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COMMENTARY

Sustainability in Cosmetic Dermatology: Moving Toward an Ecologically Responsible Future

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ABSTRACT

Sustainability in cosmetic dermatology is becoming a pivotal aspect of modern clinical practice, aligning with global environmental and public health objectives. This commentary explores the ecological impact of dermatological procedures and products, emphasizing the necessity of integrating sustainable practices to mitigate environmental harm. Key focus areas include reducing carbon footprint through energy-efficient clinics, ethical sourcing of ingredients, eco-friendly packaging, and the adoption of circular economy principles to minimize waste. Additionally, technological advancements, such as artificial intelligence (AI) and blockchain, are transforming sustainability in dermatology by optimizing resource allocation, enhancing transparency, and reducing clinical waste. Regulatory policies and industry standards are also evolving to support environmentally responsible practices. Embedding sustainability into dermatology practice contributes not only to environmental goals but also to the long-term resilience and adaptability of clinics in a shifting regulatory and consumer landscape. By fostering innovation, ethical responsibility, and regulatory compliance, sustainability initiatives in cosmetic dermatology contribute to a more resilient, health-oriented future for both patients and the planet.

Keywords: Sustainability; Cosmetic dermatology; Eco-design; Green chemistry; Environmental impact

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Key Summary Points

The cosmetic dermatology field must adopt sustainability principles, including eco-design, green chemistry, and responsible ingredient sourcing.

Lifecycle assessments of energy-based devices, injectables, and consumables are essential to quantify and reduce their environmental impact.

Dermatologists and industry stakeholders share responsibility in implementing eco-responsible practices in clinical protocols, packaging, and waste management.

Developing global guidelines and fostering interdisciplinary collaboration are critical to advancing sustainability without compromising patient safety or treatment efficacy.

Growing consumer demand for sustainable solutions is driving innovation in ethical manufacturing, eco-certification, and transparent practices in cosmetic dermatology.

Concrete examples of sustainable dermatology practices, such as refillable skincare formats, biodegradable packaging, low-energy devices, and AI optimization, enable clinicians to adopt actionable eco-responsible changes.

INTRODUCTION

The cosmetic dermatology sector increasingly acknowledges the importance of sustainability as central to modern clinical practice [1]. With rising awareness of environmental degradation and climate change, the need for ecological responsibility within healthcare industries has become imperative [2]. Sustainable cosmetic dermatology involves careful ingredient selection on the basis of low environmental impact involving their renewability and biodegradability, implementing eco-friendly manufacturing processes all along their life cycle and using compostable or recyclable packaging without compromising clinical outcomes [3]. This approach conserves resources, safeguards patient health by limiting exposure to harmful compounds, and supports biodiversity conservation [4, 5]. Adopting sustainable practices also enhances industry reputation, fosters patient trust, and positions dermatologists as healthcare innovators. The integration of sustainability influences broader industry trends, regulatory frameworks, and consumer preferences, encouraging informed patient and practitioner choices [6–8]. Additionally, they contribute to public health goals by reducing exposure to environmental toxins and lessening healthcare's ecological footprint [9]. This commentary highlights the value and implications of embedding sustainable practices into cosmetic dermatology, advocating for a more resilient and health-oriented future that integrates both patient care and environmental stewardship. Figure 1 highlights the multidimensional framework for implementing sustainability in cosmetic dermatology.

ENVIRONMENTAL IMPACT ASSESSMENT

Traditional cosmetic dermatology may contribute to environmental harm through the use of nonrecyclable or noncompostable packaging, disposable clinical materials, and ecotoxic chemical ingredients [10, 11]. Examples include polyethylene microbeads, which use has already been stopped by some cosmetic companies as they persist in aquatic ecosystems and contribute to microplastic pollution; and triclosan and certain parabens, used as preservatives and suspected of disrupting endocrine function in aquatic organisms and persist in wastewater systems, hence their non-use by certain cosmetic groups [10–12].

To improve the understanding of these risks and develop alternative solutions that mitigate their impacts, dermatology clinics and cosmetic manufacturers are increasingly adopting life cycle assessment (LCA) methodologies. LCA evaluates the full environmental footprint of a product or procedure across 16 standardized impact categories: climate change, ozone

Figure 1: Key domains of sustainability in cosmetic dermatology

depletion, human toxicity, freshwater and marine ecotoxicity, particulate matter formation, ionizing radiation, photochemical ozone formation, acidification, freshwater and marine eutrophication, terrestrial eutrophication, land use, water use, resource use (fossils and minerals), and cumulative energy demand [13, 14]. Integrating these assessments enables stakeholders to make informed decisions about material sourcing, product design, energy use, and waste management, ultimately aligning cosmetic dermatology with broader sustainability and public health goals.

