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COMMENTARY

Commentary: Facial Aesthetic Dermatological Procedures and Photoprotection in Chinese Populations

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ABSTRACT

The medical literature on aesthetic dermatology has primarily focused on a light-skinned patient population, yet patients of darker skin types have different needs and priorities. In Chinese individuals, key concerns include altered pigmentation, which is perceived to age the individual, and also relates to the Chinese cultural standard of beauty of fair skin; many seek aesthetic treatment for this. Non-invasive cosmetic procedures such as lasers and injections are also gaining in popularity in the Chinese market, but this population is prone to hyperpigmentation as an adverse effect of such procedures. Considered and tailored approaches, both to primary concerns of photoaging and the side effects of cosmetic treatments, are warranted.

Keywords: Sunscreen; Pigmentation; Laser; Noninvasive; Exposome; Photoprotection; Chinese

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Key Summary Points

Hyperpigmentation is an important concern in Chinese populations as both a primary problem related to photoaging and a secondary problem in the form of postinflammatory hyperpigmentation (PIH) as a potential side effect of aesthetic procedures.

There is increased demand for aesthetic procedures, particularly noninvasive procedures such as laser, peels, resurfacing, botulinum toxin, and fillers.

Pre- and postprocedural care should aim to minimize potential side effects. This includes avoidance of sun exposure/tanning, use of dressings such as broad-spectrum sunscreens that protect against high-energy visible light, and steroids.

The procedures themselves should also be planned taking into account the risk of PIH, with a less aggressive, less ablative approach and longer rest time between sessions.

INTRODUCTION

Certain features of skin physiology and phenotype are influenced by an individual's ethnicity. The skin's reaction to environmental factors, such as acute or chronic sun exposure, pollution, and even therapeutic treatments, should be considered in the individualized planning of dermatological care. While race, ethnicity, skin color, and skin phototype are not synonymous, there is significant overlap and certain traits among population groups are relevant to dermatology. In this article we discuss the factors that should be taken into account to optimize care for patients from a Chinese population, which may include those living in China or in other parts of the world. Acknowledging that the existing literature reports on concepts that are not always directly comparable (e.g., Asian versus Chinese, skin of color, Caucasian, white, dark skin, skin color, skin phototype, etc.), which is in itself a limitation, and that terminology may change over time, we attempt to take a pragmatic approach to extract the relevant points and ensure optimized care.

Compliance with Ethics Guidelines

This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

Skin type, skin aging and the effects of the exposome, or the total of nongenetic, environmental factors an individual is exposed to, on common cosmetic facial issues in Chinese populations.

Characteristics of Skin Type and Skin Aging in Chinese Populations

Skin color and skin type have been described as "two different subjects with a close relationship" [1]. Skin color is mainly determined by melanin content, with higher melanin content in melanosomes in the upper epidermis and a higher ratio of eumelanins/pheomelanins giving a darker color [2].

The applicability of the original Fitzpatrick scale in describing skin phototype outside of white European population groups has been questioned; calls have been made for improved methods of describing skin of color [4] and an alternative for Japanese individuals has been developed [3].

Using a questionnaire based on the traditional Fitzpatrick scale, Liu et al. interviewed over 400 women from four Chinese cities and found the predominant skin phototype to be type III (more than 70%), followed by type II and type IV [1], which is relevant because in phototypes III and IV, visible light (VL) can trigger melasma. In the same population, Liu et al. measured minimal erythema dose (MED) and minimal persistent pigmentation dose (MPPD), which correlated with skin type: from

type II to IV, MED increased gradually, while the MPPD decreased slightly [1]. Tan et al. also found, in a large-scale population study of more than 20,000 Han Chinese individuals from Shanghai, that lighter skin [based on individual typology angle (ITA)] was consistently associated with lower MED [5].

It is generally recognized that extrinsic aging manifests differently in different racial groups [6], with wrinkles occurring later in East Asian than non-Hispanic white populations, while people of East Asian origin or with darker skin are more prone to solar lentigo and hyperpigmentation [7]. In a comparative study of skin aging between Chinese and French women, wrinkles occurred around 10 years later and were less severe in the Chinese group than the French group [8], but pigmented spot prevalence and size was much greater in Chinese women [8, 9]. An artificial intelligence analysis of photographs from more than half a million Chinese and European women confirmed marked differences in signs of skin aging, with pigmentation and cheek pores being more severe in the Chinese group [10]. This aligns with Porcheron et al.'s findings on perceived age and attractiveness [11]: Chinese women rated faces that had been computer-manipulated to reduce dark spots as most attractive [11] and perceived this feature to have a greater effect on age and attractiveness than other signs of aging such as wrinkles [11].

