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ORIGINAL ARTICLE

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Tailored Touch: Test Your Knowledge on Pre-, Intra-, and Postprocedure Skincare—*Based on a Medscape Education Online Activity*

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ABSTRACT

Variations in the prevalence, clinical presentation, and approach to treatment of aesthetic dermatologic conditions are observed in patient populations with skin of color (SOC). A heightened predisposition to post-inflammatory pigment alteration and scarring following dermatologic procedures are key considerations. Optimal clinical outcomes can be achieved with rigorous skin type assessment (including phototype, as well as dyspigmentation and scarring potential); judicious selection of low-risk therapeutic modalities, including superficial chemical peels and nonablative laser systems; and implementation of pretreatment protocols and comprehensive broad-spectrum photoprotection strategies. Recommended postprocedural management includes targeted topical brightening agents alongside sustained photoprotection measures to mitigate adverse pigmentary sequelae. Successful aesthetic outcomes in SOC populations require individualized treatment algorithms that optimize therapeutic efficacy while prioritizing patient safety profiles. Contemporary best practices emphasize integrated skincare approaches that synergistically combine aesthetic procedures with targeted cosmeceutical regimens, complemented by comprehensive patient education on photoprotection and recommended skin care practices. These approaches effectively minimize pigmentary complications while maximizing clinical outcomes. Consideration of cultural factors and shared decision-making approaches are recommended for achieving high patient satisfaction and optimal treatment outcomes in this growing patient population.

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CASE 1

Amanda is a 35-year-old, Black woman currently working as a law firm secretary. She denies being a smoker and does not have any known health conditions. After an acne flare-up, her dermatologist recommended a nightly retinoid-based facial cream (triple combination topical prescription, containing adapalene, clindamycin, and benzoyl peroxide), which helped resolve the issue. However, she developed significant dark spots on her forehead and cheeks, making her self-conscious and anxious, especially when interacting with clients at work. During a follow-up, her dermatologist noted discrete hyperpigmented macules on her cheeks and forehead, consistent with postinflammatory hyperpigmentation (PIH). Amanda's skin type is documented as Fitzpatrick skin type (FST) IV, and she reports no other known conditions or medical concerns related to her skin.

Which of the following physiologic/biologic features of skin of color would increase Amanda's risk for developing hyperpigmentation conditions?

- Clustered pattern of melanocyte distribution
- Melanocyte reactivity
- High levels of ceramide
- Loosely packed stratum corneum layers

The correct answer is melanocyte reactivity.

Melanocyte reactivity refers to the responsiveness of melanocytes (melanin-producing cells) to stimuli, such as ultraviolet (UV) radiation, inflammation, and hormonal changes. Increased reactivity can lead to overproduction of melanin, causing hyperpigmentation conditions like melasma or PIH. In individuals with darker skin types, heightened melanocyte reactivity significantly raises the risk of these conditions, making it a critical factor in assessing skin health, determining susceptibility to pigmentation disorders, and guiding treatment selection.

DISCUSSION

How can we help patients with skin of color (SOC) achieve radiant and healthier-looking skin? This begins with understanding the ethnic and racial differences in skin, which stem from unique physiologic and structural characteristics.

The distribution of melanosomes within melanocytes and keratinocytes varies across the spectrum of skin pigmentation. In individuals with darkly pigmented skin, melanosomes are larger and dispersed individually, whereas in lightly pigmented skin, they are smaller and clustered together.[1,2] This biologic trait contributes to the observed skin color. Although many physiologic properties are similar across racial and ethnic groups, certain differences have been consistently noted. For example, 2 comparative studies found lower ceramide content in Black healthy subjects compared to White or Asian subjects.[3-5]

Although many physiologic properties are similar across racial and ethnic groups, specific differences have been reported. For example, 2 comparative studies found lower ceramide content in Black healthy subjects compared to White or Asian subjects.[3-5] Other studies have demonstrated that the overall thickness of the stratum corneum in Black

and White skin is similar, but has more layers that are arranged more compactly in Black skin compared to White skin.[6] This is supported by findings showing a larger number of tape strips to remove the stratum corneum in Black subjects compared with White subjects.[7] The increased compactness may contribute to variations in skin barrier function, such as the number of tape strips required to disrupt the barrier as measured by transepidermal water loss (TEWL).5 SOC also shows increased melanin content and melanocyte reactivity, contributing to increased photoprotection, but also predisposing individuals to specific skin concerns, such as pigmentary alterations due to UV light, inflammation, and hormonal changes.[8,9]

Pigmentary disorders such as PIH and melasma are leading skin concerns among populations with SOC. Postinflammatory hyperpigmentation occurs when skin darkens after inflammation or injury, while melasma presents as brown patches, often triggered by hormonal changes or sun exposure.[10-13] These conditions can significantly affect the quality of life (QOL) for individuals with SOC, leading to psychological distress, lowered self-esteem, and social isolation due to their skin appearance.[10,14,15]

Assessing constitutive skin pigmentation and reactivity can play a role in the diagnosis, severity assessment, and treatment of dermatologic disorders.[8,16] The Fitzpatrick classification system, originally developed to categorize skin types based on UV response, is often used as a proxy for constitutive skin pigmentation or skin tone assessments. Although widely used, this scale has limitations, including subjectivity and a lack of concordance between skin pigmentation and sun reactivity descriptions, particularly for Fitzpatrick Skin Type (FST) IV-VI. This has led to the creation of alternative scales that encompass a wider range of skin tones and descriptors.[17-19] The recently described Skin Color and Ethnicity Scale offers a more nuanced understanding of diverse skin tones (Figure 1).[20] This scale incorporates features such as freckling and wrinkling to help define skin type and assess photoaging characteristics, as well as the risk of scarring and PIH following dermatologic procedures.[20] As a result, it serves as a valuable tool for clinicians in selecting appropriate cosmetic and surgical options for patients.

There is a significant need for consensus-based initiatives to develop validated tools for the dermatologic care of patients with SOC.[8,16] Clinicians should be aware of the various skin classification scales available, each with its advantages, and recognize that no single scale is universally accepted as comprehensive and user-friendly. Many classification systems highlight the unique characteristics of SOC but continue to have limitations for clinical application.[8] Implementing an integrative skincare approach that addresses individual- and population-based nuances in dermatologic characteristics is essential for personalized treatment and management. Shared decision-making between members of the dermatology team and patients is crucial to tailor treatment plans to individual needs and preferences, enhancing patient satisfaction and outcomes.[21-24]

Shared Decision-Making

Amanda and her dermatologist come together to discuss preprocedural strategies and select an appropriate treatment that considers her medical history, addresses her skin concerns (see Figure 2), and aligns

FIGURE 2. Close-Up of Amanda's PIH Prior to Undergoing a Skincare Procedure.

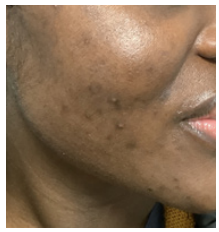
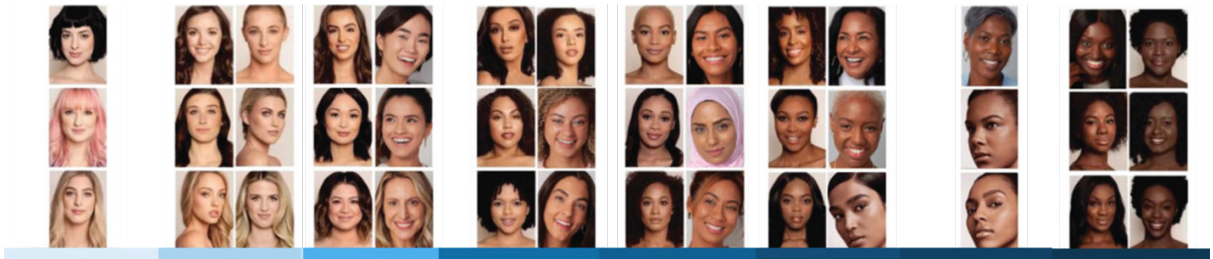


Image Courtesy of Andrew Alexis MD MPH.

