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Treatment of benign hyperpigmentations and pigmented scars by 755 alexandrite laser comparing the Single Pass versus MultiPass (MoveoPL) emission in skin types I-IV

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Abstract

Lasers are effective treatments for benign hyperpigmentations but may be difficult especially in darker skin type. In this randomized split-face controlled study on benign hyperpigmentations and pigmented scars, we compare the standard Single Pass (SP) emission with the MultiPass emission (MoveoPL) 755 alexandrite laser. Patients, skin types I-IV, with solar lentigines and ephelides of the face, chest, and hands and patients with pigmented scars of the legs, underwent laser treatment, by treating one side of the body or half scar using the SP and the other side using MoveoPL. Improvements according to a grading score system, side effects, and patient satisfaction were recorded. About 63 patients were enrolled. An overall improvement of benign hyperpigmentations and pigmented scars was recorded, with a grading score (±SD) of 2.8 ± 0.8 for SP and 3.6 ± 0.5 for MoveoPL (range, 0-4). SP emission showed best results in skin types I-II whereas MotusPL obtained successfully results in all the phototypes analyzed (types I-IV). Patients preferred MoveoPL as it was associated with fewer side effects. Both standard SP and MoveoPL emission are effective and safe. MoveoPL showed a higher efficacy and safety profile for the treatment of hyperpigmentations.

KEYWORDS
755 nm alexandrite, benign hyperpigmentation, Motus AX, MoveoPL, pigmented scars, solar lentigines

1 | INTRODUCTION

Hyperpigmentation is the result of excess melanin production, distribution, or transport.[1] Depending on the location of the melanin in the skin, pigmented lesions can be classified as either epidermal, dermal, or mixed.[2] Common etiologies include melasma, solar lentigines, ephelides, café au lait macules, and postinflammatory hyperpigmentation, such as pigmented scars. These disorders are generally benign conditions but can be distressing to patients.[3]

Due to the wide absorption spectrum of melanin (500-1100 nm), several laser systems have been proposed to remove pigmented lesions with satisfactory results[4] but may lead to dyschromia or significant downtime[5] if the treatment is not correctly managed. Treatment could be difficult especially in darker skin, given the higher melanin content in the epidermis[6-8] which can also amplify the discoloration effect between treated and untreated areas.

Recently, a novel 755 nm alexandrite laser called Motus AX (DEKA, Calenzano, Italy) has been developed. This device includes a standard Single Pass (SP) and a MultiPass emission method. The standard SP is characterized by a single emission delivered on each treatment area with high fluence. The MultiPass method, called MoveoPL, is a new technology which has been previously created for a painless and uniform photoepilation.[9] This innovative handpiece, directly applied in contact with the skin, is able to convey all the laser beam onto the skin avoiding energy losses and optimizing the energy transmission, significantly increasing energy efficiency and particularly

suitable to recognize the pigmented macules. The MoveoPL, with integrated cooling, is characterized by multiple emissions in the area of treatment with lower fluences. It makes possible to use fluid continuous movements over the treatment area by performing multiple steps so as to give this area an adequate, homogeneous, and progressive therapeutic dose without overheating the skin.

We report a randomized split-face controlled study on the treatment of benign hyperpigmented lesions and pigmented scars in skin types I-IV. Our objective was to assess the efficacy and the safety of this laser especially in the darker phototypes, comparing the standard SP emission with the MoveoPL 755 alexandrite (Motus AX) laser.

2 | METHODS

2.1 | Study population

From January 1, 2019 to January 1, 2020, patients of both sexes, skin types I-IV, presenting with benign hyperpigmentations (including solar lentigines and ephelides) of the face, chest, or hands and patients with pigmented scars of the legs were consecutively enrolled in this study from a single medical center.

Subjects with histories of pharmacologic treatment with depigmenting agents, chemical peeling, or any phototherapy modalities within 1 year before the study were excluded. Pregnancy or breastfeeding patients and individuals with histories of skin photosensitivity, previous skin tanning (<3 months), chronic systemic diseases, hypertrophic scars, and impaired wound healing were also excluded.

2.2 | Study protocol

This is a randomized split-face controlled study on benign hyperpigmentations and pigmented scars treatment, comparing the standard SP emission with the MoveoPL 755 alexandrite laser.

The study was conducted in accordance with the Declaration of Helsinki. All the participants provided informed consent before their inclusion in the study.

The study aimed to compare the standard SP emission with the MoveoPL 755 alexandrite laser by treating hyperpigmentations of one side of the face, chest, or hands using the standard SP alexandrite laser and the other side with MoveoPL. Concerning pigmented scars, half of the lesion was treated with the standard SP alexandrite laser and the other half with MoveoPL.