It is reasonable to consider potential differences in gene expression. Endo et al. found that different genes were associated with pigmented spots in individuals from Holland versus Japan [12–14]. Gao et al. suggested that genetic variants "could be responsible for distinct skin aging signs characteristic of Caucasians compared to East Asians" [15] and a similar author group also later concluded, on the basis of a genome-wide study, on the likely presence of differences in genetic susceptibility to skin aging between Han Chinese and comparison cohorts comprising French and German populations [13]. However, Yin et al.'s earlier study of epidermal gene expression patterns found great similarity between Asian (Filipino, Korean, Chinese, and Japanese) and northern European (mostly German) groups, but considerable differences compared with those of African descent (Ghana, Nigeria, Guinea-Bissau, and Eritrea) [2]. Liu et al., in a study of a full thickness skin model derived from cells of Chinese origin, found that the genes induced by daily UV radiation were similar to those upregulated in models for Caucasian populations [16], but acknowledged existing evidence of different UV sensitivities, in particular between East Asian and Caucasian populations. They suggested that this lack of a genetic difference could be due to an absence of melanocytes in the model and/or the strict control of the UV radiation used (limited UVA) [16].

Effects of the Exposome on Photoaging in Chinese Populations

In dark skin, the higher melanin content in the upper epidermis means that DNA damage from ultraviolet (UV) B exposure is confined to that area, whereas in lighter skin such damage can also occur in the basal layer [17]. Besides this protection against UVB rays, dark skin is more prone to hyperpigmentation upon exposure to VL and UVA [18, 19]. These wavelengths (UVA and VL) also penetrate deeper layers of the skin and induce skin aging [17].

Urban pollution (particulate matter and gases) and smoking have been associated with accelerated skin aging [20], manifesting as premature hyperpigmentation or wrinkles, depending on the pollutant source [21], potentially owing to aryl hydrocarbon receptor (AHR) activation [22], although a detailed biological mechanism remains to be established [22]. The aromatic compounds from particulate matter (PM) 2.5 can activate genetic expression of matrix metalloproteinases (MMPs) via AHR to induce cell senescence [23]. Furthermore, air pollutants and UV rays have synergistic effects on skin photoaging [24]. Polycyclic aromatic hydrocarbons (PAHs) are photosensitive to skin under UVA irradiation. Even at very low concentrations reflective of daily exposure, photosensitizing PAHs are likely to produce a chronic local photooxidation stress reaction that can cause damage to skin cells and ultimately accelerate the process of photoaging [24].

In the past, pollution levels (particularly urban but also rural) in China have been high, especially in the context of industrial and commercial growth, with average annual PM 2.5 levels of over 50 μg/m^3 reported on the basis of 2006 data) [25, 26]. In more recent years, this has improved to PM 2.5 levels of less than 50 μg/m^3 in Beijing [27]. A clinical study conducted in Shanghai showed several biochemical and physiological skin parameters were significantly altered upon exposure to pollution, including an increase in sebum excretion rate, decrease in the vitamin E, and squalene content in sebum and increased lactic acid [28].

Effects of the Exposome on Common Cosmetic Facial Dermatoses

Ultraviolet, pollution, and emotional stress can act as external triggers for the exacerbation of several dermatoses. UV rays are widely recognized as the main factor inducing melasma, recently described as a photoaging disease [29]. Opsin 3, a sensor identified in melanocytes, is responsible for induction of hyperpigmentation, stimulated by shorter wavelengths of VL [30]. Sunscreen that can protect against UV and VL (compared with UV only) has been shown to offer optimal protection against melasma relapses [17, 31].

UV radiation and high temperatures trigger the erythema and telangiectasia of rosacea, thought to be mediated via a dysregulated immune response [17, 32]. Mental stress, anxiety, and/or depression may also act as triggers [33, 34]. In acne vulgaris, UV rays, especially UVA, can increase the thickness of the stratum corneum and lead to disordered homeostasis of the skin microbiota. This may aggravate the inflammatory reaction of closed comedones. The skin surface composition may be oxidized owing to pollutants. Among them, squalene peroxides may mediate the progress of inflammatory acne [24]. Patients of skin phototype III and IV who suffer from severe acne (grade III–IV) may also develop postinflammatory hyperpigmentation (PIH) caused by UVA [17].