FIGURE 1. The Updated Fitzpatrick Classification Scale: Skin Type and Tanning Ability.[20]



I	II	III	IVa	IVb	Va	Vb	VI
• Burns frequently, rarely tans • Freckling • Wrinkles • Deep lines • Truncal nevi • No palmar/plantar nevi • No restrictions with lasers or peels including deep peels • Rare keloid tendency • Post inflammatory erythema more likely than PIH	• Occasionally burns, can tan • Freckling • Wrinkles • Deep lines and solar elastosis • Truncal nevi • No palmar/plantar nevi • No restrictions with lasers or peels including deep peels	• Tans more than burns • Freckling • Fine wrinkles • Etched in lines in the upper face • IGH on the chest and legs • Truncal nevi • No palmar/plantar nevi • Care with peels and lasers	• Tan, rarely burns • Freckling • Fine wrinkles • Etched in lines in the upper face • Fewer truncal nevi • Labial lentigos • Occasional palmar/plantar nevi • Care with medium peels • Caution with lasers • Beware of keloidal scarring	• Tans • Freckling • Etched in lines in the upper face • Minimal truncal nevi • Labial lentigos • Palmar/plantar nevi • Caution with medium peels • Caution with lasers • Beware of keloidal scarring	• Tans easily • Etched in lines in the upper face • Minimal truncal nevi • Labial lentigos • Palmar/plantar nevi • Caution with medium peels • Caution with lasers • Beware of keloidal scarring	• Tans easily • Features of VI but may have reactive dyschromia like a Va • May have etched in lines in the upper face • No truncal nevi • Labial lentigos • Palmar/plantar nevi • Warning with medium peels • Warning with lasers • Beware of keloidal scarring	• Tans easily • Reactive dyschromia likely • May have etched in lines in the upper face • No truncal nevi • May have labial lentigos or mottled lip pigmentation • Palmar/plantar nevi • Warning with medium peels • Warning with lasers

Coleman W, et al. Updating the Fitzpatrick classification: the skin color and ethnicity scale. *Dermatol Surg.* 2023;49:725-731. https://journals.lww.com/dermatologicsurgery/abstract/2023/08000/updating_the_fitzpatrick_classification__the_skin.1.aspx

IGH, idiopathic guttate hypomelanosis

with her personal preferences and lifestyle. Amanda expresses to her dermatologist that she strongly prefers a low-downtime procedure and is averse to treatments that are associated with considerable risks for pigmentary changes or scarring.

Amanda is a 35-year-old, Black woman, 35 years of age. She is experiencing post-PIH secondary to acne on her cheeks and forehead. Her acne is currently managed with a topical retinoid. Amanda's skin type is documented as FST IV, and she reports no other known skin conditions or medical issues. She is interested in a low-risk procedure with quick recovery to improve her PIH.

Based on current expert guidance and available clinical evidence, which of the following cosmetic procedures should Amanda's dermatologist recommend in her case?

- Ablative resurfacing
- Intense pulsed light (IPL) therapy
- Phenol peel
- Salicylic acid peel

The correct answer is salicylic acid peel.

In Amanda's case, using a salicylic acid peel is an ideal option for her skin type (FST IV) and individual treatment goals (ie, low downtime and low risk) because this is considered a gentle, yet effective, approach with a lower risk of developing PIH compared to more aggressive treatments such as ablative resurfacing, deeper peels, or modalities like intense pulsed light (IPL) therapy that have a higher risk of PIH in FST IV-VI. Additionally, the comedolytic properties of salicylic acid can help with her acne, and it requires minimal downtime, making it suitable for her condition, skin type, and preferences.

DISCUSSION

Before selecting and initiating treatment, clinicians should engage in an open and thorough discussion about the patient's motivations and expectations for undergoing an aesthetic procedure.[16] Clinicians should also capture photographs of the patient's skin at presentation and discuss potential side effects and sequelae. This is particularly important for patients with SOC, as certain procedures may heighten their risk of dermatologic issues, such as pigmentary alterations, hypertrophic scars, and keloids. Additionally, clinicians must carefully document the patient's medical history, including comorbid conditions, current medications and dietary supplements, and allergies to drugs. This thorough documentation can help prevent complications following a procedure, such as bleeding, delayed wound healing, cutaneous eruptions, and post-procedure PIH.[5,16,25]

In patients like Amanda, chemical peels, or chemoexfoliating agents, can be utilized to address various concerns in patients with SOC, including pigmentary disorders, textural changes from photoaging, and acne vulgaris.[26] In this patient population, superficial peeling agents that target the epidermis are strongly preferred over deeper peels, given the higher risks for pigmentary alterations or scarring with the latter.[16,26] Clinicians should begin with a single layer of the peeling agent, then assess the patient for tolerability before applying additional layers. While superficial peels are strongly recommended for patients with SOC (eg, 20% to 50% glycolic acid; 20% to 30% salicylic acid; 20% to 30% lactic acid; tretinoin 0.025% to 0.05% cream; 40% mandelic acid; or Jessner solution, a chemical peel formulation consisting of a blend of salicylic acid, lactic acid, and resorcinol), medium-depth peels might be considered in some clinical scenarios (eg, 15% trichloroacetic acid [TCA] for acne scarring; others: 0% to 30% TCA, 15% TCA +/- 20% glycolic acid or +/- Jessner solution) but they should generally be approached with caution due to higher risks of pigmentary complications and downtime.[16,26]

Amanda's Preprocedure Care

Before scheduling her procedure, Amanda and her dermatologist also discussed preprocedure strategies that would help her achieve and sustain satisfactory outcomes while reducing the chance of side effects.

In Amanda's case, which of the following should be done 2 to 4 weeks prior to her procedure to prevent potential adverse events and maximize clinical efficacy?

- Administer low-dose topical steroids
- Apply a deep penetrating exfoliation treatment
- Cease the use of topical retinoids
- Use low-concentration alpha hydroxy acid (AHA) daily

The correct answer is cease the use of topical retinoids.

Amanda's dermatology team should advise her to stop applying topical retinoids to prevent adverse events of her selected procedure. This is an important step toward ensuring Amanda's safety because the exfoliative effect of retinoids can increase skin sensitivity and irritation, resulting in a deeper peel. By discontinuing their use before the procedure, Amanda reduces the risk of adverse reactions, such as redness, peeling, and PIH, which are particularly concerning for individuals with FST IV-VI. Overall, this approach ensures a safer and more successful outcome for Amanda's treatment plan.

DISCUSSION

Patients like Amanda should stop using topical retinoids one week before a chemical peel.[16] To mitigate pigmentary alterations caused by sun exposure, a broad-spectrum sunscreen should be applied, ideally starting at least two weeks before the procedure.[8,27,28]

Adjunctive skincare recommendations often include hydroquinone or other agents targeting hyperpigmentation. These skin-lightening or brightening agents can reduce the risk of procedure-related PIH while addressing underlying pigmentation issues.[29] Treatments for hyperpigmentation include tyrosinase inhibitors and melanosome transfer inhibitors.[30,31] Hydroquinone, a tyrosinase inhibitor, has historically been a first-line approach for hyperpigmentation and melasma.[5,32] However, clinicians should be aware that adverse reactions can occur, such as exogenous ochronosis from excessive (especially

long-term) use or contact dermatitis in some individuals.[32,33] In light of these concerns, the US Food and Drug Administration (FDA) has issued a warning regarding hydroquinone-containing products.[34] Therefore, alternatives to hydroquinone are increasingly being used and are particularly useful for longer-term therapy.

