ORIGINAL RESEARCH

Efficacy of Black Gold, Delicate Pulse Light, Super Photon Skin Rejuvenation for Pigmented Dermatoses

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ABSTRACT

Context • Pigmented dermatoses are skin diseases characterized by pigmentation changes in the skin's surface due to abnormal melanocyte production. Photon-skin-rejuvenation technology can be effective for the management of facial pigmented dermatoses. Black Gold Delicate Pulse Light (DPL) Super Photon Skin Rejuvenation therapy is a new technology based on traditional photo rejuvenation.

Objective • The study intended to evaluate the therapeutic efficacy of DPL therapy in the management of targeted pigmented skin diseases, such as melasma, solar lentigines, and postinflammatory hyperpigmentation.

Design • The research team conducted a prospective cohort study.

Setting • The study took place at Department of Dermatology, Affiliated Hospital of Shaoxing University, Shaoxing, China.

Participants • Participants were 130 patients with facial pigmented dermatoses treated at the hospital between February 2021 and December 2021.

Interventions • The research team assigned participants to one of two groups, with 65 participants in each group: (1) the control group, the intense pulsed light (IPL) group, who received IPL treatment, and (2) the intervention group, the DPL group, who received black gold DPL super photon skin rejuvenation. Both groups received the treatments once a month for 6 months.

Outcome Measures • At baseline and postintervention for both groups, the research team: (1) collected 5 ml of fasting venous blood from participants and measured serum concentrations of melatonin (MEL), vascular endothelial growth factor (VEGF) and endothelin-1 (ET-1) using enzyme-linked immunosorbent assay (ELISA); (2) assessed the degree of reduction of facial pigmentation using the Visia skin test and each participant's clinical results and calculated total efficacy; and (3) monitored and recorded adverse events.

Results • Compared to the IPL group, the DPL group: (1) had greater symptom mitigation of the facial pigmented dermatosis, as evinced by significantly lower serum MEL (P = .001) and ET-1 (P = .020) concentrations and higher VEGF levels (P = .001); (2) for participants with freckles (P = .045), cafe-au-lait spots (P = .021), or post-acne hyperpigmentation (P = .029), had a significantly higher total efficacy; and (3) had a lower incidence of adverse events (P = .041).

Conclusions • Black Gold DPL Super Photon Skin Rejuvenation offers a significantly higher safety profile and treatment efficacy for pigmented-skin diseases compared to IPL treatment. These promising results suggest potential for its use in clinical practice, but clinical adoption requires future trials. (*Altern Ther Health Med.* 2024;30(10):232-237).

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Pigmented dermatoses are skin diseases characterized by pigmentation changes in the skin's surface due to abnormal melanocyte production, with two clinical classifications: pigment-increasing and pigment-reducing dermatoses.[1] The aesthetic implications of pigmented dermatoses far outweigh their health risks; they can cause negative emotions in patients, such as anxiety and distress, compromising their quality of life.[2] With the continuous progress of medical technology, the demand for treatments related to skin aesthetics among patients with pigmented-skin diseases has become more prominent.[3,4]

Pigment-increasing dermatoses are mostly connected with genetic factors and sun exposure. Prolonged sun exposure activates melanocytes and pigments rise to the skin's surface, resulting in brown spots and patches and having common symptoms, such as freckles, melasma, coffee spots, and freckle-like nevi.[5]

Pigment-reducing dermatoses are mostly attributable to autoimmune-system diseases and genetic factors, which destroy melanocytes, resulting in reduced melanin production and the appearance of white patches on the skin's surface, with common symptoms such as vitiligo and senile leukoplakia.[6,7]

Treatment

Given the large differences in patients' conditions due to the disease's complexity, physicians commonly manage pigmented skin diseases on a case-by-case basis. For example, vitiligo patients receive oral immunomodulators, such as total glucosides of peony capsules and compound glycopyrrolate tablets, or topical hormonal ointments, such as pimecrolimus cream and putrescine ointment or calcium-regulated phosphatase inhibitors. Cafe-au-lait, melasma, and freckles require laser treatment to accelerate the metabolic decomposition of pigments.[8,9]

