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 ORIGINAL ARTICLE

A Practical Algorithm for Integrating Skincare to Improve Patient Outcomes and Satisfaction With Energy-Based Dermatologic Procedures

Edward Lain MD FAAD,[a] Andrew F. Alexis MD FAAD,[b] Anneke Andriessen PhD,[c] Valeria Barreto Campos MD,[d] Ariel Haus MD,[e] Jihee Kim MD PhD,[f] Mark Lupin MD,[g] Cara McDonald MBBS BMedSci MPH FACD,[h] Chen Feng Zhang MD PhD[i]

[a]Austin Institute for Clinical Research, Austin, TX
[b]Weill Cornell Medical Medicine, New York, NY
[c]Radboud UMC Nijmegen, Andriessen Consultants, Malden, NL
[d]University of Jundiai, São Paulo, Brazil
[e]Dr Haus Dermatology, London, England
[f]Department of Dermatology, Yongin Severance Hospital, Yonsei University College of Medicine, Yongin 16995, Republic of Korea
[g]MedSpa Partners Ltd., Victoria, BC, Canada
[h]St Vincent's Hospital, Director Complete Skin Specialists, Sunbury, Melbourne, Australia
[i]Department of Dermatology, Huashan Hospital, Fudan University, Shanghai, China

ABSTRACT

Background: Medical aesthetic procedures for facial antiaging with laser and energy-based devices (EBDs) are rapidly increasing, but standards integrating skincare before, during, and after these treatments are lacking. The algorithm for integrated skin care for facial antiaging treatment with EBDs aims to stimulate healing, reduce downtime, and improve comfort and treatment outcomes.

Methods: A panel of 8 global physicians employed a modified Delphi method and reached a consensus on the algorithm integrating skincare based on the best available evidence, the panel's clinical experience, and opinions.

Results: The algorithm 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). Applying a broad-spectrum sunscreen with an SPF 50 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 skin of color (SOC). Clinicians may recommend skincare 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: Medical aesthetic procedures for facial antiaging with EBDs integrating skincare 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.

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INTRODUCTION

Medical aesthetic procedures for facial antiaging treatment using laser and energy-based devices (EBDs) are rapidly increasing.[1,2] The American Society for Aesthetic Plastic Surgery (ASAPS) reported that in 2020 to 2021 intense pulsed light (IPL) comprised 827,409 procedures and laser skin resurfacing 997,245 procedures (ablative 430,506 and nonablative [Fraxel, etc.] 566,739).[1,2] The EBD segment is projected by many market research groups to grow continuously, by over 5% annually between 2022 and 2027.[1,2]

Many publications have addressed methods for reducing adverse events related to EBD treatments.[3,4] The number of studies on integrating skincare in laser and EBD treatments is growing. However, standards for skincare before, during, and after medical aesthetic procedures are lacking, and few algorithms exist.[3-14] As a result, skincare integrated into EBD treatments is highly variable.

Our objective is to highlight the potential utility of EBDs (eg, lasers and fractional radiofrequency microneedling [FRFM]).

Several types of laser exist for facial antiaging treatments, such as intense pulsed light (IPL), pulsed dye laser (PDL), Neodymium: yttrium-aluminum-garnet (Nd:YAG laser), 532 nm potassium-titanyl-phosphate (KTP), and several infrared lasers, including the 1550 nm erbium glass, 1064 nm, and 1320 nm Nd: YAG lasers. Furthermore, fractional and carbon dioxide (CO2) lasers are frequently used.[15]

Laser and FRFM treatments may improve skin conditions by inducing cutaneous changes that remodel the skin matrix. Adverse events may occur, prolonging the duration and severity of the healing process. The current algorithm aims to provide clinicians with skincare recommendations for facial antiaging treatment with EBDs to stimulate healing, reduce downtime, and improve comfort and treatment outcomes.

