers in SoC.

Methodology

A literature review was performed using the PubMed database and included a search for articles in the English language from inception to December 2022. Search terms included "dermoscopy," and "dermatoscopy," combined with terms referring to different races, namely "Caucasians," "Hispanics" "Asians" "Blacks" and "Africans" and skin cancer types, namely "basal cell carcinoma", "squamous cell carcinoma", "Bowen's disease", "keratoacanthoma" and "melanoma". In case of Hispanic and Asian populations we further added investigation using countries with Hispanic and Asian residents- for example Mexico, Argentina, Chile, Uruguay and Peru and Japan, China, Korea, India. The inclusive criteria involved studies that provided dermoscopy details of skin cancer specifically reported for a particular race. However, we excluded case reports and case series or studies focusing on the dermoscopy of rare subtypes or presentations of skin cancer, as well as skin cancer occurring in specific locations such as the nail. We found 158 studies on dermoscopy of BCC, 11 of which provided detailed information on the race of the included population and were included in this review. The search for SCC, keratoacanthoma and Bowen's disease revealed 147 results, with 9 being suitable for inclusion. The search for melanoma revealed 675 results, of which 10 were suitable for the review. As a results, 30 race-specific records were included in this review.

Results

Dermatoscopy of BCC

Caucasians

Although the majority of dermatoscopy studies have been performed on Caucasians, most studies do not provide clear information on the race of the included population. Two studies clarified that the included population consisted exclusively of Caucasian individuals [5,6]. In this population,

the most common BCC type was the nodular, followed by superficial. The most frequent dermatoscopic features in nodular BCCs were arborising vessels and ulceration. Correspondingly, the most common dermatoscopic features of superficial BCC were multiple small erosions and small fine superficial telangiectasias [5]. Only 10% of the BCCs were pigmented, contrary to the high incidence of pigmented BCCs (pBCCs) in other populations [7]. In nodular pBCC the most prevalent dermatoscopic criterion was blue-gray ovoid nests, often in association with arborising vessels. The most common dermatoscopic features of superficial pBCC were maple leaf-like areas, spoke-wheel areas and concentric structures, whilst blue-gray ovoid nests were absent [5].

Hispanics

Interestingly, BCCs in Hispanic individuals tend to be more often located on the right part of the body [8], with the presence of pigmentation being twice as common as in Caucasians [9]. Regarding BCC type, the most common were nodular and superficial, however nodular subtype in Hispanics is less frequent compared to Caucasians. Hispanic individuals have a higher frequency of invasive BCC than Caucasians [10]. Due to the higher percentage of pigmented lesions, BCCs in Hispanic frequently display the classic dermatoscopic features of pigmented subtypes. For example, nodular BCCs present blue-gray ovoid nests and/or blue-gray non-aggregated globules, along with branching vessels and shiny white structures, whilst superficial BCCs exhibit brown colored structures (e.g maple-leaf like areas) and/or erosions and/or radial linear structures [11]. In a study performed in a Mexican population, the main dermatoscopic finding for nodular BCC was blue-gray ovoid nests, whilst for pBCCs were the shortened vessels, the gray-blue ovoid nests and the maple-leaf like areas. Regarding infiltrating BCC, branching and truncated vessels were more common and for the superficial BCCs the spoke-wheel areas and shortened vessels were mostly seen [12]. It is of particular importance to mention that in Hispanic populations a blue-white veil is often described in BCCs [13].

Asians

In populations with Fitzpatrick ranging from III to IV (e.g., Japanese), BCCs are usually clinically pigmented or at least with pigmented structures on dermatoscopy. In general, BCCs in this population present similar dermatoscopic features as in Caucasians [14]. Arborising vessels are the predominant morphologic vessel type. The presence of other vessel types is of low diagnostic value in this population [15]. In addition, a low sensitivity of dermatoscopy in BCCs diagnosis was recorded when the lesions involved the trunk and extremities and were hypo- or non-pigmented [15]. In populations with Fitzpatrick phototype ranging from IV to V,

such as Indians, macroscopic and dermatoscopic features of pigmentation were more frequent. Ulceration, blue-white veil, and branching vessels were significantly associated with nodular BCCs, while maple leaf-like areas, red/white structureless areas, multiple small erosions and spoke-wheel areas were noted in superficial BCCs [16,17].