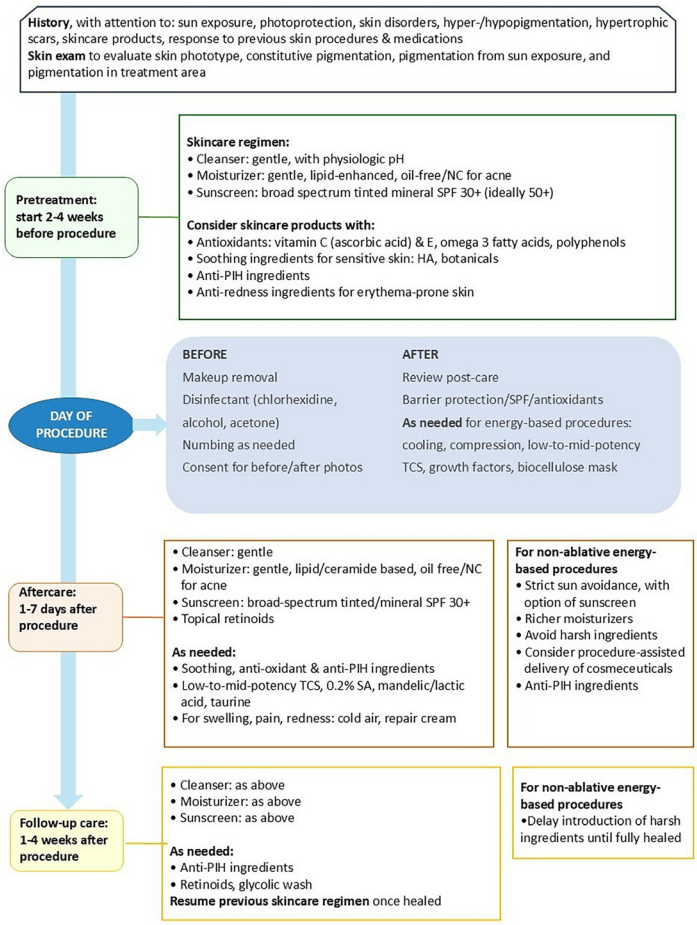
Current topical skin treatments that are widely used in populations with SOC to manage hyperpigmentation include triple combination therapy (consisting of topical fluocinolone acetonide 0.1%, tretinoin 0.05%, and hydroquinone 4%, and compounded formulations with customized concentrations of similar active ingredients). However, there is a risk of exogenous ochronosis from excessive or long-term use of hydroquinone.[30] Recently developed non-hydroquinone skin lightening agents include 2-mercaptonicotinoyl glycine, an inhibitor of melanin precursor conversion to eumelanin and pheomelanin; thiamidol, the most potent inhibitor of human tyrosinase; and cysteamine, a tyrosinase inhibitor used in various short-contact formulations.

A multimodal formulation consisting of 1% eperuline, 0.2% ectoin, 10% glycorepair, 0.2% bioceramide 603, 3% acetyl tetrapeptide-9, and 2% niacinamide (RGN-6), aimed at reducing inflammation, activating tissue repair, and triggering dermal regeneration has recently been developed as a potential peri-procedural topical therapy.

Outcomes for a small set of real-world cases of patients treated with RGN-6 following various nonablative lasers and chemical peels demonstrated favorable outcomes in SOC, providing anti-aging results and improved skin healing attributes. Larger studies are needed to further elucidate this formulation's potential benefits as an adjunct to cosmetic procedures.[35,36]

Experts recommend that patients consider using a gentle cleanser and moisturizer 2 to 4 weeks prior to undergoing a procedure. Ideally, formulations that help improve hydration of the stratum corneum and that aid in restoring the health of the skin barrier should be used (Figure 3).[5,16] Fragrance-free, hydrating skin cleansers close to physiologic skin pH (< 6.5) are preferred. Depending on a patient's skin condition and type, various topical products containing antioxidants may also be used, such as those containing vitamin C, E, or polyphenols (Figure 3). These topical products can help reduce inflammation and pigmentary alterations that may develop after a procedure, making these strategies particularly useful in Amanda's case.[5,16,37]

FIGURE 3. Periprocedural Skincare: Proposed Algorithm for Nonenergy and Nonablative Procedures in Patients With SOC.[16]



HA, hyaluronic acid; NC, noncomedogenic; TCS, topical corticosteroi

TABLE 1.

Published Strategies for Optimal and Safe Skincare in SOC.[16,47-54]
Neuromodulator injections, HA filler, and HA skincare repeated combination treatment achieved a greater change in global facial aesthetic appearance than monotherapy.[47]
HA filler and neurotoxin injections combined with a topical skin treatment regimen led to an improvement in skin quality and aesthetic appearance.[48]
HA filler and neurotoxin neuromodulator injections, a hydroquinone skincare regimen, and daily topical retinoids improved signs of photoaging.[49]
Combining neuromodulator injections for antiaging treatment with skincare containing retinol, adenosine, and HA optimized total treatment outcomes.[50]
Niacinamide inhibits melanosome transfer to keratinocytes and may be combined with TXA. Preprocedure and follow-up skincare with niacinamide, KA, AzA, and TXA-containing skin care may be recommended to improve outcomes.[51]
A randomized, double-blind, vehicle-controlled study showed improvement in irregular facial hyperpigmentation.[52,53]
KA is a radical oxygen scavenger and inhibits tyrosinase. A study compared a combination of topical KA and glycolic acid with topical hydroquinone 4% and found superior results for the KA and glycolic acid product.[54]

Creative Commons Attribution Licenses 4.0 Adapted from Alexis AF, et al. Periprocedural skincare for nonenergy and nonablative energy-based aesthetic procedures in patients with skin of color. *J Cosmet Dermatol*. 2025;24:e16712.
AzA, azelaic acid; HA, hyaluronic acid; KA, kojic acid; TXA, tranexamic acid.

An initial consultation to assess the patient's aesthetic concerns and treatment goals is key to establishing trust and developing a tailored treatment plan that balances patient needs with the risks and benefits of each procedure. An essential part of the consultation is patient education about periprocedure care, setting realistic expectations, and promoting optimal outcomes. Open communication and team collaboration foster shared decision-making, improving patient safety, satisfaction, and the overall effectiveness of integrated skincare.[8,16,38,39]

Integrated skincare combines clinically validated cosmeceuticals with professional aesthetic procedures to provide a comprehensive approach to patients' aesthetic concerns.[16,40] Common in-office treatments for patients with SOC include laser and energy-based therapies, chemical peels, and injectables, such as neuromodulators and dermal fillers.[25,41,42]

Before starting the procedure, proper skin preparation is crucial. Makeup removal and cleansing can involve solutions containing isopropyl alcohol, chlorhexidine, or hypochlorous acid. While isopropyl alcohol is inexpensive and accessible, it is flammable and may irritate the patient's skin. Chlorhexidine is effective, but it can cause eye and ear toxicity. Stabilized hypochlorous acid is potent against various pathogens (eg, bacteria, viruses, fungi) and is nontoxic to the ears and eyes. For painful procedures, appropriate management including topical anesthetics should be implemented as needed to mitigate pain.[16]

Amanda's Treatment

Amanda and her dermatologist decide to schedule her to undergo 4 to 6 chemical peeling sessions (eg, using salicylic acid), with 1 month in between sessions, to manage her postacne flare PIH.

Which of the following postprocedure strategies should Amanda's dermatology team recommend to help her achieve and sustain a satisfactory treatment outcome?

- Apply a strong exfoliating scrub twice a week
- Increase sun exposure to promote healing
- Use a broad-spectrum sunscreen daily
- Use heavy occlusive moisturizers right after the procedure

The correct answer is use a broad-spectrum sunscreen daily.

Daily use of a broad-spectrum sunscreen (sun protection factor [SPF] 30 or greater) is essential for Amanda after her salicylic acid peel to reduce the risk of PIH. In FST IV-VI skin, a sunscreen that does not leave a white cast after application is a key priority. Tinted mineral sunscreens that match Amanda's skin tone or advanced chemical sunscreen formulations that blend easily and do not leave any cast are options to consider, depending on patient preference. Tinted (iron-oxide-containing) sunscreens, as well as sunscreens with potent antioxidants, offer protection from visible light, which contributes to hyperpigmentation in FST IV-VI.