The treatment protocol consisted of two sessions of treatment spaced 50 days apart from each other. Parameters were chosen based on skin type and anatomic location. Concerning SP emission, parameters included a 5-10 mm spot size, fluences of 18 to 25 J/cm^2, external skin cooling coupled with the handpiece (Zimmer Cryo 6) and frequency ranging from 1 to 1.5 Hz. Concerning MoveoPL, parameters included: fluences ranging from 18 to 25 J/cm^2, dose ranging in 10 × 10 cm area from 2.5 to 3.5 KJ and frequency ranging from 3 to 5 Hz, according to the end-point which was considered as a mild "darkening" of the lesion itself coupled with a heat sensation that should disappear within a few minutes.

The clinical and photographic response to treatments was assessed at 1 and 3 months. Objective evaluation involved clinical photography, and three-dimensional (3D) optical skin surface measurement. Digital photographs and 3D imaging were conducted as objective assessments with LifeViz digital imaging system (QuantifiCare S.A., Valbonne, France).[10,11]

Any hyperpigmentation improvement was recorded according to a grading system, scored from 0 to 4 (0 = no improvement; 1 = 1%-25%; 2 = 26%-50%; 3 = 51%-75%; 4 = 76%-100%).[12] Adverse effects associated with laser treatments, such as erythema, edema, pain, blistering, hypo/hyperpigmentation, blistering, crusting, scarring, ecchymosis, purpura, folliculitis or other skin infections, dry skin, allergic/chemical skin reaction, paradoxical hypertrichosis, accelerated skin aging, tissue injury, and bleeding were also recorded.

Erythema was classified according to an erythema scale from 0 (no erythema) to 5 (severe erythema).[13] Pain was recorded by the patients on a numeric pain rating scale with a range from 0 (no pain) to 5 (unbearable pain).[14] Patients comfort and satisfaction were also evaluated using a 5-point Likert scale questionnaire (0, worse; 1, little satisfaction or not satisfied; 2, fairly satisfied; 3, satisfied; and 4, very satisfied).[15]

2.3 | Statistical analysis

A paired Student's *t*-test was used to compare the two laser treatments. A Mann-Whitney test was also performed for confirmation. Statistical significance was considered to be $P < .05$. Data are represented as means ± SD.

3 | RESULTS

3.1 | Patients' characteristics

Data are summarized in Table 1.

In total, 63 patients (47 female and 16 male) were enrolled. Mean age (±SD) at baseline was 57 ± 12 years (range, 37-80 years). About 42 out of 63 patients (66.7%) presented benign hyperpigmentations (solar lentigines and ephelides) and 21 participants (33.3%) presented pigmented scars.

The most common Fitzpatrick's skin type was type III (n = 19, 30.1%) followed by type I (n = 16, 25.4%) and type IV (n = 16, 25.4%), and type II (n = 12, 19.1%).

The most common treated areas were legs (n = 21, 33.3%), followed by chest (n = 15, 23.8%) and hands (n = 15, 23.8%), and face (n = 12, 19.1%).

3.2 | Grading score system

Responses are reported in Table 2.

TABLE 1 Patients characteristics

Sex, no. (%)	
Total patients	63
Female	54 (85.7%)
Male	9 (14.3%)
Age, year	
Mean	57 ± 12
Median	58
Range	37–80
Fitzpatrick's type, no. (%)	
I	16 (25.4%)
II	12 (19.1%)
III	19 (30.1%)
IV	16 (25.4%)
Body areas, no. (%)	
Benign hyperpigmentation	
Face	12 (19.1%)
Chest	15 (23.8%)
Hands	15 (23.8%)
Pigmented scars	
Legs	21 (33.3%)

TABLE 2 Improvement—3 months after the last laser treatment

	Single Pass	MoveoPL
Grading score (0-4)		
Total patients	2.8 ± 0.8	3.6 ± 0.5
Fitzpatrick's type (GR ± SD)		
I-II	3.4 ± 0.6	3.6 ± 0.5
III-IV	2.3 ± 0.6	3.5 ± 0.5
Anatomical sites (GR ± SD)		
Benign hyperpigmentation		
Face	3.2 ± 0.7	3.4 ± 0.5
Chest	2.5 ± 1.0	3.5 ± 0.5
Hands	3.0 ± 0.7	3.5 ± 0.5
Pigmented scars		
Legs	2.6 ± 0.7	3.7 ± 0.5

An overall improvement of both benign hyperpigmentations and pigmented scars was recorded, with a grading score (GR ± SD) estimated as 2.8 ± 0.8 for SP and 3.6 ± 0.5 for MoveoPL. A statistical significant difference between the two methods was found ($P < .01$) (Figures 1-3).