NONDEGRADABLE INGREDIENTS: A CRITICAL ENVIRONMENTAL CONCERN

Despite advancements in dermatological sustainability, the persistence of non-degradable ingredients remains a substantial environmental challenge. Several commonly used compounds in cosmetic dermatology, such as petrolatum-based vehicles, synthetic polymers, and microplastics, contribute to pollution, bioaccumulation, and ecological harm.

Petrolatum derivatives, including mineral oils and paraffin, are widely used as occlusive agents and emollients. However, they are non-renewable, fossil-derived, and not biodegradable, raising concerns over their long-term environmental persistence and extraction-related carbon emissions [10, 11].

Silicones (e.g., dimethicone and cyclopentasiloxane), while effective in improving texture and sensory appeal, also exhibit poor biodegradability and may accumulate in aquatic systems, posing potential risks to marine ecosystems. Similar concerns apply to acrylate copolymers, often used as film-forming or thickening agents. These substances have been identified in water sources, wastewater sludge, and even biota, indicating their environmental spread [11, 12]. Table 1 summarizes commonly used ecologically persistent ingredients in cosmetic dermatology and outlines viable, more sustainable alternatives to guide formulation reformulation and clinical selection [10–12, 15].

The dermatology sector must accelerate the transition toward biodegradable, bio-based alternatives that align with circular economy principles and ecological safety.

CARBON FOOTPRINT REDUCTION

Cosmetic dermatology clinics have significant potential to reduce their carbon footprint by adopting strategic sustainability measures. While many sustainability principles are broadly applicable across dermatology, cosmetic dermatology presents distinct environmental challenges that warrant focused attention. These include the frequent use of single-use consumables, energy-intensive procedures such as lasers and radiofrequency, and the high volume of cosmetic product packaging, which often involves complex materials and limited recyclability. Aesthetic clinics may also have higher patient turnover, leading to increased energy and water usage.

One of the most impactful strategies for reducing the carbon footprint of cosmetic dermatology clinics involves transitioning to renewable energy sources, such as solar-powered clinic operations, which help lower reliance on fossil fuels and associated greenhouse gas emissions. For instance, a dermatology center in California reported a 30% annual reduction in energy costs and carbon output following the installation of rooftop solar panels and energy-efficient heating, ventilation, and air conditioning (HVAC) systems [16]. Additional energy savings can be achieved through the use of light-emitting diode (LED) lighting, energy-efficient medical devices, and routine equipment maintenance.

Digital health tools, such as teledermatology and electronic medical records, also support sustainability by decreasing the need for patient travel and paper-based documentation, contributing to reduced transportation emissions and resource use [17, 18]. Clinics can further align with carbon neutrality goals by promoting eco-conscious commuting among staff and patients, including public transit incentives and carpooling programs. Moreover, sourcing ingredients

Table 1: Comparison of problematic cosmetic Ingredients and their sustainable alternatives

Problematic ingredient	Function	Environmental issue	Sustainable alternative
Paraffin (petrolatum)	Emollient, base	Nonrenewable	Plant oils (jojoba, sunflower, squalane)
Silicones (dimethicone, etc)	Texture enhancer, film former	Poor biodegradability	Natural esters, sugar-based thickeners
Acrylates/polymers	Film-forming agent	Nonrenewable, poor biodegradability	Biodegradable polysaccharides (xanthan gum, cellulose)
Polyethylene beads	Physical exfoliant	Microbeads banned in many countries	Crushed apricot seeds, jojoba esters

from renewable and ethically managed suppliers can reduce reliance on petrochemical-based compounds and help preserve ecosystems through practices that avoid deforestation.

Such environmental strategies also signal a broader commitment to responsible clinical practice, resonating with evolving consumer values. By influencing evolving industry norms, regulatory expectations, and patient preferences, sustainable practices contribute to more informed, value-driven choices. Ultimately, integrating sustainability into cosmetic dermatology supports both ecological stewardship and broader public health objectives, helping foster a more resilient and health-conscious future [19–21].

