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ORIGINAL ARTICLE

Algorithm for Pre-/Post-Procedure Measures in Racial/Ethnic Populations Treated With Facial Lasers, Nonenergy Devices, or Injectables

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ABSTRACT

Background: Cosmetic procedures with lasers, nonenergy devices, and injectables are increasing in popularity among patients with skin of color. Published algorithms address measures to reduce side effects related to aesthetic procedures; however, none focus on reducing adverse events in skin of color.

Methods: An expert panel of dermatologists and plastic surgeons conducted face-to-face and online meetings to develop an algorithm for measures before, during, and after using aesthetic devices (energy and nonenergy-based) and injectable treatments based on the best available evidence for skin of color. Published algorithms and literature searches for aesthetic procedures provided guidance for the current algorithm. A modified Delphi method was used to reach a consensus to apply outcomes of literature searches, along with expert opinion, resulting in the current algorithm.

Results: The four sections of the algorithm outline an approach to optimize outcomes with specific before, during, and after procedure considerations. Pre-procedural consultation includes the development of a specific treatment plan based on individual patient goals and risk profile (including history and signs that may predict a higher risk for pigmentary or scarring complications). Before the procedure, sun avoidance and sunscreen use are emphasized; herpes simplex virus 1 prophylaxis and bleaching agents are administered if indicated. During the procedure, skin cleansing products are addressed, along with judicious techniques to minimize unintended cutaneous injury or inflammation. Post-procedural sunscreen and gentle skincare that may include skin-lightening agents or formulations designed to prevent infection and promote optimum healing are advised.

Conclusions: The algorithm strives to optimize treatment outcomes for patients with skin of color by providing their physicians with guidance on measures before, during, and after office-based medical aesthetic procedures.

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INTRODUCTION

Demographic shifts as well as advances in minimally invasive and non-ablative technologies, have broadened the spectrum of patient populations undergoing aesthetic procedures. Over the past decade, the proportion of cosmetic procedures performed on patients with skin of color who belong to varying self-identified racial/ethnic groups in the United States (US) has increased considerably.[1] This population, which is characterized dermatologically as having skin of color (SOC) exhibits variations in the prevalence of specific aesthetic concerns as well as nuances in the approach to treatment due to a greater propensity toward pigment alterations or hypertrophic/keloidal scarring following skin injury or inflammation.[1-4]

Data and recommendations for best practices for aesthetic procedures are relatively limited and this, in turn, can adversely affect treatment outcomes for patients with SOC.[3,4] According to the advisors, outcomes of medical aesthetic procedures for people with SOC depend on pre- and post-procedure precautions and interventions, individualized treatment selection, and optimal technique.[3,4]

Surveys of aesthetic medicine providers confirmed a lack of consistency in the types and duration of periprocedural measures to improve outcomes associated with facial rejuvenation lasers, nonenergy devices, and cosmetic injections.[5-7] Following the surveys, two broad algorithms were designed to guide pre- and post-procedure treatment with the aim of reducing procedural side effects.[8,9] One algorithm involves facial cosmetic procedures using facial lasers and other energy devices.[8] The second algorithm covers nonenergy-based and injectable skin treatments.[9] An evidence-based periprocedural algorithm is warranted to address the unique considerations of patients with SOC.

The current algorithm focused on the care of patients with SOC is presented here as a tool for clinicians when treating patients with various skin types with laser/other energy-based devices, nonenergy-based devices/procedures, and injectables for facial rejuvenation.

METHODS

The Process

Following the publication of 3 surveys and 2 algorithms that established standards for periprocedural measures,[5-9] a panel of 8 dermatologists and plastic surgeons (advisors) convened a meeting on February 12th, 2022. The participants are members of a Pre-/Post-procedure Measures (PrePoM) Project. The goal of the meeting was to develop an algorithm on periprocedural measures for facial laser treatments and facial nonenergy-based and injectable treatments specific for ethnic-skinned individuals. The panel's previously developed algorithms became the framework for the development of the current algorithm.[8,9]

A modified Delphi approach, an interactive decision-making technique for medical projects, was used.10 Decision-making started with a face-to-face meeting with a later online follow-up. The outcome of literature searches was discussed during the meetings, including the 5 publications of the PrePoM group.[5-9]

Based on literature searches and the 5 PrePoM publications, the panel developed a proposed design for the current algorithm. After presentations of literature summaries and agreement on a proposed algorithm, the panel worked in small groups to design, edit, and revise the current algorithm. They then reconvened into a plenary group to reach a consensus through blinded reiterations and votes to customize the final algorithm. The panel obtained consensus through unanimous votes. Reviewing, editing, and discussing this manuscript took place online (Figure 1).

Literature Searches

Prior to the expert panel meeting, a systematic literature review was conducted, selecting best-practice approaches for pre- and post-procedure measures for people with SOC treated with facial lasers, nonenergy devices, or injectables. Literature was clinically relevant to pre-/post-procedure measures for aesthetic treatments in ethnic individuals and those with SOC. Inclusion criteria were English language studies, consensus papers, and other reviews with current best practice measures published from 2010 to 2022.

FIGURE 1. Algorithm development process.