MATERIALS AND METHODS

An international panel of 8 global physicians who perform medical aesthetic procedures convened a face-to-face meeting and online follow-up to develop and customize the algorithm. The physicians found this resource can provide similar philosophies across continents, thus reducing practice variability, reviewing the peri/post procedure approaches, educating patients with richly pigmented skin (also called skin of color [SOC]), and highlighting differences within EBD peri/post procedure approaches and skincare.

The panel employed a modified Delphi method and reached a consensus on the algorithm for periprocedural approaches and skincare for EBD antiaging treatments based on the best available evidence, the panel's clinical experience, and opinions.[16,17]

The algorithm focuses on skin care for EBD treatments, catering to physicians who use these treatments for facial aging.

Literature Searches

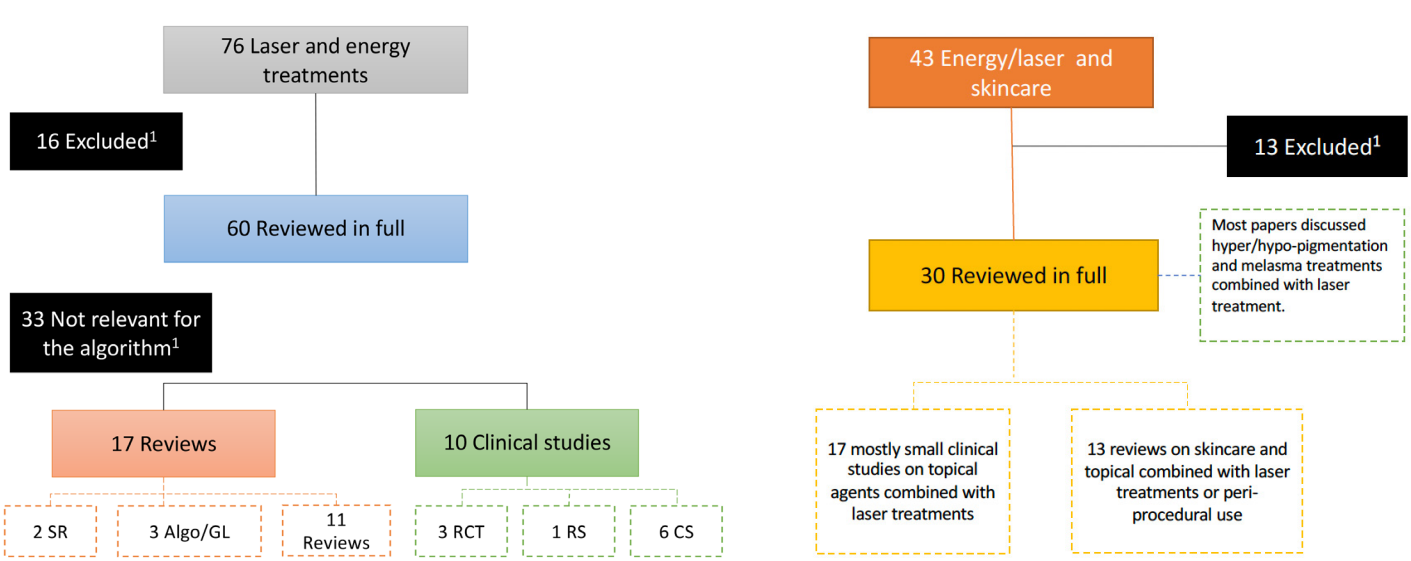
Structured literature searches on PubMed and Google Scholar (secondary source) by a physician (TE) and a physician/scientist (AA) were conducted from 20 to 22 May 2023 for publications in the English language from 2010 to April 2023. The following terms were used for the literature searches:

Group 1: Energy/laser* treatment AND wound healing OR hyperpigmentation OR hypopigmentation OR pigmented scars OR melasma OR prophylactic antiviral treatment*
Group 2: Energy/laser* treatment AND sunscreen OR skincare OR *combined with skincare OR hypochlorous acid OR topical hydroquinone OR topical tranexamic acid OR topical kojic acid OR niacinamide OR combinations*

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, the latest version was used. In group 1 the reviewers selected 76 EBD treatment articles; after excluding 16 articles, 60 remained. Article types included were clinical studies, algorithms, consensus papers, guidelines, meta-analyses, systematic reviews, and review papers (Figure 1a).