Seung-Youl et al and Zhang et al found that photon-skin-rejuvenation technology was effective for the management of facial pigmented dermatoses, with the benefits of low pain and lack of a need for exfoliation.[10,11]

Photon Skin Rejuvenation

Muddassir et al found that physicians have extensively employed the technology in the management of various skin pigmentation diseases and cosmetic skin disorders due to its noninvasiveness and lack of a need for exfoliation.[12] Lipp et al reported that photorejuvenation, while removing superficial pigments and sealing lesioned blood vessels, also stimulates inflammatory responses to achieve facial-collagen renewal, resulting in effective modification of skin color, elasticity, and texture.[13]

Both intense pulsed light (IPL) and black gold delicate pulse light (DPL) super photon skin rejuvenation (DPL therapy) are intense-pulsed-light technologies that remove superficial pigmentation by breaking down and destroying abnormal pigment cells, pigment clusters and blood vessels in a patient's skin tissue through specific spectral, intense-pulsed-light action.[14] In addition, the photothermal and photochemical effects exhibited during such treatment can effectively boost collagen proliferation and promote the reorganization of elastic fibers, substantially enhancing skin cells' repair and regeneration.[15] The difference between IPL and DPL therapy lies in the differences between the devices used and the spectrum's width.

DPL Therapy

DPL therapy is a new technology based on traditional photo rejuvenation. Conventional photon technology uses a broad spectrum featuring relatively scattered energy and a long-treatment duration. The wavelength of DPL therapy belongs to a narrow spectrum, which is one-seventh of that of conventional photon technology and can highly concentrate the effective energy in the 100-nm wavelength band to precisely act on melanin and abnormal, proliferated blood vessels.[16,17]

The underlying mechanism of DPL therapy is a unique heating mode and a 3HZ ultra-high frequency, giving rise to potent treatment effects.[18] Kim et al found that DPL therapy resulted in significantly higher treatment efficacy compared to traditional photon therapy.[19] DPL therapy incorporates a unique in-motion sliding mode in addition to the traditional spot-treatment mode, with adjustable energy points at each spot. Jiang and Yang and Li found that the new technology provides gentle and rapid heating of skin tissues and mitigates treatment pain and epidermal reactions, thereby reducing the occurrence of adverse reactions such as redness, swelling, and stinging.[20,21]

Current Study

The present study intended to evaluate the therapeutic efficacy of DPL therapy in the management of targeted pigmented-skin diseases, such as melasma, solar lentigines, and postinflammatory hyperpigmentation.

METHODS

Participants

The research team conducted a prospective cohort study, which took place at Department of Dermatology, Affiliated Hospital of Shaoxing University, Shaoxing, China Potential participants were patients with facial pigmented dermatoses treated at the hospital between February 2021 and December 2021. The research team was responsible for their diagnosis, treatment and follow-up.

The study included potential participants if they had: (1) a confirmed diagnosis of facial pigmented dermatosis; (2) no previous history of photoelectric treatment; and (3) no metabolic-system disorders.

The study excluded potential participants if they: (1) were pregnant women, (2) had local inflammatory lesions or skin infections, (3) had recently received photosensitizing drugs or photosensitizers, (4) had recently had sun exposure or (5) had a poor skin condition.

The research team provided all participants with detailed information about the study's nature, the procedures involved, potential risks, and benefits as well as informed them of their right to withdraw from the study at any point without any consequences to their future medical care. The team obtained written informed consent from each participant after ensuring they fully understood the study's purposes and procedures. For participants with cognitive impairments or language barriers, the team obtained consent from their legally authorized representatives. The team anonymized all personal data to maintain the strictest levels of confidentiality.