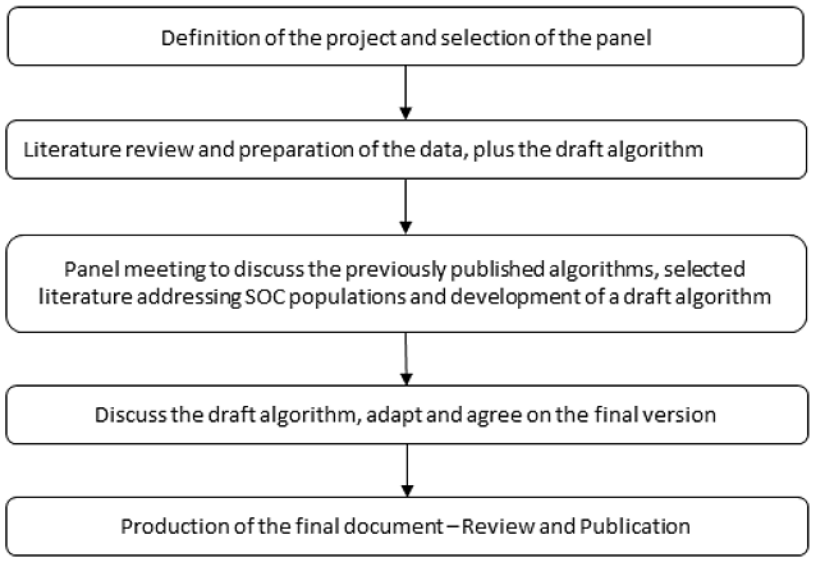
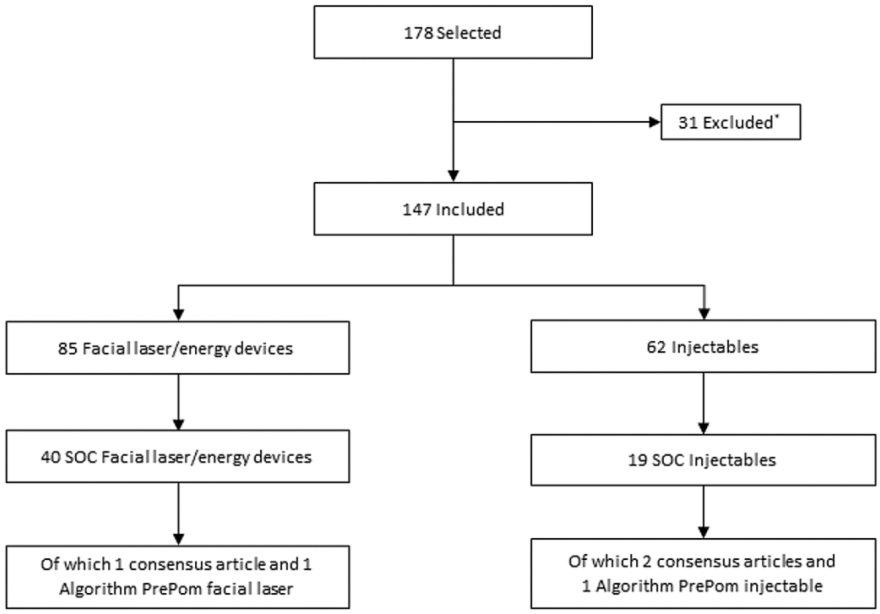


FIGURE 2. Structured literature search results.



*Excluded were duplications and poor-quality studies. In case of a review or update the latest version was used. Grading was not relevant due to a lack of publications on pre and post procedure measures (PrePom) for skin of color (SOC) patients.

Exclusion criteria were articles with no original data (unless a review was deemed relevant); articles not dealing with pre-/post-procedural care for individuals with SOC; treatment other than with facial lasers, nonenergy devices, or injectables; and studies in a language other than English.

Fitzpatrick skin phototype (SPT), the most used skin classification system in dermatology, was developed in 1975 to assess the skin's tendency to burn with sun exposure.[11] Original classifications included SPT I to IV; SPT V and VI were added later to include individuals of Asian, Indian, and African origin.[12-14] As a result, providers often use phototypes to describe race or ethnicity, which was not the original intent. A patient's perception of their ethnicity and phototype may be different than that of a physician. Although at least a dozen alternative skin type classification systems have been proposed, more clinically relevant methods for describing SOC have yet to be adopted. Without a comprehensive means to define SOC, complexions of African, Asian, and Latino subjects are termed SOC.[15] The majority of published cosmetic procedure data in SOC involves patients of East Asian descent with phototypes III and IV.[16-20]

The following terms were used for the literature search: *"Aesthetic dermatology for ethnic skin AND skin of color (SOC); lasers AND fillers OR injectables AND chemical peels AND hyperpigmentation OR post-inflammatory hypopigmentation; aesthetic dermatology for ethnic skin patients; pre-/post-procedure measures for facial laser OR energy devices treatment in SOC OR ethnic skin; pre-/post-procedure measures for minimally invasive OR nonenergy aesthetic treatments; pre-/post-procedure measures for injectable treatment."*

The review was structured but not systematic, given the limitations of available relevant articles on SOC. The literature review process is depicted in Figure 2. Publications from various ethnic regions were identified. Identifying SOC is important for dermatologists and plastic surgeons because physiologic differences in SOC increase the risk of procedure-associated complications, such as pigment alterations, hypertrophic scars, and keloids.

