

A Practical Algorithm Integrating Skin Care With Nonenergy and Injectable Dermatologic Procedures to Improve Patient Outcomes and Satisfaction

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ABSTRACT

Background: The most rapidly increasing medical aesthetic procedures for facial antiaging comprise nonenergy and injectable treatments. Currently, standards for skin care before, during, and after nonenergy and injectable treatments are lacking. The algorithm on supportive skin care for facial antiaging nonenergy and injectable treatments aims to stimulate healing, reduce downtime, and improve comfort and treatment outcomes.

Methods: A panel of 7 global physicians employed a modified Delphi method and reached a consensus on an algorithm for supportive skin care for nonenergy and injectable antiaging treatments based on the best available evidence and the panel members' clinical experiences and opinions.

Results: The algorithm has a pretreatment (starts 2 – 4 weeks before the procedure) and treatment or ongoing (day of treatment) section, followed by care after the procedure (0 – 7 days) and follow-up care (1 – 4 weeks after the procedure). Applying a broad-spectrum sunscreen with an SPF 30 or higher, combined with protective measures, such as wearing a wide-brimmed hat and sunglasses, is recommended to protect the face from sun exposure. Dyschromia is a significant concern for those with richly pigmented skin. Clinicians may recommend skin care using a gentle cleanser and moisturizer containing vitamins C and E, retinoid, or other ingredients, such as niacinamide, kojic acid, licorice root extract, azelaic acid, and tranexamic acid, depending on the patient's facial skin condition.

Conclusion: Nonenergy and injectable procedures combined with skin care or topical treatments may improve outcomes and patient satisfaction. Topical antioxidants and free radical quenchers can combat photodamage and may offer a safe alternative to topical hydroquinone.

J Drugs Dermatol. 2024;23(4): 227-232. doi:10.36849/JDD.7918

INTRODUCTION

Medical aesthetic procedures for facial antiaging treatment using nonenergy and injectable treatments are rapidly increasing.^{1,2} The American Society for Aesthetic Plastic Surgery (ASAPS) reported that in 2021 over 1 billion dollars were spent on injectables.¹ Together, botulinum toxin and hyaluronic acid injectable procedures comprised the top two non-surgical treatments performed in 2021, with botulinum toxin as the number one medical aesthetic procedure.¹ The injection-based device segment is projected to grow continuously by over 10% annually between 2022 and

2027 by many market research groups. Specifically, Fortune Business Insights shared that the global medical aesthetics market shows that the nonenergy-based segment is the largest portion of the global aesthetic market.³ Many publications have addressed methods to reduce adverse events related to nonenergy and injectable treatments; however, few algorithms exist on skincare measures before, during, and after nonenergy and injectable treatments.^{4,5} Currently, standards for skin care before, during, and after medical aesthetic procedures are lacking.^{4,5} As a result, skin care use for managing conditions

associated with nonenergy and injectable treatments is highly variable.^{4,5} Nonenergy device-based treatments may improve skin conditions by inducing cutaneous changes that remodel the skin matrix.⁶⁻¹¹ Adverse events may occur, prolonging the duration and severity of the healing process.⁴⁻⁷

The current algorithm aims to provide clinicians with skin care recommendations when treating patients with nonenergy-based and injectable treatments for facial antiaging to stimulate healing, reduce downtime, and improve comfort and treatment outcomes.

MATERIALS AND METHODS

A panel of 7 global physicians (panel) who perform medical aesthetic procedures convened a face-to-face meeting and online follow-up to develop and customize the algorithm. The panel found this resource can provide the following: Insight into the fascinating similar philosophies across continents, which may reduce practice variability, a review of the peri/post procedure space, education for patients with richly pigmented skin, and highlighted differences within the injectable space. The panel employed a modified Delphi method and reached a consensus on the algorithm for periprocedural skin care for nonenergy and injectable antiaging treatments based on the best available evidence and the panel members' clinical experiences and opinions.^{12,13}

Literature Searches

Structured literature searches on PubMed and Google Scholar (secondary source) by a physician (TE) and a physician/scientist (AA) were conducted from December 20 to 22, 2022, for publications in the English language from 2010 to January 2023. The following terms were used for the literature searches.

