

# Evaluating Brazilian skin types using digital polarized photography: a pilot study

## Avaliação com fotografia digital polarizada: estudo piloto da pele brasileira

### ABSTRACT

**Introdução:** The Brazilian skin type is a result of the mingling of three ethnicities – European, African and native population. It is difficult to quantify the intensity of brown or vascular colorations with only a visual inspection. Photography assisted by a digital circular polarizing filter and special lighting allows a more accurate dermatologic examination.

**Objective:** To identify vascular patterns, texture and melanic pigmentations of the face, in groups of dermatologic patients, using polarized pictures.

**Methods:** Open prospective study, with traditional and polarized photographs of adult women. Digital pictures taken with a Canon T1i camera with different lens configurations (100 mm fixed macro lens without a polarizing filter and 60 mm fixed macro lens with a Hoya pro 1D circular polarizing filter) and the same lighting (two 140 flash heads against an indigo background) were compared.

**Results:** Polarized and traditional photographs of 34 women (n = 34) were analyzed. Patients were classified as Phototypes II (13), III (16), IV (4) and V (1), according to the Fitzpatrick scale. In 8 patients who reported facial erythema and edema after exposure to heat sources, vascularization was observed only in the polarized pictures. Additionally, melanic pigmentation (ephelides, melasma, and post-inflammatory hyperpigmentation) was observed in all patients, rosacea acne lesions in 1 patient, and inflammatory actinic keratosis in 1 patient. The examination was helpful in recommending treatments at home, intense pulsed light, photodynamic therapy, CO<sub>2</sub> fractional laser, and in the follow-up of rosacea acne.

**Conclusions:** Medical photography using a circular polarizing filter is a tool for diagnosing and following up therapeutic treatments, being also useful for documenting skin phototypes II to V.

**Keywords:** photography; lighting; dermatology.

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### RESUMO

**Introdução:** A pele brasileira é resultado da interação de três grupos populacionais (europeu, africanos e índios). À inspeção desarmada é difícil quantificar a intensidade das colorações acastanhada ou de origem vascular. A fotografia digital com filtro polarizador circular e esquema especial de iluminação permite maior acurácia do exame dermatológico.

**Objetivo:** Identificar padrões vasculares, textura e pigmentações melânicas da face em grupo de pacientes dermatológicos, utilizando fotografias polarizadas.

**Métodos:** Estudo prospectivo e aberto com fotografias tradicionais e polarizadas de mulheres adultas. Compararam-se fotografias digitais com câmera Canon T1i, com objetiva fixa macro 100mm sem filtro polarizador (tradicionais) com outras tomadas com a mesma máquina mas com objetiva fixa macro de 60mm com filtro polarizador circular Hoya pro 1D (polarizadas), sob esquema de iluminação com 2 tochas (cabeças) de flash 140 e fundo azul-anil.

**Resultados:** Fotografias tradicionais e polarizadas de 34 mulheres (n=34) fizeram parte do estudo. Segundo a escala de Fitzpatrick, as pacientes foram classificadas em fototipos: II (13 pacientes), III (16 pacientes), IV (4 pacientes) e V (1 paciente). Em 8 pacientes, que referiam eritema e edema faciais após exposição a fontes de calor, foi observada vascularização apenas através da fotografia polarizada. Detectaram-se também pigmentações melânicas em todas as pacientes (efêlides, melasma, hiperpigmentação pós-inflamatória), lesões de acne rosácea (1 paciente) e queratoses actínicas inflamatórias (1 paciente). O exame auxiliou a indicação de tratamentos domiciliares, luz intensa pulsada, terapia fotodinâmica, laser CO<sub>2</sub> fracionado e o acompanhamento de acne rosácea.

**Conclusões:** A fotografia médica com filtro polarizador circular é uma ferramenta diagnóstica e de acompanhamento terapêutico, sendo útil para a documentação dermatológica da pele de fototipos II a V.