According to skin type, a grading score of 3.4 ± 0.6 was achieved for types I-II with SP emission whereas a grading score of 3.6 ± 0.5 was reached with MoveoPL. No statistical significant difference between the two methods was reported ($P < .5$).

When SP emission was used, a grading score of 2.3 ± 0.6 was achieved on skin types III-IV whereas a grading score of 3.5 ± 0.5 was reached with MoveoPL. A statistical significant difference between the two methods was found ($P < .01$).

According to anatomic sites, the grading score after SP Motus AX treatment was 3.2 ± 0.7 for face, 2.5 ± 1.0 for chest and 3.0 ± 0.7 for hands. After MoveoPL treatment, a grading score of 3.4 ± 0.5 was achieved on the face, 3.5 ± 0.5 on the chest, 3.5 ± 0.5 and on the hands. A statistical significant difference between the two treatments on the chest and hands was found ($P < .01$).

Concerning pigmented scars of the legs, the grading score after SP treatment was 2.6 ± 0.7 and 3.7 ± 0.5 after MoveoPL treatment. A statistical significant difference between the two methods was demonstrated ($P < .01$).

3.3 | Side effects

Adverse reactions are reported in Tables 3-5.

3.3.1 | Erythema

Transient perilesional erythema and mild perilesional edema appeared in all the patients immediately after both the procedures, with resolution in 1 or 2 days followed by a progressive darkening of the treated lesions and flacky crust which solved in 10-20 days. This was considered the end-point of the treatment, as explained to the patient, do not confuse with a real side effects. No persistent erythema was demonstrated in any patient.

On a scale of 0-5, erythema was found to be 1.9 ± 0.8 after SP and 1.4 ± 0.9 after MoveoPL treatment. A statistical significant difference between the two devices was found ($P < .01$).

According to skin type, erythema was found to be 1.8 ± 0.9 for types I-II after SP emission and 1.4 ± 0.9 after MoveoPL. No statistical significant difference between the two devices was shown ($P < .01$). When SP emission was used on skin types III-IV erythema was found to be 1.9 ± 0.7 and 1.3 ± 0.9 when MoveoPL was applied. A statistical significant difference between the two methods was found ($P < .01$).

According to anatomic sites, after SP treatment, erythema was 1.7 ± 0.7 on the face, 1.6 ± 0.7 on the chest, and 2.1 ± 0.9 on the hands. After MoveoPL treatment, erythema was 1.2 ± 0.8 on the face, 1.1 ± 0.9 on the chest, 1.6 ± 1.1 and on the hands. A statistical significant difference between the two devices was shown when face was treated ($P < .05$) and when chest and hands were treated ($P < .01$).

Concerning pigmented scars of the legs, erythema after SP Motus AX treatment was 2.0 ± 0.8 and 1.5 ± 0.9 after MoveoPL treatment. A statistical significant difference between the two methods was found ($P < .01$).

3.3.2 | Pain

Pain was reported in almost all the patients after both the treatments. On a scale of 0-5, pain was found to be 3.1 ± 0.8 after SP emission