ETHICAL SOURCING AND FAIR TRADE

Incorporating fair trade practices and ethically sourced ingredients into cosmetic dermatology strengthens its commitment to sustainability, reinforcing responsible and eco-conscious advancements in the field [1, 15]. Ethical sourcing ensures that raw materials are procured through transparent and traceable supply chains that uphold fair wages, humane working conditions, and environmentally responsible harvesting methods [22]. These practices empower local communities by fostering economic stability, promoting social equity, and strengthening community engagement. Additionally, ethical sourcing supports biodiversity conservation by implementing sustainable cultivation practices that minimize ecological disruption and protect natural habitats [23]. To further advance environmental responsibility, implementing a systematic environmental impact assessment of all ingredients across the dermatological portfolio is essential [13]. This comprehensive evaluation equips stakeholders with a transparent, scientific evidence-based understanding of ingredient-level ecological footprints. It also facilitates the substitution of high-impact substances with more sustainable alternatives and ensures that only low-impact ingredients are introduced going forward. These initiatives are backed by peer-reviewed research and internal sustainability benchmarks, reinforcing both scientific rigor and long-term ecological commitment.

Fair trade certification further reinforces these principles by ensuring compliance with international standards that safeguard workers' rights and uphold environmental integrity. By embracing fair trade and ethically sourced products, dermatology clinics maintain high ethical and professional standards while reinforcing credibility among ethically aware patients [1, 15] Beyond ethical and environmental benefits, these initiatives contribute to broader public health objectives by reducing the environmental burden of dermatological practices and aligning them with global sustainability goals [21].

Applying fair trade and ethical sourcing strengthens the sustainability of cosmetic dermatology, paving the way for a more responsible future [24].

INNOVATION AND TECHNOLOGY INTEGRATION

The integration of emerging technologies is revolutionizing sustainability in cosmetic dermatology, substantially reducing environmental impact while maintaining clinical efficacy [25]. Biotechnology has enabled the development of new manufacturing processes of novel ingredients, which offer a more sustainable alternative to traditional extraction methods. These innovations ensure high-quality, standardized active compounds and help minimize ecological disruption, biodiversity loss, and excessive resource consumption [26]. As dermatology shifts toward renewable and ethically sourced ingredients, maintaining the sensory quality of products, such as texture, scent, and absorption, remains essential for patient adherence and satisfaction. Substituting traditional components must not compromise clinical outcomes or user experience. Past efforts, such as the integration of renewable solvents, such as propanediol, illustrate the feasibility of achieving both sustainability and high sensorial performance through meticulous formulation and control of residual effects [27]. A notable example includes the development of an eco-friendly system for retinol stabilization, which successfully enhances performance while demonstrating improved environmental compatibility [28].

Future innovations include the use of biosurfactants, such as rhamnolipids and sophorolipids, derived from microbial fermentation, some of which offer excellent biodegradability and are more respectful of aquatic ecosysems compared with traditional sulfate-based surfactants. Biopolymer-based film formers, including xanthan gum and other polysaccharides derivatives, are increasingly replacing synthetic acrylates as renewable and biodegradable alternatives. In addition, biotechnologically derived peptides and plant stem cell extracts, cultivated in controlled environments, provide innovative solutions that reinforce the resilience of the supply of certain specialty botanicals which tradition production are resource-intensive. These advancements may contribute to lowering the environmental footprint (such as carbon and water footprints) across the entire product life cycle, while preserving clinical efficacy and user satisfaction.

In parallel with advances in green formulation science, digital technologies, such as artificial intelligence (AI), are emerging as powerful tools to further enhance sustainability, from ingredient selection to operational efficiency in dermatology clinics. Artificial intelligence with a necessary control of reliable data, is a pivotal driver of sustainability in both clinical dermatology and product formulation. AI-driven algorithms optimize ingredient selection, allowing for the creation of formulations that maximize efficacy while reducing reliance on resource-intensive components [29–31]. Additionally, AI enhances operational sustainability in dermatology clinics through predictive analytics, enabling precise diagnostics and personalized treatment plans that minimize product overuse and unnecessary interventions. Machine learning models facilitate more efficient resource allocation, improving inventory management and reducing clinical waste [32]. Furthermore, AI-powered supply chain optimization prevents overproduction, mitigates the carbon footprint associated with transportation and storage, and enhances sustainability across the entire dermatological care continuum [33, 34]. Moreover, AI-assisted patient education tools are instrumental in promoting sustainable skincare habits. These tools personalize recommendations based on skin needs, reducing the overuse of products while encouraging environmentally responsible consumer behaviors [30, 31, 35].