In group 2, the reviewers selected 43 laser, EBD treatment, and skincare articles; after excluding 13 articles, 30 remained. Article types included were mostly small clinical studies and review papers on skincare and a topical combined with laser treatment (Figure 1b).

FIGURE 1. Structured literature search results. (1A) Results Group 1. (1B) Results Group 2.



Each selected clinical publication that included periprocedural skincare or skincare combined with EBD treatment was graded based on reviewer consensus.[16,17] The reviewers assigned a level of evidence for each treatment (levels A, B, C, and levels 1 to 4) using the pre-established criteria.[16,17] No grading was done due to a lack of clinical studies on periprocedural skincare.

The Algorithm

Development of the Algorithm

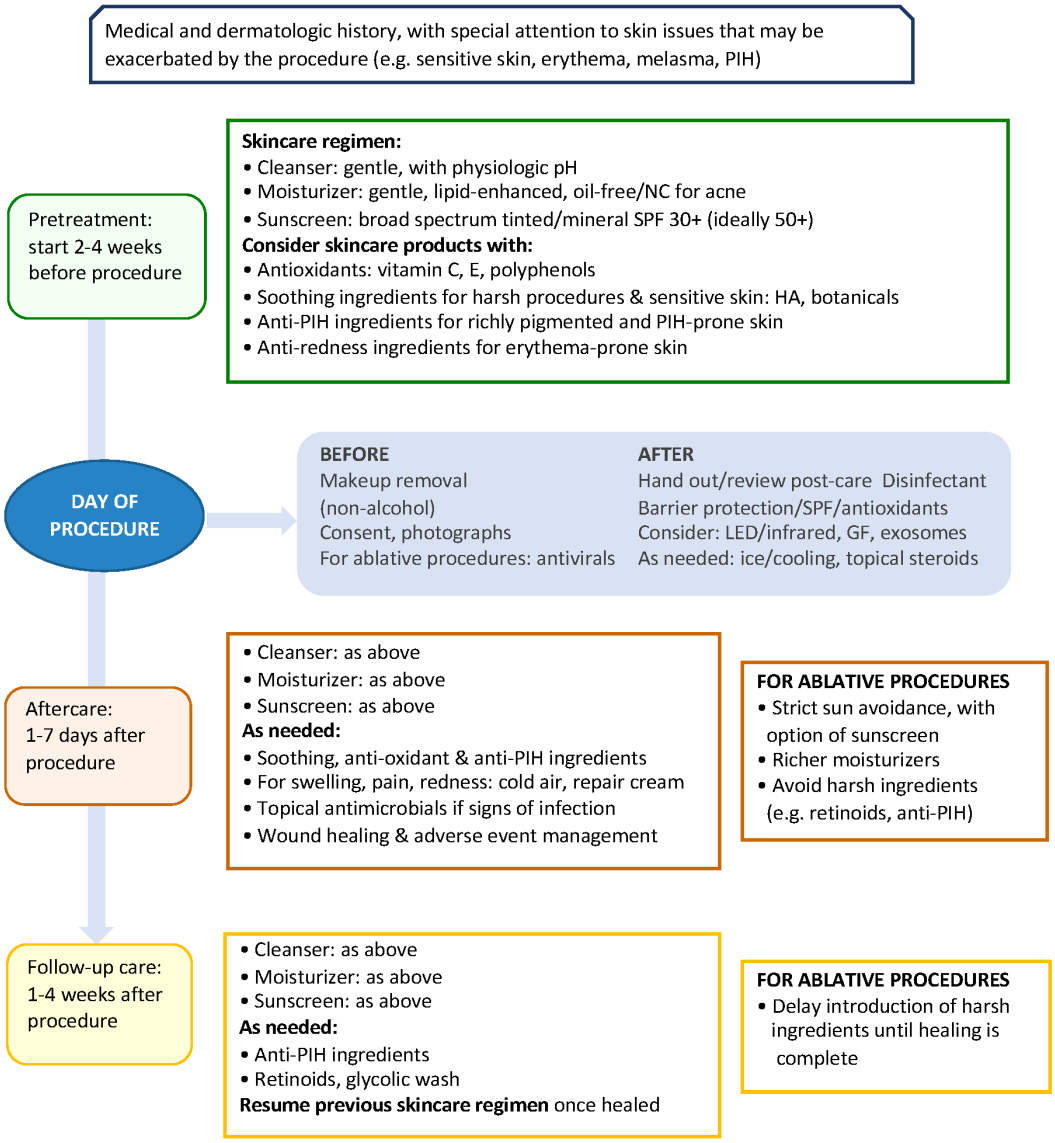
The Delphi process included a literature review and the preparation of a draft algorithm.