AESTHETIC PROCEDURES COMMONLY PERFORMED IN CHINESE POPULATIONS

In recent decades, there has been a surge in aesthetic enhancement procedures in Chinese populations, particularly in women aged 25–30 years [35]. There has also been a greater cultural acceptance of nonsurgical techniques, and demand for aesthetic medicine continues to grow, particularly for minimally invasive, low-pain procedures. Commonly performed nonsurgical procedures include botulinum toxin injection, hyaluronic acid injection, laser hair removal, intense pulsed light (IPL) treatment, and chemical peels (data based on board-certified plastic surgeons) [36]. Microneedling, radiofrequency, nonablative fractional lasers (NAFL) and fractional skin resurfacing [37, 38] have also been used with some success for the management of wrinkles, scars, pigmentary disorders, and photoaging [39]. Importantly, patients with darker skin or higher skin phototypes are more susceptible to procedural side effects such as PIH, hypopigmentation, and scarring [40].

Lasers and Other Energy-Based Devices

Laser therapy for the treatment of skin photoaging is based on selective photothermolysis. Different light wavelengths are absorbed by melanin, hemoglobin, and water [41] and converted to thermal damage, so that the treatment acts on the target tissues while preventing unwanted damage to surrounding tissues [39]. Fractionated laser therapy treats a lattice-shaped portion of the skin, allowing the treatment to reach deeper into the dermis while leaving some untreated epidermis intact that can heal faster [41]. It can effectively improve skin sagging, wrinkles, large pores, and other changes in skin texture caused by photoaging. Ablative lasers are more aggressive and may be suitable for more severe skin problems, but also need more down-time between treatments [39].

To achieve a satisfactory therapeutic effect, the multiple signs of photoaged skin—slackness/sagging and changes in texture, pigment

changes, and telangiectasia—should be treated simultaneously. Owing to the successful application of Q-switched laser [mainly 755 nm alexandrite laser, 1064 and 532 nm neodymium-yttrium aluminum garnet (ND:YAG) laser], it is no longer difficult to address pigmentation problems caused by photoaging. These lasers can target melanin granules and selectively destroy melanocytes or keratinocytes containing melanin granules [42]. There is higher probability of PIH with higher-energy Q-switched laser. More recently, fractionated picosecond lasers have been developed for the purposes of resurfacing and rejuvenation. Owing to their potential to produce substantially less nonspecific photothermal damage, they may represent an excellent option for photo rejuvenation in Chinese patients [37].

For treating changes in capillaries and redness, vascular lasers such as ND:YAG 1064 nm and pulsed dye lasers are mainly used. However, to minimize the risk of complications, these lasers should be used with extra caution in Chinese patients with darker skin types. In addition, vascular lasers can easily cause injury to surrounding tissues and form a scar. The use of proper cooling methods and avoidance of overlapping pulses is essential with vascular lasers to prevent injury associated with inadequate dissipation of heat. Laser therapists should be highly trained to ensure the condition is treated without scarring [43].

Different from lasers and IPL modalities, fractionated radiofrequency (FRF) devices induce coagulative damage to the dermis with relative sparing of melanin. By applying FRF to dermal collagen, bipolar water molecules vibrate and rotate at high speed and the dermis is heated to 50–60 °C by friction, causing immediate contraction, proliferation, and rearrangement of collagen fibers to improve wrinkles and sagging [39, 44].

Chemical Peeling

The most-used chemical peels in treating photoaging, melasma, acne, and acne scars include salicylic acid (SA), glycolic acid (GA), Jessner's solution (JS), resorcinol, and trichloroacetic acid (TCA) [45]. The use of chemical peeling in Chinese populations is generally limited to superficial or medium-depth peels to minimize inflammation and PIH; such procedures are popular as they are viewed as economically worthwhile [46].

Glycolic acid is the alpha hydroxy acid (AHA) with the lowest relative molecular weight, which is most used for chemical peeling at concentrations of 20–70%. Compared with other chemical peel products, 20–50% GA is milder and less likely to cause side effects such as pigmentation, and 70% GA should be used with caution in those with dark skin [47]. AHA up to 6% can also be added to daily-use cosmetics to brighten and moisturize skin and remove fine lines [48].