The research team conducted the study in strict accordance with the ethical standards of the Declaration of Helsinki. Prior to the study's commencement, the Institutional

Review Board (IRB) of the hospital conducted a comprehensive ethical review, which assessed the study's design, potential risks, and measures in place to protect participants' confidentiality and welfare and approved the study's protocols (number [HX-20210103).

Procedures

Interventions. The research team assigned participants to one of two groups, with 65 participants in each group: (1) the control group, the intense pulsed light (IPL) group, who received IPL treatment, and (2) the intervention group, the DPL group, who received black gold DPL super photon skin rejuvenation. Both groups received the treatment once a month for 6 months.

Additional treatments. All participants: (1) received 200 mg of vitamin E orally twice daily in a soft capsule (Xi'an Daheng Pharmaceutical, Guodianzhi H20023282, Beijing, China); (2) received 100 mg of vitamin C three times daily in tablets (Shaanxi Panlong Pharmaceutical, GMP H61020243, Beijing, China); and (3) applied vitamin E ointment (Beijing Shuangji Pharmaceutical, GMP H11022228, Beijing, China) to the affected area twice daily. The duration of these treatments was 6 weeks.

Pretreatment preparation The treatment for female patients avoided the period of menstruation. For both groups, the research team: (1) cleaned patients' faces and photographed them for archival purposes, and (2) with the patient in a prone position and with his or her eyes protected with special eye shields, coated his or her face with photonic cold gel.

Posttreatment care. Posttreatment for both groups, the research team applied ice packs to the patient's face for about 30 min to relieve swelling and pain; (2) told patients to avoid contact with water within 3 d of treatment, to keep the treatment area clean and dry; (3) instructed them to avoid skincare products and cosmetics within 10 d of treatment; (4) told patients to use sun protection creams; and (5) to avoid photosensitive food or medicine.

Outcome measures. At baseline and postintervention for both groups, the research team: (1) collected 5 ml of fasting venous blood from participants and measured serum concentrations of melatonin (MEL), vascular endothelial growth factor (VEGF), and endothelin-1 (ET-1) using enzyme-linked immunosorbent assay (ELISA); (2) assessed the degree of reduction of facial pigmentation using the Visia skin test and each participant's clinical results and calculated total efficacy; and (3) monitored and recorded adverse events.

Interventions

For both groups, the research team carefully selected the parameters for treatment based on a patient's skin type according to the Fitzpatrick scale,[22] the type and color of the pigmented lesion, and the pigment's depth within the skin. The team calibrated the equipment before each treatment session according to the manufacturer's instructions, which involved checking the output energy with a calibrated photometer to ensure consistent delivery of the pulse light. The hospital performed regular maintenance and service checks according to a service schedule to ensure optimal performance and consistent functionality.

IPL group. The IPL group received the IPL therapy, using a Lumenis M22 King's Heart (Lumenis, California) with a wavelength of 500-1200 nm and a spot-treatment mode. The handpiece has an adjustable cut-off filter to limit the lower wavelengths and protect the skin, allowing only wavelengths above 500 nanometers (nm) to reach the target tissue. 2 to 10 Joules per square centimeter, with a pulse duration of 5 milliseconds and a cooling system set to 20 degrees Celsius to minimize discomfort and prevent thermal injury to the skin. The research team generally used a wavelength of 532 nm for epidermal pigmentation spots, such as freckles, coffee spots and moles and a wavelength of 1064 nm for dermal pigmentation spots such as nevus of Ota and lipoma-like nevus and for perioral pigmentation spots.

DPL group. The DPL therapy operates with a narrower spectrum of light than the IPL technology does for a more targeted approach. The DPL group received the DPL therapy using an Israeli Feiton Black Gold DPL Super Photon Skin Rejuvenation instrument (Alma Lasers. Ltd., Caesarea, Israeli), with a wavelength of 500-600 nm/550-650 nm, 7-15 sub-pulse strings, and an in-motion sliding treatment mode. The in-motion sliding mode allows continuous movement of the handpiece over the skin for the delivery of smooth and consistent energy pulses.