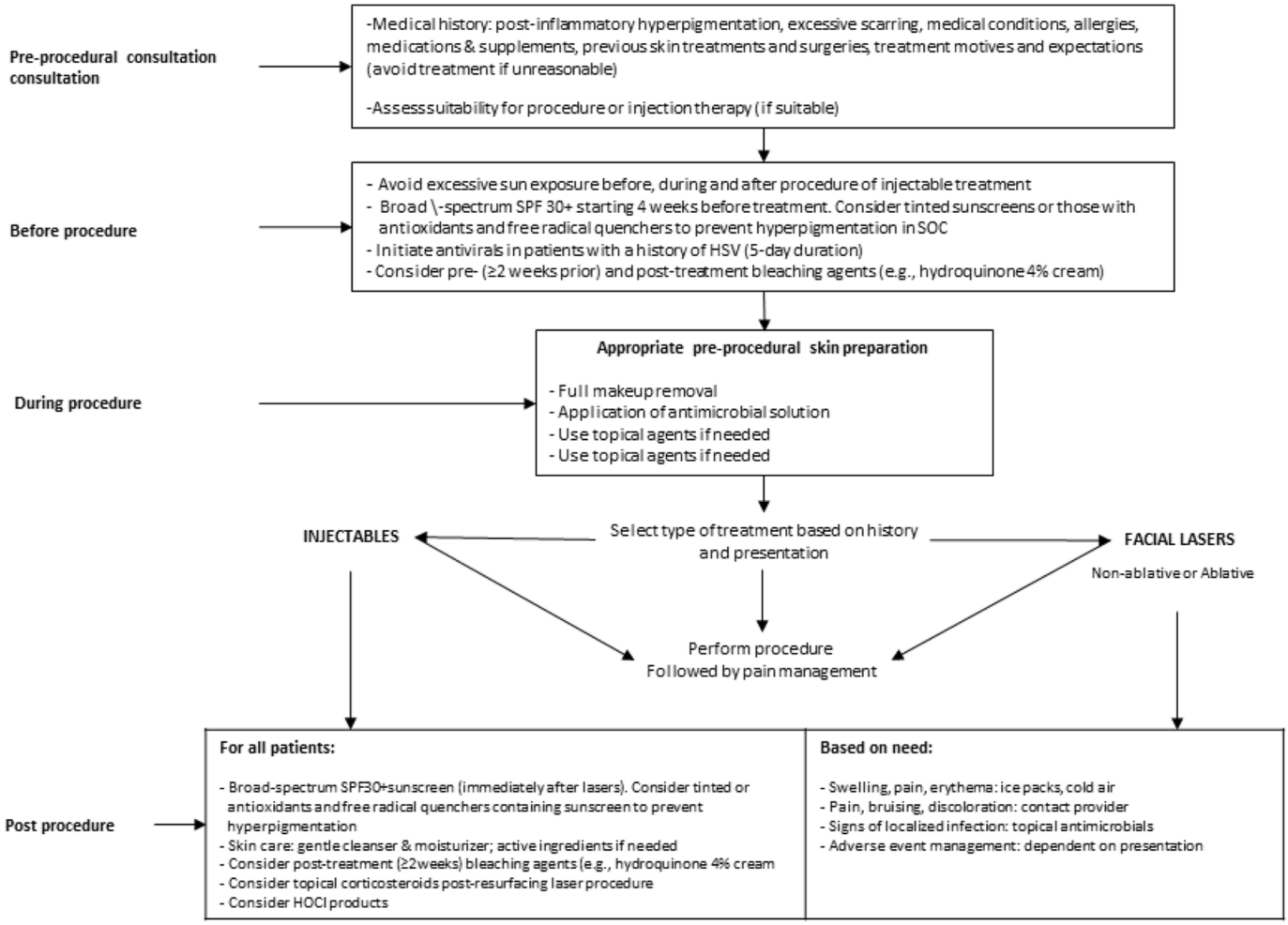
The literature review was conducted by a dermatologist and a physician/scientist using PubMed searches on January 20th, 2022. Google Scholar was used as a secondary resource. Two reviewers independently evaluated the results. Each selected clinical publication was graded based on reviewer consensus. The reviewers assigned a level of evidence for each procedure (level A, B, C [study type] and level 1 to level 4 [likelihood of change]) using pre-established criteria.[21]

RESULTS

The Algorithm

Algorithms depict an approach to a scientific problem. The purpose of a clinical algorithm is to guide medical decision-making by standardizing treatment regimens to encourage compliance with evidence-based recommendations. A well-designed medical algorithm provides patient benefits in a cost-effective manner.[21,22]

FIGURE 3. Algorithm measures before/after facial laser or injectable treatment in SOC patients.



The algorithm (Figure 3) contains 4 sections: pre-procedural consultation; preventive actions before the procedure; practices during the procedure; and post-procedure care.

