Original Articles

Comparative study: Hands rejuvenation treatment using intense pulsed light isolatedly or associated with 1,340nm non-ablative fractional laser

Estudo comparativo: tratamento do rejuvenescimento de mãos utilizando a luz intensa pulsada isolada ou associada ao laser fracionado não ablativo 1340nm

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ABSTRACT

Introduction: The dorsum of the hands is a visible part of the body and needs special attention regarding rejuvenation treatments. The combination of different techniques in this area is important to increase the effectiveness of the treatments.

Objective: This study was aimed to evaluate the clinical efficacy of a fractional non-ablative laser (1,340nm Nd:YAP) combined with intense pulsed light (IPL) for rejuvenating the hands.

Methods: A prospective comparative study evaluated 11 patients complaining of aging on hands, for 90 days. Two sessions were carried out with a two-week interval using IPL and 1,340nm Nd:YAP laser. The left hand was treated with 1,340nm Nd:YAP laser associated with IPL and the right hand with isolated IPL. The improvement was rated using scores from 1 to 4, evaluating the parameters: wrinkles, pigmentation, brightness, keratosis and overall rejuvenation observing the elasticity and filling of visible structures such as bones, tendons and vessels.

Results: By analyzing the frequencies of the categories of the variables, it was possible to observe that there was a higher frequency of improvement in the left hand. For the comparative analysis of the studied variables, the mean value of each variable computed for each hand, evidenciated that the variable overall rejuvenation and the left hand showed more marked improvements for the studied characteristics. Ten among 11 patients had a higher satisfaction degree with the combined treatment, with absence of significant adverse effects.

Conclusion: The association of 1,340nm laser to the IPL was shown to be safe and more effective than isolated intense pulsed light in the rejuvenation of the hands.

Keywords: lasers; rejuvenation; hand

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INTRODUCTION

Skin aging is a multifactorial and complex phenomenon involving intrinsic factors that combine with extrinsic alterations, the latter being mainly caused by exposure to the sunlight.[1-5] As with the face, the hands are areas of the body surface that experience intense exposure to sunlight, incurring important and visible changes, however it is often overlooked in the planning of rejuvenation treatments.[6] The search for therapies for the hands has increased significantly, probably due to the fact that they can reveal the true age of an individual.[7]

The cutaneous aging of the hands involves two main processes: the alteration in the skin's texture and loss of volume. The change in the texture involves the pigmentation of the skin, atrophy and the emergence of wrinkles.[8] The loss of volume takes place due to decreases in the subcutaneous tissue and muscles.[9] Excessive exposure to sunlight entails photoaging, as well as the appearance of lesions such as solar purpura, actinic and seborrheic keratoses, leukoderma and melanosis.[7] The combination of extrinsic alterations with intrinsic aging affects the deeper layers of the skin, causing a decrease in elasticity, the atrophy of the dermis and subcutaneous tissue (causing wrinkle signs),[6] loss of brightness and emergence of vascular structures (predominantly veins), 9 and the widening of joint structures and even bony prominences.[7]

A therapy for rejuvenating the hands requires multifactorial clinical evaluation of the dorsum of the hands 8 as well as a method to assess the degree of aging of this region, both aimed at planning and executing treatments safely (Chart 1). This is a very vascularized region with exposure of nerve and tendon structures, and thin epidermis and dermis, with decreased number of adnexal units as compared to the face.[7, 10]

In this manner, the dermatologist should be aware of proper evaluation methods and precise indications for the treatments 10 to be carried out, avoiding complications 11 such as pigmentary disorders and unsightly scars.

Several treatments are used for rejuvenating the hands 7, 10-12 (Chart 2) and the search for effective treatments led to the use of combined technologies.

The objective of the present study is to evaluate, using a prospective comparative study, the rejuvenation of hands treated with the association of intense pulsed light (IPL) and 1,340nm non-ablative fractional laser (NAFL).

Chart 1: Rejuvenation treatment of the hands

- cutaneous fillers and injectable moisturizers
- transfer of autologous fat
- sclerotherapy
- intravenous vascular ablation
- chemical peels
- laser, pulsed light and LED
- photodynamic therapy
- non-ablative fractional lasers

METHODS

A prospective, single-center, comparative study was carried out with 14 patients from the Dermatologic Ambulatory of the Faculdade de Medicina de Jundiaí (*Jundiaí Medical School*), located in the city of Jundiaí, in the Southeast Brazilian State of São Paulo. The patients selected were aged between 44 and 75 years, had Fitzpatrick skin phototypes ranging from I to III, and Glogau degree of aging adapted to the hands 13 from moderate to severe. All patients included had not undergone treatment in the hands region in the previous six months. All participants were properly informed about the risks, benefits and potential complications of the study's therapy, having signed the Free and Informed Term of Consent.