Group 1: Aesthetic dermatology AND nonenergy facial treatment; OR fillers OR injectables OR chemical peels AND hyperpigmentation OR post-inflammatory hypopigmentation.

Group 2: Aesthetic dermatology; pre-/post-procedure measures AND skincare; OR skincare for nonenergy aesthetic facial treatments; OR skincare for injectable treatment OR skincare for chemical peels

The searchers reviewed the titles and abstracts and then the full articles. Excluded were duplicates and poor-quality studies. In case of a review or update, we used the latest version. The reviewers selected 54 nonenergy and injectable treatment articles; after excluding 24 articles, 30 remained. Article types included were clinical studies, algorithms, consensus papers, guidelines, meta-analyses, systematic reviews, and review papers (Figure 1).

Each selected clinical publication that included periprocedural skin care or skin care combined with nonenergy and injectable

treatment was graded based on reviewer consensus.¹² The reviewers assigned a level of evidence for each treatment (levels A, B, C, and 1 to 4) using the pre-established criteria.¹² No grading was done due to a lack of clinical studies on periprocedural skin care.

Development of the Algorithm

Based on the literature results and in-field practice, the global panel worked in small groups on implementing and revising the initial algorithm skeleton proposed by TL and AA. The global panel reconvened into a plenary group to reach a consensus through blinded reiterations. Reviewing, editing, customizing the final algorithm, obtaining consensus, and discussing and reviewing this manuscript took place online.

The Algorithm

The purpose of a clinical algorithm is to guide medical decision-making by standardizing treatment regimens to encourage compliance with evidence-based recommendations.^{4,5} The algorithm on supportive skin care for nonenergy and injectable treatments has a pretreatment (starts 2 – 4 weeks before the procedure) and treatment (day of treatment) section, followed by care after the procedure (0 – 7 days) and follow-up care (1 – 4 weeks after the procedure or ongoing) (Figure 2). Nonenergy facial and injectable treatments included microdermabrasion, micro-needling, threads, chemical peels, fillers, and neuromodulator injections. Although microdermabrasion and micro-needling may use an energy-based device, the treatment is minimally invasive and, therefore, fits in the category. Moreover, these procedures are frequently combined with skin care or topical treatments, which is relevant for the algorithm.

Medical and Dermatological History

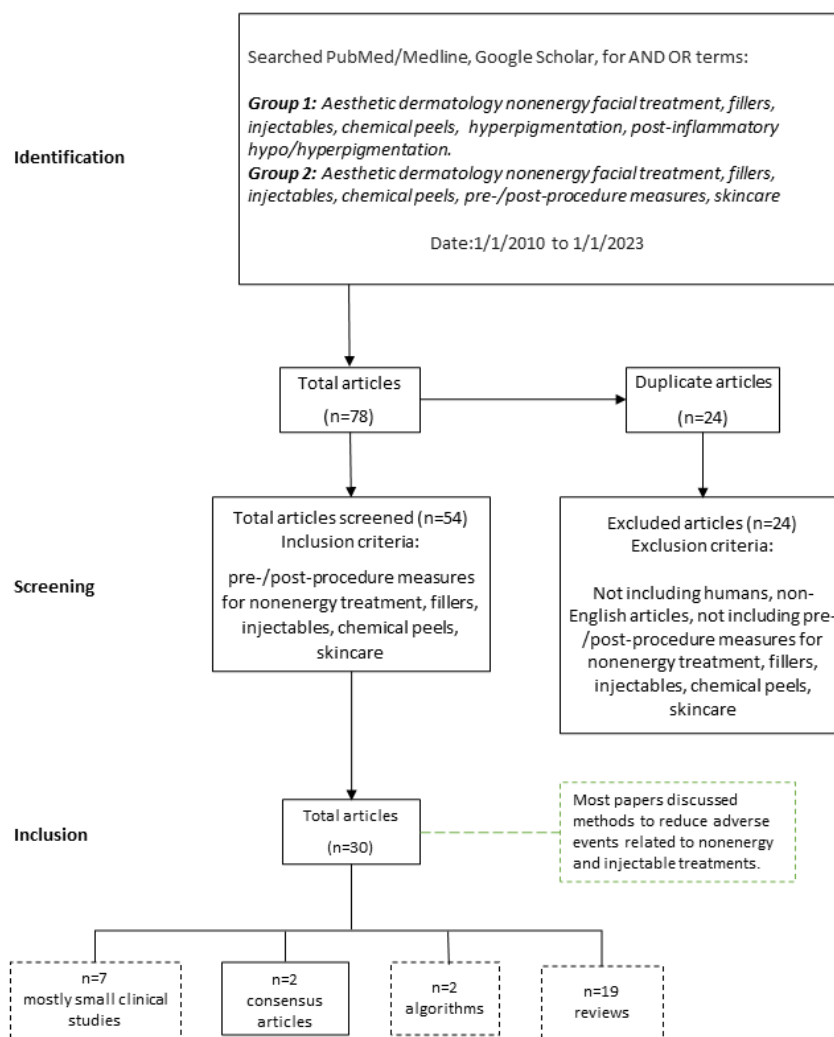
Pre-procedural consultation includes clarifying individual patient goals and expectations of the treatment, followed by a treatment plan.

