

PHOTO REJUVENATION MORE THAN A FACIAL TREATMENT

Christine Dierickx, MD discusses her experience using intense pulsed light to treat dyspigmentation across the face, neck, chest and hands



CHRISTINE DIERICKX, MD, is a Luxembourg-based dermatologist, specializing in laser surgery and cosmetic dermatology. She is a former faculty member at Massachusetts General Hospital and Wellman Labs, Harvard Medical School, Boston, USA and also served as a vice president of the American Society of Laser Surgery and Medicine

email mail@cdierickx.lu

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ABSTRACT

Christine Dierickx has almost 20 years' experience of using intense pulsed light to treat the visible signs of ageing, and is co-author of one of the early studies 'Facial Photo Rejuvenation using Two Different Intense Pulse Light (IPL) Wavelength Bands'. *Laser in Medicine and Surgery* 2004; 34: 120-126. In this opinion article, she draws upon that experience to application in a working dermatology practice, and to remind us that treatments are not limited solely to the face.

IT IS OFTEN STATED IN POPULAR MEDIA THAT OUR SOCIETY IS OBSESSED with anti-ageing, as if this were something new or unwholesome. But the wish to appear young and healthy is quite understandable as those seeking treatment are part of the first generation to have three major advantages: a long life-expectancy, which includes leisure time and retirement benefits; access to information on what methods are available and how effective they are; and medical devices that can achieve a difference. One such treatment is most often called photo rejuvenation and is normally a non-ablative procedure that targets redness and skin dyschromia while significantly improving the texture, brightness, and tone of the skin, and boosting collagen production. A variety of energy-based devices can be used; although those such as high intensity focused ultrasound, or radiofrequency, which heat the skin to cause collagen damage and rebuilding, do not form part of this article.

The scale of the problem

As we age or are aged by exposure to sunlight, several changes occur in our bodies. Collagen production decreases, while collagen breakdown increases, and our antioxidant levels fall. While some of my patients are chronologically old, many make an appointment after they first notice one or more of the three early signs: a dilation of the vessels around the cheeks and nose causing a diffuse redness (a network of small vessels which are not individually distinguishable without use of a magnifying lens or dermatoscope) in those areas, a general dyspigmentation or one or more solar lentigines ('age spots') on the face, or light perioral or periorbital wrinkles. A separate group of patients are those who suffer from enlarged pores, actually an increase in the size of the pilosebaceous unit, or a general loss of skin tone and texture. Technically all are symptoms of cutaneous ageing, a combination of the effects of both chronological and environmental factors, and it is increasingly common to have a comparatively young patient complain of 'premature ageing' as a result of environmental factors, most commonly excessive UV light irradiation.

Older patients or those who have had chronic sun-exposure may additionally demonstrate seborrhic or actinic keratoses. Seborrhic keratoses are most usually

brown in colour and have a wart-like appearance. These can be removed by laser ablation or curettage. Actinic keratoses are quite often resistant scaly lesions. Left untreated, there is the possibility that an actinic keratosis may, over time, develop into skin cancer. Solitary lesions are easily treated with cryotherapy while more disseminated and diffuse lesions are better treated with photodynamic therapy, a combination of sensitizer and light.

While all symptoms appear on the face, it is common for other body sites to be similarly affected. Dyspigmentation is common on the neck, torso (especially on the back where sun protection is difficult to apply) and limbs—and is especially noticeable on the hands. Vessel dilation can also be found on the chest and neck, and, in some cases, the skin at the sides of the neck and upper chest will show redness, areas of hyperpigmentation and hypopigmentation, as well as some atrophy. Collectively known as poikiloderma of Civatte, or erythrosis interfollicularis colli, this is typically caused by chronic sun exposure, with the probable addition of some sensitizer.

Mechanism of action

Treatment of all the above conditions, irrespective of body site, can be performed using a variety of energy-based devices. Most rely on selective photothermolysis, or the selective absorption of light energy by chromophores in the skin which convert that energy into heat, and destroy the chromophore-bearing target, while causing minimal injury to the surrounding tissue. For the conversion to be successful several factors are important.

