Chapter

Pigmentary Disorders in Black Skin from Pathophysiology to Treatment

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Abstract

Pigmentary disorders are frequent and more visible in patients with darker phototypes (Fitzpatrick's IV–VI). They also have an important psychological impact and are the cause of inappropriate cosmetic practices. Pigmentary disorders comprise a wide range of pathologies, and the pathophysiological mechanisms have evolved considerably in recent years. Pigment disorders vary in their clinical presentation from achromia to hyperpigmentation to hypopigmentation. Inflammatory dermatoses, such as acne, are often complicated by postinflammatory hyperpigmentation; psoriasis and lichen planus are accompanied by dyschromia. Some skin diseases, such as mycosis fungoides, have atypical presentations in the form of hypopigmented plaques. All these dyschromias have an important impact on the quality of life and are responsible for practices such as voluntary cosmetic depigmentation with products like dermocorticoids, hydroquinone and mercury salts, and various depigmenting products. This practice is at the origin of pigmentary disorders, such as exogenous ochronosis, lichen-like and lupus-like dermatoses, and periorbital hyperpigmentation. Therapeutic management is difficult and relies on chemical (peeling), physical (laser), and medicinal means (tranexamic acid); hence, the interest is in prevention through early diagnosis and the avoidance of favorable factors.

Keywords: postinflammatory hyperpigmentation, black skin, pigmentary disorders

1. Introduction

Pigmentary disorders refer to all alterations in skin pigmentation, which may be congenital or acquired. They may be hypo- or hyperpigmentation secondary or not to underlying conditions, most often inflammatory. These pigmentation disorders or dyschromias may also be manifestations of underlying systemic diseases. Postinflammatory hyperpigmentation (PIH) due to acne is defined as hyperchromic skin macules varying from brown to black affecting the face and/or body occurring after and sometimes during acne. It results from an overproduction of melanin following skin inflammation. It can occur on all skin types but is generally more frequent, visible, and persistent in phototypes IV–VI according to the Fitzpatrick classification [1]. In black skin, pigmentary disorders are frequent reasons for consultation [2]. Indeed, almost all pathologies can be complicated by dyschromic disorders during their evolution. Whether it is postinflammatory hyperpigmentation or

hypopigmentation, the functional and esthetic repercussions are significant, and the impact on quality of life (QOL) is considerable [3]. Curative treatments are expensive and have a limited response; hence, the interest is in prevention based on the avoidance of risk factors, an early diagnosis and treatment, and photoprotection [4].

In this chapter, we will successively classify the different pigmentary disorders and describe the epidemiology and the pathophysiology of these different pigmentary disorders as well as the clinical and dermoscopic aspects. We will end with the treatment of pigmentary disorders.

2. Skin diseases according to the phototype

The vast majority of books devoted to the study of dermatological conditions are illustrated with photos of light-skinned patients. This makes it difficult for learners to identify these diseases in patients with black skin. The clinical and dermoscopic semiological aspects of dermatological diseases vary according to the patient's phototype. In addition, the therapeutic and evolution of skin diseases are different between white and black skin.

Indeed, the intense pigmentation on black skin can modify the clinical aspects. By example, the erythema appears less visible and had a shiny appearance [5]. The classical aspect of the malar erythema of systemic lupus erythematosus may appear as hyperpigmentation; in lichen planus, the lesions appear shiny with a silvery sheen [6].

Generally, in the inflammatory skin diseases, the pigmentary disorders are more visible. For the vitiligo, the contrast with the black skin leads to a negative impact on the quality of life and psychological impairment [7].

The systemic diseases, such as lupus, systemic scleroderma, dermatomyositis, and sarcoidosis, are different in clinical aspect; the dyschromia is in the foreground [8].

For tumoral skin diseases, the characteristics are different; for melanoma, the most common localization is on the palms, soles, or nail [9].

The basal cell carcinoma is very rare and is sometimes has a tattooed appearance. For squamous cell carcinoma, it is secondary to preneoplastic skin diseases (genetic, chronic inflammation, scare of burns, etc.) [9].

Generally, the bacterial, viral, and parasitological infections are not different in their clinical presentation. The modifications seen are more linked to the long delay of consultation or the impact of alternative therapeutic in the clinical aspects. Some infections such HTLV1 and associated diseases such as infective dermatitis are more prevalent in some geographical areas (Sub-Saharan Africa) [10].

Owing to some practices, such as skin bleaching with high-potent corticosteroids, the superficial fungal infections are widespread and localized on the face like tinea faciei [11].

Treatment may be different due to the inaccessibility of health facilities and certain drugs not marketed in low-income countries. In the majority of cases of chronic diseases, such as atopic dermatitis psoriasis and systemic and autoimmune diseases, the rate of loss to follow-up is very high because of the lack of therapeutic education.

3. Different types of pigmentation disorders

Pigmentary disorders in black skin are varied and arise from different mechanisms. They may either result from postinflammatory damage or constitute manifestations of the disease.

Type of pigmentation	Disease
Hypopigmentation	Psoriasis Systemic scleroderma Vitiligo Discoid lupus Eczematides Hansen disease Achromic mycosis fungoides Parapsoriasis
Hyperpigmentation	Postacne hyperpigmentation Rosacea Melasma Atopic dermatitis Psoriasis Acute lupus Lichen planus Exogenous ochronosis Lichen- and lupus-like hyperpigmentation of the articulations Periorbital hyperpigmentation Adverse drug reaction (ADR)
Hypopigmentation and hyperpigmentation	Poikiloderma Tinea versicolor

Table 1.
Classification of pigmentary disorders by appearance and etiology.