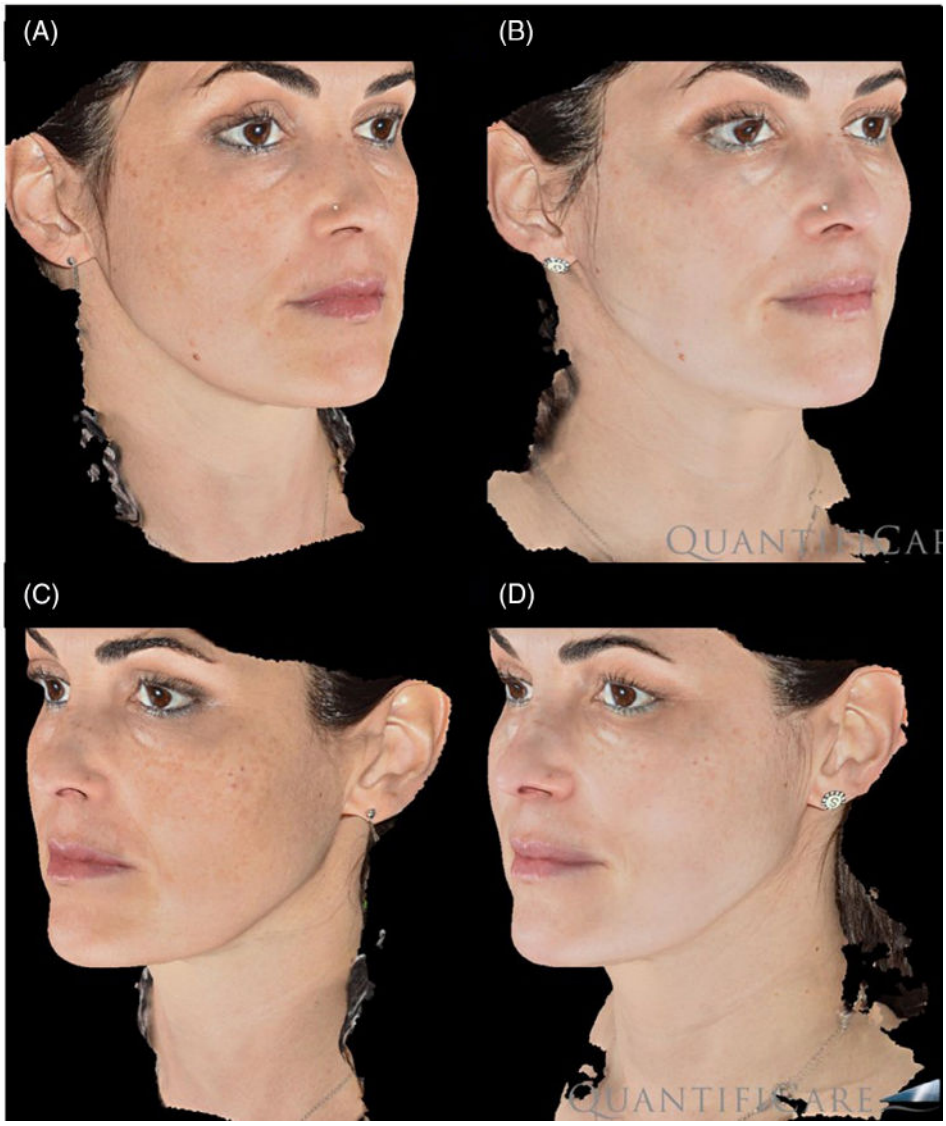

FIGURE 1 A 45-year-old female patient, phototype III, with facial benign hyperpigmentations (A-C). Skin improvement after standard SP (B) and after Moveo 755 alexandrite (D) treatment. The 3D images were captured with LifeViz digital imaging system (QuantifiCare S.A., Valbonne, France)

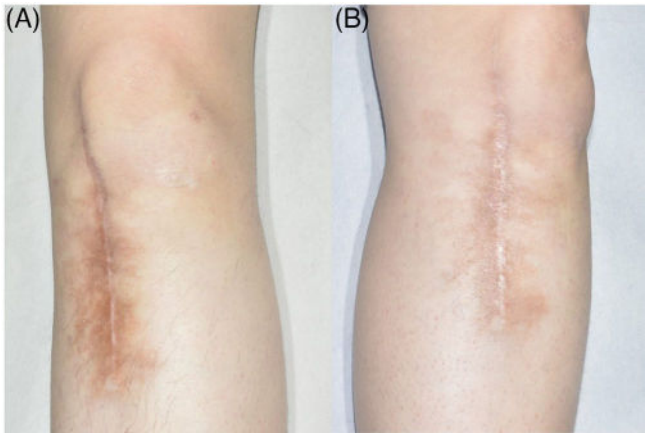

FIGURE 2 A 40-year-old female patient, phototype II, with pigmented scar on the legs (front projection) (A). The upper part of the scar was treated with standard SP while the lower part of the scar was treated with Moveo 755 alexandrite. Skin improvement after standard SP and after Moveo 755 alexandrite treatment was shown (lateral projection) (B)

and 1.8 ± 0.9 after MoveoPL treatment. A statistical significant difference between the two devices was demonstrated ($P < .01$).

According to skin type, pain was 3.2 ± 0.7 for types I-II after SP emission and 1.7 ± 0.7 after MoveoPL. No statistical significant difference between the two methods was shown ($P < .01$). When SP emission was used on skin types III-IV pain was 3.0 ± 0.9 and 1.9 ± 1.1 when MoveoPL was applied. A statistical significant difference between the two methods was found ($P < .01$).

According to anatomic sites, pain was 3.2 ± 0.8 when SP was applied on the face, 2.8 ± 0.9 on the chest and 3.0 ± 0.8 on the hands. After MoveoPL treatment, pain was 2.0 ± 0.0 on the face, 1.5 ± 1.0 on chest, 1.5 ± 1.1 and on hands. A statistical significant difference between the two devices was demonstrated in all the treated areas ($P < .01$).

Concerning pigmented scars of the legs, pain after SP treatment was 3.3 ± 0.7 and 2.1 ± 1.0 after MoveoPL treatment. A statistical significant difference between the two devices was found ($P < .01$).

