NEW TRENDS IN PHOTOEPILATION SOPRANO SHR AND HARMONY SHR.

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INTRODUCTION

Photoepilation has become the most popular and most widely used of all medical/aesthetic procedures. This method is undoubtedly the most frequently used, and of greatest demand in Europe. According to data from last year, in the USA, more than three and a half million procedures were carried out. Becoming, this way, the second medical/aesthetic procedure after Botox.

OVERVIEW AND TYPES

From this year up to 2006 industry had offered nothing completely new or revolutionary. It is in 2006 that new systems arise, based on Drs Anderson and Parrish's concept of Selective Photothermolysis - developed in 1983 - but applying low energies and high repetition rates generating what we call "Progressive Photothermolysis". This technological development is now being used with laser systems and intense pulsed light, systems which are produced only by an Israeli company (Alma Lasers, Caesarea Industrial Park). Likewise, great efforts were made to control the architecture of the pulses of the intense light, by means of LEO (Light Energy Optimization) technology through EDF (Equal Distribution of the Fluence) and AFT (Advanced Fluorescent Therapy).

Therefore, we could identify two key concepts on which new technological developments for photoepilation are based:

-Super Hair Removal(SHR): It is also called superepilation with reference to repeated and fast emission of pulses of low energy, that progressively heat the chromophores without damaging the skin. This technology is used with Diod Laser systems (Soprano, Alma Lasers) and with Intense Light systems (Harmony XL, Alma Lasers).

-Light Energy Optimization(LEO): It is also called optimization of luminic energy, and it is based in turn, on two concepts:

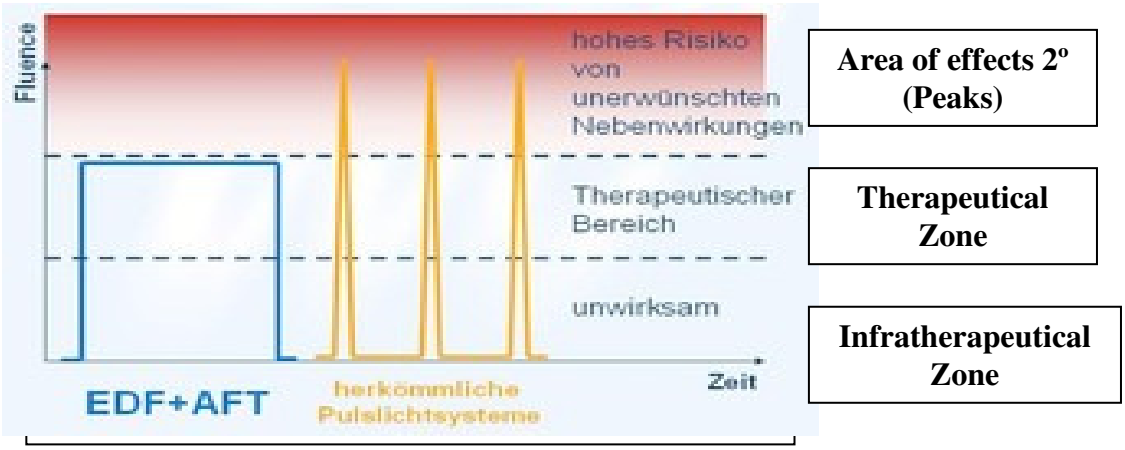
*Equal Distribution of Fluence(EDF): So called, with reference to the fact that these technologies allow to eliminate the energy peaks emitted per pulse, in intense light systems, since those peaks are the cause of unwanted effects such as burns and pain. By using this technology, every pulse that is emitted by the system is made of many micro pulses without emission peaks, so the energy is evenly distributed and best used, which in turn will allow to work with lower fluence, and achieve better results, avoiding the unwanted effects previously mentioned (Fig. 33-1).