Outcomes of previous skin treatments should be discussed with the patient, especially responses to dermabrasion or chemical peels.^{4,5,14}

Before recommending nonenergy-based and injectable treatments, the medical and dermatological history of the patient is to be obtained with specific attention to skin issues that the procedure may exacerbate, such as history, ethnicity, and/or Fitzpatrick or Rosacea skin type, that may predict a higher risk for pigmentary or scarring complications.^{4,5,14}

Pretreatment Measures

Starting 2 to 4 weeks before the procedure, clinicians advise patients to avoid excessive sun exposure before, during, and after facial nonenergy-based and injectable treatments.^{4,5,14,15} To protect the face from sun exposure, applying a broad-spectrum

FIGURE 1. Structured literature search results.

¹Excluded: Poor-quality studies. In case of a review or update, the latest version was used.
Due to a lack of clinical studies on periprocedural measures and skin care, no grading was done.

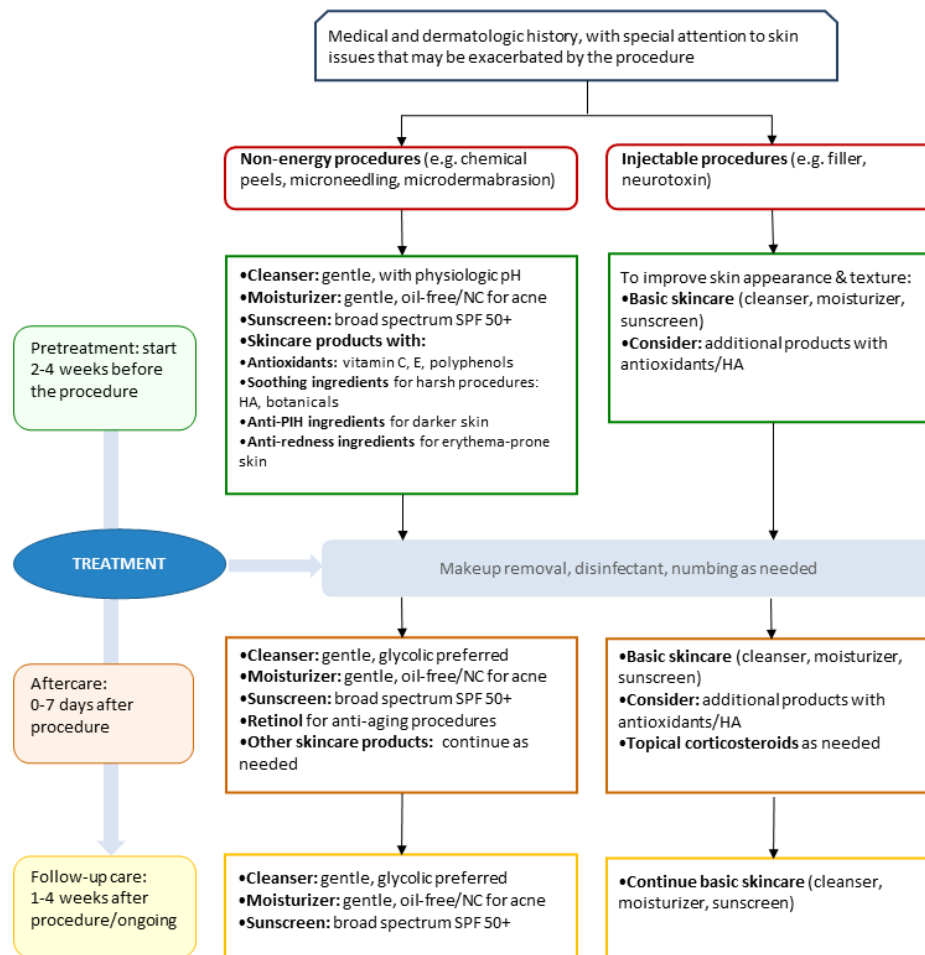
sunscreen with an SPF 50 or higher, combined with protective measures, such as wearing a wide-brimmed hat and sunglasses, is recommended.^{4,5,14,15}