Botulinum Toxin and Fillers

Botulinum toxin injection is an effective way to improve dynamic lines. It is commonly used together with other methods; for example, with chemical peeling to reduce superficial wrinkles [49, 50]. Reducing excessive muscle movement is conducive to collagen reconstruction after laser surgery and lowers the risk of hypertrophic scarring [50].

Dermal fillers have been used for augmentation of volume loss and to fill wrinkles. Currently, biodegradable hyaluronic acid fillers are the gold standard treatment together with the latest generation of dermal fillers that can induce neocollagenesis, also called collagen stimulators [these include calcium hydroxyapatite, polycaprolactone (PCL), and polylactic acid (PLLA)] [51]. When fillers are used, slower injection rates decrease the incidence of PIH and bruising with occasional subsequent hemosiderin deposition in patients with higher phototypes [52].

PREVENTING AND TREATING HYPERPIGMENTATION IN THE CONTEXT OF AESTHETIC PROCEDURES

Since even minimal levels of light can trigger PIH, protection against UVB, UVA, and high

energy visible (HEV) light is fundamental [53]. The approaches to prevention and treatment of pigmentary disorders as a primary complaint is relevant, and can take a three-tiered approach, beginning with the daily use of an SPF 50+ broad-spectrum sunscreen [54], as well as photoprotection with active formulations to ameliorate the signs of aging, using formulations based on cosmetic retinoids such as retinal and retinol, antiaging peptides, AHAs, poly hydroxy acids, vitamins, antioxidants, growth factors, and lightening agents [55, 56]. Aesthetic procedures (chemical peels, lasers, and injection of fillers and botulinum toxin) for the correction of photoaged skin [57], as described above, represent the next step.

As PIH has been reported as the most common complication in dark-skinned patients who undergo laser surgery [58], it must be kept in mind when treating susceptible patients. Risk of PIH may be increased with the presence of dermatological diseases affecting the dermal–epidermal junction: inflammation that disrupts the dermal–epidermal junction, for example, in erythema multiforme and lichen planus, can cause pigmentary incontinence leading to PIH [58]. Aspects that can be modified to minimize such effects include procedural adaptations, pre- and post-procedural topical skin care regimens including sunscreen and whitening products, and oral supplements, depending on skin type, age, gender, and physiological state. Photosensitizing drugs and foods should be avoided.

Procedural Considerations

All patients should be informed about the possibility of no improvement or complications as part of the informed consent process before treatment. Documentation adapted to the procedure and local regulations should be completed. We recommend clinical and digital photographic evaluation before and after the procedure. A test session should be performed [59].

Laser treatments should be avoided in patients with active infection such as herpes simplex or patients who are using or have recently stopped using oral isotretinoin.

It is important to avoid stimulation of melanocytes in the 2 weeks [58] before the procedure and the 2–4 weeks after it, through strict photoprotection. Patients should be advised to protect the skin from sun exposure to avoid any tan or inflammation. This can be achieved by informing the patient to seek shade when outdoors, wear photoprotective clothing including wide-brimmed hats and sunglasses, use a parasol, and apply a broad-spectrum sunscreen SPF 50+ to cover UVB, UVA, and HEV light on the exposed area.

Regarding laser procedures, in general a greater number of lower-density NAFL treatments administered over a longer time period should be the primary therapeutic modality. Ablative therapies have limitations for Chinese populations, including PIH and long downtime, so should be reserved for patients who do not respond satisfactorily to nonablative treatment. For those who do require fractional ablative lasers, Jung et al. compared CO_2 versus Erbium:YAG lasers in the treatment of photodamage and scars, and suggested that Er:YAG would be more suitable for mild superficial lesions as seen in photoaging, or for those who need a short downtime, while fractional CO_2 would be suitable for patients with scars or who want more dramatic results [60].

In our practice, we routinely combine a variety of long-pulsed, Q-switched or picosecond lasers for the treatment of benign pigmentary lesions; vascular lasers or IPL for redness and telangiectasia; and low-energy, long duration pulse and low-density NAFL for full face resurfacing and rejuvenation in combination with noninvasive skin tightening modalities such as monopolar radiofrequency, fractional radiofrequency, and microfocused ultrasound. For treating acne scars with erythema, we prefer the use of fractional resurfacing, which produces excellent results.