*Advanced Fluorescent Therapy (AFT): So called, with reference to the fact that most lamps emitting intense light do so, in a wide range of wavelength, including the ultraviolet *spectrum*, always unnecessary for the majority of the treatments carried out. By means of a fluorescence filter we can convert ultraviolet rays into a *spectrum* which is both visible and useful in our treatments, optimizing, this way, the therapeutical emission of light, reducing at the same time the fluences usually used..

PHYSICS OF THE SHR LASER AND SHR LEO SYSTEMS

The laws of physics that determine the operation of these systems are the same we have been considering with all the systems of laser beams and intense light.

Basically, these systems consist of a power supply unit, which feeds a lamp of xenon light (in the case of intense light) and a laser diode (in the case of the laser SHR).



The physical characteric that both emissions share in SHR systems is that they utilize low fluences and high repetition rates of up to 10Hz in the case of laser, and intense light pulses with a duration of 30 seconds or more. That is the reason why the use of these systems implies that the operator must keep constant movement, so that this energy at high repetition rates does not concentrate on one point producing, that way, the burn we fear.

In both cases, carrying out the treatment with constant movement, whether at low or fast speed, we will be able to control the different biological signs that appear on the skin progressively until the optimal density of energy is reached, - at this moment the selecttive photothermolysis of the targetted chromophore will take place.

The energy density formula:

ED= Energy in Joules/Area of the Spot == Joules/cm2

The effectiveness of the treatment will depend on this formula, regardless of the system used.

INTERACTION LASER-LIGHT-TISSUE

Now that we have presented the manner of application of the Laser SHR and the Intense Light LEO SHR on the tissues, we could state the interaction between Laser-Tissue in the case of these devices, based on the physics of light. We need to know a number of concepts in view of the therapeutical usefulness of these systems.

The characteristic features of the Laser SHR and the Intense Light SHR LEO systems are:

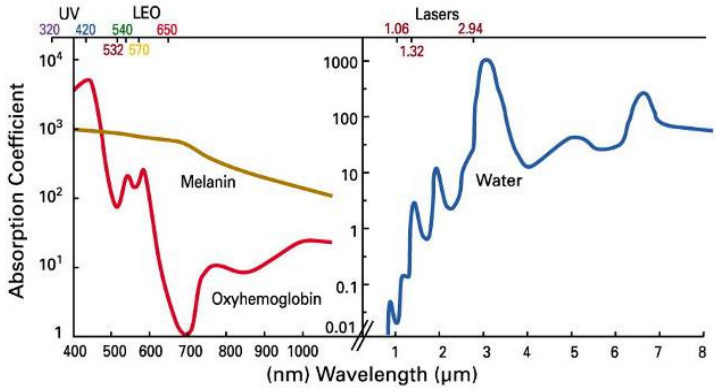
-Wavelength: INTENSE LIGHT LEO-SHR (*spectrum* 420-950nm.) using preferably the infrared band, LASER DIODE SHR(810nm.). The penetration and the absorption of energy of the chromophores will basically depend on these wavelengths (Fig. 33-2).

-Duration of the Pulse: The more the duration of the pulse the more the penetration will be.

-Size of the Spot: It determines the penetration and the energy density applied, depending on the fluence.

-Penetration: It will vary depending on the wavelength (laser) or on the trip filter (intense light), the spot, the fluence and the duration of the pulse utilized.

-Absorption: In these systems, melanin - and all its variants - is the target chromophore.



(Fig.33-2): the maximum peak of absorption of light of the melanin is at approximately 600nm The light *spectrum* that corresponds to the UV changes thanks to a fluorescence filter in visible spectrum therapeutically usefull.

The SHR system, laser as well as intense light, will consist on the application of a low dose of energy under certain parameters of wavelength, duration of the pulse and ultrafast repetition of the pulses, producing progressive heating of the target chromophore (faster) and on

the perifollicular dermis (more slowly), producing very little pain and practically no side effects. The principles of this new technology for photoepilation are:

-The energy must be absorbed by the melanin in the hair follicle.

-The hair bulb and the protuberance must me heated progressively.