Based on the literature and in-field practice results, the global panel worked in small groups to implement and revise the initial algorithm skeleton proposed by TL and AA. The international 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 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 integrative skincare for EBD treatments has a pretreatment (starts 2 - 4 weeks before the procedure) and treatment (day of treatment, before and after) section, followed by care after the procedure (1 - 7 days) and follow-up care (1 - 4 weeks after the procedure or ongoing; Figure 2).

First, the sections of the algorithm are discussed, followed by details on integrated skincare and its components.

FIGURE 2. Algorithm on integrated skin care for facial laser and energy-based rejuvenation treatments.



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, especially responses to EBD treatments, should be discussed with the patient.

Before recommending a treatment, the medical and dermatological history of the patient is to be obtained with specific attention to skin issues (sensitive skin, erythema, melasma, or dyschromia) that the procedure may exacerbate or that indicate a higher risk for dyschromia or scarring.[15]

Pretreatment Measures

It is recommended that the patients use a gentle cleanser with a physiologic (4 - 6) pH and a gentle, lipid-enhanced facial moisturizer that fits the individual patient's needs.[18] Patients should consider using skincare products with antioxidants: vitamin C, E, and polyphenols.[13,14,18,20-23] For potentially irritating procedures and patients with sensitive skin issues, soothing ingredients such as hyaluronic acid (HA)[20] or botanicals may be beneficial.[3-5]

Starting 2 to 4 weeks before the procedure, clinicians advise patients to avoid excessive sun exposure before, during, and after facial treatments. Applying a broad-spectrum sunscreen with an SPF 50 or higher, combined with protective measures such as wearing a wide-brimmed hat and sunglasses, is recommended to protect the face from sun exposure. Tinted-iron oxide sunscreens without a white cast in SOC patients may improve compliance.[21-23]

The use of topicals containing antioxidants, free radical quenchers, and tranexamic acid to prevent dyschromia, especially in SOC individuals, may be beneficial.[3-5,19-25] Clinicians may pretreat patients with products to prevent dyschromia before EBD facial treatments. However, this recommendation is primarily for patients with SOC or those with a history of dyschromia or abnormal scarring.[3-5,21-27] Melanocytes are hyper-reactive in SOC, leading to dyschromia such as hyper- or hypopigmentation, a frequent sequela of inflammatory dermatoses, skin injury, or photodamage.[5,26] Pretreatment prevention of hyper- or hypopigmentation comprises topical arnica/bromelain or hydroquinone (HQ) and agents to impact melanogenesis.[5-14, 21-23,25-27] Other options are products containing niacinamide, kojic acid (KA), azelaic acid (AzA), retinoids, and tranexamic acid (TXA).[5-14,24,27-29] Pretreatment with skincare using a gentle cleanser and moisturizer containing retinoid or other ingredients, such as niacinamide, kojic acid, licorice root extract, AzA, and TXA, is frequently recommended depending on the patient's facial skin condition.[5-14,21-26] These products may impact melanogenesis or melanosome transfer, while others enhance melanosome degradation.[25]

Measures on the Day of the Procedure

Before facial EBD treatments, it is recommended to avoid drying alcohol, retinol peels, and agents such as acetylsalicylic acid that can enhance the risk of bleeding and or bruising, as well as non-steroidal anti-inflammatory drugs (NSAIDs), amongst other agents.