DISCUSSION

The goals of integrated skincare should aim to[16,26,37,43-46]:

- Reduce the risk associated with the procedure(s)
- Enhance outcomes of the procedure(s)
- Reduce downtime of the procedure(s)
- Maintain the results of the procedure(s)

Clinicians should emphasize the importance of adhering to skincare regimens and the need to monitor patients with SOC for side effects following aesthetic procedures. Minimizing the risk of pigmentary alterations and scarring is a key priority in this patient population, and periprocedural skincare plays an important role in achieving optimal outcomes.[16]

FIGURE 4. Close-Up of Amanda's Skin Postprocedure.

Image Courtesy of Andrew Alexis MD MPH.

Expert guidance recommends continued use of cleansers, moisturizers, and sunscreen (ie, SPF > 50) for 1 to 4 weeks following a procedure. Topical skincare regimens that include anti-PIH ingredients and retinoids may be applied as needed. Concurrent skincare regimens aimed at enhancing procedure outcomes and reducing the risk of adverse events (AEs) can be used and are supported by clinical evidence (Table1).[16,47-54]

CASE 1: CONCLUSION

Amanda returned to her dermatologist 8 months after completing her superficial salicylic acid peels, showing improved skin clarity and significantly reduced dark spots (Figure 4). She reports gaining her confidence back and is more enthusiastic at work and interacting with clients.

CASE 2

Bianca is a 65-year-old Asian woman who currently works as a professional gardener and landscaper. She has a history of smoking, obesity, and takes medication to control hypertension (propranolol, twice daily). She presents to her dermatologist with increasing aesthetic concerns of aging. Upon close inspection, Bianca exhibits signs of aging, including fine lines around the eyes (crow's feet), nasolabial folds, mild skin sagging, dryness, and some lightly colored age spots. There are also areas of mild hyperpigmentation and uneven skin texture (Figure 5). Her dermatologist assesses Bianca's skin type and classifies it as FST III. Bianca reports no skin conditions or other concerns. Bianca is open about her preferences for treatment options and communicates to her dermatologist that she would like to start considering therapies that are not invasive.

What is the most significant extrinsic factor contributing to the aging of skin?

- Alcohol consumption
- Chronic stress
- Lack of sleep
- Photodamage

The correct answer is photodamage.

Photodamage is the most significant extrinsic factor contributing to aesthetic changes of the skin associated with aging. This is because UV radiation from the sun can cause the breakdown of collagen and elastin fibers in the dermis layer of skin, resulting in wrinkles, loss of elasticity, and uneven skin tone. This damage accumulates over time, making photodamage a primary cause of visible aging in the skin. In Bianca's case, this would be more significant because her occupation includes being outdoors for long periods, exposing her to the skin-damaging UV rays from the sun.

DISCUSSION

Factors influencing skin aging include both intrinsic and extrinsic elements. Intrinsic factors involve biological and physiological differences between dark and light skin, including the photoprotective effects of melanin.[55-57] This may account for variations in the onset, specific signs, and severity of photoaging across the range of skin phototypes, with lighter phototypes exhibiting earlier onset and more severe photoaging than darker phototypes. Other intrinsic factors include genetics, cellular metabolism, and hormonal changes.[58,59]

In Bianca's case, UV light from the sun is the most significant extrinsic factor contributing to skin aging, accounting for up to 80% of facial aging.[60-62] Additional extrinsic factors include visible light exposure, environmental pollutants, smoking, and poor nutrition, which can lead to coarse wrinkles, reduced elasticity, laxity, and rough texture.[60,63,64] Other external factors include stress and sleep deprivation, which can also promote skin aging.[63,64]

Patients with SOC express specific concerns regarding signs of aging, which may include[5,65-67]:

- PIH due to acne, injuries, and inflammatory dermatoses
- Uneven skin tone, which can result from UV irradiation from the sun and hormonal changes
- Loss of skin elasticity and firmness
- Dryness and rough texture

By attempting to understand the specific signs of aging in patients with SOC, clinicians involved in skincare can better target the concerns of patients like Bianca and individualize treatment options.[8,16,47,68]

For individuals with darker skin tones, skincare goals should begin with addressing general skincare needs. Clinicians should recommend sunscreens for their multiple benefits, including protection from harmful UV rays, prevention of pigmentary alterations, reduced skin cancer risk, and decreased signs of aging.[69] It is essential to advise the use of broad-spectrum sunscreen with an SPF ≥ 30, applied at a thickness of 2 mg/cm^2, 15 minutes before sun exposure, and reapplied every 2 hours. Tinted sunscreens with nonmicronized inorganic filters should be considered for protection against both UV and visible light.[69] For patients who wish to avoid a white chalky film, options with nanosized inorganic filters (eg, zinc oxide or titanium dioxide) or organic formulations may be preferable due to their transparent appearance on darker skin types.[27,28,69,70]

However, non–iron oxide-containing (ie, nontinted) sunscreens mainly protect against UV radiation, not visible light—though sunscreen formulations with antioxidants and free radical quenchers have been shown to protect against visible light-induced pigmentation.[65] Clinicians should also counsel patients on the importance of wearing sun-protective clothing (eg, hats and sunglasses with an ultraviolet protection factor UPF ≥ 40) and advise avoiding exposing skin to the sun during peak daylight hours.[69]

Several agents are available to address the effects of photoaging and other skin concerns. Useful agents include[37,71-80]:

- Antioxidants that protect against reactive oxygen species (ROS) and UV radiation
- Metal chelating agents that guard against environmental pollutants

FIGURE 5. Close-Up Highlighting Bianca's Aging Skin Concerns Prior to Undergoing a Skincare Procedure.

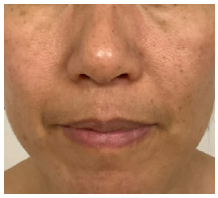


Image Courtesy of Andrew Alexis MD MPH.

- Peptides and growth factors that enhance skin firmness and reduce fine lines
- Lipids and ceramides that strengthen the skin barrier

The latter is particularly relevant for patients with darker skin tones, as ceramide levels are lower in individuals of African descent compared to other racial/ethnic groups.[2] Topical antioxidants (eg, retinoids) and free radical quenchers can also target signs of photodamage and aging, such as fine lines and changes in skin texture.[5,37,72] Glycation inhibitors are a new class of compounds being used for their ability to prevent the toxic accumulation of advanced glycation end products (AGEs), which have been linked to aging and chronic metabolic diseases including diabetes.[81-84]

Shared Decision-Making

Bianca and her dermatologist discuss her skin concerns (fine lines around the eyes, ie, crow's feet, nasolabial folds, mild skin sagging, dryness, and age spots; Figure 5) and identify a suitable treatment plan based on her situation, lifestyle, and preferences.

Considering Bianca's facial aesthetic concerns related to aging, in addition to recommending an appropriate sunscreen, which of the following procedures would you recommend for her?

- Ablative laser therapy
- Biostimulatory agents
- Neuromodulators
- Nonablative laser therapy

The correct answer is nonablative laser therapy.

Recommending an appropriate sunscreen as an adjunct to nonablative laser therapy is essential to reduce the risk of hyperpigmentation after a resurfacing procedure. Given her preference for non-invasive treatments, nonablative laser therapy (laser resurfacing) is an excellent option for addressing her aging skin concerns. Overall, this therapy effectively considers Bianca's aging issues, preferences, and skin type while minimizing downtime and risks, making it a suitable choice for her treatment plan.