-The areas surrounding the bulb must not be affected.

The wavelengths of those systems would be of 810nm for the laser SHR and a spectrum of 750-950 corresponding to the near infrared for the LEO SHR systems. They both coincide with the so called optical window of the tissue, present in dark skins, in which in the case of equal energy, there is more penetration of the light, which brings about a reduction of the risk of side effects in those patients. The *spectrum* between 950 nm and 1200 nm bears no interest from the therapeutical point of view for, in this range it has more absorption the water in the tissue.

These characteristics previously mentioned, will allow us to work with both systems, with low fluences, controlling all the time the clinical signs that appear on the skin as the treatment is carried out. The sequence of these clinical signs would be:

1.Redness of the skin

2.-Slight Erythema

3.-Intense Erythema

4.-Smell of burnt hair, and the patient feels some discomfort.

5.-Perifollicular Edema

We can say that the hair follicle is in a temperature balance with the tissue that surrounds it, which makes it more receptive to changes in temperature, being its normal temperature higher that the temperature of the surrounding tissue.(Fig.33.3). A long exposure to temperatures of approximately 45ºC will provoke the destruction of the hair follicle, being unnecessary to raise the temperature of the follicle to 65ºC which is the temperature employed by conventional systems of photoepilation with high energy per pulse and low repetition rates. (Fig.33-4).

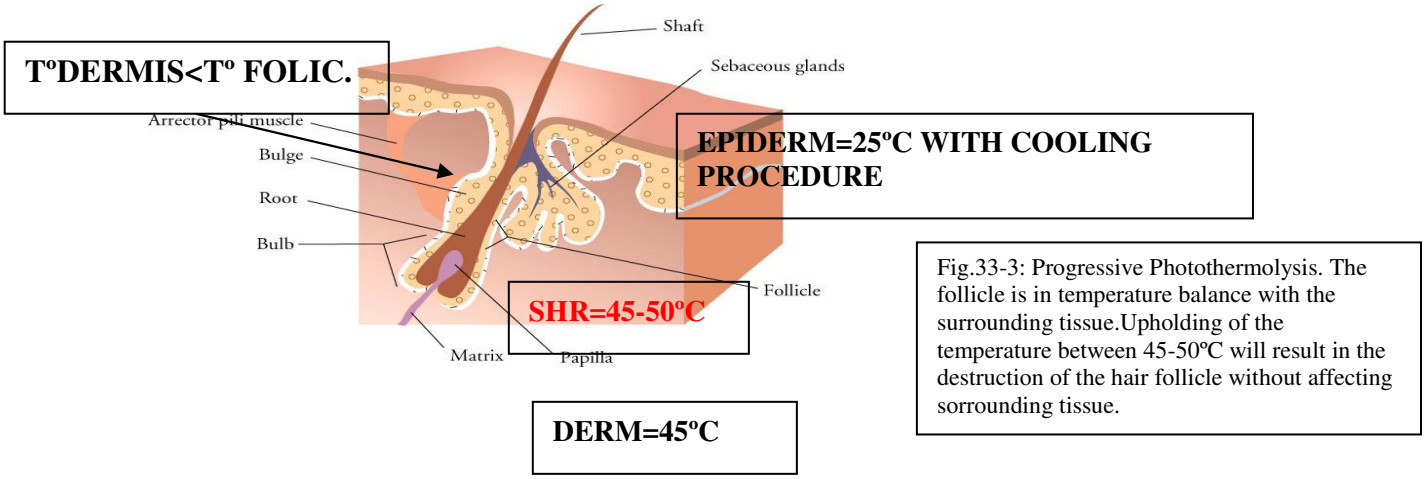


Fig.33-3: Progressive Photothermolysis. The follicle is in temperature balance with the surrounding tissue.Upholding of the temperature between 45-50ºC will result in the destruction of the hair follicle without affecting sorrounding tissue.