In **Table 1**, we list the main pigmentary disorders according to the hypo- or hyperpigmented aspect and according to the nosological group.

4. Epidemiology of pigmentary disorders in black skin

The pigmentary disorders are very frequent in black skin, with prevalence ranging from 5.4% in Nigeria [12] to 19.9% in the USA [13]. In a cross-sectional study conducted in public hospitals in Durban, South Africa, the authors found than dyschromias are the third most common dermatologic diagnosis with a frequency of 8% [14]. The most common subtypes of pigmentary disorders found in this study include vitiligo, postinflammatory hyperpigmentation, and melasma. In our experience, at the Department of Dermatology, Hospital Institut d'Hygiene Sociale of Dakar, the frequency of skin diseases with pigmentary disorders was 34.67% (unpublished data). In a multicentric descriptive study conducted in Paris, France, among 1064 Afro-Caribbean people, the main motifs of consultation were acne and pigmentary disorders, which represent 8.4% [15]. Pigmentary disorders affect the women and the adult more. Indeed, the majority of the patients in the study were female (n = 229; 75.8%) [7]. The most common pigmentary disorders in terms of frequency are postacne hyperpigmentation and pigmentary disorders. The postacne hyperpigmentation is very frequent estimated to be in 87% and persistent for one year or more in 52.6% [16].

The prevalence of pigment disorders in psoriasis was 23.7% in a single-center prospective study from February 2018 to March 2019. This study included 459 patients, out of which 287 are men with a mean age: 49.9 years (σ = 16.2) [17].

In systemic scleroderma, the prevalence of pigmentation disorders was 36.8%. Hyperpigmentation and hypopigmentation can be diffused or localized in sun-exposed area [18].

During cosmetic skin bleaching practice, the pigmentary disorders are very frequently found in 84.5%, and they are variable: hyperpigmentation of the joints, exogenous ochronosis, and lichenoid dermatitis [19].

5. Pathophysiology of pigmentary disorders

5.1 Postinflammatory hyperpigmentation

Recently, Maghfour et al. [20] have focused on the pathophysiology of PIH with recent development. The melanocytes and the dermal fibroblasts are involved. The mechanisms implicated are the release of inflammatory cytokines and growth factors. Among the mechanisms identified, the following are worth noting:

- The increase production of arachidonic acid metabolites (leukotrienes LTC4 and LTD4, prostaglandins, and thromboxane) that promotes melanogenesis through an increase of tyrosinase-related protein.

- Inflammatory reactions and UV light exposure induce the production and upregulation of prostaglandins, which are considered as paracrine factors for melanocytes.

- Some receptors (the most common on the skin PGE-2 and PGF2-$\propto$) activated by their ligands increase the dendricity of melanocytes, and then, the transfer of melanosomes is facilitated.

The mechanisms by NO production after UV light exposure also play a clue role in the upregulation of tyrosinase activity and tyrosinase related protein (TPR).

Another mediator of melanogenesis is histamine, which is released from dermal mast cell and mediated by UV irradiation. Recently, Nakaro et al. [21] have revealed the prominent distribution of dermal mast cells in PIH lesions.

Mast cells are implicated in another way by the secretion of IL33 that promotes the expression of microphthalmia-associated transcription factor (MITF) (microphthalmia) and thyrosinase related proteins involved in melanogenesis.

5.2 Systemic scleroderma

In systemic scleroderma, there is a dysregulation of CCN3, a matricellular protein implicated in angiogenesis and pigmentation regulation [22].

Some authors found a downregulation of this protein in melanocytes in patients with systemic scleroderma and pigmentary disorders.

6. Clinical aspects of pigmentary disorders

The PIH is frequent in many inflammatory skin diseases; the most common are acne, lichen planus, and psoriasis, but also in cutaneous infectious and tumoral

diseases. Others autoimmune skin diseases, such lupus erythematosus, scleroderma, and dermatomyositis, are frequently associated with dyschromias, which can lead to misdiagnosis. Wood's light examination and dermoscopy help to assess the diagnosis showing the common signs in different pathologies.

In addition to the common dermatological conditions, there are other dermatoses that are secondary to the cosmetic use of depigmenting products. The pigmentary disorders that accompany these various conditions are the cause of inappropriate cosmetic practices.

We will consider successively inflammatory dermatoses, infectious autoimmune systemic dermatoses, and finally dermatoses associated with the use of depigmenting cosmetics.

6.1 Inflammatory and autoimmune skin diseases

6.1.1 Acne

For acne, PIH (**Figure 1**) is very frequent and has an important impact on the quality of life and is a frequent reason for consultation more than acne lesions [1]. The clinical presentation is polymorphous, and the adult women are often