Negishi et al. studied PIH (study referred to Asian patients, specific region not stated, though authors' affiliations were Japanese medical schools) following a single treatment with Q-switched lasers for the removal of solar lentigines in individuals with skin types III–V, comparing aggressive (immediate whitening) versus nonaggressive treatment with QS ruby or

QS frequency doubled Nd:YAG lasers. Similar clearance rates were achieved in all groups, but PIH rates were lower in the nonaggressive groups [61].

Chan et al. studied the prevalence and risk factors of PIH after fractional resurfacing in a group of Chinese patients and found that perioral PIH occurred in patients who received repeat passes without adjunctive air cooling therapy, concluding that risk of PIH was determined by the density and energy of the treatment [58]. Cooling therapy should therefore be used. This sentiment is echoed for hair removal treatment. Alster and Husain reported the usefulness of concomitant epidermal cooling to minimize thermal injury [62].

Chan et al., following their research findings, reduced the number of passes from 8–12 to 4–6, and the amount of skin removed from 16–20% to 8–10% at each session. They also lengthened the treatment interval to 2–4 weeks (epidermal lesions) or 4–6 weeks (dermal) [58]. We would favor a similar approach.

Table 1 summarizes the key points on aesthetic procedures in the context of a Chinese population.

Topical Photoprotection Regimes Pre and Postprocedure

Sunscreens

Chinese populations, more so than white populations, must pay special attention to photoprotection after facial aesthetic dermatological procedures to prevent or reduce adverse effects from treatments and improve efficacy. This is owing to their photobiological characteristics. The skin barrier is severely damaged after procedures, meaning the skin is less protected and more easily affected by UV and blue light, leading to PIH as well as recurrence of treated conditions such as melasma.

Passeron et al. suggested the use, where possible, of opaque dressings for 2 weeks after inflammation has subsided; if not possible, broad-spectrum SPF 50+ sunscreen (including UVB, UVA, and HEV protection) is essential [17].

Table 1 Key points on aesthetic procedures in a Chinese population

General points
Hyperpigmentation a key concern linked to perceived age and beauty
Increased acceptance of cosmetic procedures
Majority of patients young women, e.g., 25–30 years
Non-invasive procedures viewed as "good value for money"
Common procedures
Botulinum toxin injection
Dermal fillers
Laser hair removal
Chemical peel
IPL
Microneedling
Laser
Fractional skin resurfacing
Important potential side effects
PIH, especially in highly ablative procedures
Hypopigmentation
Scarring
Approach to procedure
Inform patients of possible non-improvement/complications
Avoid laser in active infection or recent isotretinoin
Patient advice to avoid tanning/sun exposure (2 weeks prior and 2–4 weeks post) [63]
Cover with dressing for 2 weeks after procedure, if possible
Topical steroids for 2 weeks postprocedure where possible
Laser: lower density, NAFL preferred
Ablative therapies reserved for nonresponse following nonablative options
More treatment sessions over longer period
Increase time interval between sessions
Fewer passes per session (e.g., 4–6 instead of 8–12)
Ensure use of sufficient cooling (fractional resurfacing, hair removal)

IPL intense pulsed light, *NAFL* nonablative fractional laser, *PIH* postinflammatory hyperpigmentation

Table 2 summarizes the key points to consider regarding sunscreen. As these procedures impair the skin's capacity to filter deleterious sunlight, direct sun exposure should be avoided and the daily use of a broad-spectrum sunscreen SPF 50+ is of great importance [64]. This should contain a combination of organic and inorganic filters [65]. The two most commonly used inorganic sun filters are titanium dioxide and zinc oxide, which, if not micronized, leave an undesirable and unattractive white residue on the skin. New technology means these inorganic sun filters can be micronized into very small particles, significantly improving the cosmesis of inorganic sunscreen formulations. These inorganic sun filters have not been shown to permeate the skin and are the primary sunscreen option to be used immediately after aesthetic procedure and before re-epithelialization [64].

The deleterious role of VL and particularly its blue component in this population group has been confirmed [66]. Tinted sunscreens that contain iron oxide protect against HEV, the short wavelength of the VL spectrum, and help prevent the pigmentary effect of this part of VL.