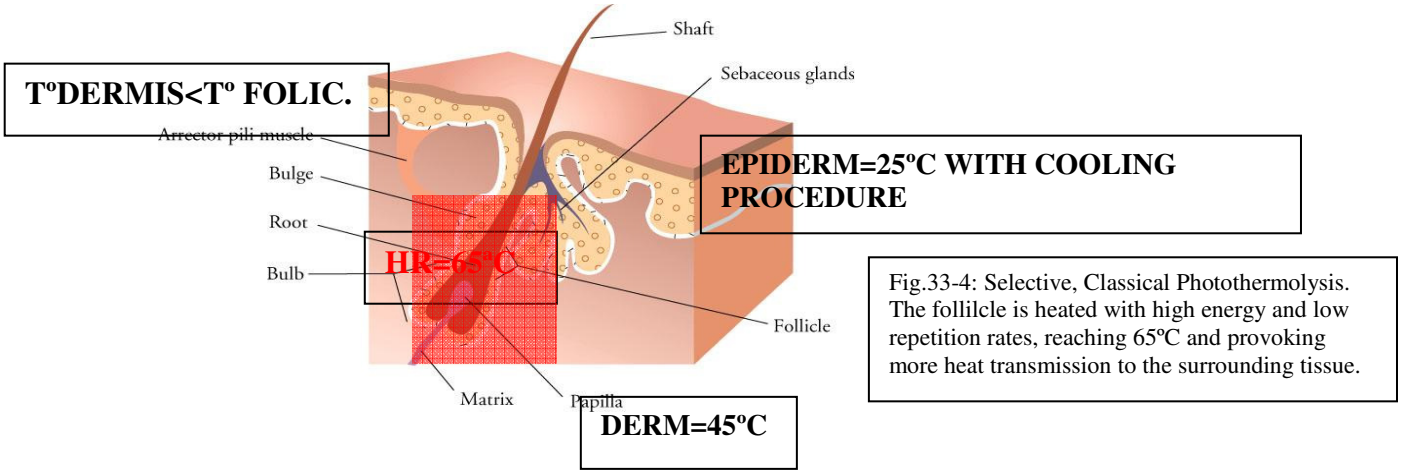


Fig.33-4: Selective, Classical Photothermolysis. The follilcle is heated with high energy and low repetition rates, reaching 65ºC and provoking more heat transmission to the surrounding tissue.

The thermal relaxation time of a tissue was defined by R.Anderson and S.Parrish as the time that the chromophore needs to dissipate 50% of the energy absorbed by the surrounding tissue, and that time is equal to the square of the diameter of the structure of the chromophore.

$$t_r \simeq d^2$$

In the case of Selective Photothermolysis the optimal duration of the pulse should be greater than the thermal relaxation time of the epidermis - making its cooling easier - but shorter the thermal relaxation time of the hair follicle, concentrating the heat on this structure. The thermal relaxation time has been defined as the square of the diameter of the target chromophore, just below 8 ms for the epidermis and 10-50ms for the hair follicles, depending on the diameter of the bulbs.

INDICATIONS OF SHR LASER AND SHR LEO SYSTEMS

The main clinical indications of the SHR Intense Light LEO and Laser systems in photoepilation, are:

-Photoepilation for men and women on first sessions: It is much more effective on thick dark hair, like almost all conventional systems, but much less painful due to the sequential emission of energy and the minimal transmission of heat to the tissue surrounding the follicle. It can be applied on the body or on the face on all skin phototypes.

-Male Photoepilation: It would be the best choice because it is progressive, safe as regards the emission of energy and above all because of almost complete absence of the pain, usually associated with conventional systems in cases of very thick and dense hair. No anesthetic creams or cooling procedures are necessary.