Blacks

BCCs scarcely affect black individuals, mostly in the background of albinism and Gorlin syndrome. BCCs in Blacks are less common than SCCs and were more frequently metastatic. It has been reported that the morphea-like BCC is rare [10]. Dermatoscopically, pigmented subtypes are similar to the ones seen in Caucasians (maple-leaf areas, spoke-wheel areas, etc). Reticular pigmentation can be observed in the surrounding uninvolved skin, more intense around the lesion with central hypopigmentation [18].

Dermatoscopy of SCC

Caucasians

In the Caucasian population, we can literally observe all SCC subtypes. In terms of dermatoscopy studies related to SCC, the majority come from Australia, Austria, Greece, Italy or they are multi-country based. The most common dermatoscopic features of SCC include the presence of keratin, white scales, blood spots, white circles, white structureless areas and white halos [19]. Bowen's disease is usually non-pigmented and in dermatoscopy often displays glomerular and dotted vessels, white scales, and small erosions [20]. Keratoacanthoma is dermatoscopically characterized by a crateriform morphology the characteristic mass of keratin surrounded by elongated and sometimes thick telangiectasias or hairpin-like vessels, as well as by white circles, white halos and white structureless areas. In general, the discrimination of a keratoacanthoma and a well-differentiated SCC on the clinical and dermatoscopic basis is very challenging. However, it has been suggested that the presence of keratin and white background color may indicate keratoacanthoma, whilst mixed color favors an invasive cSCC [21]. Poorly differentiated SCCs are dermatoscopically characterized by a predominant red color, resulting from the presence of dense neo-vascularization and/or hemorrhage [19].

Hispanics

Very limited literature data report on dermatoscopic features of SCC in Hispanic population. The dermatoscopic features are similar to those described in white individuals, but there is a higher incidence of the pigmented variants [11]. Pigmented Bowen's disease appears with asymmetric structureless, brown areas, gray, brown or blue dots in linear arrangement usually at the periphery of the lesion and tortuous vessels [22]. Keratoacanthoma presents with the same

dermatoscopic presentation as in Caucasians [11]. Patients in this population more often than Caucasians can present with pigmented SCC that dermatoscopically has radially arranged brown lines and brown dots aligned in a linear fashion [11].

Asians

Concerning light-colored Asian populations, glomerular vessels plus a scaly surface were the most common dermatoscopic findings in Bowen's disease [23]. BD had also a high probability of detecting pigmentation in dermatoscopy [23]. The three most frequent dermatoscopic findings of pigmented BD included structureless pigmentation and pigment streaks combined with scaling [24]. Common dermatoscopic findings for non-pigmented BD were glomerular vessels, scales, a pinkish-white network, dotted vessels, hairpin vessels, and pinkish-white structureless areas [24]. Scarce case reports show that the main dermatoscopic features of SCC subtypes are similar to those seen in Caucasians. In the dark-skinned Asian population, the vast majority of BD are also pigmented [25]. A combination of pigmented structures associated with BD is often observed and includes structureless brown hyperkeratotic area, homogeneous areas of different shades (focal/multifocal), brown to blue-gray dots/globules (in a peripheral clustered or linear arrangement), and brown to blue-grey peppering [25]. Keratoacanthoma presents with the same dermatoscopic image (corneal plug and/or ulceration), while SCC presents with the same main features as in Caucasians, but with an increased likelihood of presenting its specific characteristics, as radially arranged brown lines and brown dots [11].

Blacks

SCCs in black individuals are often superficial, discrete, hard lesions with an indurated, rounded, and raised base [26]. The dermatoscopic features observed are similar to those described in Caucasians, but there is a higher incidence of pigmented variants [18]. Dermatoscopically, loss of the normal pigmented network surrounding the squamous cell carcinoma lesion can be observed [18].