Section 1: Pre-Procedural Consultation

Before an aesthetic procedure can be deemed suitable for a specific patient, the individual's medical history is gathered. Medical conditions, medications, dietary supplements, and allergies to drugs, latex, or topical products are detailed. Outcomes of previous skin or surgical treatments are obtained, especially responses to dermabrasion or chemical peels. The expert panel agreed physicians should ask to examine scars that may not be obvious. People with hypertrophic scars, keloids, or changes in pigmentation will need periprocedural cosmetic practices to reduce the risk of these complications.[8,9]

The patient's motivation for seeking a procedure should be sought. Expectations of cosmetic benefits need to be realistic for a satisfactory outcome. Baseline photographic imaging can be helpful, followed by a detailed discussion about side effects and complications.[8,9]

The provider should acknowledge structural and functional differences in ethnic skin to discuss potential complications.4 Skin pigment is the most obvious difference. Increased melanin content and wide melanin distribution within epidermal keratinocytes confer greater protection against ultraviolet damage. Yet, melanocytes are labile in dark skin, leading to more pigment disorders. In SOC, hyperpigmentation is a frequent sequela of inflammatory dermatoses, skin injury, or photodamage.[23-28] Inflammation induces cytokine production from epidermal keratinocytes, dermal fibroblasts, and other cells, which enhance melanin production.[23] The result is post-inflammatory hyperpigmentation (PIH) with uneven skin tone or dyschromia.[23] Dyschromia is a significant concern for patients of color and is a frequent presenting complaint in dermatology clinics.[4,24,25]

In addition to undesirable pigment changes, invasive or traumatic procedures increase the risk of scarring.[23] Scarring may occur through a complex interaction between fibroblasts, other cutaneous cells, and cytokines that foster excessive collagen production while inhibiting the degradation of extracellular

matrix components.[23] Scarring has not been studied in all SOC types, and the evidence for fibroblast differences is limited to Black skin.[28]

Choice of appropriate cosmetic procedures is crucial to avoid iatrogenic dermal injury with resultant hypertrophic or keloid scars in higher-risk individuals.[26] Racial/ethnic variations in stratum corneum structure and function have been reported; however, data are limited.[27,28]

The consulting physician can minimize epidermal and dermal injury through careful treatment selection, along with the use of pre- and post-treatment actions to optimize cosmetic outcomes in SOC.[2,4,25,26,28,29]

Section 2: Preventative Actions Before the Procedure

Previously published surveys and algorithms confirmed more than 90% of clinicians recommended sun avoidance before, during, and after facial cosmetic treatments.[5-9] Sun exposure is a major contributor to undesirable post-inflammatory pigment changes. Despite the importance of sunscreen, there are few commercially available sunscreens designed for SOC. A recent report indicates people with SOC are less likely to use sunscreen and are less likely to receive sunscreen recommendations from a dermatologist.[30] There are few cosmetically elegant sunscreens developed for SOC.[4] To protect the face from visible light, a broad-spectrum, preferably tinted sunscreen (and/or one rich in antioxidants and free radical quenchers) with an SPF of 30 or higher is recommended for at least 4 weeks prior to aesthetic procedures.[31]

Sun exposure or skin trauma can trigger herpes simplex virus type 1 (HSV-1) flares. If a patient has ever had a cold sore, assess symptom frequency, prior location of the lesions, prior use of antiviral medication, and identifiable triggers, especially whether lesions were provoked by previous procedures. Reactivation following cosmetic procedures occurs, but reliable data on the incidence of reactivation is inconsistent. Reports of HSV-1 reactivation following dermal filler injections are uncommon. A case series of 138 patients in 6 centers in the US found that 2 patients (1.45%) developed herpes-like infections within 2 weeks of dermal filler treatment.[32] When outbreaks occur, they are seen in the area injected with filler, usually the lips or nasolabial folds.[33]

Compared to the risk with fillers, ablative procedures have a higher risk of HSV-1 infection. In a 500-patient study, post-operative HSV-1 infection was seen in 7.4% of patients following an ablative laser procedure, regardless of prior history.[34] Prophylaxis for patients undergoing ablative laser resurfacing procedures should be considered with or without a history of HSV-1.[34] If there is a history of HSV-1, careful lip examination for early infection or healing lesions is necessary. Aesthetic treatments should be delayed until the skin is fully healed.[35,36] In patients at risk, the expert panel recommends a 5-day treatment course with antiviral therapy, starting one day prior to the procedure.

Patients who demonstrate hyperpigmentation in response to skin trauma can be treated for 2 or more weeks with bleaching agents. Hydroquinone or a similar agent may be necessary for select patients for the prevention and treatment of PIH.[16,17,37]

Depending on the planned procedure, individual patients may need instructions about withholding anti-inflammatory drugs, retinols, and tobacco for days or weeks peri-procedurally to reduce bleeding risks, minimize skin irritation, and optimize wound healing.

Section 3. During the Procedure

All patients

For all patients, makeup removal and skin cleansing are required to prepare the skin. Available cleansing agents include isopropyl alcohol, chlorhexidine, or hypochlorous acid (HOCl). Isopropyl alcohol is inexpensive and easy to obtain, but it is flammable and can irritate the skin. Chlorhexidine is an effective cleanser, but it can be toxic to the eyes and ears.[38,39] Stabilized HOCl is highly active against bacteria, viruses, and fungal organisms without the oto- or ocular toxicity of chlorhexidine.[40] HOCl had dose-dependent favorable effects on fibroblast and keratinocyte migration compared to povidone iodine and media alone.[40] It also increases skin oxygenation at treatment sites, which may aid healing. There is evidence that HOCl may reduce the risk of hypertrophic scars and keloids as it reduces inflammation and the risk for infection.[40]

Local anesthesia and pain management can be customized depending on the procedure and added at the discretion of the treating physician. Specific recommendations to minimize risks during laser and injection procedures are discussed below.