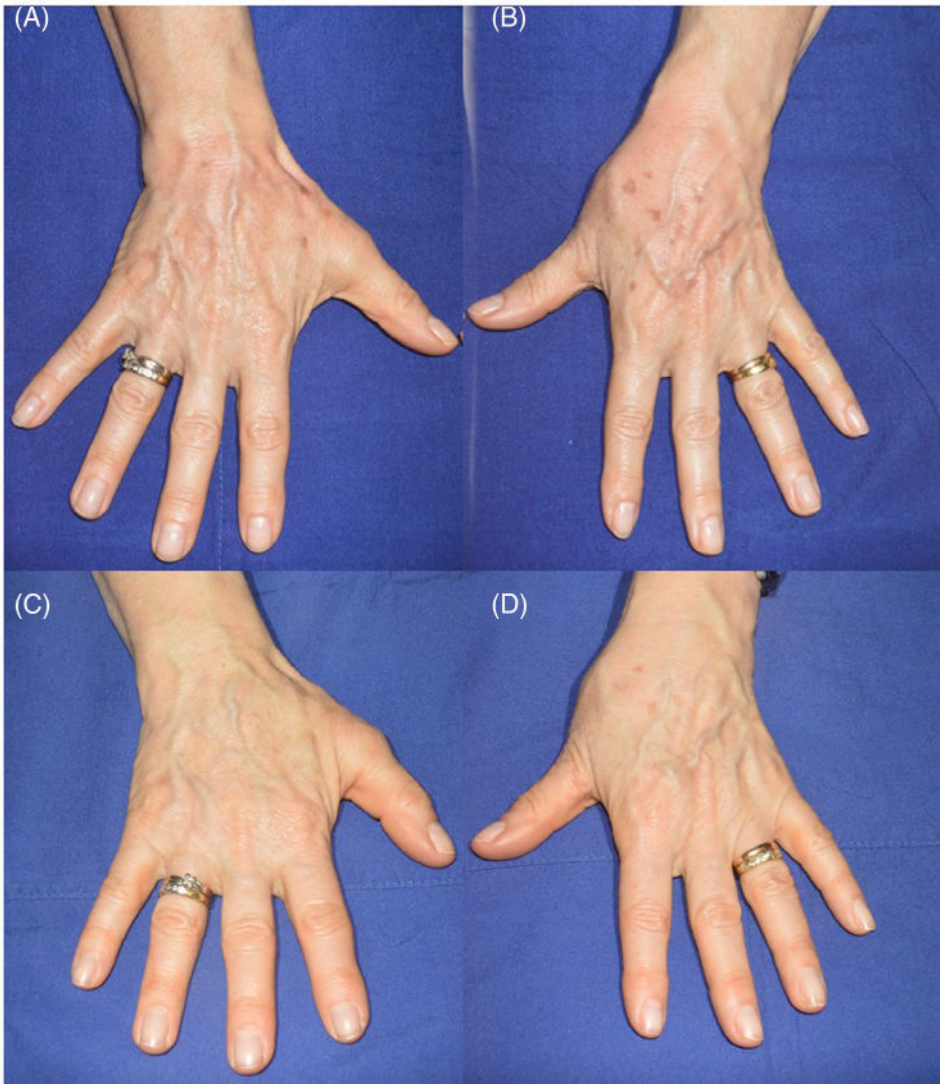

FIGURE 3 A 65-year-old female patient, phototype II, with benign hyperpigmentations on the hands on photodamaged skin (A,B). Skin improvement after Moveo 755 (C) and after standard SP (D) alexandrite treatment was shown (B)

TABLE 3 Erythema—immediately after laser treatment

	Single Pass	MoveoPL
Score (0-5)		
Total patients	1.9 ± 0.8	1.4 ± 0.9
Fitzpatrick's type (GR ± SD)		
I-II	1.8 ± 0.9	1.4 ± 0.9
III-IV	1.9 ± 0.7	1.3 ± 0.9
Anatomical sites (GR ± SD)		
Benign hyperpigmentation		
Face	1.7 ± 0.7	1.2 ± 0.8
Chest	1.6 ± 0.7	1.1 ± 0.9
Hands	2.1 ± 0.9	1.6 ± 1.1
Pigmented scars		
Legs	2.0 ± 0.8	1.5 ± 0.9

TABLE 4 Pain—during laser treatment

	Single Pass	MoveoPL
Score (0-5)		
Total patients	3.1 ± 0.8	1.8 ± 0.9
Fitzpatrick's type (GR ± SD)		
I-II	3.2 ± 0.7	1.7 ± 0.7
III-IV	3.0 ± 0.9	1.9 ± 1.1
Anatomical sites (GR ± SD)		
Benign hyperpigmentation		
Face	3.2 ± 0.8	2.0 ± 0.0
Chest	2.8 ± 0.9	1.5 ± 1.0
Hands	3.0 ± 0.8	1.5 ± 1.1
Pigmented scars		
Legs	3.3 ± 0.7	2.1 ± 1.0