Dermatoscopy of Melanoma

Caucasians

Melanoma is mostly studied in Caucasian populations. Melanomas in situ are characterized by dermatoscopic features such as irregular hyperpigmented areas, atypical network, and gray structures, and less commonly radial lines, multiform vessels, and polygonal structures [27]. Both in situ and invasive melanomas often display irregular blotch, atypical network and gray or blue structures [27]. Atypical network, blue-white veil, irregular globules and dots, pseudopods or striae, and the blue-black veil can distinguish melanoma from other tumors [28]. Melanomas in the neck area

dermatoscopically show irregular dots, gray color and regression and in almost 50% they present dermatoscopic criteria of a lentigo maligna [29]. In palmoplantar melanomas the two most common patterns were irregular diffuse pigmentation and parallel ridge pattern [30]. A hyperpigmented follicular opening, annular-granular pattern, pigmented rhomboidal structures, obliterated hair follicles, as well as increased density of the vascular network, red rhomboidal structures, target-like patterns, and pigmentation are lentigo maligna characteristics [31].

Hispanics

As in Caucasians, superficial melanoma is the most common subtype [32]. Dermatoscopic features of melanomas in Hispanics are similar to Caucasians; however, more dermatoscopic studies are needed in this population to determine frequency of specific melanoma patterns and any specific dermatoscopic signs. Dermatotomy signs such as blue white veil, white shiny structures and milky red areas increased are more frequent in thick melanomas [32]. Biaxial asymmetry is the most common dermatoscopic finding in in situ and invasive melanoma [33].

Asians

In Asian population, there is a high incidence of site-specific melanomas such as palmoplantar melanomas [34]. Melanomas in trunk and limbs may appear dermatoscopically with an asymmetric colorful pattern, blotches, blue-white veil, atypical pigment network, irregular peripheral streaks, atypical vascular pattern, ulceration, atypical dots/globules bright white lines and regression structures [15,34]. Palmoplantar melanomas are typified by a parallel ridge pattern and irregular diffuse pigmentation [35].

Blacks

The most frequent melanoma type in this population is palmoplantar melanoma that shows a parallel ridge pattern, while loss of pigmentation around the lesion itself may be present, creating a hypomelanotic "halo" [18].

A summary of the most common dermatoscopic features observed in skin cancer subtypes (BCC, SCC, and melanoma) among patients with Skin of Colour is presented in Table 1.

Discussion

SoC is a descriptive term frequently used in studies reporting on dark-skinned, or in non-Caucasians individuals, in general. Skin color outweighs other vague terms that do not focus on the type, tone or characteristics of the skin [1]. However, even nowadays there is not a clear categorization of the characteristics of the skin of color individuals. The Fitzpatrick

Table 1. Summarizes the most frequent dermatoscopic characteristics of skin cancer subtypes (BCC, SCC and melanoma) in Skin of Colour patients.

