
elōs technology for Hair Removal – Combination of 810 nm diode laser with conducted Bi-polar RF energy

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Introduction

About six years ago, the first diode hair removal laser was introduced into the market. The following system characteristics made it a popular hair removal device [1-2].

1. Wavelength: Diode lasers are most popular at a wavelength of 810 nm which is at the center of the hair removal wavelength band of 694-1064 nm. The 810nm wavelength has a deep penetration depth, and therefore can target major parts of the hair follicle down to the papilla. At the same time, melanin absorption is lower than the Ruby laser wavelength (694 nm)^[3], and the Alexandrite laser (755 nm), and is more suitable to treat darker skin types.
2. Pulse duration, energy and spot size: Power density of the diode laser is typically lower than other lasers, but in contrast to the treatment of pigmented lesions, hair removal does not require high peak power. Pulse durations up to 350 msec, which are ideal for hair removal, and can be easily generated by diode lasers. The development of large diode bars opened the possibility to generate lasers with hundreds and thousands of Watts, which can be used with larger spot sizes.
3. Reliability and compact design: Diode lasers are solid-state technology and highly reliable. In addition, the diode arrays can last for millions of pulses.

The disadvantages of diode lasers are typical of other light source / laser devices used for hair removal. Light hairs do not respond to treatment due to a lower concentration of melanin in the hair shaft. Limited amount of heat, and therefore poor results, are also accomplished when treating fine hairs. Additionally the treatment of dark skin is still associated with risk of adverse effects.

The objective of this paper is to present a clinical study with what I believe to be the next generation of hair removal devices: The Comet/Polaris DS by Syneron

Medical Ltd utilizing elōs (Electro-Optical Synergy), technology.

Comet/Polaris DS technology

The Comet/Polaris DS is a device that combines two forms of energies – laser light energy (optical) and conducted bi-polar radio-frequency (RF) energy, simultaneously applied to the tissue.

By using two different types of energies, one can reduce the optical energy to a level that is safe even for dark skin. Treatment efficacy is not compromised because of the use of additional conducted bi-polar RF energy that selectively heats the hair follicle. The conducted RF selectivity mechanism is not based on absorption by neither the skin melanin, nor the hair shaft melanin^[4]. Still, the theory behind the Comet/Polaris DS is based on the principle of *selective thermolysis*^[5]. According to this principle, parameters of optical and RF energy (spectrum, exposure duration and energy density) are chosen and optimized to selectively damage (destroy) the hair follicle without damaging the surrounding tissues.

Optical properties of the Comet/Polaris DS: The light source that is utilized in the Comet/Polaris DS is a high power 810 nm diode laser. As discussed in the introduction, this is the most suitable laser for depilation. Optical energy density can go as high as 50 J/cm².

Conducted bi-polar RF properties of the Comet/Polaris DS: The Bipolar system of the Comet/Polaris DS can generate RF energy as high as 50 J/cm³.

Study objectives

The aim of the clinical study was to evaluate a new method of hair removal. The main idea behind the method is to decrease optical energy to the level that is safe for all skin types, while compensating for the lack of light by utilizing an additional energy that is not optical, but is selectively absorbed by the hair structure. The other key requirement for the selected energy was that it would not affect the melanin of the epidermis. The study was conducted with the Syneron Medical Ltd. Comet/Polaris DS hair removal system. The

accumulated energy is comprised of electrical energy and optical energy in approximately equal parts. Conducted bi-polar RF energy was applied through the electrodes embedded in the system applicator and brought into contact with the skin surface. The geometry of the electrodes was optimized to provide an energy penetration depth of several millimeters.

Procedures

Patients

30 male and female patients’ ages 16-42 years with Fitzpatrick skin types II-V and various hair colors were selected for the study. Table 1 below, shows the distribution of patients by skin type.

Table 1

Skin Type	Number of patients
II	7
III	9
IV	8
V	6

A variety of body sites were chosen for the study, as shown in Table 2 below. The face was the least prevalent site treated.

Table 2

Site	Number of Sites*
Facial	3
Bikini Line	15
Axilla	17

* Some of the patients had more than one treatment site

Informed consent of all participants was obtained and the body sites to be treated were identified and photographed. A baseline hair count was obtained manually. The target areas were shaved prior to treatment. No topical anesthetic cream or other anesthetic was applied.

In the study, the laser energy density range used varied from 20 to 42 J/cm², while the RF energy range was 30-50 J/cm³. Applicator tip temperature was maintained at around 5° Centigrade by the epidermal cooling device integrated in the system handpiece.

Treatment technique

A thin layer of clear conductive gel was applied to the treatment site. Light pressure was applied via the applicator in order to ensure good coupling of the electrodes to the skin surface. Treatment overlap of up to 20% was acceptable.

Laser energy density was set according to the skin types, and the pain tolerance of the patient. Conducted

RF energy density was set according to the body location, hair thickness and density.

Follow-up

Patients were observed immediately, one week, and three months following the treatment.

Results

Immediate response

In contrast to other purely optical devices, the Comet/Polaris DS system uses a low level of optical energy, which leads to less heating of hair shafts. Hence, hair shaft evaporation was not commonly observed because RF energy mainly affects the hair follicle, causing it to coagulate. Effective cooling protected the epidermis from immediate perifollicular erythema and only perifollicular blanching was observed after the pulse. In most cases, perifollicular edema and erythema were delayed, appearing after 10 to 15 minutes. No visible side effects were noted within one hour, and none of the patients reported any later adverse side effects.

Follow-up observation

During the first week post treatment, no significant hair reduction was observed, which was the expected response, due to the time it takes for the hair to expel out of the follicle. Maximum reduction in hair was observed at 2 weeks to 2 months after a single treatment.

Assessment of hair clearance

Study patients were observed 3 months after one single treatment. A clinical examination and hair count was employed to assess the efficacy of the treatments. Clearance (see Table 3 below) was calculated as the ratio between the value of the baseline hair count taken immediately pre-treatment and the value obtained at the 3-month post-treatment hair count.

Table 3

Site	Average Clearance
Axilla	42%
Bikini Line	38%
Face	35%

The clinical study results show average clearance of 40% 3 months post one treatment. In most of the cases, the maximal RF energy (40-50 J/cm³) was used. The level of optical energy varied, in the range of 20-42 J/cm², according to skin type.

Figure 1 shows a typical before and after photo of Axilla of a 30 year old female.



Figure 1: Axilla of a 30 years old female before (upper) and after (lower) one Comet/Polaris DS treatment

Conclusion

The Comet with elōs technology represents a new and exciting approach to current hair removal methodologies. The current study of a combination of conducted RF and optical energies for hair removal, as delivered by the Comet, showed that an energy pulse strong enough to cause the destruction of the hair follicle can be safely delivered without damaging the surrounding tissue.

The treatments were well tolerated by the subjects, none of whom required topical or other anesthesia. The only post-treatment side effect observed was transient erythema, which resolved within a few hours.

The efficacy, absence of adverse side effects, and treatment tolerance by the patients, shown in this clinical study, established that the combination of conducted bi-polar RF energy and optical energy, as delivered by the Comet/Polaris DS hair removal

system, is an excellent methodology for hair removal in a broad cross section of the population.

Preliminary results suggest that this technology of combined 810nm diode laser with conducted bi-polar RF energy could have superior clinical results compared with current hair removal devices.

References

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