DISCUSSION

When deciding on an optimal procedure for addressing aging skin concerns in patients with SOC, several patient-related factors may influence the decision to undergo a given cosmetic procedure over another, including[5,8,16,26,41,85-88]:

- Skin type
- Aesthetic goals, including motivations and expectations
- Potential adverse events
- Medical history
- Age of the patient
- Lifestyle factors, such as sun exposure habits
- Psychological challenges
- Financial considerations

Lasers or energy-based devices can be considered for patients with SOC who want to reduce signs of aging. Indications for laser therapy include hair reduction and facial rejuvenation. Patients with SOC seeking laser therapy should avoid sun exposure before their procedure. During the procedure, sufficient cooling of the area following application of the laser energy should be allowed. Ablative laser procedures are associated with a high risk for hyperpigmentation and scarring and are therefore not recommended for most patients with darker skin tones (eg, FST IV-VI).[16,26]

Nonablative laser procedures are considered a safe and effective treatment option for patients with SOC when conservative settings and appropriate periprocedural care is incorporated.[89] Clinicians should carefully select an appropriate device, treatment parameters, and institute proper pre- and post-treatment precautions. Paying attention to these details can help patients achieve their goals related to skin resurfacing, skin tightening, hair removal, or addressing pigmentary alterations.[5,8,16,26,41,85,86]

The use of technologies that rely on infrared, radiofrequency, or focused ultrasound energy can be applied to the skin for tightening and improvement in laxity. These devices leverage the power of thermal energy to remodel deeper layers of the skin, with the goal of enhancing the negative effects of photoaging.[85]

Bianca's Treatment

Bianca and her dermatologist schedule a nonablative laser procedure to begin addressing her aging skin concerns. Before her procedure, Bianca and her dermatologist discuss expectations and outcomes, as well as possible complications of the selected procedure.

Which of the following adverse events of interest associated with non-ablative laser therapy would be of greatest concern for Bianca to be monitored for during and after her procedure?

- Infection
- Pain and discomfort
- Pigmentary alterations
- Scarring

The correct answer is pigmentary alterations.

Pigmentary alterations from nonablative laser therapy are a significant concern for Bianca due to her skin type. This therapy can cause changes in pigmentation, such as hyperpigmentation or hypopigmentation, so careful management is essential to avoid adverse events. These alterations may develop over time as the skin heals and responds to

treatment. Monitoring for pigmentary changes is crucial for Bianca, who aims to address signs of aging, as these changes can impact her overall aesthetic outcome. By being vigilant about potential pigmentary alterations, her dermatology team can implement timely interventions, ensuring optimal results from the therapy.

DISCUSSION

Ablative laser skin resurfacing is an effective method for facial rejuvenation and treating acne scars, but its use has declined due to prolonged downtime and potential adverse events. Fractional photothermolysis with nonablative lasers is the preferred alternative, providing effective results while reducing recovery time and complications.[85] This technique creates microthermal treatment zones in the dermis of varying sizes, allowing for faster healing compared to traditional ablative lasers, as viable keratinocytes migrate from surrounding areas, promoting quick re-epithelialization of the treated areas.[85]

Patients, like Bianca, with darker skin tones are more likely to experience pigmentary changes, including PIH, after laser therapy. The risk is higher with ablative lasers, while longer wavelength (eg, 1064 nm Nd:YAG) or nonablative fractional lasers (eg, 1927 nm diode, 1927 nm thulium fiber, and 1500 nm erbium lasers) are associated with lower rates of PIH in SOC.[16,26,85,89] Factors such as laser energy, density, and the patient's FST must be carefully considered when assessing the risk of PIH for patients like Bianca undergoing resurfacing procedures.[16,26,85] Other potential complications and side effects of fractional laser therapy include[85]:

- Prolonged erythema
- Wound infection
- Acne
- Milia
- Scarring

Key expert recommendations for enhancing therapeutic outcomes following a skincare procedure in patients with SOC, like Bianca include[16]:

- Maintaining sunscreen use
- Resuming retinoids after one week
- Using gentle products for sensitive skin
- Avoiding all topicals except cleanser/moisturizer for 24 h after microneedling
- Consider lightening agents for high-risk procedures

Key expert recommendations for minimizing and preventing adverse events and complications associated with energy-based and light-based treatments, include the following[85]:

- ***General approaches:*** Lower energy settings, fewer passes, adequate cooling, comprehensive sun protection
- ***Laser-specific modifications:*** Longer wavelengths (1064 nm preferred), avoid pulse stacking, minimal fluence for clinical endpoints
- ***Pretreatment protocols:*** Hydroquinone/retinoid preparation, proper skin preparation
- ***Technical adjustments:*** Ultrapulse modes, prompt tissue removal, appropriate IPL filters, avoid aggressive endpoints (purpura/blistering)
- ***Injectable modifications:*** Fewer punctures, linear threading, middermal placement

Indeed, several studies support the use of adjunctive skincare therapies and formulations that contain antioxidants. Among patients with pigmentary alterations, antioxidant topical treatment postlaser therapy results in improvements in skin quality and signs of aging and enhances rapid wound healing compared to control.[44,65,90,91]

Combination Therapy Consideration

Bianca follows up with her dermatologist and completes her treatment sessions. While she has achieved better skin quality, she believes there is room for improvement as she remains incompletely satisfied with her nasolabial folds, dynamic rhytids on her forehead, glabella, and crow's feet. She notes to her dermatologist that she is open to any type of procedure that will provide the satisfactory results she is seeking, while balancing this with her safety.

Bianca returns to her dermatologist's office to discuss next steps in her skincare.

Which of the following strategies might be the next best approach for managing Bianca's aging skin concerns?

- Chemical peels
- Dermal fillers
- Microneedling
- Topical retinoids

The correct answer is dermal fillers.

Dermal fillers or biostimulatory injectables are good next choices for Bianca, as they directly address her ongoing aging skin concerns, including volume loss, fine lines, and sagging. Dermal fillers offer immediate results by restoring volume and enhancing facial contours, significantly improving her appearance. Biostimulatory injectables, such as poly-L-lactic acid, promote collagen production over time, improving skin texture and elasticity. These injectable treatments effectively target multiple aesthetic issues simultaneously, providing immediate and progressive results, making them a fitting subsequent step in Bianca's integrated skincare regimen for a healthy and rejuvenated look.

DISCUSSION

Dermal fillers (eg, various hyaluronic acid HA compositions with FDA-approved devices) are ideal for restoring facial volume and enhancing contours in nasolabial folds, cheeks, chin, lips, and dorsal hands.[92-94] Biostimulatory agents (eg, poly-L-lactic acid [PLLA], polycaprolactone [PCL], calcium hydroxyapatite [CaHA], polymethyl methacrylate [PMMA]) stimulate collagen production, improving skin firmness and elasticity.[5,8,16,26,41,78,79,85-88,95]

Dermal filler injections may cause mild, temporary adverse events (AEs) such as edema, tenderness, erythema, bruising, and pain at the injection site or, less commonly, severe effects in the event of vascular occlusion.[8,16] In patients with SOC, AEs may include hyperpigmentation, hypopigmentation, and hemosiderin deposition from bruising.[8,16] The American Society for Dermatologic Surgery emphasizes thorough patient assessment and proper injection techniques to minimize the risk of intravascular injection and manage complications related to vascular occlusion.[96] Hyaluronic acid (HA) fillers can be reversed with hyaluronidase therapy, which degrades HA and serves as a rescue option for vascular occlusion. Other treatments include skin massage, corticosteroids, warm compresses, and oral aspirin.[96]

To reduce pigmentary alterations, low-risk injection methods, such as slow injection times and threading techniques, should be used. If pigmentary issues arise, topical lightening agents (as above) combined with a mineral-based sunscreen may be effective.[16] Hemosiderin deposition can be treated with various lasers (eg, Q-switched 650-nm, 755-nm Q-switched alexandrite laser, and picosecond lasers used alone or in combination with non-ablative 1550-nm fractional resurfacing),[103] but to minimize adverse events, heating should be limited by pausing between laser passes and applying ice packs. Topical corticosteroids may be prescribed for erythema or edema that develops post-procedure.[16]