Blockchain technology, originally developed to support cryptocurrencies, is a decentralized and tamper-proof digital ledger that securely records transactions and data across a network. In the context of cosmetic dermatology, blockchain enables transparent tracking of product ingredients, sourcing, manufacturing, and distribution, allowing stakeholders to verify environmental claims and ethical standards. By creating an immutable audit trail, blockchain enhances trust, traceability, and accountability throughout the supply chain, particularly in an industry where greenwashing is a growing concern. By securely documenting the sourcing, manufacturing, and distribution of dermatological products, blockchain enhances consumer trust and ensures adherence to ethical and environmental standards [36–38]. This technology plays a crucial role in verifying sustainability claims, reducing the prevalence of misleading greenwashing, and fostering greater industry accountability. By integrating AI, biotechnology, and blockchain with a necessary control of energy consumed, the field of cosmetic dermatology can achieve a more sustainable future, balancing scientific innovation with ecological responsibility [32, 39, 40]. However, the increasing use of computational resources associated with AI presents direct environmental challenges, particularly in terms of energy consumption, water use, and the mining of rare earth elements. The industry faces the critical challenge of achieving an optimal balance between these environmental impacts and the scientific and clinical benefits brought by technological innovation.

CIRCULAR ECONOMY APPROACHES

Adopting circular economy principles systematically reduces waste through recycling, refilling, and reusing materials. Clinics and cosmetic brands increasingly offer refillable packaging solutions, incentivize product returns for recycling, and implement rigorous waste management protocols [41–43]. These practices effectively minimize landfill waste, conserve natural resources, and promote sustainable consumption patterns, significantly contributing to long-term ecological responsibility and resilience. Additionally, incorporating compostable or recyclable packaging solutions enhances sustainability efforts [12]. The use of post-consumer recycled materials and innovative zero-waste product designs further reinforces circular economy principles. Cosmetic dermatology clinics can also adopt closed-loop systems, where used products and packaging are repurposed into new materials, minimizing overall waste production [44, 45].

However, the current level of circularity in cosmetic dermatology remains limited [46]. In a clinical audit of 28 emollient samples commonly used in dermatology clinics, Allwright and Ali et al. found that none displayed recycling symbols; only 18% were confirmed recyclable after contacting manufacturers, and 64% had no clear information, highlighting a significant transparency gap [47, 48].

Material types further influence circular potential. While glass containers are recyclable, their heavy weight and energy-intensive production increase their carbon footprint. Conversely, sachets and multilayer plastic tubes, frequently used in dermatology clinics, are often unrecyclable owing to complex composite structures. Klein et al. emphasized that many dermatology clinics lack dedicated systems to sort and process recyclable packaging, making implementation of sustainable practices more difficult [49].

The Organization for Economic Co-operation and Development (OECD) Global Plastics Outlook (2022) further estimates that of the 353 million tons of plastic waste produced globally in 2019, only 9% was recycled, while 50% ended up in landfills and 22% was mismanaged, including open burning and leakage into the environment. Cosmetics packaging accounts for a significant proportion of nonrecyclable multilayer plastics, especially in sachets and tubes, which are nearly impossible to separate for recycling with current infrastructure [50].

The Minderoo-Monaco Commission on Plastics and Human Health (2023) underscores the urgent need for systemic change, noting that plastics, including cosmetic microplastics and packaging materials, are now found in human blood, lungs, placenta, and breast milk, with over 140,000 plastic-related chemicals identified, many of which are toxic, carcinogenic, or endocrine-disrupting. The commission concludes that the full life cycle of plastic, from production to disposal, poses serious risks to planetary and human health [51].

Regionally, Europe leads with 30–35% packaging recyclability, thanks to advanced infrastructure, compared with <15% in North America and <10% in many low- and middle-income countries. In terms of materials, glass bottles, though recyclable, require 5–6× more energy to produce and transport compared with plastic alternatives. Flexible plastic sachets, widely used in dermatology clinics, remain <5% recyclable globally, with high contamination and low recovery value contributing to their exclusion from standard recycling streams [50, 51].

Implementing sustainable procurement policies that prioritize suppliers committed to circular economy principles fosters long-term sustainability across the entire supply chain [44, 45]. Beyond structural waste management practices, effective sustainability requires consistent alignment between public communication and internal implementation strategies. Highlighting successful collaborations between dermatology clinics and industrial packaging teams, particularly on recyclable and refillable formats, would reinforce trust and transparency. Refill initiatives, such as those in the fragrance sector, offer scalable examples of patient engagement and product lifecycle extension. Bridging the gap between sustainability claims and actual practices fosters authenticity and encourages greater consumer adherence.