Laser Wavelength

With the right preparation and an experienced provider, patients with SOC can safely undergo laser and light-based treatments for hair removal, pigment abnormalities, skin resurfacing, and skin tightening.[16,37] Laser outcome studies remain scarce in patients of African ancestry or those with SPT V or VI. Published studies for acne and facial rejuvenation in East Asian patients have reported a 55% incidence of PIH after ablative lasers; by 6 months later hyperpigmentation decreased to an 11% incidence.[19] A provider can minimize risks with proper wavelength selection. Shorter wavelengths increase the risk for permanent pigment changes and scarring due to melanin acting as a competing chromophore. Skin containing high amounts of melanin absorbs energy more efficiently than fair skin, but the absorption coefficient of melanin decreases

significantly as wavelengths become longer.[41,42] Fitzpatrick phototype VI, the darkest skin, absorbs up to 4 times as much energy with a 694 nm ruby laser as with a longer wavelength laser such as the 1064 nm neodymium:yttrium aluminum-garnet (Nd:YAG) laser.[41,42] Longer wavelengths penetrate more deeply into the dermis with less tissue damage and are not efficiently absorbed by melanin. Even with longer wavelengths, lasers do create skin inflammation, which can lead to PIH. Although hyperpigmentation is more common, over-treatment with lasers can disrupt melanin production and reduce melanocyte populations, leading to longstanding or permanent areas of hypopigmentation. A test spot may be necessary prior to more extensive laser use to assure treatment has the desired effect.[43]

Laser Treatment Techniques

Besides wavelength selection, additional laser treatment practices will minimize skin injury. Patients with SOC require more conservative treatment, with lower fluences and longer pulse duration. For certain procedures, such as laser hair removal, a more conservative approach will require a greater number of sessions. For laser resurfacing, lower treatment densities are recommended.[16] Epidermal cooling with slower treatment speeds and pauses between passes while resurfacing will reduce skin heating and resultant skin injury.[16]

Injection Techniques

As with laser procedures, physicians who are well acquainted with available cosmetic toxins and fillers are best equipped to use cosmetic injections in the service of patients with SOC. Injection of botulinum toxin is the most widely used cosmetic procedure in the US. This practice has been safe and effective for correction of facial wrinkles in all ethnic groups.[24]

Historically, safety concerns and misconceptions related to facial aging in racial/ethnic populations with SOC have limited use of soft tissue fillers.[37] Proper placement of filler depends on knowledge of anatomic differences among racial/ethnic groups and how aging affects population-specific features. Aging patients of Asian ancestry tend to be more concerned about pigment changes, including lentigines, seborrheic lesions, and mottled pigmentation than about volume loss.[24] Among East Asian populations, a wider bizygomatic facial diameter is more common, thus if filler is desired it is important to avoid augmenting the maxilla and lateral zygoma.[24] African American individuals tend to have a less prominent malar eminence. With age, African American patients tend to lose volume in the mid-face, an area in which volume restoration may be desired.[24] Among Hispanic populations, skin mottling, jowl formation, and infraorbital hollowness have been reported as leading facial aging concerns.[24] Accumulation of mid-face fat, leading to exaggeration of the nasolabial folds has been reported in Hispanic patient populations.[24]

Clinical trials of soft tissue fillers have included diverse patient populations with SOC, but data specific to individual racial/ethnic groups are relatively limited.[44] In an investigator blinded study, 150 (predominantly African American) patients with SPT IV to VI had facial filler using either small or large particle hyaluronic acid. Patients reported good cosmetic effects with both fillers. Changes in pigmentation occurred in 17 patients; 6% of those who received large particle HA, and 9% of those who received small particle HA. Pigmentation changes were more likely to occur in SPT V and VI. Within 3 months, most pigment changes resolved. Three patients noted hyperpigmentation for longer than 3 months. There was no hypertrophic scarring nor keloid formation. Three patients had injection-site mass formations, 2 of which were infectious in nature. The authors concluded variable-particle HA fillers are effective and well tolerated in patients with SOC.[44]

Proper injection techniques for SOC can reduce the risk of PIH. Serial and rapid filler injections may contribute an increased risk for PIH and bruising. Injecting sub-dermally with longer, slower injection times will decrease the risk of PIH.[44] Cosmetic providers should be aware of skin thickness variability among facial areas in SOC, which affects optimal injection depth. To avoid vascular injury, large filler volumes should be avoided in areas with less collateral circulation, such as the glabella.[44,45]

Section 4: Post-Procedural Care

All patients

Following cosmetic laser/other energy-based treatment, nonenergy treatment, or injectables, all patients should be counseled to continue adequate sunscreen containing SPF of at least 30.[30,37] All patients require gentle skin care with non-irritating cleansers and fragrance-free gentle moisturizers.

Cosmetic procedures, especially those that are more invasive, put patients at risk of infection. HOCl has been shown to be effective in preventing infection, and in reducing hypertrophic and keloid scarring after surgical procedures.[40,46] It is available as a solution, skin spray, and as a gel. HOCl has antimicrobial and antibiofilm activity. Use of HOCl solution has been associated with a lower risk of wound infection than povidone-iodine. It increases oxygenation at wound sites, which may enhance healing.[40,46] Additional studies to investigate the use of HOCL in post-procedure treatment and scar management in patients with SOC are warranted.