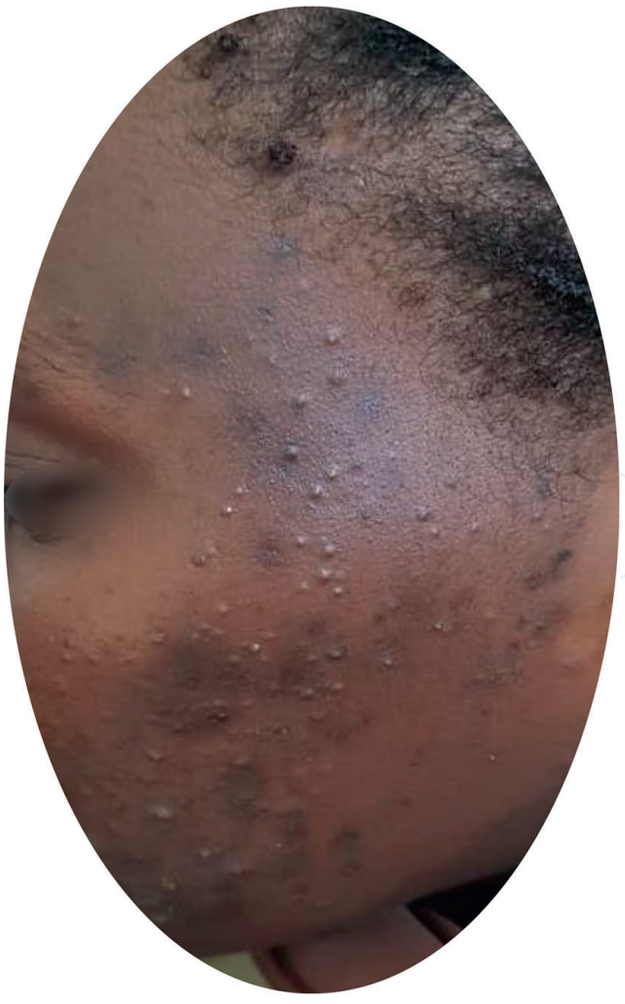


Figure 1.
Postinflammatory hyperpigmentation during acne.

affected [23]. A multicentric study had shown that PIH and involvement of the cheeks and forehead were significantly more common in darker phototype patients ($p < 0.001$) [24].

Pandaya et al. had already designed a scale to measure the severity of postinflammatory hyperpigmentation during acne [25]. This scale has been recently validated in phototype VI patients from Sub-Saharan Africa [26]. In addition to the severity of hyperpigmentation, this scale is useful for monitoring the evolution of the disease.

6.1.2 Psoriasis

Psoriasis can appear as lichenoid aspect, and dyschromias are frequently observed in psoriasis and may be either hyperpigmentation or hypopigmentation (**Figure 2**). Hyperpigmentation appears to be more frequent and occurs either in a lentiginous or diffuse form. Hypopigmentation has a well-limited border in the Wood's light [27]. These pigmentary disorders seem to be associated with an insufficient duration of treatment. It should also be noted that vitiligo can be associated with psoriasis [28]. The dermoscopic aspects showing the vascular aspect as globules and white squames help to assess the diagnosis.

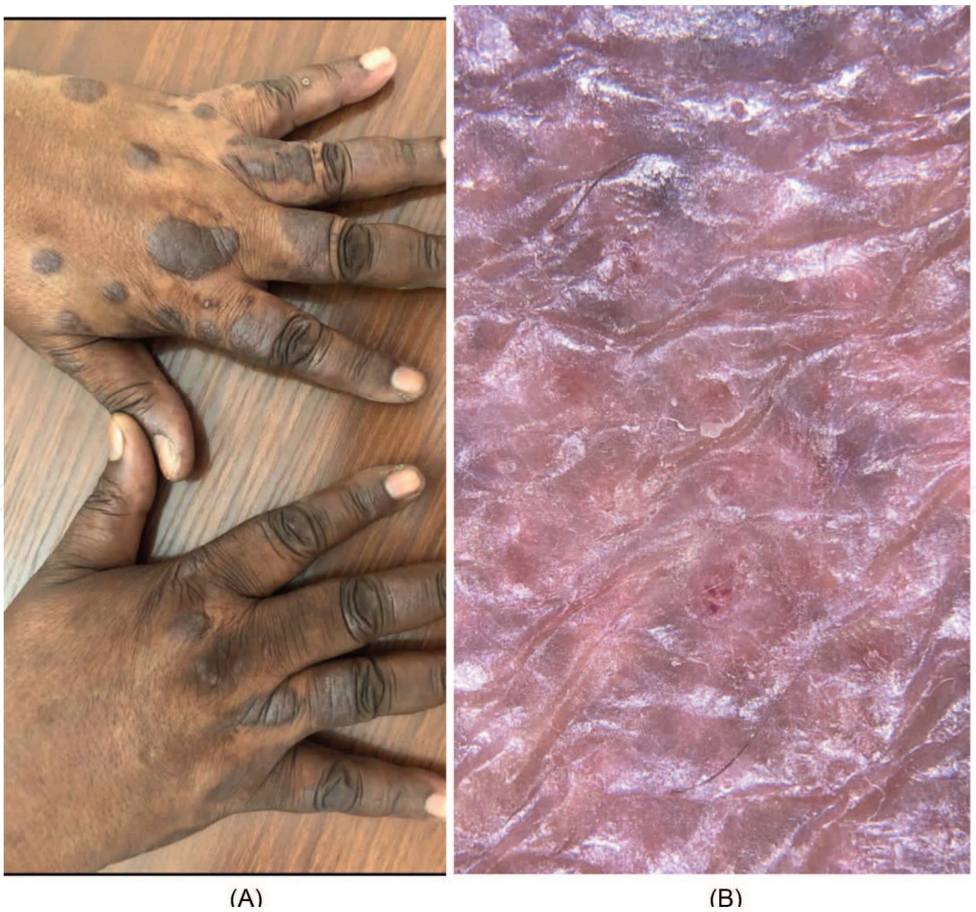


Figure 2.
Clinical (A) and dermoscopic (B) aspects of psoriasis on the hand.