The research team set the energy levels for DPL between 10 and 30 Joules per square centimeter. Prior to the treatment's initiation, the team subjected the DPL device to a rigorous calibration process. This involved the use of a manufacturer-provided calibration device to verify the energy output and adjust any deviations.

Prior to treatment, the team performed a high-, medium-, and low-energy-density spot test on patients' ears and foreheads and determined the appropriate pulse form, energy density, and pulse width based on the tests' results and the patient's skin condition.

The team placed the instrument's light guide crystal lightly on patients' skin and released a strong pulsed light, using a 420-950 nm handpiece for acne and a 500-600 nm handpiece for blood vessels, with a pulse duration of 20 milliseconds. Two consecutive pulses of light with varying intensities, which is the delivery purported to enhance the absorption by the target chromophores while preserving the surrounding tissue.

Outcome Measures

MEL, ET-1, and VEGF levels. A decrease in MEL and ET-1 levels and an increase in VEGF levels indicate a good treatment effect.

Clinical efficacy. The research team determined the total efficacy of treatment by evaluating a set of clinical outcomes that indicated a positive therapeutic response. These outcomes included the degree of pigmentary-lesion improvement, the patients' reported satisfaction, a reduction

Table 1. Participants' Demographic and Clinical Characteristics at Baseline (n = 130)

Group	Gender		Age, y	Duration of Disease, y	Disease type				
	Female n (%)	Male n (%)	Mean ± SD	Mean ± SD	Freckles n (%)	Cafe-au-lait Spots n (%)	Post-acne Hyperpigmentation n (%)	Perioral Pigmentation n (%)	Nevus of Ota n (%)
IPL, n = 65	46 (70.77)	19 (29.23)	29.72 ± 6.13	3.80 ± 2.15	25 (38.47)	13 (20.00)	17 (26.15)	6 (9.23)	4 (6.15)
DPL, n = 65	49 (75.38)	16 (24.62)	30.05 ± 5.92	4.14 ± 1.86	23 (35.39)	12 (18.46)	18 (27.69)	7 (10.77)	5 (7.69)
t/χ^2 value	0.352		0.312	0.964	0.219				
P value	.553		.756	.337	.640				

Abbreviations: DPL, delicate pulse light; IPL, intense pulsed light.

Table 2. MEL, ET-1, and VEGF Levels (n = 130)

Group	MEL, pg/ml		ET-1, pg/ml		VEGF, ng/ml	
	Baseline	Postintervention	Baseline	Postintervention	Baseline	Postintervention
IPL, n = 65	263.55 ± 30.46	235.52 ± 15.46	87.85 ± 16.66	79.88 ± 10.27	90.73 ± 6.25	98.90 ± 5.56
DPL, n = 65	262.74 ± 31.02	224.48 ± 15.27	88.21 ± 16.84	75.63 ± 10.30	90.25 ± 6.38	103.76 ± 5.80
t value	0.150	4.096	0.123	2.356	0.433	4.877
P value	.881	.001[b]	.902	.020[a]	.666	0.001[b]

[a]*P* < .05, indicating that the DPL group's ET-1 was significantly lower than that of the IPL group postintervention
[b]*P* < .01, indicating that the indicating that the DPL group's MEL was significantly lower and vascular endothelial growth factor was significantly higher than that of the IPL group postintervention

Abbreviations: DPL, delicate pulse light; ET-1, endothelin-1; IPL, intense pulsed light; MEL, melatonin; VEGF, vascular endothelial growth factor.