**Palavras-chave:** fotografia; iluminação; dermatologia.

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## INTRODUCTION

Brazilians are one of the most heterogeneous populations in the world, consisting of a hybrid population composed mainly of Europeans, Africans and native Indians.<sup>1,2</sup>

When the Portuguese explorers arrived in Brazil in 1500, they found approximately 2.5 million natives in the area known today as Brazil. Intermingling began with the first settlers and was encouraged from 1755 as a strategy to occupy the country. Historical registers suggest that between 1551 and 1850 around 3.5 million Africans were brought to Brazil, and that 500,000 Portuguese colonists arrived in the country from 1500–1808. Following this period, four million immigrants came from various parts of the world, mainly from Italy, Spain and Germany.<sup>2</sup> At the time of its independence, Brazil was home to about 1.3 million whites and 3.9 million blacks and mestizos.<sup>3</sup> The distribution of slaves was concentrated in areas such as Pernambuco and Bahia in the northeast and Minas Gerais and Rio de Janeiro in the southeast.<sup>3</sup>

The relatively small number of female settlers contributed to the European settler's interaction with the native Indian and black women. According to DNA-based analysis, there was a predominance of indigenous lineages in the north of the country, African lineages in the northeast, a balance of ethnicities in the southeast, and European predominance in the south of the country. Parra (in 2003) verified that it is possible to find traces of African ancestry in white Brazilians in the four main regions of the country. The African contribution to the urban population varies from 4–34% and that of the Indians, from 0–27%.<sup>1,3</sup> Although physical features such as skin and hair color, hair texture, and lip and nose format are constantly used to describe people's appearance, anthropologists and geneticists maintain that from a biological perspective, human "races" do not exist.<sup>1</sup> The Brazilian history and social structure indicate that physical appearance results from a small number of genes and should not be used to determine African ancestry.

The perception of skin color is a consequence of the reflection of light on the epidermis, of the presence of melanin and carotenoids (responsible for brown and yellow pigments, respectively), of oxyhemoglobin and carboxyhemoglobin (responsible for the subpapillary vascular plexuses' red color).<sup>4</sup> It also depends on genetics, UV irradiation and hormonal influences, in addition to disorders of the melanic pigmentation. Although the Fitzpatrick phototypes classification 5 indicates resistance to sunburn for phototypes IV and V, and sun sensitivity for phototypes II and III, empirical experience suggests diverse combinations of such characteristics Brazilian skin types.

The Brazilian population's exposure to the sun depends on factors linked to work, leisure or sports activities; time spent outdoors is influenced by the weather, which varies among regions – from equatorial in the North to temperate in the South.<sup>6</sup> Erythema and edema triggered by physical agents (sun, artificial light, heat) in higher phototypes can correspond to the expression of genetic characteristics resulting from the hybrid inheritance of the Brazilian population. Also, phototype classification is many often hampered by an individual's chronic expo-

sure to the sun. Visual inspection of Brazilian skin, unassisted by technological devices, offers certain limitations such as the difficulty in quantifying the intensity of the brown or vascular coloration.

When light hits the skin, it is both reflected in a regular manner and absorbed by the dermis, disseminating in several directions. The use of a circular polarizing filter on a digital camera with the assistance of automatic focus eliminates the regular reflection of the light on the skin and enables the photographic documentation of the red (vascular or inflammatory lesions) and brown (hemosiderin or dermal melanin) chromophores. The polarizer also enhances the skin's texture and wrinkles in normal and pathological conditions. In external environments, this filter is used to reduce the reflectivity of metallic surfaces, glass or water – or to enhance the color of the sky.

## OBJECTIVE

The objective of this study to record and identify the patterns of subpapillary vascularization and dermal pigments of Brazilian skin types by comparing digital pictures taken with and without a polarizing filter.

The elimination of the regular reflexion of the light on the skin through the use of a polarizing filter allows visualizing, through the picture, the brown (hemosiderin or dermal melanin) or red (vascular or inflammatory lesions) pigments of the skin.<sup>7</sup>

## METHODS

In this prospective and open study, developed at the author's private practice according to the concepts of the 2000 Helsinki Declaration, adult women aged 20–90 were selected randomly and photographed with and without a polarizing filter. Patients who had previously undergone photodynamic therapy, fractional CO<sub>2</sub> laser or intense pulsed light were excluded, since these treatments alter the vascular pattern of the skin.

The pictures were taken using a Canon EOS T1i digital camera with settings of ISO 100, 160s speed and f11. A fixed focus 100 mm macro lens was used for the non-polarized pictures, while a 60 mm fixed focus macro lens was used with a Hoya pro1D circular polarizing filter. The lighting system was designed to simulate daylight. It consisted of two 140 flash heads (installed on pantographic arms running on rails attached to the ceiling), synchronously activated by radio-transmission, assembled with short parabolic reflectors and white diffusers positioned at a 45-degree angle to the subject. A modelling light provided uniform light to the whole face of the patient, who sat in front of an indigo background.<sup>12</sup> All pictures were taken, in a standardized manner, from a frontal position and from a 45-degree angle,<sup>7,8</sup> from a distance of around 1 meter, adjusted according to the ideal focal distance in each situation (Figure 1).