Adverse events associated with biostimulatory agents include erythema, ecchymosis, and edema, as well as long-term complications such as nodules and granulomas, particularly in the lips.[92] To minimize these events, treatment should be performed by an experienced professional.[92,96] Biostimulatory fillers, such as CaHA, can cause noninflammatory nodules that cannot be dissolved with hyaluronidase, making them more challenging to treat.[97,98] Clinicians must understand facial anatomy to prevent and manage AEs related to injectable fillers.[92,96]

Microneedling is another minimally invasive technique that can improve skin texture, fine lines, and uneven skin tone in patients with SOC. Patients may also opt to undergo neuromodulators injections (ie, botulinum toxin), to reduce dynamic wrinkles.[5,8,16,26,41,85,86]

When appropriate, a multimodal approach can leverage the benefits of various fillers, biostimulatory agents, neuromodulators, and energy-based devices, enabling clinicians to address multiple biochemical and structural changes in aging skin. By integrating neuromodulators for muscle relaxation, lasers for resurfacing, dermal fillers for volume restoration, and biostimulatory fillers for skin quality, patients can achieve simultaneous improvements. Recent studies indicate that such multilayered strategies can produce synergistic effects, leading to superior and longer-lasting outcomes without compromising safety.[92,99-102]

Adherence to adjunctive skincare regimens in patients with SOC is essential for achieving optimal treatment outcomes and improving overall skin health. Consistent and appropriate use of recommended products enhances the effectiveness of interventions, leading to better results and increased patient satisfaction.[5,16,26] Patients should be educated about their skincare routines and any safety considerations. This can help safely target treatment goals and address their motivations for seeking cosmetic procedures. As a result, patients may be more likely to experience higher satisfaction, positively influencing their self-esteem and QOL.[5,26,37,85,90]

CASE 2: CONCLUSION

After 4 sessions, Bianca reports feeling more confident and rejuvenated in her appearance. Her dermatologist notes improvements in skin laxity, reduced fine lines, and smoother texture (Figure 6). To continue gaining the benefits of her skincare regimen, Bianca is recommended to have regular follow-up appointments (monthly during treatment sessions and 3 months after the final session) to monitor progress and adjust her treatment plan as necessary.

FIGURE 6. Close-Up Highlighting Bianca's Skin Postprocedure.

Image Courtesy of Andrew Alexis MD MPH.