Facial makeup must be fully removed, and the skin should be cleansed with a gentle facial cleanser. Typically, an antimicrobial solution is applied to the treatment area upon performing the procedure. Agents such as isopropyl alcohol, chlorhexidine, or hypochlorous acid (HOCl) are frequently used for skin preparation.[30-33] Isopropyl alcohol, although inexpensive, can irritate the skin and is flammable, whereas chlorhexidine, although effective, has ocular and ototoxicity.[30,31] Stabilized HOCl for skin preparation before and after EBD treatments is highly active against bacterial, viral, and fungal microorganisms.[32,33] When choosing topical antiseptics, antimicrobial resistance and factors such as geographic region/practice setting (outpatient vs hospital-based) associated with microbial epidemiology should be considered.[32,33]

The literature supports oral antiviral prophylaxis for ablative laser procedures, starting 1 day before the procedure for 5 days. The patients are given instructions on aftercare, including ice, cooling, or topical steroids as needed. LED/infrared, topical growth factors, or exposomes may be considered. Patients require facial skin barrier protection using skincare and sun protection, as described in the pretreatment section.

Aftercare: One to Seven Days After the Procedure

Aftercare is started on day 1 after the procedure for up to 7 days. The treatment of pain and anesthesia for laser and EBD procedures should be at the treating physician's discretion and depends upon the patient and the type of treatment administered.

Post-procedural sunscreen and gentle skincare that may include skin-lightening agents or formulations designed to prevent infection and promote optimum healing are advised.

Patients are recommended to use a gentle facial cleanser typically free of comedonal oils with neutral skin surface physiological pH (4 - 6). Formulas with glycolic or lactic acid for skin rejuvenation may be recommended, but they can be irritating and less tolerated immediately postprocedure. Continue applying a broad spectrum SPF 50 or higher sunscreen and a moisturizer as before the procedure, and consider additional products with antioxidants.[19]

Follow-up Care

Follow-up care is provided 1 to 4 weeks after the procedure and comprises skincare as described for aftercare.[13,14] For ablative lasers, reinforce strict sun avoidance and use a broad spectrum SPF 50 or higher sunscreen. Recommend lipid-enhanced facial moisturizers and avoid hash ingredients such as topical retinoids or other topical irritants.[4,5,13,14,17] Anti-post-inflammatory hyperpigmentation products at this stage may help prevent dyschromia; however, they should be gentle, avoiding irritation.[4,5,13,14,17]

Adverse Events

The snapping and burning sensation of the laser pulse may cause minimal to moderate discomfort. Pain should be considered as a potential sign of a side effect, and a topical anesthetic should be used judiciously. There are many different types of laser treatment, and the reaction varies depending on whether it is treating skin, erythema, pigmentation, etc. Immediately after laser treatment, the area may appear grey or blue-black, which will fade over the next 7 to 10 days. However, there are instances of blue-black occurring that will not fade. After laser treatment, erythema and edema may occur within a few minutes, especially in areas treated under the eyes and neck. The edema subsides within 3 to 5 days if ice is regularly applied. Parallel- and post-cooling will reduce edema. Infection may occur but is rare. Edema, erythema, crusting, pain, and fever can indicate an infection. The treating physician decides if topical antimicrobials or oral antibiotics should be used. Dyschromia, such as hyperpigmentation, may occur and typically fades within 2 to 6 months.[5,21-23] This reaction is more common in SOC patients and worsens if the laser-treated area is exposed to the sun.[5,21-23] Hypopigmentation may be caused by overtreatment and may resolve within 3 to 6 months; however, it more frequently persists in the neck.[21-23] Scarring after PDL and 532nm KTP laser treatments is rare; it is somewhat more common with alexandrite laser, while the risk may be significant with Nd:YAG laser due to the deeper laser light penetration.[3-5,34,35]