TABLE 5 Other adverse reactions

Blistering	Single Pass	MoveoPL
Total patients	7%	7%
Fitzpatrick's type (%)		
I-II	5%	4%
III-IV	2%	3%
Anatomical sites (%)		
Benign Hyperpigmentation		
Face	2%	2%
Chest	2%	0%
Hands	2%	0%
Pigmented scars		
Legs	1%	5%
Hypopigmentation		
Total patients	5%	2%
Fitzpatrick's type (%)		
I-II	0%	0%
III-IV	5%	2%
Anatomical sites (%)		
Benign hyperpigmentation		
Face	0%	0%
Chest	3%	2%
Hands	2%	0%
Pigmented scars		
Legs	0%	0%
Hyperpigmentation		
Total patients	2%	0%
Fitzpatrick's type (%)		
I-II	2%	0%
III-IV	0%	0%
Anatomical sites (%)		
Benign hyperpigmentation		
Face	0%	0%
Chest	2%	0%
Hands	0%	0%
Pigmented scars		
Legs	0%	0%

3.3.3 | Other side effects

Immediately after the treatment, 7% of the patients reported blistering after both SP and MoveoPL treatment which was solved in a week with antibiotic ointment (2% fusidic acid) applied twice a day. According to our results, blistering was homogeneously distributed both by anatomical area and by phototype.

Hypopigmentation was revealed in 5% of the patients after SP and in 2% of the participants after MoveoPL. Particularly, hypopigmentation due to the discoloration effect between treated and untreated areas occurred only in patients with phototypes III-IV on the chest and hands.

Hyperpigmentation was found in 2% of the patients after SP, on the chest area with light phototype, while no participants developed this side effect after MoveoPL.

Other side effects such as dry skin, allergic/chemical skin reaction, paradoxical hypertrichosis, accelerated skin aging, tissue injury, and bleeding were not shown. No patient reported clinical or dermoscopic changes in nevi nor melanoma.

TABLE 6 Preference (%)—3 months after the last laser treatment

	Single Pass	MoveoPL
Total patients	7%	93%
Fitzpatrick's type (%)		
I-II	7%	37%
III-IV	0%	56%
Anatomical sites (%)		
Benign hyperpigmentation		
Face	2%	21%
Chest	3%	16%
Hands	2%	23%
Pigmented scars		
Legs	0%	33%

3.4 | Subject satisfaction

Data are reported in Table 6.

Almost all the patients declared to be satisfied with both the treatments, with a median satisfaction index of 3.5 (range 0-4). Participants were more satisfied with MoveoPL; indeed, 93% of the patients reported a preference for MoveoPL, whereas only 7% preferred the standard SP treatment. MoveoPL was declared to be more comfortable with lower side effects.

4 | DISCUSSION

Laser treatment of benign pigmented lesions is based on the theory of selective photothermolysis.[16] Optimal wavelengths for targeting melanin lies between 630 and 1100 nm, where there is good skin penetration, preferential for melanin, with minimal absorption by hemoglobin or water.[17,18] Several types of lasers have been used to treat benign hyperpigmentations, including long-pulsed 755-nm alexandrite,[19-21] Q-switched (QS) Ruby (694 nm), QS Alexandrite (755 nm), QS Nd:YAG (1064 nm),[22,23] and picosecond lasers,[6,24] with variable results.

In a recent position paper of the European Society of Laser in Dermatology,[17] authors underlined the potential efficacy of lasers in treating several hyperpigmented lesions, but also underlined that these devices can worsen some conditions and have potential side

effects, thus they have to be considered with great caution, taking into account the skin phototype, origin, and depth of the target pigments.

In our study, we evaluated a novel long-pulsed 755-nm alexandrite, the Motus AX (DEKA, Calenzano, Italy), which include a specific handpiece, called MotusPL, with a contact cooled sapphire cylinder tip that conveys the laser beam into the patient's skin. As previously shown, selective cooling of the epidermis minimizes epidermal injury and the use of this sapphire guide drastically reduces the system energy leaks to the skin.[9] Accordingly, we showed that the Motus AX with both methods (SP and MoveoPL) is an effective and safe device to treat both benign hyperpigmentations, such as solar lentigines and ephelides, and pigmented scars. Comparing the SP emission with MotusPL, we found a higher overall improvement of both the type of hyperpigmentations. When patients were stratified by phototype and anatomical location, a greater effectiveness with MotusPL was obtained. Particularly, while the SP emission showed best results in skin types I-II, the MotusPL obtained successfully results in all the phototypes analyzed (types I-IV), with overlapping and homogeneous improvement especially in large treatment areas. According to location, an overall improvement was achieved in every treated area especially after MotusPL treatment.

