Radio-frequency energy

Consumers are increasingly seeking less-invasive aesthetic treatments with minimal downtime and consistent results. Dr Michael Kreindel and Dr Stephen Mulholland assess the benefits of using radio-frequency energy for non-invasive procedures.

Radio-frequency energy has been used reliably in medical and cosmetic applications for almost 100 years. Its use through various procedures and devices has demonstrated its consistency, efficacy and safety. RF energy used in medical applications is applied to the tissue by alternating high frequency electrical current. This creates a thermal effect in the tissue in the area of the RF electrode. At frequencies higher than 100kHz, the electrical current creates a pure thermal effect without affecting local nerve and muscle tissue, thereby enabling the RF energy to become an effective instrument for safe tissue treatment. By controlling RF current density through optimising output power and electrode size, physicians can heat, coagulate and ablate tissue.

The simplicity, versatility and efficiency of the RF devices, such as the electrosurgical device, developed by Harvard University professor Dr Bovie and first used by Dr Harvey Cushing in surgery, have made RF energy the most popular thermal treatment modality in a variety of medical applications. The big advantage of RF energy over laser, cryotherapy and other treatment modalities is the ability to monitor tissue electrical parameters simply and reliably through the direct measurements of its impedance. Practitioners can adjust output power according to local properties of the treated tissue.

There are many hand-piece designs that allow the optimal delivery of RF energy according to application. Mono-polar RF is used most frequently for cutting where RF energy is focused near a needle-type electrode, creating tissue ablation and a second large-area return electrode is used to close the current loop. Bi-polar devices are mainly used for coagulation of blood vessels and tissue, and heat is generated between two electrodes positioned within the treatment area.

Many versatile RF energy devices are available, and it has become common practice to use RF electrosurgical devices in plastic and dermatological surgery for skin and tissue cutting and blood coagulation. Simultaneous tissue cutting and blood coagulation make it an effective tool for face-lifting, blepharoplasty, abdominoplasty and other excisional and incisional surgeries. In the last decade, RF energy has become incorporated in non-invasive cosmetic treatments alone or in combination with laser or intense pulsed light. The leading companies in this RF aesthetic market are Solta Medical Inc (formerly Thermage Inc) and Syneron Medical Ltd. The biggest advantage of RF versus laser energy is its unlimited penetration depth. Laser radiation can penetrate to the depth of only a few millimetres, requires a specific target chromophore for absorption and must often respect skin type.

However, RF energy effectively penetrates into and through the subdermal layer into the subcutaneous tissue. RF energy is indifferent to chromophore and is skin-type independent. These unique features make RF energy efficient for skin tightening, body contouring and subcutaneous fat treat-
ment, which are the fastest-growing segments in the aesthetic industry, even during the recent economic downturn.

As with electrosurgery, both monopolar and bipolar configurations of applicators and handpieces are used for non-invasive procedures. Non-ablative cosmetic treatments are usually based on remodelling of collagen and ground substances, whereas heating adipocytes to sub-necrotic levels contours fat. Large electrode surface areas allow the delivery of energy in a uniform manner to a large treatment area.

The main advantages of non-invasive treatments are their simplicity, safety and minimal recovery time—often making them lunch-time procedures. However, non-invasive RF or laser therapy requires multiple treatments, demonstrating diminished efficacy and consistency in comparison to invasive treatments.

While some patients have good results following a series of non-invasive procedures, the majority will often report minor improvement. The inherent limitation of a non-invasive approach is based on the concept in which RF energy is delivered through the skin to affect the subdermal layer without epidermal damage.

The most recent application of aesthetic RF energy is radio frequency assisted liposuction (RFAL), which deploys both the advantages of electro-surgical and non-invasive technologies, combining aggressive coagulation of internal adipose, vascular and fibrous tissue and gentle, uniform and safe heating of the superficial dermal layer. Developed by Invasix Inc, the BodyTite RFAL system is gaining awareness among cosmetic physicians by creating a new approach in aesthetic medicine. The first use of RFAL is focused on improvement of body contour and cellulite, but there is also a big potential of this minimally invasive RF technology for face-lifting, blepharoplasty and tightening of loose skin in areas such as the knees and arms.

RF energy continues to be the most popular aesthetic energy used in invasive aesthetic medicine and now we see a RF renaissance for a new minimally invasive treatment to address the consumer desire for dramatic and consistent results with less downtime and risk.

The use of RF energy in minimally invasive aesthetic treatments allows the physician to develop procedures for heavier patients, older patients and those with decreased skin elasticity. Therefore, the unique properties of RF energy, which include unlimited penetration depth, good control of parameters and versatility of electrode configurations, make it one of the most important instruments in the hands of aesthetic medical professionals.

Dr Stephen Mulholland is a consultant plastic surgeon and director of SpaMedica Infinite Vitality Clinic in Toronto, Canada. W: www.spamedica.com; Dr Michael Kreindel is chief technical officer of Invasix Ltd. W: www.invasix.com

RF electro surgical device used during abdominoplasty. Simultaneous tissue cutting and blood coagulation makes it an effective tool for face-lifting, blepharoplasty, abdominoplasty and other excisional and incisional surgeries