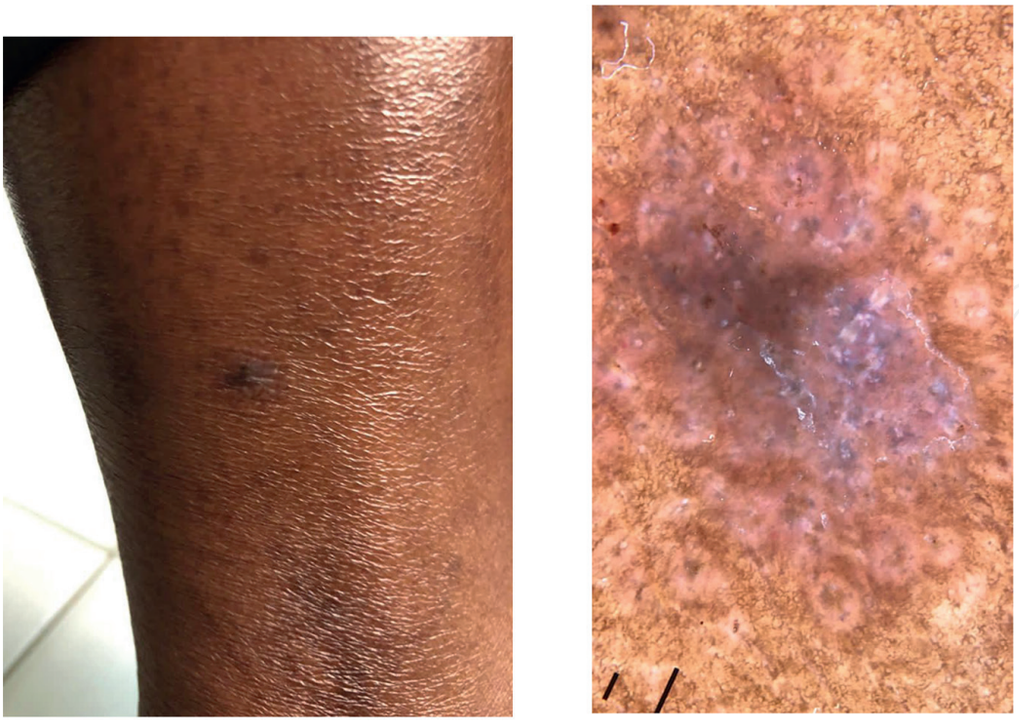


Figure 3.
Clinical appearance with hyperpigmented (A) and dermoscopic papule with Wickham's streaks (B) of lichen planus.

6.1.3 Lichen planus

In patients with phototype VI, the lichen planus is characterized by pruriginous hyperpigmented silvery papules, which regress leaving large patches of hyperpigmented macules (**Figure 3**), which are unsightly. The topography is variable; the lesions may be localized or generalized sparing the face. No factors have been found to favor borderline or diffuse nature [29].

Clinical forms of pigmentogenic lichen planus have been reported in patients with a darker phototype. The dermoscopy is very helpful for diagnosis and to characterize the aspect of pigmentation, which can be homogenous or granular depending on the site of melanocytes [30].

6.1.4 Melasma

In black skin, melasma is a common condition more frequently seen in women, the etiopathogeny remains unclear, and many factors were incriminated: genetics, estro-progesterone, sun exposure, thyroid dysfunction, and pregnancy.

The clinical aspect is a brown or black macule localized on centrofacial, malar, and mandibular regions. Wood's lamp illumination shows epidermal (black or brown) or dermal (blue) pigmentation.

The dermoscopy shows scattered islands of brown reticular network with dark fine granules scattered on surface suggesting epidermal type of pigmentation.

In the dermal type of pigmentation, uniform skin involvement and no areas of sparing with dark brown gray hyperpigmented lesions with reticulo-globular pattern, telangiectasia and arciform structures [31].

6.1.5 Vitiligo

In patients with black skin, the clinical aspects with achromic macules on the skin and mucous membranes. Dermoscopy is useful to determine the disease's activity. Thus, perifollicular depigmentation (PFD) was predictive of stable vitiligo, and perifollicular pigmentation (PFP) was characteristic of active disease. Starburst appearance, altered pigment network, and comet tail appearance were also noted, and these were typical of progressive vitiligo [32].

Vitiligo is very stressful with psychological and emotional impact. Recently, in Nigeria, some authors assess the QOL impairment among Nigerian patients with vitiligo using a disease-specific quality-of-life index questionnaire (VitiQoL). They include 77 patients, and they found that QOL is impaired significantly in Nigerian patients with vitiligo [26].

6.2 Infectious skin diseases

The tinea versicolor can be associated in black skin with dyschromia [33]. Thus, macules may present as hyperpigmented or hypopigmented on the usual topography (**Figure 4**). However, in patients using high-potent corticosteroids for cosmetic purposes, clinical forms with achromic and atrophic lesions on the lower limbs may be found [34].