Furthermore, clinics can integrate digital solutions, such as AI-driven inventory management, to reduce overproduction and waste [52]. Educating patients on the importance of reusability and waste reduction through in-clinic initiatives, loyalty programs for sustainable product returns, and awareness campaigns reinforces consumer engagement with circular economy practices [53]. These comprehensive measures help drive an industry-wide shift toward sustainability, ensuring dermatology practices contribute to a healthier planet.

EXAMPLES OF SUSTAINABLE BEST PRACTICES IN COSMETIC DERMATOLOGY

The practical implementation of sustainability can be illustrated through several current examples in clinics and industry. For instance, dermatology practices have adopted refillable skincare dispensers and eliminated single-use plastic packaging, replacing it with tubes made from more biodegredable sugarcane-based bioplastics. Clinics that switched to solid-format cleansers and serums report a marked reduction in packaging waste and water use, supporting eco-efficiency without compromising clinical efficacy [54, 55]. In terms of procedural sustainability, energy-based device manufacturers have introduced low-energy-consuming lasers and LEDs with extended life cycles, while some practices have integrated AI-powered predictive scheduling to reduce patient wait times and HVAC usage [16, 30]. On the sourcing front, companies have been developing innovative and more sustainable processes for the production and transformation of feedstock. For instance, some fermentation-derived bioactives have replaced traditional extract-heavy formulations, cutting water and energy use during extraction. Vertical farming systems are also being explored for the production of high value botanical actives, which traditional cultivation process may involve deforestation and impacts land use [26, 56].

These examples serve as replicable models that empower clinics and manufacturers to shift toward more sustainable operations, creating a measurable reduction in their ecological footprint.

SUSTAINABLE INNOVATION THROUGH RESEARCH AND DEVELOPMENT

In parallel with technological integration, research and development (R&D) processes are central to driving sustainability in cosmetic dermatology. Sustainable innovation begins well upstream, through early formulation design, choice of synthesis methods, and pre-manufacture environmental evaluations. Several companies and clinical partners have implemented systematic methodologies such as life cycle assessments, eco-toxicological screening, and renewable solvent development to anticipate and minimize ecological impact from the outset [58–61]. For instance, the transition to bio-based solvents, such as propanediol, and to biosurfactants, such as rhamnolipids, has been guided by R&D efforts to ensure not only reduced carbon footprint, but also preserved sensorial qualities, such as texture and fragrance, critical to patient adherence [3, 14, 57, 58]. In some cases, laboratories with over 30 years of dedicated expertise have contributed to published research and sustainability benchmarks that now guide ingredient choice, formulation processes, and internal evaluation criteria. By institutionalizing environmental impact assessment within R&D, dermatology stakeholders ensure long-term ecological responsibility that goes beyond surface-level claims.

POLICY AND REGULATORY PERSPECTIVES

International regulatory frameworks are playing an increasingly influential role in shaping sustainability practices within the dermatological industry [59, 60]. Policies such as the European Union's (EU) Green Deal highlight the growing regulatory emphasis on environmental safety and sustainability [61]. These global efforts are reinforced by the United Nations Sustainable Development Goals (SDGs), which emphasize responsible consumption, climate action, and sustainable innovation. Within this context, green chemistry plays a pivotal role by offering environmentally friendly alternatives to conventional chemical processes, driving sustainable progress across the cosmetic dermatology industry [62]. Expanding these frameworks to incorporate comprehensive sustainability criteria, including mandatory eco-labeling, rigorous ingredient evaluations, standardized waste management protocols, and incentives for renewable energy adoption, can significantly advance global sustainability efforts within cosmetic dermatology [3, 53].

Establishing unified global standards through international collaboration can further enhance regulatory consistency, ensuring that dermatological practices worldwide adhere to sustainable principles while maintaining patient safety [63]. A harmonized approach to sustainability in dermatology facilitates compliance while fostering innovation by promoting environmentally responsible product development and clinical operations [64, 65]. Beyond regulatory compliance, these initiatives contribute to broader public health objectives by minimizing the environmental impact of dermatological practices and aligning them with global ecological and social responsibilities.

At the European Union level, two major initiatives, the recently enforced Corporate Sustainability Reporting Directive (CSRD) and the forthcoming Corporate Sustainability Due Diligence Directive (CS3D), are reshaping corporate responsibilities in the field of sustainability. The CSRD mandates that companies disclose detailed information on their sustainability practices, while the CS3D aims to drive change in corporate behavior through mandatory due diligence obligations. As a result, companies are increasingly required to conduct a double materiality analysis. This process assesses sustainability from two interconnected perspectives: financial materiality, which considers how sustainability issues may pose prospective material risks or opportunities that could affect a company's financial performance and position, and impact materiality, which examines the actual or potential short-, medium-, and long-term effects that a company's operations and value chain may have on people and the environment.