## RESULTS

Pictures of 34 women, taken with and without a polarizing filter, were analyzed. Patients were aged 20–90 years (50% were between 50 and 70 years old). Patients were classified



**Figure 1:** Photoaging observed in traditional picture in frontal position (A) and left lateral view (C) ISO 100, aperture f11, exposure time 1/160s, focal length - punctual measurement. Photoaging observed in polarized picture in frontal position (B) and left lateral view (D) ISO 100, aperture f11, exposure time 1/160s, focal length - punctual measurement, Hoya pro D1 circular polarizing filter.

according to the Fitzpatrick scale 1 as follows: phototype II (13 patients), phototype III (16 patients), phototype IV (4 patients) and phototype V (1 patient). Non-polarized and polarized pictures of the face's cutaneous characteristics in the upper, middle and lower thirds were compared.<sup>9</sup>

Polarized pictures illustrated the skin's vascular pattern that is not usually perceptible by simple visual inspection or in non-polarized pictures, by enhancing the vascular network with telangiectasias and erythematous nodules (Figure 2).

The vascular pattern's intensity was correlated with the clinical history of intensity of erythema and edema resulting from the exposure to sunlight, heat, photodynamic therapy or fractional CO<sub>2</sub> laser sessions. Of the 34 women evaluated, eight (one in her 40s, two in their 50s and five in their 60s) presented facial erythema and edema after exposure to heat sources; vascularization was observed in the polarized picture in the middle third of the face or the whole face. Two women were classified as phototype II,

four were phototype III, and two were phototype IV on the Fitzpatrick scale. In three women clinical examination and traditional pictures revealed very light erythema. Telangiectasias were observed in 10 patients; the remaining patients did not present any erythema in a simple visual inspection.

Melanic pigmentations were also recorded in all patients, including those of lower phototypes – probably since they live in a sunny area. The pigmentary lesions observed in the polarized pictures were characterized as follows: 3 patients with brownish post-inflammatory hyperpigmentation (and slightly grayish macules, with undefined margins and darker center) (Figure 3); 21 patients with ephelides (beige macules with well-defined borders); 5 patients with melasma (irregular brownish macules with variable shape and color intensity, with or without vascular network); and 9 patients with solar melanoses. Additionally, the skin's texture (open and closed pores, wrinkles, scars), photoaging characteristic (Figure 4), rosacea and inflammatory actinic keratoses were observed.



**Figure 2:** Patient with rosacea acne. Traditional picture showing erythematous nodules in the central and mentonian areas of the face (A). Polarized photograph showing intense vascular network and melanic pigmentation (B).



**Figure 3:** Patient with post-inflammatory hyperpigmentation (A): chestnut brown pigmentation without well-defined borders and darker center visible in the polarized picture (B).

Photodynamic therapy was indicated for a 73-year-old patient whose actinic keratoses presented a erythematous base and were distributed all over the face. In one woman who presented rosacea, the polarized picture demonstrated melanic pigmentation forming a slight mask on the face, accompanied by thin vascular network with nodulation areas in the malar regions.

#### DISCUSSION

Linear polarizing filters have been used in the past in analogical photography, previously limited to manual focus and a 35° angle in relation to the subject, as described in the study by Phillips and contributors in 1997.<sup>10</sup> Circular polarizing filters allow the capturing of images with automatic focus digital cameras. Because it behaves as a neutral density filter, it reduces the light by 1 1/3. The light used should be sufficient to allow the digital camera's CCD sensor to be sensitized.<sup>11</sup> In addition, the

development of 15 megapixel CCD for semi-professional cameras has enhanced the ability to record small details. The use of luminous 60 mm and 100 mm fixed focus macro lenses facilitates the focal distance calculation, thus helping to standardize the distance between the camera and the subject without anatomical distortions.