Table 3. Clinical Efficacy (n = 130)

Disease type	Group	n (%)	Markedly Effective n (%)	Effective n (%)	Ineffective n (%)	Total Efficacy n (%)	χ^2 value	*P* value
Freckles	IPL	25	9 (36.00)	12 (48.00)	4 (16.00)	21 (84.00)	4.015	.045[a]
	DPL	23	13 (56.52)	10 (43.48)	0 (0.00)	23 (100.00)		
Cafe-au-lait spots	IPL	13	3 (23.08)	5 (38.46)	5 (38.46)	8 (61.54)	5.344	.021[a]
	DPL	12	5 (41.67)	7 (58.33)	0 (0.00)	12 (100.00)		
Post-acne hyperpigmentation	IPL	17	5 (29.41)	8 (47.06)	4 (23.53)	13 (76.47)	4.782	.029[a]
	DPL	18	8 (44.44)	10 (55.56)	0 (0.00)	18 (100.00)		
Perioral pigmentation	IPL	6	0 (0.00)	3 (50.00)	3 (50.00)	3 (50.00)	0.627	.429
	DPL	7	1 (14.29)	4 (57.14)	2 (28.57)	5 (71.43)		
Nevus of Ota	IPL	4	0 (0.00)	2 (50.00)	2 (50.00)	2 (50.00)	0.090	.764
	DPL	5	0 (0.00)	3 (60.00)	2 (40.00)	3 (60.00)		

[a]*P* < .05, indicating that participants with freckles, cafe-au-lait spots, and post-acne hyperpigmentation in the DPL group had a significantly higher total efficacy than participants in the same groups in the IPL group

Abbreviations: DPL, delicate pulse light; IPL, intense pulsed light

in lesion size, and any changes in the skin's texture and complications. The team assigned each outcome a weighted score based on its importance to the overall treatment objective: markedly effective = a pigmentation reduction of >50%; effective = a pigmentation reduction of 25%-50%; and ineffective = a pigmentation reduction of <25%.

Adverse events. The adverse events included redness, a tingling sensation, temporary blistering, and discoloration.

Statistical Analysis

The research team analyzed the data using the SPSS 22.0 statistical software (SPSS Inc., Chicago, IL, USA). The team: (1) expressed continuous data as means ± standard deviations (SDs) and compared the groups using the *t* test for intergroup comparisons and the paired t-test for intragroup comparisons, and (2) expressed the categorical data as numbers (N) and percentages (%s) and compared the groups using the Chi-square (χ^2) test. $P < .05$ indicated significant differences.

RESULTS

Participants

The research team included and analyzed the data of 130 participants, 65 in each group (Table 1). The IPL group included 46 females (70.77%) and 19 males (29.23%), with a mean age of 29.72 ± 6.13 y and a mean disease duration of 3.80 ± 2.15 y. The group had 25 participants with freckles (38.47%), 13 with cafe-au-lait spots (20.00%), 17 with post-acne hyperpigmentation (26.15%), six with perioral pigmentation disorders (9.23%), and four with nevus of Ota (6.15%).

The DPL group included 49 males (75.38%) and 16 females (24.62%), with a mean age of 30.05 ± 5.92 y and a mean disease duration of 4.14 ± 1.86 y. The group had 23 participants with freckles (35.39%), 12 with cafe-au-lait spots (18.46%), 18 with post-acne hyperpigmentation (27.69%), seven with perioral pigmentation disorders (10.77%), and five with nevus of Ota (7.69%). No significant differences existed between the groups at baseline ($P > .05$).

MEL, ET-1, and VEGF Levels

Postintervention, the IPL group's levels of MEL were 235.52 ± 15.46 pg/ml of ET-1 were 79.88 ± 10.27 pg/ml, and of VEGF were 98.90 ± 5.56 pg/ml (Table 2). Postintervention, the DPL group's levels of MEL were 224.48 ± 15.27 pg/ml of ET-1 were 75.63 ± 10.30 pg/ml, and of VEGF were 103.76 ± 5.80 pg/ml.

