New technology in aesthetic medicine: ELOS™
electro optical synergy

Amir Waldman & Michael Kreindle, Synetron Medical Ltd.

Introduction
Laser and broad spectrum intense pulse light sources have been used extensively in the past decade for a variety of aesthetic procedures. The most popular are non invasive treatments such as hair removal and skin renewal. Younger and better looking skin usually involves the treatment of aging signs on the face such as vascular and pigmented lesions, skin texturing and winkle reduction. The main limitation of light based technology, either laser or intense pulse light, is that the light must penetrate deep into the tissue and be selectively absorbed by the target, while the surrounding skin should remain untouched. Darker skin types contain higher levels of melanin, which absorb larger portions of the energy and therefore are more difficult to treat. Results are generally poor and complications are greater. The same considerations are in effect when treating a lighter target, such as light hair, where the light absorption is minimal.

EOLS Technology
The basic concept of ELOS is to use two types of energies: light and conducted RF electrical energy, where each has a different selectivity mechanism. By combining the two energies, less optical energy can be used with greater safety, while treatment efficacy is not compromised since the conducted RF energy is additionally used to coagulate the target. Optical energy, which can be either intense pulse light or laser, will – with the right choice of wavelength and pulse duration – selectively heat the target. Electrical conducted RF energy is chromophore independent and not sensitive to skin or target color. Bipolar electrodes deliver RF current inside the tissue in the lowest impedance route between the electrodes. By selecting the ideal distance between the electrodes, using contact cooling and an appropriate pulse duration combined with light energy one can achieve selective heating of the target without damaging the surrounding tissue.

The main advantages of ELOS are that there is a reduction of the optical energy to a safe level for all skin types, and that it compensates for the lack of optical energy with electrical conducted RF energy that is not sensitive to skin or target color.

Aurora DS/SR
The Aurora system combines conducted RF with intense pulse light. The Aurora DS is indicated for non invasive hair removal. Many users report the superiority of the Aurora in difficult cases of hair removal such as darker skin types and light hair. The Aurora SR is indicated for treatments of benign superficial vascular and pigmented lesions. One of the most popular treatments with this
device is for skin renewal. Treating the face for pigmentation and vascular lesions has improved skin appearance, resulting in smoother texturing and reduced pore sizes giving an overall more youthful appearance.

The unique pulse sequence of the Aurora is designed to maximize the effect of the combination of light and RF energy. In order to deliver the requested amount of RF energy, one must first check the tissue impedance with a test shot; the machine will then calculate and set the appropriate voltage and current. Each pulse is therefore started with an RF test pulse in order to determine the tissue impedance, typically in the range of 5 msec. A pulse of light is simultaneously applied to the tissue with a pulse of RF immediately following the test pulse. A typical light duration is 20 msec with a RF duration of 100 msec. Figure 1 shows the Aurora pulse sequence. The impedance measurement is performed during the RF pulse every 1 msec; by the end of the pulse the Aurora displays an ISM (impedance safety measurement) which is a relative impedance change from the initial condition, before the pulse, to the final condition, after the pulse. Since the impedance is directly related to the tissue temperature, the ISM measurement gives a unique insight into how aggressive the treatment is. Treatment parameters can be changed according to the ISM value in order to maintain safety.

**Hair removal with the Aurora DS**

A light spectrum of 680–980 nm heats the hair shaft by selective absorption of the energy by the melanin in shaft. Heat is then dissipated to the follicle and heats it, the shaft therefore acts as heat exchanger (Figure 2a). The conducted RF energy selectivity mechanism is different than the light and is not sensitive to the shaft melanin concentration. The RF field for a bi-polar system is controlled by the tissue impedance, The current will always flow through the minimal impedance distance between the electrodes. The two major factors that control the tissue impedance are: (1) material, the hair shaft contains mostly keratin which is not conductive, therefore the RF current is forced to go around the shaft and heat the follicle directly (Figure 2b); (2) temperature, as the temperature increases the impedance or resistance is decreased. By creating a preheated area inside the tissue with the light, the RF field is focused into the preheated area due to the lower impedance compared with the rest of the tissue. Again this translates into heat directly at the follicle. Figure 2c shows the combine effect of light and RF on the hair shaft and follicle. The heat profile is uniform across the target and therefore results are excellent and risk is minimal.

Long term multi-site clinical trails on hair removal have demonstrated that the Aurora DS is safe and shows superior results for removal of unwanted hair.

**Skin renewal with the Aurora SR**

The treatment head of the Aurora SR emits light at wavelengths of 580–980 nm. The shorter wavelengths are absorbed better in melanin which is the chromophore of most of the superficial pigmented lesions to be treated. Additionally, blood absorption at the shorter wavelengths is higher and better results on superficial vascular lesions can be achieved. Selectivity of the RF current in this case is controlled predominantly by the preheating by the light mechanism, and also by the pre-cooling of the epidermis by contact cooling mechanism. Figure 3a shows a typical RF current distribution inside the tissue with maximum current on the surface of the skin. When pre-cooling is added the upper layer is cooled and skin impedance is higher, therefore the RF field is forced deeper into the tissue, as can be seen in Figure 3b. By adding blood vessels into the calculation and pre-heating them by a pulse of light, the RF selectively targets the blood vessel (Figure 3c).

Results of skin renewal procedure are impressive. Typically, five treatment sessions are performed and the improvement can be significant. Vascular and pigmented lesions are removed in three sessions with the last two contributing mostly to enhance skin texture and improvement on type I and II wrinkles.

**Conclusions**

ELOS technology is a new promising concept in aesthetic medicine. The first products that utilized this technology show excellent results in the two most popular applications of hair removal and skin renewal. Potential new
applications will result with the introduction of new products that combine RF energy with diode laser energy.