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REFERENCES

1. Iwuala C, Taylor SC. Structural and functional differences in skin of colour. *Clin Exp Dermatol.* 2022;47:247-250.
2. Rawlings AV. Ethnic skin types: Are there differences in skin structure and function? *Int J Cosmet Sci.* 2006;28:79-93.
3. Sugino K, Imokawa G, Maibach HI. Ethnic difference of varied stratum corneum function in relation to stratum corneum lipids. *J Dermatol Sci.* 1993;6:108 [Abstract 569].
4. Alexis AF, Woolery-Lloyd H, Williams K, et al. Racial/ethnic variations in skin barrier: Implications for skin care recommendations in skin of color. *J Drugs Dermatol.* 2021;20:932-938.
5. Quiñonez RL, Agbai ON, Burgess CM, Taylor SC. An update on cosmetic procedures in people of color. Part 1: Scientific background, assessment, preprocedure preparation. *J Am Acad Dermatol.* 2022;86:715-725.
6. Weigand DA, Haygood C, Gaylor JR. Cell layers and density of Negro and Caucasian stratum corneum. *J Invest Dermatol.* 1974;62:563-568.
7. Chu M, Kollias N. Documentation of normal stratum corneum scaling in an average population: Features of differences among age, ethnicity and body site. *Br J Dermatol.* 2011;164:497-507.
8. Harvey VM, Alexis A, Okeke CA, et al. Integrating skin color assessments into clinical practice and research: A review of current approaches. *J Am Acad Dermatol.* 2024;91:1189-1198.
9. Hossain MR, Ansary TM, Komine M, Ohtsuki M. Diversified stimuli-induced inflammatory pathways cause skin pigmentation. *Int J Mol Sci.* 2021;22:3970.
10. Huerth KA, Hassan S, Callendar VD. Therapeutic insights in melasma and hyperpigmentation management. *J Drugs Dermatol.* 2019;18:718-729.
11. American Academy of Dermatology (AAD) Association. Melasma: Overview. American Academy of Dermatology website. Accessed May 2025. https://www.aad.org/public/diseases/a-z/melasma-overview.
12. Espósito AC, Cassiano DP, da Silva CN, et al. Update on melasma - Part I: Pathogenesis. *Dermatol Ther (Heidelb).* 2022;12:1967-1988.
13. Markiewicz E, Karaman-Jurukovska N, Mammone T, Idowu OC. Post-inflammatory hyperpigmentation in dark skin: Molecular mechanism and skincare implications. *Clin Cosmet Investig Dermatol.* 2022;15:2555-2565.
14. Darji K, Varade R, West D, Armbrecht ES, Guo MA. Psychosocial impact of postinflammatory hyperpigmentation in patients with acne vulgaris. *J Clin Aesthet Dermatol.* 2017;10:18-23.
15. Bhattacharya I, Paschal D, Kanchan D. Impact of postinflammatory hyperpigmentation on quality of life in patients with skin of color. *Pigment Int.* 2024;11:33-41.
16. Alexis AF, Andriessen A, Beach RA, et al. Periprocedural skincare for nonenergy and nonablative energy-based aesthetic procedures in patients with skin of color. *J Cosmet Dermatol.* 2025;24:e16712.
17. Ly BC, Dyer EB, Feig JL, Chien AL, Del Bino S. Research techniques made simple: cutaneous colorimetry: A reliable technique for objective skin color measurement. *J Invest Dermatol.* 2020;140:3-12.e1.
18. Subedi SK, Ganor O. Considerations for the use of Fitzpatrick skin type in plastic surgery research. *Plast Reconstr Surg Glob Open.* 2024;12:e5866.
19. Goon P, Banfield C, Bello O, Levell NJ. Skin cancers in skin types IV-VI: Does the Fitzpatrick scale give a false sense of security? *Skin Health Dis.* 2021;1:e40.
20. Coleman W, Mariwalla K, Grimes P. Updating the Fitzpatrick classification: The skin color and ethnicity scale. *Dermatol Surg.* 2023;49:725-731.
21. Alexis A, Del Rosso JQ, Forman S, et al. Importance of treating acne sequelae in skin of color: 6-month phase IV study of trifarotene with an appropriate skincare routine including UV protection in acne-induced post-inflammatory hyperpigmentation. *Int J Dermatol.* 2024;63:806-815.
22. Gorbatenko-Roth K, Prose N, Kundu RV, Patterson S. Assessment of Black patients' perception of their dermatology care. *JAMA Dermatol.* 2019;155:1129-1134.
23. Yee D, Kingston P, Lee K, et al. Shared decision-making and satisfaction with care in patients with psoriasis: A population-based study in the United States. *J Am Acad Dermatol.* 2023;89:920-926.
24. Kingston P, Yee D, Huang MY, et al. Shared decision-making and satisfaction with care: A population-based study in patients with acne with skin of colour in the USA. *Clin Exp Dermatol.* 2023;48:1032-1035.
25. Gold M, Alexis A, Andriessen A, et al. Supplement individual article: Algorithm for pre-/post-procedure measures in racial/ethnic populations treated with facial lasers, nonenergy devices, or injectables. *J Drugs Dermatol.* 2022;21:SF3509903-SF35099011.
26. Quiñonez RL, Agbai ON, Burgess CM, Taylor SC. An update on cosmetic procedures in people of color. Part 2: Neuromodulators, soft tissue augmentation, chemexfoliating agents, and laser hair reduction. *J Am Acad Dermatol.* 2022;86:729-739.
27. Skin of Color Society. A guide to sunscreen selection. Skin of Color Society website. Accessed May 2025. https://skinofcolorsociety.org/patient-dermatology-education/guide-sunscreen-selection/.
28. Jesus A, Mota S, Torres A, et al. Antioxidants in sunscreens: Which and what for? *Antioxidants (Basel).* 2023;12:138.
29. Callender VD, Harvey VM, Hartman CL, et al. Do women with skin of color think they are well represented in skin aging prevention information? *J Clin Aesthet Dermatol.* 2024;17:18-22.
30. Juhasz ML, Levin MK. The role of systemic treatments for skin lightening. *J Cosmet Dermatol.* 2018;17:1144-1157.
31. Nautiyal A, Wairkar S. Management of hyperpigmentation: Current treatments and emerging therapies. *Pigment Cell Melanoma Res.* 2021;34:1000-1014.
32. Desai SR, Alexis AF, Elbuluk N, et al. Best practices in the treatment of melasma with a focus on patients with skin of color. *J Am Acad Dermatol.* 2024;90:269-279.
33. Lazar M, De La Garza H, Vashi NA. Exogenous ochronosis: Characterizing a rare disorder in skin of color. *J Clin Med.* 2023;12:4341.
34. US Food and Drug Administration. FDA works to protect consumers from potentially harmful OTC skin lightening products. FDA Drug Safety and Availability website. Accessed May 2025. https://www.fda.gov/drugs/drug-safety-and-availability/fda-works-protect-consumers-potentially-harmful-otc-skin-lightening-products.
35. Demessant-Flavigny AL, Petkar G, Jodun D, Le Dantec G, Le Floc'h C, Kerob D. Efficacy of a 2-MNG-containing depigmenting serum in the treatment of post-inflammatory hyperpigmentation. *J Cosmet Dermatol.* 2025;24:e16735.
36. Hartman CL. New innovations with SkinCeuticals: advanced RGN-6. *J Drugs Dermatol.* Webinar. Accessed May 2025. https://jddonline.com/new-innovations-skinceuticals-advanced-rgn6/
37. Lain E, Alexis AF, Adriessen A, et al. A practical algorithm for integrating skincare to improve patient outcomes and satisfaction with energy-based dermatologic procedures. *J Drugs Dermatol.* 2024;23:353-359.
38. Antonson M, Thomas S, Borucki R, Wei EX. The impact of multidisciplinary clinics in dermatology: A review. *JAAD Rev.* 2024;2:20-24.
39. Lindblad AK, Kjellgren KI, Ring L, Marott M, Serup J. The role of dermatologists, nurses and pharmacists in chronic dermatological treatment: Patient and provider views and experiences. *Acta Derm Venereol.* 2006;86:202-208.
40. Ding Y, Zhang C, Xiang LF. Application of integrated skincare in medical aesthetics: A literature review. *J Eur Acad Dermatol Venereol.* 2024;38(suppl 6):5-16.
41. Desai M, Gill J, Luke J. Cosmetic procedures in patients with skin of color: Clinical pearls and pitfalls. *J Clin Aesthet Dermatol.* 2023;16:37-40.
42. Amechi M, Halpin J. Considerations for laser therapy, microneedling, and chemical peels when treating patients with skin of color. *Plast Aesthet Nurs.* 2023;43:14-21.
43. Lupo M, Jacob L. Chapter 28: Cosmeceuticals for enhancing cosmetic procedures. In: Farris P, ed. *Cosmeceuticals and Cosmetic Practice.* Wiley; 2013:268-276.
44. Waibel JS, Mi Q-S, Ozog D, et al. Laser-assisted delivery of vitamin C, vitamin E, and ferulic acid formula serum decreases fractional laser postoperative recovery by increased beta fibroblast growth factor expression. *Lasers Surg Med.* 2016;48:238-244.
45. Machado BH, Zhang J, Frame J, Najlah M. Treatment of scars with laser-assisted delivery of growth factors and vitamin C: A comparative, randomised, double-blind, early clinical trial. *Aesthetic Plast Surg.* 2021;45:2363-2374.
46. Bruce S, Roberts W, Teller C, Colvan L. The effects of a daily skincare regimen on maintaining the benefits obtained from previous chemical resurfacing treatment. *J Drugs Dermatol.* 2016;15:1145-1150.
47. Cartier H, Hedén P, Delmar H, et al. Repeated full-face aesthetic combination treatment with abobotulinumtoxinA, hyaluronic acid filler, and skin-boosting hyaluronic acid after monotherapy with abobotulinumtoxinA or hyaluronic acid filler. *Dermatol Surg.* 2020;46:475-482.
48. Dayan SH, HoTT, Bacos JT, Gandhi ND, et al. A randomized study to assess the efficacy of skin rejuvenation therapy in combination with neurotoxin and full facial filler treatments. *J Drugs Dermatol.* 2018;17:48-54.
49. Schlessinger J, Kenkel J, Werschler P. Further enhancement of facial appearance with a hydroquinone skin care system plus tretinoin in patients previously treated with botulinum toxin type A. *Aesthet Surg J.* 2011;31:529-539.