Laser and Topical Treatment

Laser and Topical Treatment for Melasma

Er:YAG laser was mostly used in the studies. Topical HQ was mostly used in the selected studies. Although it is effective, it can lead to exogenous ochronosis and cannot be used during pregnancy.[7,8,37]

A single-center, prospective, split-face trial evaluated the tolerance and efficacy of laser-assisted (Q-switched 1064 nm Nd: YAG) delivery of 3% tranexamic acid, 5% niacinamide, and 1% kojic acid for melasma in 25 subjects.[6] One side of the face was treated with laser alone, and the other side received a combination of laser and topical tranexamic acid, niacinamide, and kojic acid. Each treatment included 5 sessions at 2-week intervals.[6] The subjects were followed up to 4 weeks after the final laser treatment. For assessment, the Melasma Area and Severity Index (MASI) was scored, and a specialized imaging system and photographs were evaluated (5-point scale) by 2 independent evaluators at weeks 2, 4, 6, 8, and 12.[6] The researchers concluded that topical facial serum containing 3% tranexamic acid, 1% kojic acid, and 5% niacinamide is safe and effective when combined with laser treatment for melasma.[6]

Studies have compared laser and topical combination treatment with that of the topical treatment alone for melasma.[7-11] A split-face study using fractional erbium-doped yttrium aluminum garnet laser-assisted drug delivery of HQ in the treatment of melasma was conducted. Six sessions took place over 2 weeks. The study showed a MASI improvement for the laser and topical of 6.82 (9.1) vs the topical only of 3.74 (9.31).[7] Another split-face study using Er:YAG laser applied a combination of HQ 4% with HQ 4% alone in 3 sessions during 4 weeks. At week 28 a MASI improvement was noted for the laser and topical of 9.29 (17.6) vs the topical only of 7.61 (18.4).[8]

Picosecond laser was used in a split-face study in 5 sessions over 1 week combined with HQ 4% and compared with the topical only. A MASI improvement was noted for the laser and topical of 5.58 (22.3) vs the topical only of 1.53 (21.9).[9]

Er:YAG laser combined with kojic acid vs the topical was applied during 6 sessions over 2 weeks. The split-face study noted a MASI improvement for the combination treatment of 3.6 (12.1) vs the topical-only treatment of 2.7 (4.25).[10]

A randomized controlled study applied fractional erbium: YAG laser (2940 nm) plus topical HQ compared with intradermal tranexamic acid plus topical HQ to treat refractory melasma. The split-face study applied the treatment in 6 sessions over 2 weeks and observed a MASI improvement for the combination treatment of 2 (4.25) vs mesotherapy and the topical of 2.5 (4.25).[11]

Facial Laser Treatment and Skincare

Nonablative lasers may be beneficial to enhance the delivery and absorption of topicals such as skincare.[12] An ex vivo study used donor human skin tissue to measure the uptake of 3 topical antioxidants (15% vitamin C serum, 10% vitamin C serum, and botanical serum) following pretreatment with 1440-nm nonablative laser compared with untreated controls. Cumulative permeation of 15% and 10% vitamin C serums through 24 hours after laser pretreatment showed an enhanced skin uptake of the vitamin C serums and the botanical serum compared with the controls.[12] These findings support that nonablative fractional diode lasers can enhance topical uptake depending on the laser and the characteristics of the topical formulations.[12]

Laser use must be tailored for a given case according to the indication for treatment, characteristics of the topical (eg, lipophilicity, ingredient concentrations, and vehicle), and patient expectations regarding side effects and postprocedural downtime.[12]