Tinted iron oxide sunscreens without a white cast in richly pigmented skin could improve compliance. In addition, using topical technologies that contain ingredients with antioxidants and free radical quenchers may help to prevent dyschromia,¹⁴⁻¹⁶ which is a significant concern for those with richly pigmented skin and of Asian descent.¹⁴⁻¹⁷

Injecting fillers sub-dermally with longer, slower injection times may help decrease the risk of dyschromia.^{17,18} Healthcare providers should be informed on skin thickness variability among facial areas in richly pigmented patients, which affects optimal injection depth.^{17,18} During the procedure, skin cleansing

products are addressed, along with judicious techniques to minimize unintended cutaneous injury or inflammation.

Clinicians may pretreat patients with products to prevent hyper or hypopigmentation before nonenergy or injectable treatments. However, this recommendation is primarily for patients with richly pigmented skin or those with a history of dyschromia or abnormal scarring.^{4,5,14-17} Melanocytes are hyper-reactive in richly pigmented skin, leading to more pigment disorders, such as hyper or hypopigmentation, a frequent sequela of inflammatory dermatoses, skin injury, or photodamage.¹⁴⁻¹⁷ Pretreatment prevention of hyper or hypopigmentation comprises topical arnica/bromelain or hydroquinone and agents to impact melanogenesis.^{4,5,14,15} Other options are products containing niacinamide, kojic acid (KA), azelaic acid (AzA), retinoids, and tranexamic acid (TXA). Pretreatment with skin care using a

FIGURE 2. Algorithm on integrative skin care for facial nonenergy and injectable dermatologic procedures.

HA = hyaluronic acid; NC = noncomedogenic; HSV = herpes simplex virus

gentle cleanser and moisturizer containing a retinoid or other ingredients, such as vitamin C, niacinamide, KA, licorice root extract, AzA, and TXA, is frequently recommended depending on the patient's facial skin condition.^{4,5,14-17} These products may impact melanogenesis or melanosome transfer, while others enhance melanosome degradation.¹⁵

Measures During the Treatment Phase

Before nonenergy-based and injectable treatments, avoid drying alcohol, retinol peels, and agents such as acetylsalicylic acid, high-dose vitamin E and omega 3, ginkgo biloba, and garlic that can enhance the risk of bleeding and or bruising, and non-steroidal anti-inflammatory drugs (NSAIDs), amongst other agents, is recommended.^{4,5,14,15} The panel agreed that depending on the depth of the peel, avoiding them for at least two weeks or longer prior to the procedure is recommended, together with avoiding unprotected sun exposure.