- The waveband of light, or single wavelength in the case of laser, must penetrate sufficiently deeply into the skin to reach the chosen target and then be easily absorbed by the target chromophore, but less so in the adjacent skin.
- The pulse length chosen must be sufficient to heat up the target but must not allow sufficient time for that heat to radiate out from the target into surrounding tissue, as this would cause bulk heating.
- The energy delivered should be enough to damage the target without causing a general burn.

This is made more complex when you consider that one of the principal target chromophores, melanin, while stationary, is found throughout the epidermis. Treatment must, therefore, target the excess melanin found in keratinocytes, while minimizing absorption in normally pigmented skin, and causing no problem in melanin-producing melanocytes. The other target chromophore is technically a group of targets, the haemoglobins—found in red blood cells. These move through the dilated vessels we wish to remove and for this to happen the pulse must be sufficient not only to heat up



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the erythrocytes but also to transfer enough heat to the inner wall of the vessel to ensure its destruction. But as we are treating excess pigment or excess vascularization if we choose the correct parameters, the treatment can remove the excess without adversely affecting the baseline. To choose the correct parameters it is first necessary to perform a comprehensive analysis of the skin to determine the relative levels of haemoglobin and melanin. Both chromophores absorb light of similar wavebands, but the absorption spectra are sufficiently different to enable treatments to target the real problem.

There is a third chromophore, water, which fortunately absorbs light at different wavelengths than melanin or haemoglobin. Some devices can be used to specifically target water, but for normal photo rejuvenation, water absorption is a barrier to good treatment results.

Treatment causes melanin to photo-oxidise, and it visibly darkens within a minute or so, taking longer in darker-skinned patients. While it is quite safe to repeat a shot if there is no reaction, photo-oxidised pigment is a super-target, which will absorb heat excessively. Blood vessels will occasionally disappear immediately, if they are the perfect size, but will more usually undergo a short-term colour shift towards blue, before returning to their ▶



Figure 1 (A) Before and (B) after two treatments, 555-950nm waveband, Pulse 2.5ms - delay 10ms - Pulse 2.5ms. First treatment 9.3J/cm²; second treatment 10J/cm²

▷ normal colour. The temporary change may last from under one second to several seconds depending on the vessel size, and the energy and pulse length used. However, the blue response indicates the vessel wall has been terminally damaged, which requires heating to 70°C for approximately 1ms. After treatment, the pigment will continue to darken and will rise towards the surface of the skin whence it will slough off as part of normal skin turnover. Vessels will be removed by phagocytosis.

Since the treatment simulates thermal injury to the skin, in the post-treatment period the body demonstrates a typical wound-healing response², initially with enhanced local production of collagen III fibres, laid down in a disorganised fashion over a 21-day period post-treatment, and later remodelled into more structured collagen I fibres over the next three to six months. It is this collagen remodelling process that results in improvements to texture and pore size.

Initial consultation

The choice of treatment, and areas to be treated, largely depends upon the patient's perception of his or her condition; this is by nature highly subjective, and frequently at variance with the physician's observations, so it is important that the physician engages in a meaningful dialogue with the patient, and wherever possible supplies the patient with easily-understandable objective data. A pigment spot rarely appears in isolation on otherwise unblemished skin, and the use of a Woods lamp or UV photography is useful to explain to some patients that their sun-damage is more widespread than first thought. Since the technology shows pigment damage as yet invisible to the human eye under natural light, it also enables the patient to extend the area to be treated from face to neck and chest, or from a few spots on the hand to the arm.

Commercial imaging exists that can show the vascularisation of the area, the pore size, skin texture and severity of wrinkles, some of which conditions have often escaped the patient's notice. While treatment of diffuse redness and pigmentation gives results that almost offer instant gratification, the slower process of neocollagenesis can result in an uninformed patient looking in a mirror daily to see fine lines and wrinkles miraculously disappear. Use of images with various filters as part of the before and

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after treatment picture series is therefore of considerable benefit in showing the patient that remodelling has taken place and is a tool that can be used when talking to future patients.