One of the concerns regarding the use of long-pulsed lasers for the treatment of hyperpigmentations is the potential for thermal diffusion from the epidermis to the dermis, and the subsequent risk of side effects, especially in patients with darker skin types.[25] Indeed, the higher melanin content can absorb laser energy and induce thermal injury to neighboring structures, thus resulting in increased risks of unwanted side effects,[26] such as erythema, blistering, hypopigmentation, postinflammatory hyperpigmentation, and scarring.[25] The melanin also acts as a competitive chromophore to absorb laser energy intended for treatment targets therefore reducing treatment efficacy.[6] Long excessive pulses (over 10 ms) can in fact overcome the confinement of the energy supplied and not respect the photothermal transfer. For this reason the MoveoPL handpiece has an emission with less duration than the thermal relaxation time of epidermal melanin. Furthermore, Ho et al[20] reported a comparison study of QS and long-pulsed alexandrite laser for the treatment of freckles and lentigines in Asians. They found a statistically significant improvement in pigmentation in both groups, with no statistical difference in efficacy. Postinflammatory pigmentations were more frequently found after nanosecond laser (22%), compared with long-pulsed laser (6%). The author's concluded that long-pulsed alexandrite laser is quick and effective, and carries a lower risk of adverse effects when compared with the nanosecond alexandrite laser (pure photoacoustic) for the removal of freckles and lentigines in darker skin types. It therefore emerges that an adequate treatment with aesthetic orientation must have a pulse duration which is placed in an intermediate way between a purely photoacoustic effect and a photothermal one.

In our study, almost all the patients, regardless of the skin type, developed transient erythema (with resolution in 1 or 2 days), and pain. Comparing the SP emission to the MoveoPL, the amount of erythema and pain was significantly lower during and after the treatment with MoveoPL. This data was indeed confirmed as a whole and stratifying the patients by anatomical location and phototype.

In a few cases, blistering was reported with both the methods used, regardless of location or phototype. Hyperpigmentation was found in a few phototypes I-II patients after SP treatment. On the contrary, hypopigmentation was reported by a minority of phototypes III-IV patients after SP emission when chest and hands were treated, resulting in excessive lightening of the skin, with an inhomogeneous aspect.

Almost all the patients declared to be satisfied after the treatment with a clear preference for MotusPL, which was associated with fewer side effects in comparison with SP. An explanation could be the particular emission mode of the MoveoPL. The Motion technique with the cooled handpiece uses a minimal energy emission to reduce the pain sensation. The continuous movement of the handpiece allows a progressive increase of the target temperature, monitoring the cutaneous reactions and being able to interrupt or modify the treatment at any time, thus minimizing the side effects typical of the traditional method.[9] Moreover, a circular or linear movement within a treatment area with successive passages allows a greater homogeneity of coverage especially in large treatment areas such as the chest. Any incorrectly untreated areas will in fact be highlighted especially in patients with a dark skin type. The single impulse SP emission allows to treat the lesion at higher power, guaranteeing a greater interaction with melanin with a more evident result in light phototypes. Although supported by a preliminary spot test, in SP treatment there is a greater variability of the parameter to be applied which could in some cases be overdosed if not correctly used and therefore requires a greater sensitivity of the operator during the treatment of a large area that could require a continuous adjustment of the fluence.

5 | CONCLUSION

Both standard SP and MoveoPL emission with 755 alexandrite (Motus AX) laser are effective and safe technologies that are able to treat benign hyperpigmentations and pigmented scars in skin types I-IV. In our study, the Moveo technology has shown to be safer, showing less side effects.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available on request from the authors. The data that support the findings of this study are available from the corresponding author upon reasonable request.