-Photoepilation on phototypes III to V: Because of what has been previouly explained, photoepilation on high phototypes is the safest system. On thick hair, on first sessions the use of the laser has many advantages: large areas can be treated rapidly and easily. On facial areas and finer hair it is better the use of the Intense Light SHR LEO because of the broad range of wavelengths it offers, much more effective on fine hair.
-Photoepilation and Sun Exposure: These systems permit to carry out photoepilation sessions on patients recently sun tanned, even from the day before, once again, because of the feature of progressive emission of energy. When photoepilation is over, it is better to advise patients to use a sun screen for a couple of days when going out into the sun, while this protection is not necessary before the treatment..
-Photoepilation in difficult cases: The use of the Light LEO SHR can solve complicated cases of photoepilation in the case of fine, blond hair, both on the body or the face, allowing us to proceed more safely without incurring the risk of iatrogenic exposure - easy to overcome with these patients with conventional systems - allowing us to conclude certain treatments that do not evolve well with conventional systems.

METHODOLOGY OF THE TREATMENT WITH THE SHR LASER AND THE SHR LEO SYSTEMS

The clinical methodology in the application of these systems takes into account the following:
-Medical History of all patients.
-Examination of the skin and the hair on the areas to be treated. colour, thickness, density, phototype, hormonal pathology.
-Assessment of contraindications
-Shave with a razor blade before the session
-Marking of the areas: In order to sistematize the different times the operator passes over the areas during the treatment.
-Use of cold coupling gel..
-Selection of the parameters: In the case of the laser SHR system we must bear into account that the range of use of the fluences is from 5 to 10 joules, with fixed repetition rates of 10Hz and pulse durations from 8 to 20 ms. The duration of the pulse, in these systems, settles itself automatically to the selected fluence, in this way, fluences of 5 joules correspond to pulses of 8 ms and fluences of 10 joules will correspond to pulses of 20 ms.
-Treatment Skills: The treatment is always carried out dinamically, i.e. the therapist moves the light emitting head sweeping across the areas to be treated - previously selected - at different speeds depending on the clinical signs that appear on the skin and that were described above. Thick hair

must be treated with long pulses of 16-20 ms, corresponding to fluences of 8-10 joules, running over the surface, fewer times. Fine hair must be treated with shorter pulses of 8-14 ms, corresponding to fluence levels from 5 to 7 joules, in this case it will be necessary to run over the surface more times until clinical signs can be observed.
The end point of the treatment will be marked by intense erythema, together with slight pain and perifollicular edema.
Unlike with classical photoepilation systems, hair will fall progressively over the next two or three weeks after the treatment. Patients should be informed about this..
-Treatment Intervals: These are the same as for convencional epilation, it is necessary to observe the cicles of follicular growth to try to have most sessions during the anagenic phase, i.e. the phase of hair growth. Let us remember that it is precisely during this phase when the concentration of the chromophore melanin is at the highest level, compaired to all phases of hair growth.

CONTRAINDICATIONS OF THE SHR LASER AND SHR INTENSE LIGHT LEO SYSTEMS

The contraindications of these systems are those typically related to photoepilation systems in general, with certain exceptions, as regards sun exposure before the treatment, which, with these technologies,is possible, as well as the use of these systems with phototypes V and VI, so far forbidden with other systems.
The main contraindications are:
-Pregnancy: During pregnancy there is an increase of the levels of prolactin, a hormone secreted in the hypophysis and associated with the production of milk. Prolactin has a melanocyte stimulating effect, reason why all light therapies would be forbidden in cases of hyperprolactinemia, whether because of pregnancy or of amenorrhea galactorrhea syndrome.
-Heat Urticaria: These patients develop urticariform lesions after therapies with heat generating light, and should this happen, they ought to be treated with corticoids.
-Photosensitizing Medicines: Patients who take those medicines cannot undergo light therapies because of the risk of dyschromia. A clear example is that of those patients with acne, who take 15-cis retinoic acid. To be able to undergo light treatments they must not take this medicine for 6 months.
-Melasm: Patients with melasm can be treated but very cautiously because of the risk of reproducing the problem on the areas under treatment .
-Autoimmune Diseases: Like *lupus erythematosus*, since it is a disorder that presents a certain photosensitivity.