The DPL group's levels of MEL ($P = .001$) and ET-1 ($P = .020$) were significantly lower and of VEGF ($P = .001$) was significantly higher than those of the IPL group, indicating that the DPL provided more symptom mitigation of facial pigmented dermatosis than the IPL did.

Clinical Efficacy

Postintervention, for the IPL group (Table 3): (1) nine participants with freckles had markedly effective results (36.00%), 12 had effective results (48.00%), and four had ineffective results (16.00%), for a total efficacy of 84% for 21 participants; (2) three participants with cafe-au-lait spots had markedly effective results (23.08%), five had effective results (38.46%), and five had ineffective results (38.46%), for a total efficacy of 61.54% for 8 participants; (3) five participants with post-acne hyperpigmentation had markedly effective results (29.41%), eight had effective results (47.06%), and four had ineffective results (23.53%), for a total efficacy of 76.47% for 13 participants; (4) no participants with perioral pigmentation had markedly effective results (0.00%), three had effective results (50.00%), and three had ineffective results (50.00%), for a total efficacy of 50.00% for three

Table 4. Adverse Events (n = 130)

Group	Redness and Swelling	Tingling Sensation	Temporary Blistering	Discoloration	Total Incidence
IPL, n = 65	3 (4.62)	5 (7.69)	2 (3.08)	0 (0.00)	10 (15.39)
DPL, n = 65	2 (3.08)	1 (1.54)	0 (0.00)	0 (0.00)	3 (4.62)
χ^2 value	-	-	-	-	4.188
P value	-	-	-	-	.041[a]

[a]$P < .05$, indicating that the DPL group's total incidence of adverse events was significantly lower than that of the IPL group

Abbreviations: DPL, delicate pulse light; IPL, intense pulsed light.

participants; and (5) no participants with nevus of Ota had markedly effective results (0.00%), two had effective results (50.00%), and two had ineffective results (50.00%), for a total efficacy of 50.00% for two participants.

Postintervention, for the DPL group: (1) 13 participants with freckles had markedly effective results (56.52%), 10 had effective results (43.48%), and none had ineffective results (0.00%), for a total efficacy of 100.00% for 23 participants; (2) five participants with cafe-au-lait spots had markedly effective results (41.67%), seven had effective results (58.33%), and none had ineffective results (0.00%), for a total efficacy of 100.00% for 12 participants; (3) eight participants with post-acne hyperpigmentation had markedly effective results (44.44%), 10 had effective results (55.56%), and none had ineffective results (0.00%), for a total efficacy of 100.00% for 18 participants: (4) one participant with perioral pigmentation had markedly effective results (14.29%), four had effective results (57.14%), and two had ineffective results (28.57%), for a total efficacy of 71.43% for five participants; and (5) no participants with nevus of Ota had markedly effective results (0.00%), three had effective results (60.00%), and two had ineffective results (40.00%), for a total efficacy of 60.00% for three participants.

Participants with freckles ($P = .045$), cafe-au-lait spots ($P = .021$), and post-acne hyperpigmentation ($P = .029$) in the DPL group had a significantly higher total efficacy than participants in the same groups in the IPL group. This indicates that DPL exhibited potentiated treatment efficacy for freckles, cafe au lait spots, and post-acne hyperpigmentation, but the efficacy of the two groups was similar for participants with pigmentation disorders and nevus of Ota when compared with IPL (both $P > .05$).

Adverse Events

With respect to adverse events (Table 4), the IPL group had three participants who experienced redness and swelling (4.62%), five with tingling sensations (7.69%), two with temporary blistering (3.08%), and none with discoloration (0.00%). The DPL group had two participants who experienced redness and swelling (3.08%), one with tingling sensations (1.54%), none with temporary blistering (0.00%), and none with discoloration (0.00%).

The DPL group's total incidence of adverse events was 4.62% for three participants, which was significantly lower than that of the IPL group at 15.39% for 10 participants ($P = .041$), indicating that DPL had a higher safety profile than IPL.