A prospective, single-arm split-face, double-blind, controlled pilot study including 15 subjects with moderate (Glogau scale 3) photodamage after whole-face fractional ablative laser (Lumenis Ultra Pulse ActiveFX) treatment followed by immediate topical 15% vitamin C, 1.0% Vitamine E, and 0.5% ferulic acid serum to 1 side and daily application for 7 days compared with vehicle (other side).[13] Standardized photographs were assessed by 4 blinded investigators, scoring post-laser wound healing, edema, and erythema (4-point scale: 0 = none, 3 = severe) and TaqMan Real-Time RT-PCR (molecular pathways and biomarkers (miRNA assays). A patient questionnaire was completed daily for 7 days.[13]

Physician scores showed that the side treated with topical 15% vitamin C, 1.0% vitamin E, and 0.5% ferulic acid serum had almost completely healed at day 5 compared with the vehicle-treated side, which showed erythema, edema, and weeping areas.[13] Subjects reported similar findings and less burning sensation on the serum-treated side compared with the vehicle-treated side.[13] The researchers concluded that topical 15% vitamin C, 1.0% vitamin E, and 0.5% ferulic acid serum compared with vehicle (split-face) after fractional ablative laser correlated with wound healing and was well tolerated.[13]

A single-blinded, prospective randomized split-face study including 18 men and women between 26 and 53 years old evaluated the effect of a topical antioxidant serum containing vitamin C, vitamin E, and ferulic acid after Q-switched 1064-nm Nd:YAG laser for treatment of environment-induced skin pigmentation.[14] The side of the face receiving the combination of laser and topical treatment showed a significantly greater reduction in the MASI scores vs laser alone.[14] No differences were noted for the post-treatment erythema scores.[14] The researchers suggested that the topical application of a combination of vitamins C, E, and ferulic acid antioxidant formula is promising for facial antiaging treatment.[14] Adjuvant skincare treatments with antioxidants may improve laser treatment outcomes and are safe and well-tolerated.[14]

Minimal Invasive Energy-Based Facial Treatments

Minimal invasive mechanical with rollers or EBD facial treatments included microdermabrasion and micro-needling.[38-44] Most commonly used for cosmetic rejuvenation and acne scars, treatment benefit has however also been seen in keloids, acne, varicella scars, burn scars, and periorbital melanosis, and in enhanced transdermal delivery of topical products.[40] Microneedling is a minimally invasive procedure that uses fine needles to puncture the epidermis. The micro-wounds created stimulated the release of growth factors and induced collagen production.[38,44] A study showed that 4 microneedling facial treatments, spaced 4 weeks apart, significantly improved lines, wrinkles, skin laxity, and skin texture 90 and 150 days after the first treatment. The treatment was well tolerated, with minimal pain, discomfort, and downtime.[39] A human study of 480 patients treated with MN plus topical vitamins A and C reported 40% thickening of the stratum spinosum lasting up to 1 year later.[40] Microneedling is often combined with topical tretinoin and vitamin C for the treatment of acne scarring and skin rejuvenation.[40-44]

Limitations

Clinical studies on integrated skincare for facial laser and energy-based procedures mostly have a small sample size, but some used biophysical assays to support the findings.

CONCLUSION

The algorithm provides clinicians with integrated skincare recommendations for facial antiaging treatments using EBDs 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 integrated skincare may improve outcomes and patient satisfaction with these aesthetic procedures. Procedures combined with skincare or topical treatments improved skin condition.

Dyschromia is a significant issue for SOC patients, and the literature suggests that topical antioxidants such as free radical quenchers and topical tranexamic acid can protect against photodamage. The use of HQ remains controversial, especially given the alternatives currently available.

DISCLOSURES

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AUTHOR CORRESPONDENCE

Anneke Andriessen PhD

E-mail:..... anneke.a@tiscali.nl