-Scarring Disorders: These are patients to whom any attempt of skin repair, generates hypertrofic scars or keloids. These patients must be carefully assessed to avoid at all costs the possibility of epidermolysis. Decompensated diabetic patients, also have scarring difficulties, so they should have their problem under control before attempting treatment.

SIDE EFFECTS OF THE SHR LASER AND SHR INTENSE LIGHT LEO SYSTEMS

The side effects of these systems are common to all photoepilation treatments with other systems, except for some slight differences:

-Burns: When they occur they are first degree burns or on rare ocassions second degree burns and they respond quite well to the treatment. Frequently the operator does not move the laser or the intese light head the way he or she should, it remains stationary and generates a burn. Due to the progressive feature of energy emission of these systems, this is unlikely. The speed of the sweeping movement over the surface of the skin under treatment with these systems varies. You should constantly watch the clinical signs that appear on the skin, and no shooting should be done without moving the head.

-Hyperpigmentation: It can be more frequent in patients who are predisposed, such as in patients with caucasic skin, in phototypes IV and V or in patients with hyperpigmentation post inflammatory-melasm. The hyperpigmentation produced by light treatments in phototypes I-III evolves satisfactorily spontaneously and with a depigmentation treatment. Those produced in phototypes IV and V evolve correctly with depigmentation agents and intense light therapies.

-Hypopigmentation: It is more frequent in phototypes IV and V and it is less frequent with these systems than with classical systems. It is not usually necessary to treat these patients to restore their pigmentation, since they do it spontaneously. On ocassions they need some exposure to ultraviolet rays of near band (300-380nm) over several sessions, looking for a minimal erythemal dose (MED) for treatment effectiveness. In this way, repigmentation can be accelerated thus solving the problem in a short time.

-Scars: Scars are formed in cases of second degree burns, which is quite unlikely when employing these systems.

-Folliculitis: This condition occurs in 6 to 7% of the cases of photoepilation, on the groin area, thighs, and mostly on the axilla. These are patients prone to repetition of folllicullitis when using any epilation system, whether light or not. Their skin has usually hyperpigmentation stains due to post inflammation post folliculitis, that cause pigmentation spread on the groin area and the legs. For these patients photoepilation

itself is the treatment, since once the hair has been destroyed, recurrent folliculitis is wiped out. Some authors suggest these patients should use lotions or creams with chlorhexidine before and after photoepilation, so as to diminish the probability of folliculitis.

CONCLUSIONS

We could state as a conclusion, as regards the use of the Láser SHR and Intense Light LEO SHR systems for photoepilation that:

-Photoepilation SHR is conceptually different to all systems used so far.

-The ultimate goal of Photoepilation SHR is not to produce spectacular and immediate clinical effects such as intense smell of burnt hair, noticeable perifollicular edema, vaporization of hair at the medical center, it just seeks to increase the temperature of the follicle, to the exact and necessary temperature level (45-50ºC) that will guarantee the destruction-involution of the follicle, without producing side effects on the surrounding tissues.

-Photoepilation SHR can be carried out with patients who belong to phototype IV and V and at any time during the year, since the possibilities of producing side effects on these patients - as we have already explained - are fewer. Prior to the sessions it is not necessary to avoid sun exposure, since it is not incompatible with the treatment.

-Photoepilation SHR is very effective, as well a traditional systems, whith thick and medium hair, though less resolvent in the case of fine, blond hair.

-Photoepilation SHR produces very little pain because of the low heat transmission to the tissue surrounding the follicle, since the fluence employed is low and the pulses long and at high repetition rate. The patient experiences a slight feeling of discomfort - only when the intense erythema appears - and the smell of burnt hair. There is no need to use external cooling or anesthetic systems or agents, in general.

-Photoepilation SHR is safe and can be done by health technicians, ruled and supervised by a professional.

-Photoepilation SHR sessions should be done at the same intervals as conventional epilation, treating facial and body areas in accordance with the cicle of follicular growth of each area. And summer is not an obstacle to undergo this treatment.

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