Before injectable treatments, the patient's skin should be clean so makeup or other material does not cover or camouflage, for example, blood vessels. Facial makeup must be fully removed, and the skin should be cleansed with a gentle facial cleanser. Upon performing the procedure, typically, an antimicrobial solution is applied to the treatment area.^{4,5,14} Agents such as isopropyl alcohol, chlorhexidine, or hypochlorous acid (HOCl) are frequently applied for skin preparation.^{4,5} Isopropyl alcohol, although inexpensive, can irritate the skin and is flammable, whereas chlorhexidine, although effective, has ocular and ototoxicity.^{4,5,15,19,20} Stabilized HOCl for skin preparation before and after nonenergy or injectable treatments is highly active against bacterial, viral, and fungal microorganisms.^{21,22} When choosing topical antiseptics, antimicrobial resistance should be taken into account, and factors such as geographic region/practice setting (outpatient versus hospital-based) associated with microbial epidemiology.^{4,5}

Aftercare

Aftercare is started immediately after the procedure for up to 7 days. The treatment of pain and anesthesia for nonenergy and injectable procedures should be at the treating physician's discretion and is dependent on the patient and the type of treatment administered.^{4,5}

Immediately, post-procedural sunscreen and gentle skin care that may include skin-lightening agents or formulations designed to prevent infection and promote optimum healing are advised.

It is recommended that patients use a gentle facial noncomedonal cleanser typically free of comedonal oils with neutral skin surface physiological pH (4 – 6); formulas with glycolic or lactic acid for skin rejuvenation are recommended.^{4,5,15} Patients should continue applying a broad spectrum SPF >50 or more sunscreen as before the procedure and a moisturizer, and consider additional products with antioxidants, HA, or both.^{4,5,15} Topical retinol is recommended for those who received drug-based procedures, and other skincare products that were used before the procedure may be continued as needed.

Follow-up care

Follow-up care is provided 1 to 4 weeks after the procedure and comprises skin care as described for aftercare.^{4,5,15} The panel agrees that prescribing a skincare routine to patients receiving neuromodulator and dermal filler procedures improves skin quality and overall aesthetic outcomes. The synergy between skin care and injectable procedures improves patient satisfaction and promotes long-term prevention and maintenance. The panel agreed that recommending postprocedure skincare routines long term, beyond 1 to 4 weeks postprocedure, improves outcomes.

Adverse Events

The panel agreed that general neuromodulator and dermal filler procedures do not pose a significant risk of hyper- and hypopigmentation with dyschromia even in more richly pigmented individuals, unlike peels, microdermabrasion, or laser procedures. Delayed adverse effects after various types of filler injections may include pigment change, nodule formation, and infection.^{4,5,14-18} Different patterns of pigment change provide clues for etiology and treatment.¹⁵⁻¹⁸ The most common type of pigment change, hyper- and hypopigmentation with dyschromia results from skin trauma.¹⁵⁻¹⁸ Hyper- and hypopigmentation with dyschromia may spontaneously resolve over months, but the diligent use of sunscreen, skin-lightening agents, and possibly superficial chemical peels may hasten resolution.¹⁵ Reticulated brown-red discoloration can occur a few months later at the site of HA fillers, representing a hypersensitivity reaction to the HA filler.^{23,24} These pigment changes are unresponsive to hydroquinone and may require laser treatment with Nd:YAG 1064 nm. This brown-red hyper- and hypopigmentation with dyschromia may also respond to hyaluronidase treatment, which dissolves

the hyaluronic acid.^{23,24} This type of hypersensitivity reaction has not been seen with fillers composed of hydroxyapatite or poly-L-lactic acid.²⁴

DISCUSSION

Integrating Skin Care for Facial Nonenergy and Injectable Treatments

Patients frequently choose facial nonenergy or injectable treatments due to the minimally invasive nature, reduced risks, and shortened downtime compared to ablative laser and surgical modalities.⁶⁻¹¹ Cost, age, and access all play a role in the type of treatment considered.