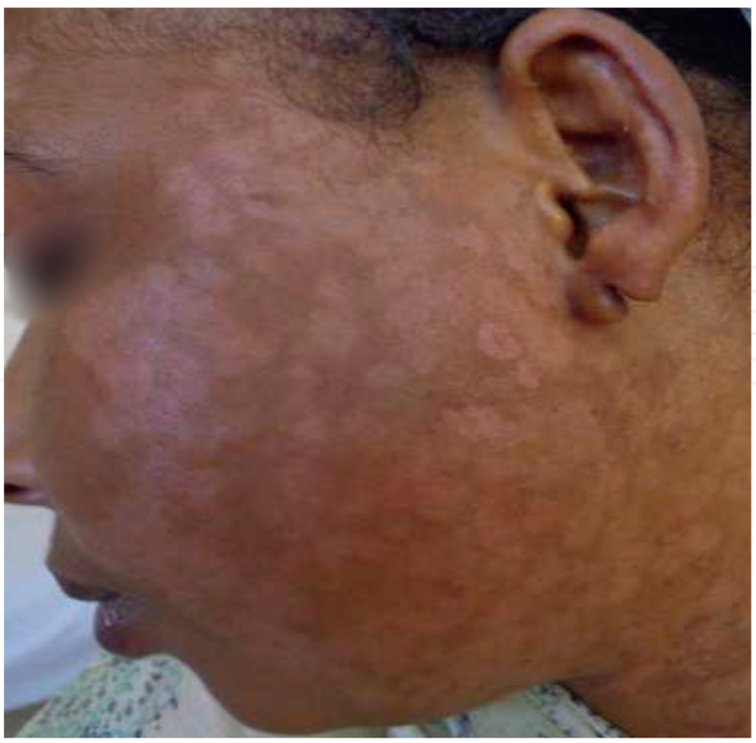


Figure 4.
Tinea versicolor on the face after skin bleaching by high-potent corticosteroids.

The clinical presentation of scabies varies with sometimes very diffuse hyperpigmented macules particularly in immunocompromised patients [35].

For other infectious skin diseases, the clinical aspects are variable: hypopigmentation is common in Hansen disease, in endemic treponematosis such Pinta, and in onchocerciasis. These latter are now very rare [36].

6.3 Systemic autoimmune diseases with skin manifestations

6.3.1 Lupus

In lupus, the dermatological manifestations are polymorphous; in patients with phototype VI, the skin disorders are often of pigmentary type (**Figure 5**). Whether it is specific acute, subacute or chronic lupus, or nonspecific, hyperpigmentation or

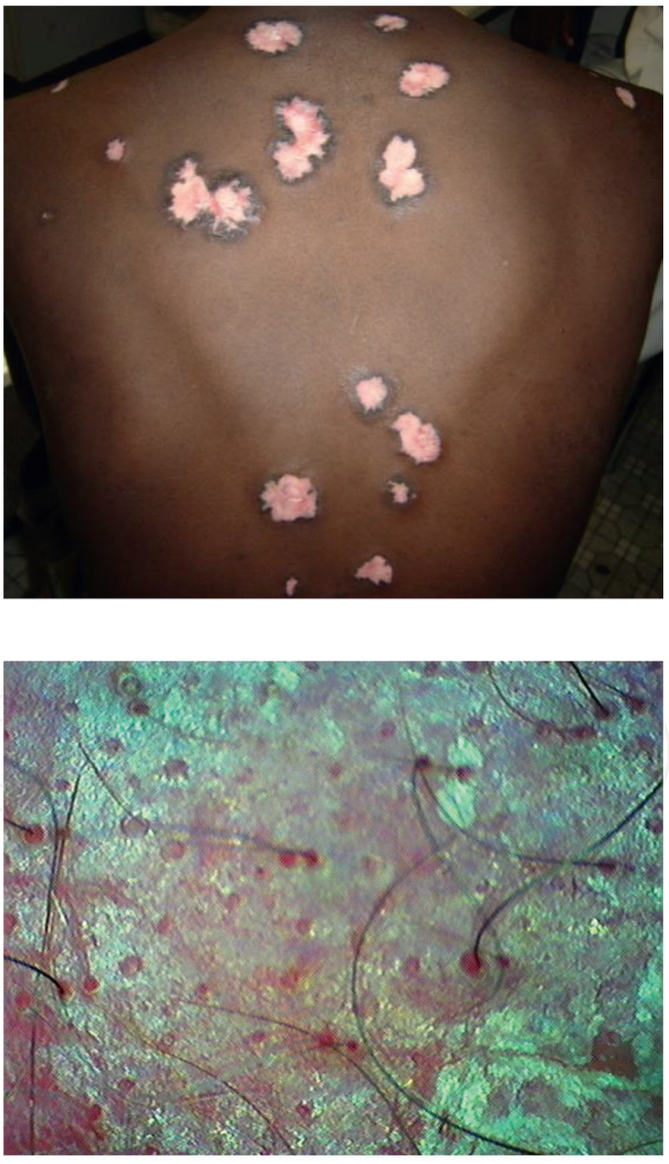


Figure 5.
Discoid lupus on the back clinical and dermoscopic aspect.

hypopigmentation is found in almost all the patients. For acute lupus, the vespertilio involvement may be complicated by hyperpigmented scars, depending on the intensity of the junctional involvement. For subacute lupus, it is more often the psoriasiform form that is complicated by hypochromia, whereas the annular form is rather hyperchromic. Finally, in chronic lupus, in addition to atrophy, erythema, and scaling, hypopigmentation is the hallmark. All these lesions have a considerable esthetic impact. Let us mention vitiligoid lupus, which is a variant of chronic lupus [37].

6.3.2 Systemic scleroderma

On black skin, scleroderma is characterized by pigmentary disorders, which are distinguished into five types. Hypopigmentation may be localized on the face, neck, and trunk (**Figure 6**), or on the extremities, or it may be diffuse, whereas hyperpigmentation may be either diffused or localized to the photoexposed areas [38]. The clinical aspects of pigmentary disorders during systemic scleroderma are the following:

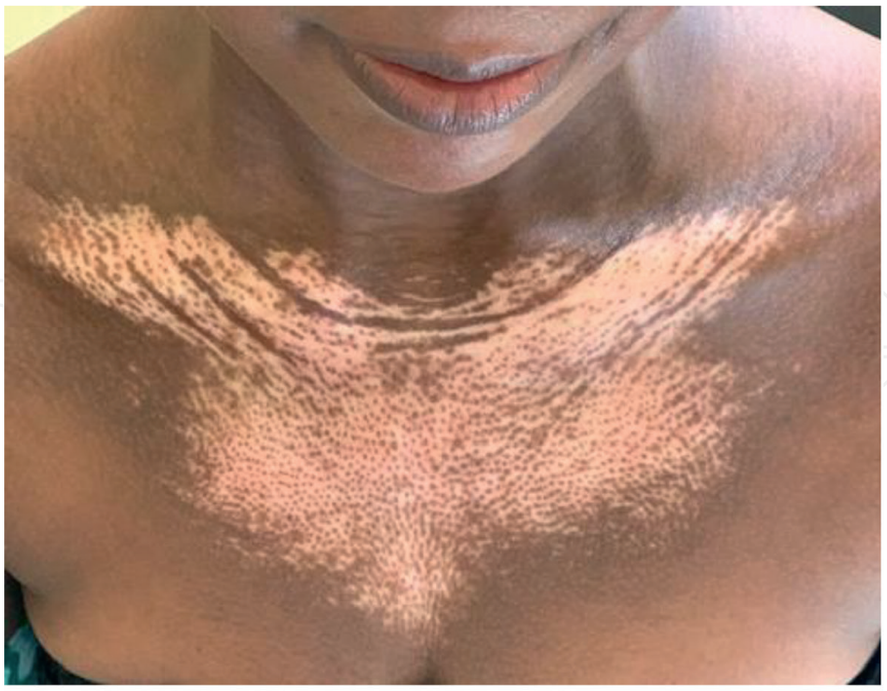
- confetti depigmentation synonyms "salt and pepper," pseudo-vitiligo, speckled achromia, and speckled spots;
- diffuse hyperpigmentation;
- hyper- and hypopigmentation in areas of sclerosis;
- linear pigmentation within depigmented areas next to superficial vessels;
- localized hyperpigmentation;
- localized hyperpigmentation;
- Hyper- and depigmentation in belt with telangiectasia;
- hyperpigmented macules without cutaneous sclerosis.

Dyschromias are associated with the severity of the sclerosis. Indeed, diffused hyperpigmentation and hypopigmentation are more frequently found with a modified Rodnan score of over 30. The Rodnan score allows one to assess the degree of cutaneous sclerosis on different segments of the body (face, thorax, abdomen, and lower and upper limbs); it varies from 0 to 51.

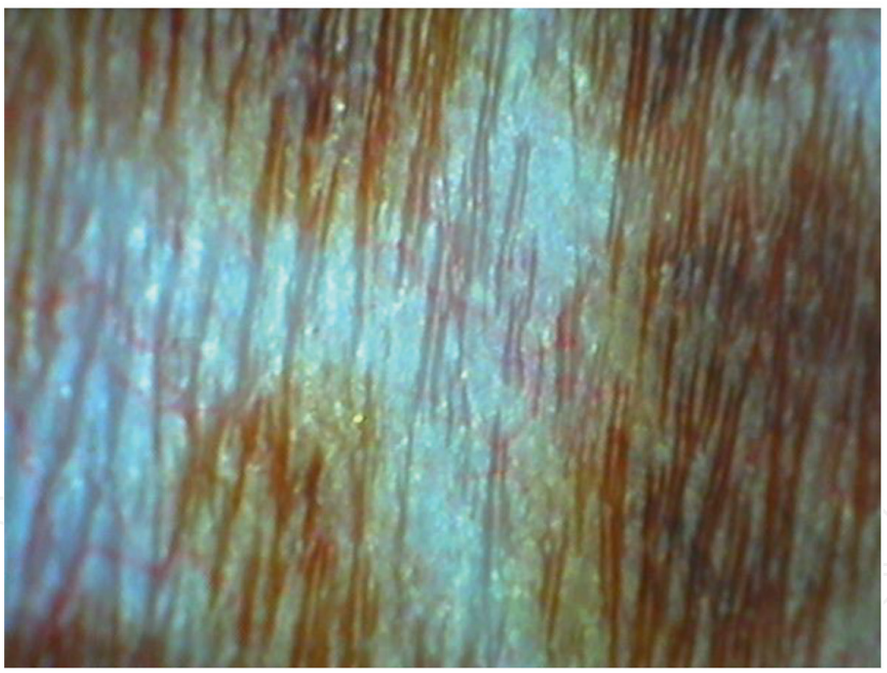
Moreover, the duration of Raynaud's phenomenon of less than 10 years seems to be associated with the presence of dyschromic disorders.

6.3.3 Dermatomyositis

The particularities of dermatomyositis in black skin are flagellated macules and hyperpigmentation. Gottron's papules may take on a hypopigmented appearance. The association with muscular involvement helps the diagnosis [39].



(A)



(B)

Figure 6.
Clinical (A) and dermoscopic (B) aspects of speckled achromia in systemic scleroderma.

6.4 Skin diseases associated with the cosmetic use of skin bleaching products

Skin bleaching is a practice consisting of the use of products containing high-potent topical corticosteroids, hydroquinone, and mercury or other depigmenting substances (fruit acids, kojic acid, arbutin, and injectable glutathione) for cosmetic purpose. It is a worldwide practice widely used by women from Sub-Saharan Africa,

Asia, and America. It is common in women from Sub-Saharan Africa where prevalence from 52–71% was found [40, 41].

The complications associated with this practice are varied, essentially bacterial, fungal, and parasitic infections, but also acne, trophic disorders, and pigmentary disorders. The latter include exogenous ochronosis, lichen- and lupus-like dermatoses, poikiloderma, and hyperpigmentation of the joints.