Exclusion criteria included: infection in the treated site, history of keloidal scarring, known connective tissue or autoimmune disease, Raynaud's phenomenon or alterations in the circulatory system, pregnancy or lactation, the presence of a lesion with suspected malignancy on dermoscopy, previous history of allergy to anesthetics and unrealistic expectations regarding the treatment.

All patients were prepared for treatment with the application of topical anesthetic with 4% lidocaine 30 minutes before the session. The platform used in the treatment was the Etherea® (Industra Technologies, São Paulo, Brazil) and the IPL-Sq® and Proodeep handpieces – non-ablative fractional 1,340nm Nd:YAP laser (Neodimiun:Ytrium Aluminum Perovskite). The right hand was treated only with IPL using 540/580nm filter, 10-21J/cm2 fluence, 15-30ms pulse duration. The contralateral hand was treated with IPL (set on the same parameters described above), associated with 1,340nm NAFL set on 60mJ fluence, 10ms pulse duration, 100mtz/m2, using a single pass without overlapping and air-based cooling. The order of application of IPL and NAFL in left hand was random, according to the availability of the handpieces. The reaction of the skin following the two treatments in the immediate port-procedure was similar in all patients, with comparable levels of edema and erythema.

The patients underwent two sessions with an interval of one month. Photographic records were performed in all patients (before the treatment (D0), 30 days after each session (D30 and D60). A subjective medical evaluation was carried out and a self-administered questionnaire implemented, aiming at analyzing the data and final outcomes at 90 days. After the procedure, patients were instructed to avoid exposure to sunlight and apply sunscreen daily (broad protection spectrum against UVA and UVB - SPF 50) on treated area until full recovery. In addition, patients were advised to avoid contact with substances that could irritate or sensitize the treatment region in the first week after the application.

A dermatologist physician not related to the study and subjective evaluation carried out by each patient assessed the treatment's clinical efficacy. A sequential photographic documentation was also performed. Comparative evaluations were performed before the treatment (D0), 30 days after the first session (D1), 30 days after the second session (D2) and 90 days after the start of the study (D3). The parameters used for the clini-

Chart 2: Glogau aging scale adapted to the hands

Degree of aging	Chronological age	Clinical alterations
Medium	28-35 years	discreet wrinkles with absence of changes in pigmentation, loss of elasticity and turgor
Moderate	35-50 years	visible wrinkles, pigmentary lesions and actinic keratoses, loss of elasticity and turgor
Advanced	50-60 years	visible wrinkles completely covering the hand's dorsum, presence of pigmentary alterations, actinic and seborrheic keratoses, vascular purpura, vascular prominence and sinking of the skin on flexion of the hand
Severe	65-80 years	visible and severe wrinkles, pigmentary changes, actinic and seborrheic keratoses, neoplastic or non-neoplastic lesions, permanent sinking of the skin with prominence of vessels, tendons and bones

cal evaluation were: *wrinkles*, *pigmentation*, *brightness*, *keratoses* and *overall rejuvenation* (the latter specifically observing the elasticity and the filling of visible structures such as bones, tendons and vessels). The subjective evaluation was carried out by the own patients and was limited to: the *preference for techniques*, *sensitivity*, *adverse effects* and *expected visible results* for the quality of the skin in the treated area.

The data analysis was performed using the statistical package SPSS version 18.0. Categorical variables were described using absolute frequencies and percentage relative frequencies. The binomial test was used to compare the improvement between the hands. Scores ranging from 1 to 4 were used to rate the improvement (1 = *exceptional*, 2 = *marked*, 3 = *little* and 4 = *unchanged*). Quantitative variables were described using mean values and standard deviation, and were compared using the Student t test for paired samples. A significance level of 5% was adopted.

RESULTS

The patients were evaluated during 90 days, between the first treatment and the last clinical evaluation. Eleven patients aged between 44 and 75 years (ten women and one man) completed the study (Fitzpatrick skin phototype I to IV, moderate to severe degrees of aging in the Glogau scale modified for the hands). The analysis of the frequencies of the categories using the Binomial test ($p = 0.012$), revealed that the improvement in the left hand had been greater than that in the right hand. Table 1 presents the frequencies of the different degrees of improvement for the hands, with statistically significant emphasis for the parameters: *wrinkles*, *pigmentation*, *keratoses* and *overall rejuvenation* in the left hand.