Photography has been used as the base of computational data analyses.<sup>12</sup> Setaro (in 2002) observed the erythema degree in a group of 348 healthy Caucasian adults and verified that digital images are more efficient than the conventional evaluation of observers. This study evaluated erythemas after aesthetic procedures (peels or lasers) and graded the erythema according to the following scale: 0 = absent; 1 = light erythema or without well-defined margins; 2 = moderate erythema with well-defined margins; 3 = intense erythema with elevated margins. The evaluations were carried out at a constant temperature and air humidity, with no use of tobacco, coffee, alcohol and drugs for three hours prior to evaluation.<sup>13</sup>



**Figure 4:** Fitzpatrick phototype III patient.(A) The polarization of the picture allows the visualization of the vascular network and melanic pigmentation.(B)

Bae and contributors (in 2010) 14, in addition to previous studies,<sup>5,8,9</sup> verified the utility of photographing with polarized light to evaluate cutaneous surface alterations. The researchers used polarized light sources and linear polarizing filters, which increases the complexity of the technique and makes it difficult to obtain the white balance and true skin colors at the same time. The use of flash heads that provide 5500° K (equivalent to daylight) improves the technical quality of traditional pictures as well as those taken with a circular polarizing filter, allowing the use of SLR digital cameras, automatic focus, ISO 100, high shutter speeds and adequate diaphragm openings, simplifying the photographic technique and reducing its cost.

This pilot study – the first focusing on the Brazilian type of skin – allowed, through polarized photographs, the observation of vascular and pigmentary patterns as well as the diagnosis of rosacea and inflammatory actinic keratoses not detectable by simple visual inspection or traditional photographic techniques. The examination was also useful in the indication of treatments such as intense pulsed light, photodynamic therapy, and fractional CO<sub>2</sub> laser – and in the clinical follow-up of rosacea.

## CONCLUSIONS

Medical photography with circular polarizing filter is a helpful tool for diagnosis and therapeutic follow-up, and is also useful in the dermatologic documentation of the Brazilian type of skin. In the outpatient clinic, it enhances the inspection of the skin and the detailed record of vascularization in normal and pathological skin. ●

## REFERÊNCIAS

1. Parra F, Amado RC, Lambertucci JR, Rocha J, Antunes CM, Pena SDJ. Color and genomic ancestry in Brazilians. *Proc Natl Acad Sci U S A*. 2003;100(1):177-82.
2. Pimenta JR, Zuccherato LW, Debes AA, Maselli L, Soares RP, Moura-Neto RS, et al. Color and Genomic Ancestry in Brazilians: A Study with Forensic Microsatellites. *Hum Hered*. 2006;62(2):190-5.
3. Costa EV. *Da Senzala à Colonia*. São Paulo. Fundação Editora da UNESP, 1998.
4. Stewart MI, Bernhard JD. The Structure of Skin Lesions and Fundamentals of Diagnosis. In: Freedberg IM, Eisen AZ, editors. *Fitzpatrick's Dermatology in General Medicine*. EUA;Mc Graw-Hill; 2003 p.12.
5. Fitzpatrick TB, Ortonne JP. Normal Skin Color and General Considerations of Pigmentary Disorders. In: Freedberg IM, Eisen AZ, et al editors. *Fitzpatrick's Dermatology in General Medicine*. The Mc Graw-Hill ; 2003 p.819-20.
6. IBGE - Instituto Brasileiro de Geografia e estatística. Disponível em URL: [HTTP://www.ibge.gov.br](http://www.ibge.gov.br)
7. Anderson RR. Polarized Light Examination and Photography of Skin. *Arch Dermatol*, 1991; 127(7): 1000-5.
8. Hochman B, Nahas FX, Ferreira LM. Fotografia aplicada na pesquisa clinico-cirurgica, *Acta Cir Bras*. 2005; 20(2):19-25.
9. Tamura BM. Anatomia da face aplicada aos preenchedores e a toxina botulínica - parte I. *Surg Cosmet Dermatol*. 2010;2(3):195-204.
10. Phillips SB, Kollias N, Gillies R, Muccini JA, Drake LA. Polarized light photography enhances visualization of inflammatory lesions of acne vulgaris. *J Am Acad Dermatol*. 1997;37(6):948-52
11. Nagaoka T. Inspection of skin hemodynamics with hyperspectral camera. *Proceedings of the 29th Annual International Conference of the IEEE EMBS, Lyon, France, August 2007*, 23-26.
12. Brand VC, Souza RCA, Pedrini H, Lima HC. Avaliação da intensidade das rugas periorbitais por processamento digital de imagens: um estudo de validação. *Surg Cosmet Dermatol*. 2009;1(1):15-20.
13. Setaro M, Sparavigna A. Quantification of erythema using digital camera and computed-based colour image analysis: a multicentre study. *Skin Res Technol*. 2002;8:84-88.
14. Bae EJ, Seo SH, Kye YC, Ahn HH. A quantitative assessment of the human skin surface using polarized light digital photography and its dermatologic significance. *Skin Res and Technol*. 2010; 16(3): 270-4.