It is important that this initial discussion with the patient covers not only the treatment itself but also post-treatment care and self-care, both to minimize social downtime and so that the maximum long-term benefit is enjoyed by the patient. It should also introduce the concept of future prophylactic treatments to prevent the signs of environmental ageing from reoccurring.

Choice of treatment

I use a multiplatform device (Nordlys, Candela, USA) to treat the majority of my patients. The device combines a choice of narrowband intense pulsed light applicators (for rejuvenation I use the 530-750nm or 555-950nm wavebands depending on the specific treatment), but I can treat any resistant pigment or areas of very pale pigment with the 400-720nm waveband. Each of these applicators has a 10mmx48mm spot size that allows quick treatment of a large area. For spot treatment of small benign pigmented lesions or small telangiectasias, I have the alternative of using a 90mm² small spot. If there are deeper vessels I can follow up with a long-pulsed Nd:YAG 1064nm wavelength and the device also has a non-ablative fractional 1550nm wavelength for skin resurfacing and boosting of dermal collagen.

For all treatments, I want to choose an energy that is effective, but still comfortable for the patient. My device gives me a suggested setting based on the patient skin type and sun tan combination. But this needs to be changed a little for each patient based on skin reaction (darkening or blueing) and patient comfort. The energy then needs to be lowered (typically by 1-1.5J/cm²) if treating areas of thin skin or directly over bone. Since Nordlys requires a thin layer of optical coupling gel to maximise light penetration into the skin, this can be used to note the treated area, as the treatment head leaves a mark in the gel when it touches the skin. No pressure is needed, as this can cause blanching of the skin and is counterproductive when treating haemoglobin.

To achieve the best results, it is important to treat the chromophores in the correct order. Patients of Fitzpatrick Skin Types 1 and 2 typically have more vascular damage, while Types 3 and 4 are more prone to dyspigmentation. However, it is common for Skin Types 1 to 3 to have a combination of dyspigmentation and vascular damage, with the dyspigmentation acting as an overlying mask which hides the full extent of vascular damage.

Stage 1: To remove the mask of epidermal pigment, I typically use the 555-950nm waveband, with a 2.5ms pulse-10ms delay-25ms pulse train, which additionally removes some diffuse redness. If a patient has almost no dyspigmentation, I will instead use the 530-750nm waveband with the same pulse train. Since 530-750nm has a significantly higher absorption by both melanin and haemoglobin, I restrict its use to Fitzpatrick Skin Types 1-3 with at most a light sun tan.

Stage 2: As the 530-750nm waveband is highly effective at removing diffuse redness, I would use this to remove any redness remaining after stage 1 pigment removal in Skin Types 1 to 3. It is often possible to treat small areas of individually visible vessels at this stage, but in severely sun-damaged patients this can easily be delayed by 1 month.

Stage 3: Treatment of any separately distinguishable vessels; if these are on the cheeks, I will again typically use the 530-750nm waveband. My device gives the choice of four pulse lengths chosen to match the size of the vessel, but increasingly I choose a short 15ms pulse, which simulates that used in pulsed dye laser treatment but uses narrowband light instead of the PDL's 595nm wavelength. Any deeper or awkwardly placed vessels can easily be treated with Nd:YAG.

Stage 4 (as an optional): I would combine the use of the 530-750 nm or 555-950nm waveband and the fractional 1550 laser to treat areas of fine lines and wrinkles.

Moving off-face

Photo rejuvenation can be performed in any area where sun damage is found, and this is useful not only for those with long-term UV exposure from sunbeds or natural sunlight, but also for that group of patients who take sun protection seriously on the facial area, but do not apply the same protection to other exposed areas.