DISCUSSION

The current study showed that DPL therapy provided more symptom mitigation of facial pigmented dermatosis than IPL therapy did, as evinced by the DPL group's significantly lower serum MEL and ET-1 concentrations and higher VEGF levels ($P < .05$). In addition, DPL exhibited significant potentiated treatment efficacy for freckles, cafe au lait spots, and post-acne hyperpigmentation but similar efficacy for pigmentation disorders and nevus of Ota when compared with IPL. Also, DPL was associated with a higher safety profile compared to the IPL treatment, indicated by the significantly lower incidence of adverse events.

In discussing the outcomes of the current investigation, a candid reflection on its limitations is pivotal for readers' proper comprehension and assessment. Three potential constraints for the current study for the treatment of pigmented skin alterations are sample size, diversity constraints, and geographic limitations. The current research team predicated the inquiry on a comparatively modest cohort, predominantly confined to a specific geographic locale and demographic. This constriction may have impeded the extrapolation of the findings, particularly across a spectrum of skin tones, ethnicities, and age brackets. Future research endeavors necessitate expansion to broader and more heterogeneous populations to reinforce the universality of the results.

Also, the temporal scope of the current study's follow-up was brief, potentially eluding the capture of long-term therapeutic effects and latent adverse reactions. For chronic conditions, long-term follow-up data are indispensable, and the preliminary outcomes for the current study warrant corroboration through extended-term studies.

The current study juxtaposed DPL therapy solely with IPL treatment, offering a direct comparison between the two modalities yet not encompassing other potential therapeutic interventions, such as laser therapy, chemical peels, or pharmacological treatments. Moreover, the absence of a placebo or untreated control group may have constrained the assessment of the genuine therapeutic efficacy. By thoroughly discussing these limitations upon dissemination of the study's outcomes, not only can the scientific community gain a more lucid understanding of the existing evidence but also can receive critical guidance for clinical practitioners contemplating the adoption of novel therapeutic modalities.

The current investigation into the use of DPL therapy presents a promising adjunct or alternative to conventional IPL treatment for pigmented dermatoses. Clinically, the current study's demonstration of DPL's superior safety profile and enhanced treatment efficacy suggest that it could become a preferred option for patients, especially those with darker skin types who are at a higher risk of postinflammatory hyperpigmentation or burns from traditional IPL.

Moreover, the improved precision and reduced recovery time associated with DPL therapy may translate to greater patient satisfaction and adherence to treatment regimens. This is particularly relevant for pigmented dermatoses that

often necessitate multiple treatment sessions; thus, a regimen that is both effective and well-tolerated is paramount.

The potential reduction in side effects and the improved outcomes highlighted by the current study may also impact the cost-effectiveness of pigmented-dermatosis treatments. By potentially minimizing the need for repeated sessions and the management of adverse effects, DPL therapy could contribute to more efficient resource use in dermatological practice.

It's imperative to consider that the introduction of new technology in clinical settings requires a thorough understanding of its operation, limitations, and training of personnel. As such, the implementation of DPL therapy would necessitate appropriate training programs to ensure that clinicians can achieve optimal results safely. Future studies that provide further evidence on long-term outcomes and compare black gold DPL directly with existing standards of care will bolster the case for its integration into clinical protocols. Given the observed benefits, a compelling argument exists for the adoption of this technology in the management of pigmented dermatoses, subject to validation from larger-scale, multicenter trials with diverse populations and longer follow-up periods.

CONCLUSIONS

Black Gold DPL Super Photon Skin Rejuvenation provided a significantly higher safety profile and treatment efficacy for pigmented-skin diseases compared to IPL treatment. These promising results suggest potential for its use in clinical practice, but clinical adoption requires future trials.

AUTHOR CONTRIBUTIONS

Mi Zhou and Na Xu contributed equally to this work.

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