6.4.1 Exogenous ochronosis

Clinically, exogenous ochronosis is manifested by blackish papules with a tar-like appearance and a sensation of rape on palpation; these lesions are grouped in vast sheets and are located in the exposed areas (**Figure 7**). The back and the face are the most common localization, but recently other localizations have been described, such as hands on interdigital spaces and the backs of the feet [42].

6.4.2 Lichen- and lupus-like dermatoses

First described in 1976 by Marchand, the lupus- and lichen-like dermatoses are associated with a long-term use of hydroquinone.

The lesions occurred in a mean duration of 7.5 months after the use of hydroquinone and as macule or infiltrated papule with an annular border or hyperpigmented or macules (**Figure 8**). These lesions are localized on the face or upper limbs on the photoexposed area [43].

6.4.3 Poikiloderma

The poikiloderma associates atrophy, telangiectasia, and dyschromia and is secondary to the the association of high-potent corticosteroids and hydroquinone. The localization is preferentially on the upper limbs [44]. These complications are observed after a long-term use of bleaching products.

6.4.4 Hyperpigmentation

Hyperpigmentation can be localized or generalized; preferential localizations are the periorbital area or at the interphalangeal joints (**Figure 9**). This hyperpigmentation is one of the stigmata of skin bleaching.

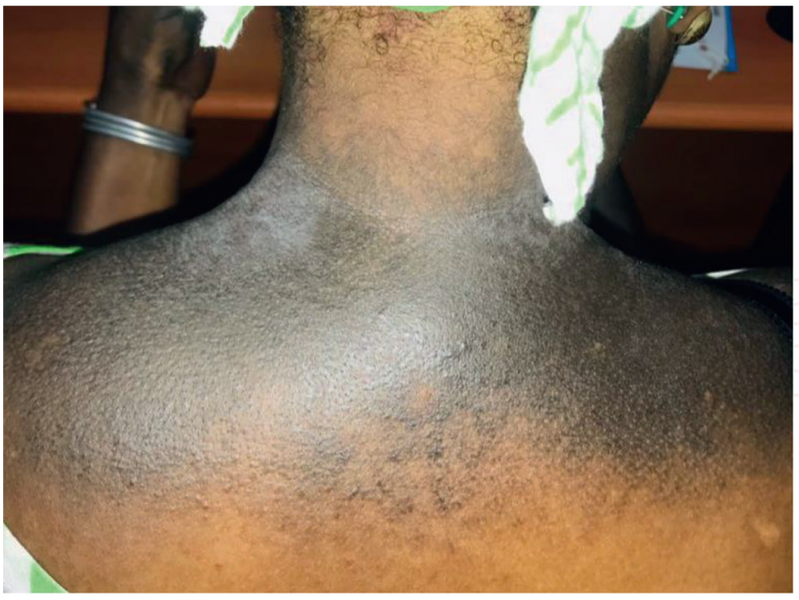
This hyperpigmentation had a high psychological impact. Different types of pigmentary disorders can be associated in the same patient.

7. Treatment of pigmentary disorders

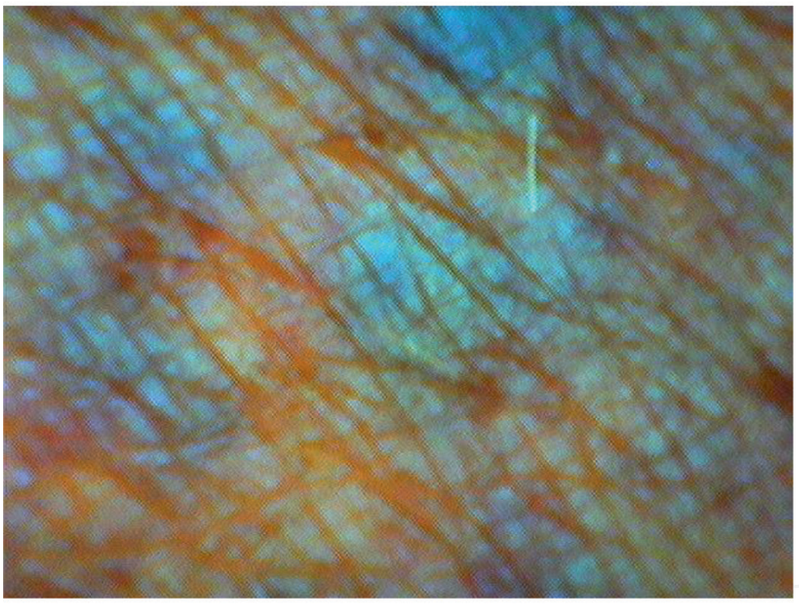
The treatment strategy of pigment disorders in patients with black skin remains a veritable challenge.

For symptomatic treatment, topical corticosteroids and retinoids are the most common treatment. However, hydroquinone at 4% alone, or in magistral preparations, gives a good result; arbutin and kojic acid are also indicated at all the stages of postinflammatory hyperpigmentation [42].

The photoprotection is also necessary for the treatment and the prevention of different pigmentary disorders.



(A)



(B)

Figure 7.
Exogenous ochronosis on the back: Clinical with black papules (A) and dermoscopic aspect with brown gray globular structures (B).

For physical treatment, different types of lasers are available: 755-nm alexandrite picosecond, 694-nm ruby, and 532- and 1064-nm neodymium: YAG nanosecond lasers appear to be safe and effective modalities for the removal of pigmentary disorders in skin of color patients with no long-term complications if used appropriately [43].

For general treatments, tranexamic acid was used with good results in patients with melasma [44]. The early treatment of acne with low doses of isotretinoin, topical retinoids (adapalene), and photoprotection is associated with good results in acne postinflammatory hyperpigmentation.

