Supplementary Material

Additional Contact RF Devices

Exilis (BTL Aesthetics, Prague, Czech Republic)
Exilis is a monopolar RF device. Monopolar RF is delivered in a dynamic or continuous pulse with constant rotation of the handpiece, thereby targeting specific areas of laxity more quickly to a final temperature.[1] Temperature is monitored by continuous surface temperature measurements. The "energy flow control system" constantly monitors tissue impedance and detects the tip contact with skin, and automatically shuts off power when the tip contact and/or energy flow is disrupted to eliminate the risk of burns.[2] Peltier cooling is a built-in safety feature that can be adjusted to allow targeting of skin or subcutaneous tissue. Treatment includes 10 minutes per 20 to 25 cm area, with surface temperature 40 to 43°C, weekly for 4 total sessions.

Pelleve (Ellman International, Inc., Oceanside, NY)
Pelleve is a monopolar RF device. It contains a cooling gel and infrared laser thermometer to ensure epidermal temperatures stay between 41 and 43°C.[3] One study containing 32 patients demonstrated statistically significant changes in facial wrinkling 1, 3, and 6 months after treatment.[4] Another study containing 17 patients noted an overall 25 to 30% improvement in facial wrinkling 2 weeks after the first treatment, with an average improvement of 46% at 1-year follow- up.[5]

Biorad (GSD Biorad, Guangdong, China)
Biorad is a monopolar RF device. In a small series of six patients, facial skin tightening improved in all patients from 35 to 40% at the end of treatment to 70 to 75% at 3 months following treatment.[6]

Accent (Alma Lasers, Inc, Ft Lauderdale, FL)
Accent is a hybrid monopolar and bipolar device. The monopolar handpiece achieves deep volumetric heating of the skin whereas the bipolar handpiece is used for more superficial localized (nonvolumetric) heating. In a study evaluating the treatment of facial rhytids and skin laxity, 56% of participants had improvement.[7] In a split face study comparing the two hand pieces for the treatment of facial rhytids and laxity, there was a slightly greater degree of improvement with the bipolar handpiece after four treatments but this was not statistically significant.[8]

Apollo (Apollo, Pollogen, Israel)
Apollo is a tripolar RF device. In a study of 37 patients treated for facial laxity and rhytids weekly for 7 weeks, significant improvement was noted with no adverse effects.[9]

eMatrix (Syneron, Irvine, CA)
eMatrix is a fractional RF device. The handpiece contains a fixed placement of 64 mini bipolar electrodes, capable of delivering energy of 10 to 20 J, that can penetrate up to 450 µm in the dermis.[10] In a study of 33 patients treated for photoaging, skin laxity, and rhytids, greater than half of the patients experienced more than 40% improvement in texture, and 80% of patients were satisfied.[11] Similar findings were reported in a study of 26 Asian women treated with the device,[12] as well as 15 patients with Fitzpatrick V-VI skin types without any post inflammatory pigmentary alteration.[13] Adverse events were limited, with 87% of patients reporting minimal pain and discomfort during treatment and no downtime,[12] and few experiencing edema and erythema.[11,12]

Additional RF Microneedling Devices

INTRAcel (Jeisys, South Korea)
INTRAcel is an insulated bipolar fractional motorized microneedle RF device with monopolar and bipolar options.[14] The tip contains 36 insulated microneedles with four needle depth options ranging from 0.1 to 2.0 mm. The monopolar mode enables deeper penetration.[15]

INFINI, Genius (Lutronic, Burlington, MA)
INFINI is an insulated bipolar fractional motorized microneedle RF device. The INFINI device contains an array of 200-µm-thick insulated microneedles with a 49-needle tip (10 mm × 10 mm, 7 × 7 needles) and a 16-needle tip (5 mm × 5 mm, 4 × 4 needles) array option, of adjustable penetration depth from 0.5 to 3.5 mm, and adjustable energy from 2.5 to 50 W, with exposure time ranging from 10 milliseconds to 1 second.[16] The microneedles are surgical stainless-steel gold-coated for conductivity and then double coated with an insulating silicon compound, except for the distal 300-µm tip. The insulation of the microneedles protects the epidermis.[10] Treatment regimens typically include 2 to 3 30-minutes sessions for the neck and face. Weiner's 2019 review on microneedle RF devices noted that this device's high energy may be painful.[15]

Histologic analysis in a skin model system showed coagulated dermal columns forming a cocoon-shaped zone of sublative thermal injury immediately following treatment, and re-epithelialization, neovascularization, and granulation tissue formation 4 days after treatment.[17] Clinical trials have demonstrated wrinkle reduction with similar clinician-assessed overall efficacy and patient satisfaction index from 80 to 89%.[18]

This system lacks real-time temperature feedback. Genius is Lutronic's second-generation microneedle RF device, with proprietary continuous impedance monitoring technology that allows for more precise needle and energy delivery for optimal treatment.[14]

Vivace (Cartessa)
Vivace is an insulated bipolar fractional motorized microneedle RF device with 36-microneedle tips with a simultaneous two-option light-emitting diode light delivery (blue light for antibacterial effect and red light for collagen stimulation).[14] Depths range from 0.5 to 3.5 mm, power 30 to 70 W, and pulse duration of 100 to 800 milliseconds.

Venus Viva (Venus Concept, Toronto, CA)

Venus Viva is a noninsulated bipolar fractional motorized RF device.[2] The nanofractional RF technology delivers RF energy individually through 160 pins per tip (each pin $150 \times 20\,\mu m$), 62 mJ per pin. SmartScan tip technology provides more than 1,000 pulses of energy and can penetrate depths of up to 500 µm, with multiple pattern selection options, enabling the user to change energy density without changing the tip. Together, the Venus Viva offers increased control of power and pulse duration, and the reduced pin footprint is thought to reduce reported side effects of treatment. Typical treatment protocols include 1 to 3 treatments at 2-week intervals. A retrospective study of 43 patients treated for rhytids, hyperpigmentation, or redness, demonstrated clinical improvement and high patient satisfaction at 3-month follow-up.[19]

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