FUTURE PROSPECTS OF SUSTAINABILITY IN DERMATOLOGY CLINICS

The future of sustainability in dermatology clinics will be driven by advancements in materials, energy efficiency, and waste reduction strategies [66]. Recyclable or compostable packaging are being developed from a wide variety of bio-materials, directly from bamboo, from bioplastics produced from sugarcane and in a foreseeable future from mycelium-based and algae-derived materials, offering improved sustainability and lower production-related emissions [67, 68]. Waterless skincare formulations, such as solid cleansers and concentrated serums, could further minimize water consumption in both product manufacturing and daily skincare routines [54, 55, 69, 70].

Energy efficiency will play a crucial role, with clinics integrating renewable energy solutions such as geothermal heating, hydrogen fuel, and AI-powered energy optimization systems. [56, 71, 72] Circular economy models are likely to replace single-use packaging with refillable or upcycled alternatives, and in-clinic refill stations could encourage patient participation in waste reduction efforts [73].

Advancements in ethical sourcing and transparency are also expected to reshape dermatological formulations [15]. The development of controlled environment agriculture to produce botanical actives, such as in door farming or cultivation in pods, will reduce dependence on resource-intensive agricultural practices [74]. Meanwhile, blockchain technology plays a crucial role in enhancing transparency in ingredient sourcing, enabling verifiable sustainability claims and strengthening consumer trust. With future regulatory shifts toward stricter eco-certifications and the gradual phasing out of environmentally harmful ingredients, such as microplastics, clinics will need to proactively adapt to evolving compliance standards [75].

THE ECONOMIC VIABILITY OF SUSTAINABILITY IN DERMATOLOGY CLINICS

Although adopting sustainable practices involves initial investments and operational adjustments, these may be balanced by long-term advantages such as improved resource efficiency, strengthened patient loyalty, and alignment with evolving regulatory standards. Implementing renewable energy sources, such as solar power and optimizing resource consumption, through AI-driven systems can significantly reduce operational expenses [76–79]. Water conservation measures, including advanced recycling systems, lower water costs while supporting sustainable clinical practices. Additionally, biodegradable and refillable packaging solutions minimize waste management expenses and align with evolving environmental regulations. Beyond cost savings, sustainability provides a distinct competitive advantage. As patient demand for eco-conscious skincare continues to grow, clinics that integrate sustainable initiatives into their practice can attract a broader patient base and strengthen their market position [80]. Consumers increasingly seek dermatological treatments that align with their environmental values, making sustainability a key factor in patient retention and clinic reputation.

Financial incentives further support the transition to sustainability. Many regions offer tax benefits, grants, and subsidies for clinics adopting renewable energy, implementing waste reduction strategies, or reducing water consumption [81]. These incentives help offset initial investment costs, making eco-friendly transitions more financially feasible [82]. Sustainability-driven practices not only improve financial resilience but also foster patient loyalty [83, 84]. Clinics adopting eco-responsible strategies also benefit from stronger market positioning and increased patient retention [85]. Ultimately, adopting sustainability is both an ethical imperative and a strategic economic decision, ensuring long-term profitability while contributing to a more responsible future for cosmetic dermatology [43, 86].

CONCLUSIONS

The integration of sustainability within cosmetic dermatology is crucial for the future of healthcare, patient well-being, and environmental conservation. Dermatologists who adopt ecological responsibility not only support global sustainability efforts but also enhance their clinical practice and economic viability. By continuing to adopt innovative technologies, sustainable practices, and ethical sourcing, the cosmetic dermatology sector can effectively address environmental challenges, reinforce the field's leadership in sustainable innovation and strengthen long-term engagement with environmentally conscious patients. Furthermore, ongoing collaboration among dermatologists, industry stakeholders, policymakers, and consumers will accelerate the transition toward a more sustainable and resilient healthcare system. Educating both practitioners and patients about the importance of sustainability can amplify the impact of these initiatives, driving wider adoption and facilitating broader cultural shifts toward ecological responsibility. Ultimately, a strong and unified commitment to sustainability in dermatology ensures long-term environmental health, strengthens community engagement, and promotes a healthier and more sustainable future for generations to come.

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Declarations

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