For each disease, a specific treatment is indicated depending on the etiology and the patient's needs.

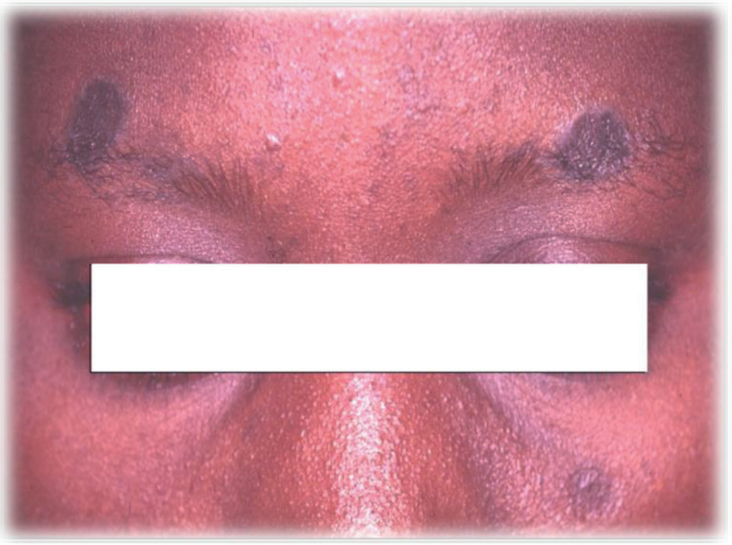


Figure 8.
Lichen-like dermatosis after skin bleaching with hydroquinone.

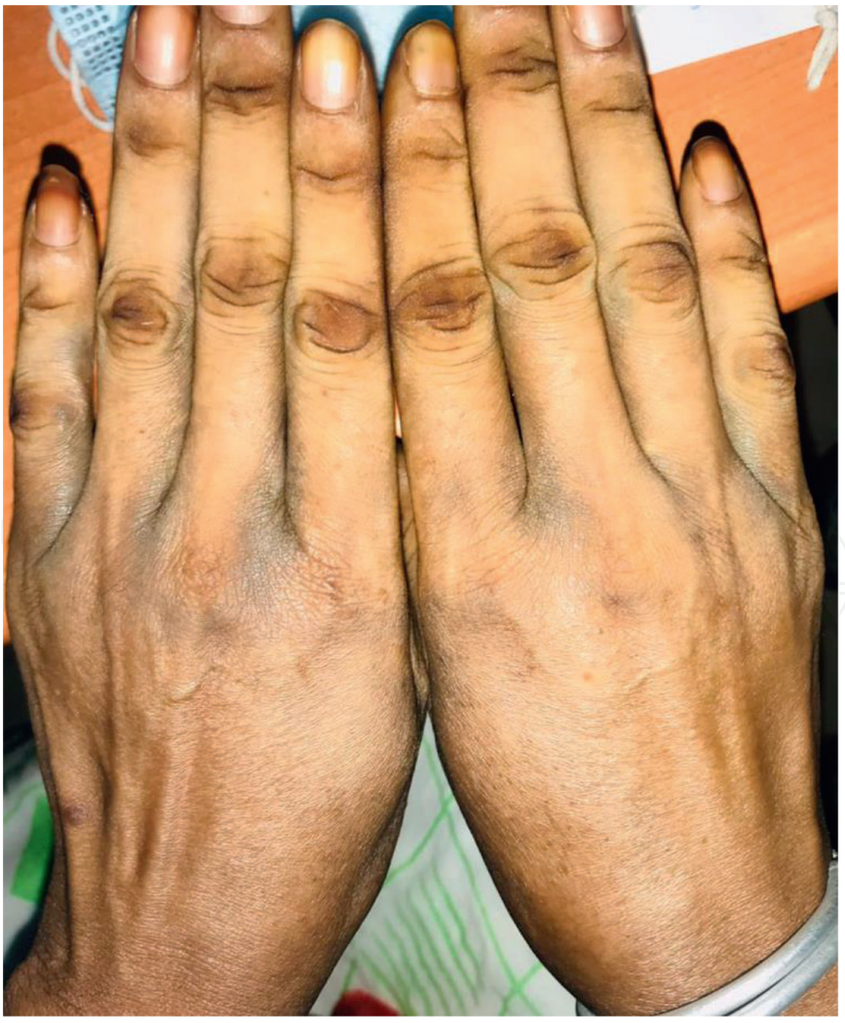


Figure 9.
Hyperpigmentation on the joints' dorsal aspect on the hand associated with exogenous ochronosis on interdigital folds.

Depending on the quality of life and the impact on pigmentary disorders, a psychological approach can be indicated [45].

Finally, prevention is particularly indicated in women using corticosteroids, hydroquinone, and mercury in cosmetic purpose. By information, communication and education by using safe cosmetics and by improving the cosmetovigilance system.

8. Conclusion

Pigmentary disorders are very frequent in phototype VI patient; etiologies are variables. Indeed, all the skin diseases can be associated with hyper- or hypopigmentation. The last few years' news data about the pathophysiology of postinflammatory hyperpigmentation were available. This latter is particularly associated with acne and can be evaluated by a scale that has been validated in phototype VI patients from Sub-Saharan Africa. The impact of pigmentary disorders on the quality of life of the patients with black skin was also evaluated. Moreover, dermoscopy, a noninvasive tool, is very helpful to establish the diagnosis and prognosis of such disorders.

The treatment is symptomatic and etiologic, and the prevention by photoprotection is a veritable challenge.

Conflict of interest

No conflicts of interest.

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