Table 2 Key points on sunscreen in preventing hyperpigmentation

When possible, opaque dressing should be used; otherwise, sunscreen is paramount
Broad-spectrum SPF 50+ sunscreen (covering UVB, UVA, and HEV/blue light) essential
Start at least 2 weeks preprocedure
Addition of lightening/depigmenting ingredients may reduce PIH
Consider products containing antioxidants for UVA damage mitigation
Consider multifunction products, e.g., anti-pollution agents
Choose products with good cosmesis to aid in compliance

HEV high energy visible light, *PIH* postinflammatory hyperpigmentation, *UVA* ultraviolet A

Sunscreens containing lightening or depigmenting ingredients may reduce the incidence of PIH [17].

A comparative split-face study that showed benefits with use of a tinted broad-spectrum SPF 60+ sunscreen containing antiinflammatory agents started on the first day after ablative fractional skin resurfacing (and continued for 3 months) concluded that this decreased the incidence of PIH at 1-week post-laser treatment in type IV skin (conducted in Thailand) [67].

We would also recommend a broad-spectrum SPF 50+ sunscreen started at least 4 weeks prior to the first treatment to help protect the skin at any time during the year.

Incorporation of antioxidants can provide some protection against infrared A. Given the role of pollution via AHR, a focus of innovation should be on making sunscreens with additional active ingredients that protect against the effects of air pollution.

The sunscreens used should have good cosmesis and tolerability to help compliance.

Pre- and postprocedural application of the appropriate cosmetic, depending on the procedure, is important. When performing, for example, a procedure in which there will be greater damage to the stratum corneum, such as ablative laser or fractionated radiofrequency, special care should always be taken to avoid the use of cosmetics that can be potentially sensitizing or absorbed. Some doctors recommend application of a repairing cream with hyaluronic acid before applying sunscreen.

In the case of procedures for melasma and PIH, sunscreens should be broad-spectrum SPF 50+ with protection against UVB, UVA, and HEV. Tinted sunscreens based on iron oxides and pigmentary titanium dioxide and zinc oxide can offer protection against HEV. Patients suffering from melasma have a high risk of clinical relapse. Prolonged use of photoprotection is highly recommended [31].

Other Topical Agents

Dermatologists often use pre- and postprocedure skin care routines to enhance or prolong the effects of nonsurgical facial rejuvenation

procedures (superficial and medium-depth chemical peels, light- and laser-based treatments, botulinum toxin, and filler injections) to decrease posttreatment side effects and to enhance tolerability [64, 68, 69]. This may begin several weeks before the procedure. Such routines consist of antiaging active ingredients such as AHAs and/or cosmetic retinoid products (retinal, retinol, retinyl esters, etc.), collagen-stimulants, moisturizers, pigment lightening, and sunscreens products [64, 69].

Jones reported good results (but no control group) with the combination of IPL treatment with a skin care regimen containing a tinted broad-spectrum SPF 50 physical sunscreen and an SPF 60 mineral powder sunscreen containing antioxidants and ingredients to act on melanin synthesis and transfer for the treatment of photodamage [70]. High-potency topical steroids daily for 2 weeks postprocedure are recommended in this group at high risk of PIH [59]. In our practice (WL and WL), we use a broad-spectrum SPF 50+ that also covers blue light protection before (for 2–4 weeks) and after aesthetic procedures when treating Chinese patients with pigmented lesions, especially melasma; otherwise, the melasma lesions can be aggravated or relapse quickly.

Goldman studied effects of IPL on melasma when combined with a triple combination cream (fluocinolone acetonide 0.01%, hydroquinone 4%, and tretinoin 0.05%) versus control inactive cream and found the triple combination cream to improve efficacy in patients with skin types II–IV [71]. Woodhall et al. also found that adjunctive use of a hydroquinone/tretinoin system used along with IPL gave better overall improvements in facial skin rejuvenation and less hyperpigmentation [72]. Passeron et al. demonstrated that pulsed dye laser combined with a triple cream (4% hydroquinone, 0.05% tretinoin, and 0.01% fluocinolone acetonide) was significantly better than the triple cream alone for melasma treatment, including relapse [73].

It is thought that new therapeutic targets for melasma that may help restore the altered basal membrane and act on the factors secreted by fibroblasts, mast cells, sebocytes, and endothelial cells will continue to emerge, to be used in addition to depigmenting agents and solar protection [29].