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REFERENCES

1. Yamaguchi Y, Hearing VJ. Melanocytes and their diseases. *Cold Spring Harb Perspect Med*. 2014;4(5):a017046.

2. Del Bino S, Duval C, Bernerd F. Clinical and biological characterization of skin pigmentation diversity and its consequences on UV impact. *Int J Mol Sci*. 2018;19(9):2668.
3. Plensdorf S, Livieratos M, Dada N. Pigmentation disorders: diagnosis and management. *Am Fam Physician*. 2017;96(12):797-804.
4. Bukvić Mokos Z, Lipozenčić J, Ceović R, Stulhofer Buzina D, Kostović K. Laser therapy of pigmented lesions: pro and contra. *Acta Dermatovenerol Croat*. 2010;18(3):185-189.
5. Vazirnia A, Ortiz AE. Treatment of benign pigmented lesions using a novel Dermal Cooling System. *Lasers Surg Med*. 2019;51(1):59-61.
6. Kung KY, Shek SY, Yeung CK, Chan HH. Evaluation of the safety and efficacy of the dual wavelength picosecond laser for the treatment of benign pigmented lesions in Asians. *Lasers Surg Med*. 2019 Jan;51(1):14-22.
7. Tizmann T, Balda BR. Laser skin resurfacing after dermabrasion of acne scars. *J Appl Cosmetol*. 2000;18:73-75.
8. Puglisi A, Morganti P. To protect and regenerate the skin after laser treatments. *J Appl Cosmetol*. 2001;19:59-66.
9. Nistico SP, Del Duca E, Farnetani F, et al. Removal of unwanted hair: efficacy, tolerability, and safety of long-pulsed 755-nm alexandrite laser equipped with a sapphire handpiece. *Lasers Med Sci*. 2018;33(7):1479-1483.
10. Hoeffelin H, Jacquemin D, Defaweux V, Nizet JL. A methodological evaluation of volumetric measurement techniques including three-dimensional imaging in breastsurgery. *Biomed Res Int*. 2014;2014:573249.
11. Chaby G, Lok C, Thirion JP, Lucien A, Senet P. Three-dimensional digital imaging is as accurate and reliable to measure leg ulcer area as transparent tracing with digital planimetry. *J Vasc Surg Venous Lymphat Disord*. 2017;5(6):837-843.
12. Ibrahim SM, Elsaie ML, Kamel MI, Mohammed EE. Successful treatment of traumatic scars with combined nonablative fractional laser and pinpoint technique of standard CO2 laser. *Dermatol Ther*. 2016;29(1):52-57.
13. Tan J, Liu H, Leyden JJ, Leoni MJ. Reliability of clinician erythema assessment grading scale. *J Am Acad Dermatol*. 2014;71(4):760-763.
14. Breivik H, Borchgrevink PC, Allen SM, et al. Assessment of pain. *Br J Anaesth*. 2008;101(1):17-24.
15. Bonan P, Verdelli A. Combined microwaves and fractional microablative CO2 laser treatment for postpartum abdominal laxity. *J Cosmet Dermatol*. 2021;20(1):124-131.
16. Anderson RR, Parrish JA. Selective photothermolysis: precise microsurgery by selective absorption of pulsed radiation. *Science*. 1983;220(4596):524-527.
17. Passeron T, Genedy R, Salah L, et al. Laser treatment of hyperpigmented lesions: position statement of the European Society of Laser in dermatology. *J Eur Acad Dermatol Venereol*. 2019;33(6):987-1005.
18. McGoldrick RB, Theodorakopoulou E, Azzopardi EA, Murisom M. Lasers and ancillary treatments for scar management Part 2: Keloid, hypertrophic, pigmented and acne scars. *Scars Burn Heal*. 2017;3:2059513116689805.
19. Trafeli JP, Kwan JM, Meehan DY, Gilbert S, Malomo K, Ross EV. Use of a long-pulse alexandrite laser in the treatment of superficial pigmented lesions. *Dermatol Surg*. 2007;33(12):1477-1482.
20. Ho SG, Yeung CK, Chan NP, Shek SY, Chan HH. A comparison of Q-switched and long-pulsed alexandrite laser for the treatment of freckles and lentigines in oriental patients. *Lasers Surg Med*. 2011;43(2):108-113.
21. Kim YK, Kim DY, Lee SJ, Chung WS, Cho SB. Therapeutic efficacy of long-pulsed 755-nm alexandrite laser for seborrheic keratoses. *J Eur Acad Dermatol Venereol*. 2014;28(8):1007-1011.
22. Arora P, Sarkar R, Garg VK, Arya L. Lasers for treatment of melasma and post-inflammatory hyperpigmentation. *J Cutan Aesthet Surg*. 2012;5(2):93-103.
23. Trivedi MK, Yang FC, Cho BK. A review of laser and light therapy in melasma. *Int J Womens Dermatol*. 2017;3(1):11-20.
24. Kasai K. Picosecond laser treatment for tattoos and benign cutaneous pigmented lesions (secondary publication). *Laser Ther*. 2017;26(4):274-281.
25. Kono T, Shek SY, Chan HH, Groff WF, Imagawa K, Akamatsu T. Theoretical review of the treatment of pigmented lesions in Asian skin. *Laser Ther*. 2016;25(3):179-184.
26. Haimovic A, Brauer JA, Cindy Bae YS, Geronemus RG. Safety of a picosecond laser with diffractive lens array (DLA) in the treatment of Fitzpatrick skin types IV to VI: a retrospective review. *J Am Acad Dermatol*. 2016;74(5):931-936.

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