Copious recommendations and publications exist for integrated skin care for energy-based device treatments.²⁵ The panel agreed that data and recommendations for best practices for periprocedural skin care or skin care combined with aesthetic nonenergy and injectable procedures are relatively limited. For the algorithm on integrated skin care for nonenergy and injectable procedures, we reviewed periprocedural skin care and specific ingredients as an adjunct or combined with nonenergy and injectable facial treatments.

Antioxidants

Topical antioxidants can be effective in protecting against and reversing photodamage of the facial skin.²⁶ Studies have shown that topical vitamins C and E and the mineral selenium may protect against sunburn and discoloration.²⁶ Certain forms of these antioxidants are stable and active after application to the skin, such as non-esterified, acidic vitamin C, non-esterified vitamin E, and the isomer D-alpha tocopherol.²⁶

Topical Retinoid, Topical Hyaluronic Acid

Adjunctive or combined specialized aesthetic skin care may enhance aesthetic procedure outcomes.²⁶⁻³¹ Creams, serums, and gels containing various ingredients such as HA may improve skin hydration and elasticity.²⁶⁻³¹ The use of skin care by individuals receiving neuromodulator injections has reduced the mean volume and depth of facial lines and hyperpigmentation and improved skin smoothness, tone, and color compared with neuromodulator injections alone.^{26,27}

A study of 20 volunteers treated with a neuromodulator and HA injections in the cheeks, nasolabial folds, and lips randomized participants to a skincare regimen for 12 weeks in conjunction with injections.²⁶ Ten volunteers (group 1) received skin care with a cleanser, antioxidant, exfoliator, retinol, and sunscreen. Group 2 (n = 5) received the same skincare regimen plus a series of 6 alpha-hydroxy acid pigment-balancing peels every 2 weeks, and group 3 (n = 5) received skin care with a cleanser, moisturizer, and SPF 50 sunscreen. Group 2 showed the most marked improvement (blinded evaluator Global Aesthetic Improvement Scale [GAIS]).²⁶ Groups 1 and 2 exhibited markedly improved self-esteem scores.²⁶

Topical Hydroquinone, Niacinamide, Kojic Acid, Licorice Root Extract, Azaleic Acid

Neuromodulator injections, a hydroquinone skincare regime, and daily topical retinoids improved signs of photoaging.²⁶ A further study combined neuromodulator injections for antiaging treatment with skincare containing retinol, adenosine, and HA, which optimized total treatment outcomes.²⁸

Pre-procedure or follow-up care with skin care using topical products containing niacinamide, KA, AzA, and TXA may be recommended.²⁹ Niacinamide inhibits melanosome transfer to keratinocytes and may be combined with TXA. A randomized, double-blind, vehicle-controlled study showed improvement in irregular facial hyperpigmentation.³⁰

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.³¹

LIMITATIONS

The panelists agreed that standardization for supportive skin care for nonenergy and injectable facial treatments is lacking, and many products are recommended without expert consensus. Clinical studies on skin care for these procedures mostly have a small sample size, but some used biophysical assays to support the findings. The discussion of skin care containing various ingredients supporting outcomes of nonenergy and injectable treatments was mostly limited to studies that combined skin care with these treatments. As data is lacking on combining nonenergy treatments and injectables with topical products containing niacinamide, KA, licorice root extract, AzA, and TXA, the discussion was limited to informing clinicians on the action of these ingredients.

CONCLUSION

The algorithm provides clinicians with skincare recommendations when treating nonenergy-based and injectable facial antiaging treatments to stimulate healing, reduce downtime, and improve comfort and treatment outcomes. A structured literature search was conducted to guide the algorithm's development. Clinical studies suggest that periprocedural skin care may improve outcomes and patient satisfaction with aesthetic procedures. Procedures combined with skin care or topical treatments improved skin condition.

Dyschromia is a significant issue for richly pigmented skin, and the literature suggests that topical antioxidants and free radical quenchers can protect against photodamage. The use of hydroquinone remains controversial, especially given the alternatives currently available.

DISCLOSURES

This work was supported by an unrestricted educational grant from SkinCeuticals International. The authors contributed to the development of the manuscript, reviewed it, and agreed with its content.

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