50. Ascher B, Fanchon C, Kanoun-Copy L, et al. A skincare containing retinol adenosine and hyaluronic acid optimises the benefits from a type A botulinum toxin injection. *J Cosmet Laser Ther.* 2012;14:234-238.
51. Hollinger JC, Angra K, Halder RM. Are natural ingredients effective in the management of hyperpigmentation? A systematic review. *J Clin Aesthet Dermatol.* 2018;11:28-37.
52. Lee DH, Oh IY, Koo KT, et al. Reduction in facial hyperpigmentation after treatment with a combination of topical niacinamide and tranexamic acid: a randomized, double-blind, vehicle-controlled trial. *Skin Res Technol.* 2014;20:208-212.
53. Tremaine AM, Avram MM. FDA MAUDE data on complications with lasers, light sources, and energy-based devices. *Lasers Surg Med.* 2015;47:133-140.
54. Draelos ZD, Yatskayer M, Bhushan P, et al. Evaluation of a kojic acid, emblica extract, and glycolic acid formulation compared with hydroquinone 4% for skin lightening. *Cutis.* 2010;86:153-158.
55. Woolery-Lloyd H. Skincare in skin of color: A comprehensive approach to preprocedure, intraprocedure, and postprocedure [Individual Article]. *J Drugs Dermatol.* 2024;23:62041s5-62041s10.
56. Fernández-Varela-Gómez F, Gago-Veiga AB, Rodríguez-Fernández F, et al. Signs of skin aging: a review. *Int J Res Med Sci.* 2024;12:2674-2679.
57. Kaidbey K, Agin PP, Sayre RM, Kligman AM. Photoprotection by melanin--a comparison of black and caucasian skin. *J Am Acad Dermatol.* 1979;1:249-260.
58. Knaggs HE, Stangl D, Perley C. Enhancing skin anti-aging through healthy lifestyle factors. *Cosmetics.* 2023;10:142.
59. Alexis AF, Alam M, Baumann LS, et al. Ethnicity and aging skin. *J Drugs Dermatol.* 2017;16(suppl 4):s77-s80.
60. Griffiths T, Bouez A, Cula X. Skin ageing and topical rejuvenation strategies. *Br J Dermatol.* 2023;189(suppl 1):i17-i23.
61. Xie M, Jiang Y, Wang W. Application of plant extracts cosmetics in the field of anti-aging. *J Dermatol Sci Cosmet Technol.* 2024;2:100014. doi:10.1016/j.jdsct.2024.100014.
62. Goodman GJ, Bagatin E. Photoaging and cosmeceutical solutions in sun-overexposed countries: the experience of Australia and Brazil. *J Eur Acad Dermatol Venereol.* 2024;38(suppl 4):36-44
63. Coats JG, Maktabi B, Abou-Ghazala A, et al. Blue light protection, part I - effects of blue light on the skin. *J Cosmet Dermatol.* 2021;20:714-717.
64. Zhang S, Duan E. Fighting against skin aging: the way from bench to bedside. *Cell Transplant.* 2018;27:729-738.
65. Vashi NA, de Castro Maymone MB, Kundu RV. Aging differences in ethnic skin. *J Clin Aesthet Dermatol.* 2016;9:31-38.
66. Humphrey S, Woodward J, Fitzgerald R, et al. Defining skin quality: clinical relevance, terminology, and assessment. *Dermatol Surg.* 2021;47:974-981.
67. Alexis AF, Downie JB, Baumann LS, et al. Racial and ethnic differences in self-assessed facial aging in women: results from a multinational study. *Dermatol Surg.* 2019;45:1635-1648.
68. Jagdeo J. Breaking barriers: advancing cosmeceuticals and integrated skincare for skin of color. *J Drugs Dermatol.* 2025;24:41491s5-41491s10.
69. Tsai JY, Vashi NA. Photoprotection for skin of color. *Am J Clin Dermatol.* 2022;23:195-205.
70. Schneider SL, Lim HW. A review of inorganic UV filters zinc oxide and titanium dioxide. *Photodermatol Photoimmunol Photomed.* 2019;35:442-446.
71. Lim HW, Arellano-Mendoza R, Draelos ZD, et al. Impact of visible light on skin health: the role of antioxidants and free radical quenchers in skin protection. *J Am Acad Dermatol.* 2022;86(3 suppl 1):S27-S37.
72. Motamedi M, Chehade A, Sanghera R, Grewal P. A clinician's guide to topical retinoids. *J Cutan Med Surg.* 2022;26:71-78.
73. Valacchi G, Sticozzi C, Cervellati F, et al. Protective effects of topical vitamin C compound mixtures against ozone-induced damage in human skin. *J Invest Dermatol.* 2017;137:1373-1375.
74. Ferrara F, Woodby B, Pecorelli A, et al. Additive effect of combined pollutants to UV induced skin oxinflammation damage. Evaluating the protective topical application of a cosmeceutical mixture formulation. *Redox Biol.* 2020;34:101481.
75. Oresajo C, Pillai S, Manco M, et al. Antioxidants and the skin: understanding formulation and efficacy. *Dermatol Ther.* 2012;25:252-259.
76. Pambianchi E, Pecorelli A, Woodby B, et al. Deferoxamine treatment improves antioxidant cosmeceutical formulation protection against cutaneous diesel engine exhaust exposure. *Antioxidants (Basel).* 2021;10:1928. doi:10.3390/antiox10121928.
77. Draelos ZD. The science behind skin care: moisturizers. *J Cosmet Dermatol.* 2018;17:138-144.
78. Wan D, Bozzo JE. Moisturizing different racial skin types. *J Clin Aesthet Dermatol.* 2014;7:25-32.
79. Searle T, Al-Niaimi F. The top 10 cosmeceuticals for facial hyperpigmentation. *Dermatol Ther.* 2020;33:e14095.
80. Husein El, Hadmed H, Castillo T. Cosmeceuticals: peptides, proteins, and growth factors. *J Cosmet Dermatol.* 2016;15:514-519.
81. Chen C, Li J, Liu X. Advanced glycation end products in the skin: molecular mechanisms, methods of measurement, and inhibitory pathways. *Front Med (Lausanne).* 2022;9:837222.
82. Song Q, Han X, Yang W, Xu Y. Novel advances in inhibiting advanced glycation end product formation using natural compounds. *Biomed Pharmacother.* 2021;140:111750.
83. Zhu J, Wang L, Li J, et al. Advanced glycation end products and health: a systematic review. *Ann Biomed Eng.* 2024;52:3145-3156.
84. Twarda-Clapa A, Olczak A, Białkowska AM, Koziołkiewicz M. Advanced glycation end-products (AGEs): formation, chemistry, classification, receptors, and diseases related to AGEs. *Cells.* 2022;11:1312.
85. Harnchoowong S, Vachiramon V, Jurairattanaporn N. Cosmetic considerations in dark-skinned patients. *Clin Cosmet Investig Dermatol.* 2024;17:259-277.
86. Maisel A, Waldman A, Furlan KC, et al. Self-reported patient motivations for seeking cosmetic procedures. *JAMA Dermatol.* 2018;154:1167-1174.
87. Brown A, Grob R, Papini S, et al. Factors that affect the likelihood of undergoing cosmetic surgery. *Aesthet Surg J.* 2007;27:501-508.
88. Flament F, Bazin R, De Salvert A, et al. Impact on facial skin aging signs of a 1-year standardized photoprotection over a classical skin care routine in skin phototypes II–VI individuals: a prospective randomized trial. *J Eur Acad Dermatol Venereol.* 2023;37:2090-2097.
89. Kaushik S, Dhingra N. Nonablative fractional laser resurfacing in skin of color: evidence-based review. *J Clin Aesthet Dermatol.* 2017;10:51-67.
90. Wang JV, Friedman PM. Enhancing skin uptake of topical antioxidants with 1,440-nm nonablative fractional diode laser pretreatment. *Dermatol Surg.* 2022;48:927-931.
91. Park KY, Kim BJ, Kim MN. Evaluating the tolerance and efficacy of laser-assisted delivery of tranexamic acid, niacinamide, and kojic acid for melasma: a single center, prospective, split-face trial. *Dermatol Ther.* 2022;35:e15287.
92. Guo J, Fang W, Wang F. Injectable fillers: current status, physicochemical properties, function mechanism, and perspectives. *RSC Adv.* 2023;13:23841-23858.
93. Rho NK, Lee WJ. Injectable "skin boosters" in aging skin rejuvenation: a current overview. *Arch Plast Surg.* 2024;51:528-541.
94. Attenello NH, Maas CS. Injectable fillers: review of material and properties. *Facial Plast Surg.* 2015;31:29-34.
95. Waibel J, Nguyen TQ, Le JH, et al. Gene analysis of biostimulators: poly-L-lactic acid triggers regeneration while calcium hydroxylapatite induces inflammation upon facial injection. *J Drugs Dermatol.* 2025;24:34-40.
96. Jones DH, Fitzgerald R, Lorenc ZP, et al. Preventing and treating adverse events of injectable fillers: evidence-based recommendations from the American Society for Dermatologic Surgery Multidisciplinary Task Force. *Dermatol Surg.* 2021;47:214-226.
97. McCarthy AD, Berkowitz S, Chernoff WG. Successful treatment of noninflammatory CaHA nodules using focused mechanical vibration. *Aesthet Surg J Open Forum.* 2024;6:ojae018.
98. Park K, Mehta P, Caceres V, et al. Response of 21 hyaluronic acid fillers to recombinant human hyaluronidase. *Plast Reconstr Surg Glob Open.* 2023;11:e5457.
99. Tam EM, Fazzalari J, De Lacerda E, et al. A systematic review on the effectiveness and safety of combining biostimulators with botulinum toxin, dermal fillers, and energy-based devices. *Aesthetic Plast Surg.* 2024. [Epub ahead of print].
100. American Society for Dermatologic Surgery. Combination of soft-tissue filler and neuromodulator injections for aging skin. https://www.asds.net/skin-experts/skin-treatments/combination-of-soft-tissue-filler-and-neuromodulator-injections-for-aging-skin. Accessed May 2025.
101. Urdiales-Gálvez F, Fornasari E, Vercelli S, et al. Concomitant use of hyaluronic acid and laser in facial rejuvenation. *Aesthetic Plast Surg.* 2019;43:1061-1070. Correction in: Aesthetic Plast Surg. 2020;44:251.
102. Cervantes J, Cervantes B, Ortiz E, et al. Laser-assisted and device-assisted filler delivery: a histologic evaluation. *Dermatol Surg.* 2023;49:865-870.
103. Swali RN, Rajanala S, Friedman PM. Hemosiderin staining with a 785-nm picosecond titanium sapphire laser in combination with a nonablative 1550-nm fractional resurfacing laser. *Dermatol Surg.* 2025;51(1):108-109. PMID: 39023926.

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