Oral Supplements in Photoprotection of Facial Therapeutic Procedures

Antioxidants, vitamins, and plants can optimize photoprotection measures for in-office procedures, although studies to generate evidence of the different ingredients with photoprotection activity are difficult to design. There is evidence that the use of dietary supplements could provide protection against UVA-induced delayed cyclobutane pyrimidine dimer (CPD) formation by enhancing the scavenging activity of reactive oxygen species (ROS) and inhibiting melanogenesis [74]. Carotenoids, such as ß-carotene, lycopene, or lutein can provide a photoprotective effect, although not as an alternative to other behaviors to avoid sun damage [75].

Goji berries have been used as a traditional medicinal food in China for centuries [76]. The nutritional compounds from the goji berry are very diverse and include a high concentration of the carotenoid zeaxanthin [76], polysaccharides, carotenoids, polyphenols, betaine, vitamins, amino acids, and oligoelements. The key effects of the goji berry are its antioxidant activities and inhibition of the generation and spread of cancer cells [77].

In traditional Chinese medicine, ginseng is regarded as helping to maintain a healthy immune system. In a model of human dermal fibroblasts exposed to UVB radiation, cultivated ginseng increased cell viability, inhibited production of ROS, inhibited collagenolytic MMP production, and suppressed collagen degradation [78]. The antiinflammatory, anticancer, and antioxidant properties of ginseng are attributed to ginsenosides, which are saponins found in ginseng root and the major pharmacologically active components [79]. In animal models, the ginsenoside Rg1 downregulated the inflammatory mechanisms induced by UVB by reducing the local mRNA expression of the cytokines IFN-γ, IL-10, and TNF-α, which may explain its mechanism [80].

Polypodium leucotomos (PL) is a natural extract from tropical fern leaves with

photoprotective and immunoprotective activities [81]. It has been found to reduce sunburn/increase MED [81] and decrease VL-induced hyperpigmentation [82]. It decreases UV-mediated oxidative damage to DNA, enhances the activity of endogenous antioxidant systems, blocks UV-induced cyclooxygenase-2 expression, reduces UV-induced immune suppression, and promotes p53 suppressor gene expression [83]. A recent study showed that chemical peel combined with an oral supplement containing PL extract, green tea extract, and vitamin C was a suitable and effective treatment option for refractory melasma [84].

French maritime pine (*Pinus pinaster*) bark extract is a plant extract containing proanthocyanidins and other antioxidant compounds. Oral Pycnogenol (the standardized extract) [85] in association with broad-spectrum sunscreen [86] has been shown to be effective in the treatment of facial melasma, and was also found to prevent skin darkening in Chinese outdoor workers [87].

Nicotinamide (vitamin B3) is a safe, widely-available vitamin that reduces the immunosuppressive effects of UV, enhances DNA repair in keratinocytes, and has shown promise in the chemoprevention of nonmelanoma skin cancer (dose of 500 mg twice daily) [88, 89].

A food supplement containing multiple actives with mainly antioxidative properties (vitamins A, C, D3, E, selenium, lycopene, lutein, and green tea, polypodium, and grape extracts) demonstrated a beneficial effect in terms of photoprotection, enhancing the antioxidative status of the skin and improving general skin condition. This supplement increased the MED and antioxidant capacity of the skin and improved parameters related to skin aging [90].

CONCLUSION

Individuals from a Chinese population have characteristics that should be taken into account when planning aesthetic procedures and long-term dermatological care. Pigmentation is a common complaint both as a primary issue and, importantly, as a side effect of cosmetic procedures. Care should be planned on an individual basis, taking into account the patient's ethnic background. Use of suitably formulated sunscreens, that is, with high, broad-spectrum protection to cover UVB, UVA, and HEV light protection, and ingredients to combat exposome factors such as pollution, with a cosmetically acceptable consistency and appearance, can be highly beneficial as a preventative approach.

In laser- and energy-based device procedures, using appropriate treatment parameters and respecting the unique characteristics of Chinese skin allow the dermatologist to treat a variety of cutaneous issues safely and effectively. Suitable pre- and postprocedural skin care, including sun protection products and selection of lower-density settings over a greater number of treatments, while allowing for full recovery between sessions, play a critical role in mitigating complications.

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