More invasive procedures also increase the risk for PIH. Although most cases of PIH resolve over the course of several months,[16,17] post procedure bleaching agents, such as hydroquinone 4% cream, can be continued for 2 weeks or longer on a case-by-case basis.

Post-Procedural Adverse Events

Common, mild immediate adverse events, such as swelling and tenderness at the treatment site, or redness, bruising, and pain are transitory in most patients. Swelling and bruising are most common around the eyes and the neck. Use of ice packs or cold air to the affected areas is effective for edema.[9] Bruising or hematoma formation is usually mild and will fade without intervention in 7-10 days. Use of pain medication is dependent on the patient and is at the discretion of the physician. Persistent pain can be an important marker of an evolving vascular occlusion event and should be followed-up.[9]

In the weeks following laser treatment, PIH can develop in dark skinned individuals. Few studies show whether PIH can be prevented or minimized. In a split face study of 40 patients of Asian descent with SPT IV, short-term use of post-operative topical corticosteroids reduced the risk of PIH following fractional CO2 laser for acne scars. Both sides of the face were treated with petrolatum while one side also received 7 days of post-operative 0.05% clobetasol ointment. Assessments at 2 and 3 months showed significant reduction in PIH in the side of the face treated with the steroid ointment.[47]

Delayed adverse effects after filler injections include pigment change, nodule formation, and infection. Different patterns of pigment change provide clues for etiology and treatment. The most common type of pigment change, PIH, is brown in hue and is the result of skin trauma. Although this often resolves in several months, strict sunscreen use with hydroquinone treatment and facial peels can hasten improvement.[45] Although uncommon, reticulated brown-red discoloration can occur a couple months later at the site of hyaluronic acid fillers. This represents a hypersensitivity reaction to the hyaluronic acid filler.[48] Pigment changes are unresponsive to hydroquinone and to laser treatments with Nd:YAG 1064 nm. The brown-red hyperpigmentation will respond to hyaluronidase treatment, which dissolves the hyaluronic acid.[48] This type of hypersensitivity reaction has not been seen with fillers composed of hydroxyapatite or poly-L-lactic acid.[4]

A different pigment change, consisting of a slate gray appearance, can occur due to hemosiderin deposition in the skin.[4] The hemosiderin comes from extravasated red blood cells. Hemosiderin associated pigment does not respond to bleaching agents. It will respond to Q-switched Nd:YAG laser treatments over several months. If laser therapy is not helpful, hyaluronidase can be tried.[4,48]

Operator skill and experience, literature-backed choice of treatment, and careful pre-procedural patient education and periprocedural management will reduce the risk of adverse outcomes following aesthetic procedures in people with SOC. The current algorithm aims to use available evidence to underscore nuances in SOC that should be considered to optimize outcomes of medical aesthetic treatments.

LIMITATIONS

Statements used in the algorithm are based on a combination of data and expert opinion. While alternatives for periprocedural measures for laser, nonenergy and injectable cosmetic procedures in patients with SOC are possible, the algorithm represents best practices developed from a panel of expert clinicians supported by peer-reviewed literature. However, there is a lack of literature for periprocedural measures for cosmetic procedures specifically for people with SOC.

CONCLUSIONS

Patients who desire aesthetic procedures deserve high-quality care administered by an experienced provider. The aim of the new algorithm presented here is to develop a clinical pathway that establishes an informed decision-making, stepwise process for optimal periprocedural care in patients with SOC who undergo laser, nonenergy, and injection aesthetic procedures. Prevention includes sun avoidance and use of sunscreen with an SPF of at least 30. Oral viral prophylaxis is recommended for those with a history of HSV-1 and should be considered in those who undergo ablative procedures. Longer laser wavelengths and techniques to avoid excessive skin injury are recommended. Fewer injections and slower injection speeds will reduce risks with aesthetic fillers. Pre- and post-procedure topical agents such as topical corticosteroids, hydroquinone/other bleaching agents, photoprotection, or adjunctive stabilized HOCl, may help improve treatment outcomes in patients with SOC.

DISCLOSURES

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REFERENCES

1. 2021 Plastic Surgery Statistics Report. American Society of Plastic Surgeons. Accessed [DATE]. plasticsurgery.org/documents/news/statistics/2021/plastic-surgery-statistics-full-report-2021.pdf.
2. Taylor SC. Skin of color: biology, structure, function, and implications for dermatologic disease. *J Am Acad Dermatol.* 2002 Feb;46(2 Suppl Understanding):S41-62. doi:10.1067/mjd.2002.120790. PMID: 11807469.
3. Pandya AG, Alexis AF, Berger TG, Wintroub BU. Increasing racial and ethnic diversity in dermatology: A call to action. *J Am Acad Dermatol.* 2016;74(3):584-587. doi: 10.1016/j.jaad.2015.10.044.
4. 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 Apr;86(4):715-725. doi:10.1016/j.jaad.2021.07.081.
5. Gold MH, Andriessen A, Cohen JL, et. al. Pre-/postprocedure measures for laser/energy treatments: A survey. *J Cosmet Dermatol.* 2020;19(2):289-295. doi:10.1111/jocd.13259.
6. Gold MH, Andriessen A, Goldberg DJ, et. al. Pre-/postprocedure measures for minimally invasive, nonenergy aesthetic treatments:

A survey. *J Cosmet Dermatol.* 2020;19(7):1587-1592. doi:10.1111/jocd.13460.
7. Gold MH, Andriessen A, Hu S, et al. Physician survey on pre-/post-procedure measures for injectable treatments. *J Cosmet Dermatol.* 2020;19(9):2246-2251. doi:10.1111/jocd.13625.
8. Gold MH, Andriessen A, Cohen JL, et. al. algorithm for pre-/post-procedure measures for facial laser and energy device treatment. *J Drugs Dermatol.* 2021;20:1(Suppl):S3-11
9. Gold M, Andriessen A, Goldberg DJ, et al. Algorithm for pre-/post-procedure measures for nonenergy-based and injectable skin treatment. *J Drugs Dermatol.* 2021;20:11(Suppl):S3-10. doi:10.36849/jdd.1121.
10. Trevelyan EG, Robinson N. Delphi methodology in health research: how to do it? *Eur J Integrative Med.* 2015;7(4):423-428. doi:10.1016/j.eujim.2015.07.002.
11. Fitzpatrick TB. Soleil et Peau. *J Med Esthet.* 1975(2) 33-34.
12. Eilers S, Bach DQ, Gaber R, et. al. Accuracy of self-report in assessing Fitzpatrick skin phototypes I through VI. *JAMA Dermatol.* 2013;149(11):1289-94. doi: 10.1001/jamadermatol.2013.6101.
13. He SY, McCulloch CE, Boscardin WJ, Chren MM, Linos E, Arron ST. Self-reported pigmentary phenotypes and race are significant but incomplete predictors of Fitzpatrick skin phototype in an ethnically diverse population. *J Am Acad Dermatol.* 2014;71(4):731-7. doi: 10.1016/j.jaad.2014.05.023.
14. Fitzpatrick TB. The validity and practicality of sun-reactive skin types I through VI. *Arch Dermatol.* 1988;124(6):869–871. doi:10.1001/archderm.1988.01670060015008.
15. Ware OR, Dawson JE, Shinohara MM, Taylor SC. Racial limitations of Fitzpatrick skin type. *Cutis.* 2020;105(2):77-80. PMID: 32186531.
16. Alexis AF. Lasers and light-based therapies in ethnic skin: treatment options and recommendations for Fitzpatrick skin types V and VI. *Br J Dermatol.* 2013;169 Suppl 3:91-7. doi: 10.1111/bjd.12526. PMID: 24098905.
17. Kaushik SB, Alexis AF. Nonablative fractional laser resurfacing in skin of color: evidence-based review. *J Clin Aesthet Dermatol.* 2017;10(6):51-67.
18. Manuskiatti W, Triwongwaranat D, Varothai S, Eimpunth S, Wanitphakdeedecha R. Efficacy and safety of a carbon-dioxide ablative fractional resurfacing device for treatment of atrophic acne scars in Asians. *J Am Acad Dermatol.* 2010;63(2):274-83. doi: 10.1016/j.jaad.2009.08.051.
19. Chan NP, Ho SG, Yeung CK, Shek SY, Chan HH. Fractional ablative carbon dioxide laser resurfacing for skin rejuvenation and acne scars in Asians. *Lasers Surg Med.* 2010;42(9):615-23. doi: 10.1002/lsm.20974.
20. Eimpunth S, Wanitphadeedecha R, Manuskiatti W. A focused review on acne-induced and aesthetic procedure-related postinflammatory hyperpigmentation in Asians. *J Eur Acad Dermatol Venereol.* 2013;27 Suppl 1:7-18. doi: 10.1111/jdv.12050.
21. Smith Begolka W, Elston DM, Beutner KR. American Academy of Dermatology evidence-based guideline development process: responding to new challenges and establishing transparency. *J Am Acad Dermatol.* 2011;64(6):e105-12. doi: 10.1016/j.jaad.2010.10.029.
22. Greep JM, Siezenis LM. Methods of decision analysis: protocols, decision trees, and algorithms in medicine. *World J Surg.* 1989;13(3):240-4. doi: 10.1007/BF01659028.
23. Hossain MR, Ansary TM, Komine M, Ohtsuki M. Diversified Stimuli-Induced Inflammatory Pathways Cause Skin Pigmentation. *Int J Mol Sci.* 2021;22(8):3970. doi: 10.3390/ijms22083970.
24. Alexis AF, Obioha JO. Ethnicity and Aging Skin. *J Drugs Dermatol.* 2017;16(6):s77-s80. PMID: 29028856.
25. Maisel A, Waldman A, Poon E, Alam M. Types of cosmetic procedures requested by different types of patients and the reasons for these preferences. *Dermatol Surg.* 2020;46:1728-1732. doi: 10.1097/DSS.0000000000002632
26. aylor SC. Meeting the unique dermatologic needs of Black patients. *JAMA Dermatol.* 2019;1;155(10):1109-1110. doi: 10.1001/jamadermatol.2019.1963.
27. Muizzuddin N, Hellemans L, Van Overloop L, Corstjens H, Declercq L, Maes D. Structural and functional differences in barrier properties of African American, Caucasian and East Asian skin. *J Dermatol Sci.* 2010;59(2):123-8. doi: 10.1016/j.jdermsci.2010.06.00.
28. 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(9):932-938. doi: 10.36849/jdd.6312.