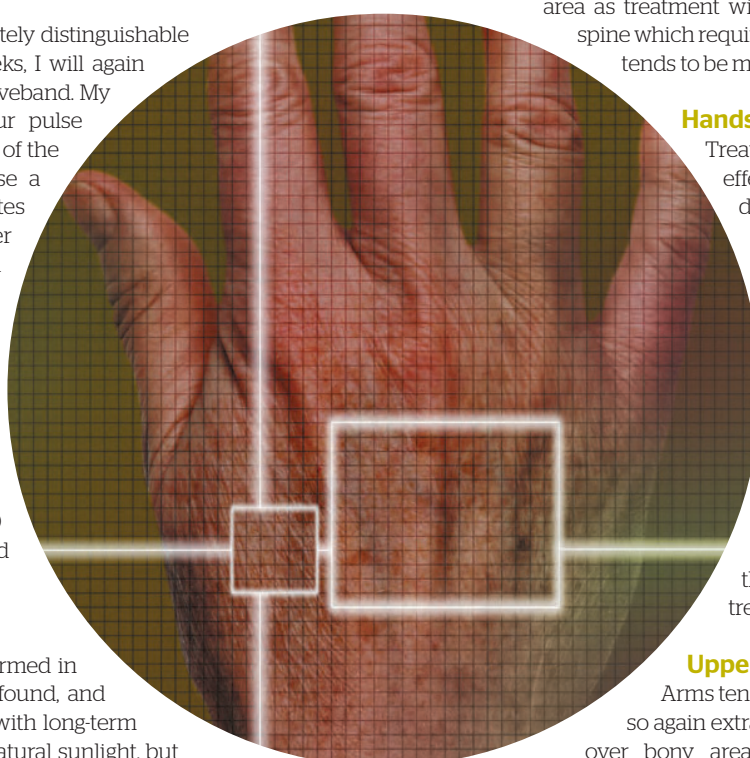
The same general guidelines apply as when treating the face, but it is important to remember that there are anatomical and other differences.

Neck

The area is prone to general dyspigmentation, diffuse redness or a combination of both. Poikiloderma of Civatte is not uncommon. The standard rejuvenation pulse train can be used, with energy 1J lower than on the face, and any remaining small vessels can be removed one month later using a 1.5ms pulse.

Chest and breast

A good technique is needed as the area combines treatment over the clavicle, sternum and upper ribs all of which require lower energy than surrounding fleshier areas. But the tongue depressor used to spread the gel uniformly on the skin can additionally be used to mark out the lines of treatment. Unless treating the whole torso together with the upper limbs, it is advisable to agree with the patient the area to be treated and to progressively reduce the energy when treating the border with the surrounding untreated area.



Key points

- 1 Dyspigmentation is common on the neck, torso (especially on the back where sun protection is difficult to apply) and limbs
- 2 I use a multiplatform device (Nordlys, Candela, USA) to treat the majority of my patients
- 3 Photorejuvenation can be performed in any area where sun damage is found

Dyspigmentation is the most common symptom displayed, but small areas of diffuse redness and the occasional larger vessel can be found. These should be treated using the 3-stage process described above.

Shoulder and back

Again, the medical practitioner needs to take care in this area as treatment will pass over the scapula, ribs and spine which require lower energy. Pigmentation often tends to be more pronounced than on the chest.

Hands

Treatment of the hands is highly effective, and normally only dyspigmentation is found, which means light pressure can be applied over pigment spots. Alternatively, a second shot can be fired specifically over the spot. It is important that the skin be stretched during treatment, either by the patient making a fist or by manipulation of the hand by the physician. To avoid a 'white glove' effect, it is necessary to progressively reduce energy when approaching the border with the area not to be treated.

Upper limbs

Arms tend to heal more slowly than the face, so again extra care must be taken when treating over bony areas. The prime concern is again dyspigmentation.

Lower limbs

Although telangiectasias are common, it is generally a mistake to attempt to treat these with intense pulsed light, as they do not respond well and there is a risk of side-effects. Treatment should, therefore, be confined to areas of pure dyspigmentation or should be delayed until vessels have been treated with sclerotherapy or laser. However, an uncommon vascular condition – progressive disseminated telangiectasia – can be effectively treated.

► **Declaration of Relationships** Dr Dierickx has received honorarium for podium presentation from Candela Corp.

► **Figure 1** © Dr Dierickx

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