For the comparative analysis between the parameters studied, the mean value for each parameter and hand was computed (Table 2). It was possible to observe that the parameter with the best response was that of *global rejuvenation* and that the left hand has had a more representative improvement for the studied characteristics. Moreover, it was also observed that there was an improvement in the parameter *brightness* in both hands, with no statistically significant difference.

The overall rejuvenation received the *exceptional* and *marked* improvement scores in all treatments. In the dermatologic evaluation, the best clinical results were observed on the left hand, which was treated with the association of IPL with 1,340nm NAFL, in 100% of patients.

In the patients' subjective evaluation, 90.9% (10:11 patients) experienced a higher rate of satisfaction with the combined treatment. They had already shown an evident satisfaction level after the first re-assessment (before the second session), expressing their interest in maintaining the treatment carried out.

The side effects reported were: crusts (81.8% of patients, 9:11) and blisters (36.3%, 4:11), after the second session, possibly caused by a flaw in the application technique.

DISCUSSION

The hands are considered a part of the body that reveals an individual's age because of its being exposed most of the time.[9] They have many particularities, which should be carefully evaluated so that the right treatment is chosen.[6] There are several options for rejuvenating hands, such as peelings,[9,10] radiofrequency[14], cutaneous fillers[15, 16], that can improve the quality of the skin, contribute to the stimulation of collagen and help to prevent melanocytic and premalignant lesions in the back of hands. Nonetheless, these treatments are deemed of limited improvement when used as monotherapies.[17]

Intense Pulsed Light has been successfully used over the last decade in the photorejuvenation of the hands' region. 18 It has filters with varying wavelengths that can be used according to the skins' phototypes, allowing that different targets and depths be reached. 19 The greatest advantage of IPL is the ability to simultaneously correct telangiectasias, erythemas and pigmentary lesions, such as melanoses, ephelides and benign lentigines with minimal patient's downtime and very tolerable discomfort.[7]

Studies show that the main complaints of patients with aging hands regard pigmentary changes,[20, 21] such as lentigines and solar melanoses. IPL is considered a safe procedure, since its effects depend on specialized medical evaluation capable of determining the parameters of potency and pulse duration according to the target-chromophore and the skin's phototype.

Table 1: Descriptive table of improvement in the left and right hands

Variables	Right hand		Left hand	
Wrinkles		N	%	N %
exceptional	-	-	1	9,1
marked	3	27,3	8	72,7
little	7	63,6	2	18,2
unchanged	1	9,1	-	-
Pigmentation				
exceptional	-	-	3	27,3
marked	7	63,6	6	54,5
little	4	36,4	2	18,2
unchanged	-	-	-	-
Brightness				
exceptional	-	-	-	-
marked	6	54,5	7	63,6
little	5	45,5	4	36,4
unchanged	-	-	-	-
Global rejuvenation				
exceptional	-	-	2	18,2
marked	7	63,6	7	63,6
little	4	36,4	2	18,2
unchanged	-	-	-	-
Keratosis				
exceptional	-	-	3	27,3
marked	5	45,5	6	54,5
little	6	54,5	2	18,2
unchanged				

Data presented as frequencies and percentages

Moreover, one of the major advantages of IPL is that it allows simultaneous correction of pigmented and vascular lesions (erythema and telangiectasias), having become a procedure that generates results and benefits in the rejuvenating treatment of the hands. It is also considered a safe procedure for combination with other treatment methods, such as laser.

In the present study, it was possible to observe a significant improvement in hyperpigmented lesions treated with IPL. Furthermore, dermal heating has been demonstrated to lead to histological improvement, with induction of neocollagenesis in the papillary and reticular dermis, promoting improvement in the skin texture and reduction of fine lines.[22] Goldman et al. performed two IPL monthly treatment sessions in 23 patients with dermal elastosis and solar lentigines on the dorsum of the hands. They observed excellent results in 100% of cases treated, with improvement of lesions and overall skin quality, and no significant adverse effects.[4]

Non-ablative fractional laser acts causing damage in the dermis by creating thermal microzones and collagen remodeling with minimal effects in the skin. It allows rapid tissular repair with few adverse effects. Despite the fact that many studies have shown promising results in the treatment of facial rejuvenation using non-ablative fractional laser, there are few published papers on the rejuvenation of the hands using this technique. Also, there is no knowledge of studies evaluating the association of the two techniques for global rejuvenation treatments.