29. Leal-Silva H. Predicting the risk of postinflammatory hyperpigmentation: The palmar creases pigmentation scale. *Journal of Cosmetic Dermatology.* 2021 Apr;20(4):1263-70. doi: 10.1111/jocd.13968
30. Song H, Beckles A, Salian P, Porter ML. Sunscreen recommendations for patients with skin of color in the popular press and in the dermatology clinic. *Int J Womens Dermatol.* 2020;7(2):165-170. doi: 10.1016/j.ijwd.2020.10.008.
31. Lyons AB, Trullas C, Kohli I et al. Photoprotection beyond ultraviolet radiation: A review of tinted sunscreens. *J Am Acad Dermatol.* 2021 May;84(5):1393. doi: 10.1016/j.jaad.2020.04.079.
32. Restylane injectable gel. In: Summary of safety and effectiveness data. Food and Drug Administration. 2003. Accessed May 24, 2022. https://www.accessdata.fda.gov/cdrh_docs/pdf2/P020023b.pdf.
33. Gazzola R, Pasini L, Cavallini M. Herpes virus outbreaks after dermal hyaluronic acid filler injections. *Aesthet Surg J.* 2012;32(6):770-2. doi: 10.1177/1090820X12452293.
34. Nanni CA, Alster TS. Complications of carbon dioxide laser resurfacing. An evaluation of 500 patients. *Dermatol Surg.* 1998;24(3):315-20. doi: 10.1111/j.1524-4725.1998.tb04161.x.
35. Nestor MS. Prophylaxis for and treatment of uncomplicated skin and skin structure infections in laser and cosmetic surgery. *J Drugs Dermatol.* 2005;4(6 Suppl):S20-5. PMID: 16300226.
36. King M. Prophylaxis and treatment of herpetic infections. *J Clin Aesthet Dermatol.* 2017;10(1):E5-E7. PMID: 28210384; PMCID: PMC5300736.
37. Alexis AF, Few J, Callender VD, et. al. Myths and knowledge gaps in the aesthetic treatment of patients with skin of color. *J Drugs Dermatol.* 2019;18(7):616-622. PMID: 31329382.
38. Bever GJ, Brodie FL, Hwang DG. Corneal injury from presurgical chlorhexidine skin preparation. *World Neurosurg.* 2016;96:610.e1-610.e4. doi: 10.1016/j.wneu.2016.09.035.
39. Steinsapir KD, Woodward JA. Chlorhexidine keratitis: safety of chlorhexidine as a facial antiseptic. *Dermatol Surg.* 2017;43(1):1-6. doi: 10.1097/DSS.0000000000000822. PMID: 27399954.
40. Gold MH, Andriessen A, Bhatia AC, et. al. Topical stabilized acid: The future gold standard for wound care and scar management in dermatologic and plastic surgery procedures. *J Cosmet Dermatol.* 2020;19(2):270-277. doi: 10.1111/jocd.13280.
41. Shah S, Alster TS. Laser treatment of dark skin: an updated review. *Am J Clin Dermatol.* 2010;11(6):389-97. doi: 10.2165/11538940-000000000-00000. PMID: 20866114.
42. Alster TS, Tanzi EL. Laser surgery in dark skin. *Skinmed.* 2003;2(2):80-5. doi: 10.1111/j.1540-9740.2003.01664.x. PMID: 14673304.
43. Woolery-Lloyd H, Viera MH, Valins W. Laser therapy in Black skin. *Facial Plast Surg Clin North Am.* 2011;19(2):405-16. doi: 10.1016/j.fsc.2011.05.007. PMID: 21763999.
44. Taylor SC, Burgess CM, Callender VD. Safety of nonanimal stabilized hyaluronic acid dermal fillers in patients with skin of color: a randomized, evaluator-blinded comparative trial. *Dermatol Surg.* 2009; Suppl 2:1653-60. doi: 10.1111/j.1524-4725.2009.01344.x. PMID: 19807760.
45. Hosseinipour M. Dermal fillers strategies and adverse events specific to skin of color. Pearls from the expert. *J Drugs Dermatol.* December 11, 2021. Accessed May 26, 2022. https://nextstepsinderm.com/derm-topics/dermal-filler-strategies-and-adverse-events-specific-to-skin-of-color/
46. Gold MH, Andriessen A, Dayan SH, Fabi SG, Lorenc ZP, Henderson Berg MH. Hypochlorous acid gel technology-Its impact on post-procedure treatment and scar prevention. *J Cosmet Dermatol.* 2017;16(2):162-167. doi: 10.1111/jocd.12330.
47. Cheyasak N, Manuskiatti W, Maneeprasopchoke et al. Topical corticosteroids minimise the risk of postinflammatory hyperpigmentation after ablative fractional CO2 laser resurfacing in Asians. *Acta Derm Venerol.* 2015;95(2)201-205.
48. Mikkilineni R, Wipf A, Farah R, Sadick N. New classification schemata of hypersensitivity adverse effects after hyaluronic acid injections: Pathophysiology, treatment algorithm, and prevention. *Dermatol Surg.* 2020; 46(11):1404-1409. doi: 10.1097/DSS.0000000000002385

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