Skin cancer in skin of colour	Dermatoscopy characteristics
BCC in Hispanics	<ul style="list-style-type: none"> • the chance of pigmentation for BCC is twice as common as in white patients. • the main dermatoscopic finding for nodular BCC was blue-gray ovoid nests. • The main dermatoscopic feature for pBCCs were the shortened vessels, the gray-blue ovoid nests and the maple-leaf like regions. • In superficial BCCs the spoke-wheel areas and shortened vessels were mostly seen. • A blue-white veil subtype of BCCs can be observed.
BCC in Asians	<p>III – IV phototype populations</p> <ul style="list-style-type: none"> • The majority BCCs are pigmented or at least with pigmented structures in dermatoscopy • Similar dermatoscopic features and approach as that of Caucasians • Branching vessels as the dominant vascular pattern. The presence of other vascular formations has a low diagnostic value in this population <p>IV-VI phototype populations</p> <ul style="list-style-type: none"> • Ulceration, blue-white veil, and branching vessels are significantly associated with nodular BCC • Maple leaf-like areas, the red-white structureless areas, multiple small erosions, and radial wheel areas were noted in the surface BCCs
BCC in Blacks/Africans	<ul style="list-style-type: none"> • Pigmented subtypes with characteristic structures that are also observed in white populations (maple-like leaves, radial wheel structures, etc.) are reported. • Reticular pigmentation can be observed in the surrounding uninvolved skin, more intense around the lesion and central hypopigmentation.
SCC in Hispanics	<ul style="list-style-type: none"> • Very limited literature on SCC in this population and on its dermatoscopic features • The dermoscopic features observed are similar to those described in white subjects, but there is a higher incidence of pigmented variants
SCC in Asians	<p>III – IV phototype populations</p> <ul style="list-style-type: none"> • Glomerular vessels plus a squamous surface were the most common dermoscopic findings of BD • High probability of detecting pigmentation dermatoscopically • Common dermatoscopic findings for pigmented BD included dotted vessels, hairpin vessels, a pink-white network, and a pink-white structureless area. <p>IV-VI phototype populations</p> <ul style="list-style-type: none"> • A combination of pigmented structures associated with Bowen's disease is often seen
SCC in Blacks/Africans	<ul style="list-style-type: none"> • The dermoscopic features observed are similar to those described in white individuals, but there is a higher incidence of melanocytic variants. • Dermatoscopically, loss of the normal pigmented network surrounding the lesion of squamous cell carcinoma can be observed.
Melanoma in Hispanics	<ul style="list-style-type: none"> • Dermatoscopic features of melanomas in Hispanics are similar to those in Caucasians; • Dermatoscopic features such as whitish blue veil, bright white structures and milky red areas were reported
Melanoma in Asians	<ul style="list-style-type: none"> • Usually, melanomas of specific location • They may appear dermatoscopically with an asymmetric colorful pattern, blotches, blue-white veils. atypical pigment networks, irregular peripheral striae, atypical vascular patterns, ulcer, atypical dots/balls bright white lines and hypopigmented structures • The most common vascular pattern seen in melanoma was linear and irregular vessels.
Melanoma in Blacks/Africans	<ul style="list-style-type: none"> • High incidence of palmoplantar melanomas that show a parallel ridge pattern • There may be loss of pigmentation surrounding the lesion itself, creating a hypopigmented “halo”

phototype system assesses the minimum erythema dosage for fair-skinned patients. However, studies presented many limitations, as far as Asian population is concerned [36]. From the combination of race and Fitzpatrick system [37] to

the comparison cards of the Taylor hyperpigmentation scale, [38] there is still no consensus on how to evaluate skin color patients. As a result, many studies have significant limitations due to lack of important information.

Furthermore, in every SoC study should provide detailed information on the characteristics of the included population. Usually, studies follow the definition of CDC and interpret ethnicity as 1 of 2 categories—Hispanic/Latino and not Hispanic/Latino—and race as 1 of 5 categories: American Indian/Alaskan Native, Asian, Black/African American, Native Hawaiian/from pacific island and white [39]. As for their skin type, most Hispanics range from IV to VI, whereas regarding the Asians, there is a wider range, for example from III to IV in the Chinese and Japanese and from types IV to V in Indians and Pakistanis [40]. However, this skin categorization has many limitations and should not be considered as a standard deviation, due to the variability between the races that occurred by immigration and race combinations [41].

The dermatoscopic characteristics of skin cancers had been studied more on white populations. There are many possible reasons for this discrepancy. First, this is definitely related to the high incidence of skin cancers in this population (with the exception of acral lentiginous melanoma to Asians and Blacks). However, limited access of some other populations to medical assistance may also contribute. Furthermore, the role of limited financial resources and the lack of investments in scientific groups working in developing countries may have resulted in limited production of publications from these countries. An attempt to bridge this gap has recently been made with more studies on the dermatoscopy of skin lesions in SoC patients, making this section a field of great interest.