With the aging of the hands, the skin's thickness and individual capacity for regeneration and neocollagenesis decreases.[9] Therefore it is important to perform a treatment that stimulates collagen and improves the skin's texture,[4] clinically improving the appearance of atrophy, which evidences deep structures of the hand's anatomy, such as bones, tendons and vessels. The present study on the use of 1,340nm NAFL can assist in the rejuvenation of the hands due to its deep penetration into the dermis,[7] stimulating the production of collagen and promoting overall rejuvenation.

Other studies described the use of NAFL for rejuvenating the hands. Goldberg used Nd:YAG NAFL for remodeling the collagen in ten patients, having demonstrated that after three sessions (performed with four-week intervals) all patients showed significant improvement in the skin's appearance within six months of follow up, with histologic increase of collagen formation.[23] Later on, Lupo et al.[24] conducted a randomized study of 50 patients who received treatment for wrinkles with two passes of 1,320nm Nd:YAG, with moderate improvement of 40% in wrinkles after 15 months of follow-up.

In another study, 1,320nm Nd:YAG was used for treating the aging of the dorsum of the hands in seven patients with, with a greater number of sessions than that of the present study (six monthly sessions), leading to an improvement ranging from1% to 19%.[25] The objective and subjective clinical results obtained in the present study reinforce the data found in a study by Sadick,

Table 2: Improvement comparison between the right and left hands (1 to 4 scale, 1 = exceptional and 4 = unchanged)

Parameters	Right hand	Left hand	P
Wrinkles	2,82±0,60	2,09±0,54	<0,001
Pigmentation	2,36±0,51	1,91±0,70	0,016
Brightness	2,45±0,52	2,36±0,51	0,341
Global rejuvenation	2,36±0,51	2,00±0,63	0,038
Keratosis	2,55±0,52	1,91±0,70	0,011

Data presented as mean ± standard deviation, compared by the Student t-test for paired samples

Figure 1: D0 (before the treatment)

Figure 3: D3 (90 days after)

Figure 2: D1 (30 days after)

who claims that non-ablative laser is capable of improving the skin's photodamage and that clinical improvement is related to collagen remodeling in the dermis.[26]

The present study demonstrates in an unprecedented way that the combination of techniques led to a faster result, for it was able not only to improve the melanocytic lesions with the application of IPL, but also yield the benefits of collagen increase with the associated use of NAFL, aiming at comprehensively treating aging hands. Other studies have already shown clinical improvement of these pigmentary alterations using LIP [9] as monotherapy. However, it was possible to observe that the association with 1,340nm Nd:YAP resulted in an improved regeneration capacity, with the stimulation of collagen even leading to good responses in lesions lighter in color, which had uniform whitening with fewer sessions, without the compromising of the safety (Figures 1 to 3).

The safety of the procedure was achieved with the use of the advanced technology Square-Wave® Pulse (IPL-Sq®), that promotes energy delivery in a controlled and micro-processed way, uniformly releasing energy throughout the pulse.

It is important to note that the combination of techniques leads to the ideal treatment, fundamentally where melanocytic and vascular lesions are treated with IPL and collagen stimulation and the texture of the hand's skin are approached more effectively with the use of 1,340nm NAFL.

It was also possible to observe that in the short and medium terms (up until 90 days after the first session), patients had

already had good clinical outcomes that progressively improved with the neocollagenesis process.

The parameters used in the present study were safely approached, thus avoiding even minimum adverse effects. Most patients experienced the emergence of crusts, which improved progressively and did not develop into post-inflammatory hyperpigmentation. All adverse events were managed with photoprotection, resulting in the absence of complications reported in other studies, such as hypopigmentation, burns or unsightly scars.

CONCLUSION

Despite the small sample with treated patients, the treatment combining IPL and 1,340nm NAFL was demonstrated to be safe and more effective for rejuvenating the hands when compared to that with isolated IPL. The assessment of the degree of aging is a valuable tool for the safe implementation of the combined action in the rejuvenating treatment of the hands, increasing the possibility of achieving optimal results. Based on the present study's findings, the combination therapy can be considered a choice that leads to success in the rejuvenation treatment of the hands. The combination of IPL and 1,340nm NAFL techniques results in more beautiful hands with rejuvenated appearance. ●

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