Considering that the skin of white and black individuals presents differences, it is essential to fill this knowledge gap. The melanosomes that are responsible for the skin color are of different stage, organization and endurance amongst the races. In people of African descent, melanosomes are scattered throughout the epidermis, in contrast to non-sun-exposed white skin, where melanosomes are confined to the basal layer and absent in the upper epidermal layers [42]. Larger keratinocyte size, greater keratinocyte density, reduced proteolytic activity, increased fibroblast number and slow desquamation rates are found in black skin, as well as a higher number of cell layers consisting the stratum corneum than a thinner stratum corneum in people of Asian descent [43]. Taking into account the aforementioned differences, it is expected that the skin cancer arising in different skin types would possibly differ in terms of frequency, qualitative and quantitative dermatoscopic, mostly emerging from the heterogeneity of pigmentation.

Compared to Caucasians, in Hispanics and Asians, BCCs were more often pigmented, or at least display pigmented dermatoscopic structures, such as maple-leaf likes and spoke-wheel areas. In black individuals, a characteristic in the background of the BCC was detected, namely an intense pigment network, which is not a typical characteristic

in Caucasians [18]. In studies investigating dermatoscopy of BCCs in Caucasian [5], Hispanic [12], Indian [17] and Black populations [18], certain similarities but also important differences in the frequency of dermatoscopic structures were found. Grey-blue ovoid nests were seen in 50% of BCCs in Black population [18], 40.6 % of nodular BCCs in Indian population, 58% of nodular BCCs in Hispanics and 50% of nodular BCCs in in Caucasians [5]. Milia-like cysts, a typical structure of seborrheic keratosis, were observed in 37.5% of nodular BCCs in the Indian population [17]. Maple leaf like areas were observed in 50% of BCCs in Black individuals, 92.5% of superficial BCCs in Indian individuals, 43% of pigmented BCCs in Hispanics and 37.7 % of superficial BCCs in Caucasians. Ulceration was found in 53.2% of nodular BCCs Caucasians and in 84.3% of nodular BCCs in Indians. Another frequency difference was observed regarding the spoke wheel like structures, which appeared with a percentage of 18.2% in the superficial BCCs in Caucasians, while the respective percentage in Indians was 55.5%.

SCC and keratoacanthoma were the least studied cutaneous neoplasm in SoC individuals. Case series including the frequency of dermatoscopic characteristics concerning Hispanic and Indian populations were limited in the number of participants. As a result, the comparison between them and the Caucasian studies that have numerous subjects would not lead to a safe conclusion. However, in studies describing Bowen's disease in SoC, the authors found that the lesions were often pigmented and displayed glomerular vessels and a scaly surface in dermatoscopy [23–25]. As for the Japanese and a Caucasians (Europe country based) study, the scales and the glomerular vessels were the dominant findings in the classic Bowen's diseases, reaching a 94% and 97% respectively for the Asians and 90% and 90% respectively for the Caucasians [20,23].

The most of the SoC melanoma studies focus on the acral lentiginous melanoma of the sole. These melanomas in SoC patients have many similarities with melanomas in Caucasians in dermatoscopy. Specifically, the parallel ridge pattern in palmoplantar areas is the most frequent dermatoscopic pattern. In a study focusing on Black individuals [18], all cases (100%) displayed a structureless pattern with multiple shades of different colours, while 75% of them had also the typical parallel ridge pattern. In a study conducted in Caucasians, irregular diffuse pigmentation was found in 60% and parallel-ridge pattern in 53% of the lesions, whilst polychromia and existence of an abrupt edge were also melanoma indicators. [30].

The limitations of the study are connected mainly with the unclear and often confusing correlation between races and skin tones. Races (especially Hispanic and Asian) encompass also "light skin type" (mainly phototype III), so the analysis may be affected by the mixture of fair and dark skin types (which are classically phototypes IV-VI) for such racial

groups. Moreover, it is crucial to consider the specific focal points of certain studies which may be centered on a particular characteristic (for example the association of dermatoscopy characteristics and histology type [5]), rather than the race of the patients, potentially affecting the results.

Conclusions

There is limited data concerning dermatoscopy of skin cancer in SoC patients. In this review, we have highlighted the most frequent and unique dermatoscopy features of skin cancers, based on a review of studies including Caucasians, Hispanics, Asians and Blacks /Africans. Further studies focusing on the combination of race and phototype are needed, in which dermatoscopic features described in Caucasian populations should be re-evaluated about their significance in SoC.

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