Noninvasive Vulvar and Intravaginal Treatments

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KEYWORDS

• Noninvasive labiaplasty • Vulvovaginal rejuvenation • Pelvic floor restoration • Radiofrequency

KEY POINTS

- Radiofrequency is an effective and safe method for both pelvic floor restoration and nonsurgical labiaplasty.
- Bipolar radiofrequency with temperature control is more effective than monopolar radiofrequency for volumetric heating of vulvovaginal tissue.
- Combination of electrical muscle stimulation and radiofrequency can provide combined nonsurgical restoration of the vulvovaginal tissues.

INTRODUCTION

Since its first description in the plastic surgery literature in the 1980s labiaplasty and vulvovaginal treatments have rapidly increased in popularity.[1] The American Society of Aesthetic Plastic Surgery reported 12,756 labiaplasty surgeries in 2018, more than a 53% increase over the last 5 years. The growing popularity vulvovaginal procedures have been attributed to decreased stigmatization, changes in fashion trends, and increased exposure to nudity in social media.[2] Over the last 20 years, energy-based devices including radiofrequency and laser (CO2 and Erbium:yttrium-aluminum-garnet [YAG]) have been used successfully in aesthetic and functional procedures.[3] The goal of these energy-based devices have been to contract soft tissue and stimulate neocollagenesis and neoangiogenesis. Indications for these devices included vaginal laxity, dryness, vaginal atrophy, itching, dyspareunia, and urinary incontinence.

Erbium:YAG laser devices emit a wavelength of 2940 nm with a penetration depth of 1 to 3 um of tissue per J/cm^2 allowing for surface injury with minimal thermal damage to surrounding tissue. The mechanism is to contract vulvovaginal mucosa through neocollagenesis. This contraction does not tighten the vaginal tone but rather contracts mucous membranes. Different devices have developed micropulses combined with long-pulse modes to control the heating of target mucous membranes inside the vaginal canal.[4,5] FotonaSmooth (Dallas, TX, USA), Action II (Goyang, South Korea), and MCL 31 Demablate (Jena, Germany) used in clinical trials have demonstrated decrease in Visual Analogue Scale (VAS) scores of both vaginal dryness and dyspareunia, increase in Vaginal Health Index Score, improvement in spontaneous urinary incontinence, improvement in postvoid residual urine volume, and improvement in International Consultation on Incontinence Questionnaire-Urinary Incontinence scores. Histologic findings suggested better elasticity of the vaginal wall with tightening and firming. Adverse events were mild and included transient edema and tolerable heating sensation and rare spotting.[6–9]

Numerous carbon dioxide lasers have been developed for vulvovaginal restoration (FemiLift, SmratXide [Florence, Italy], MonaLisa Touch [Florence, Italy], AcuPulse [Yokneam, Israel], Co2RE Intima [Wayland, MA, USA]). The CO2 laser ablates tissue by emitting light at a wavelength of 10,600 nm, targeting water in tissue. Carbon dioxide is 20X less specific than Erbium, which develops more heat spread to surrounding tissues, leading to neocollagenesis and alteration of vaginal mucosa. Numerous studies have shown improvement in ICIQ-UI, reduction in vaginal

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dryness, improvement in dyspareunia, improvement in VAS scores for all symptom categories, and improvement of VHI scores. Adverse events reports have been limited to mild discomfort, swelling, and mild bleeding.[10–12]

This article focuses on radiofrequency, which more recently has emerged as a promising minimally invasive treatment for both treatment of the labia as well as pelvic floor. Radiofrequency (RF) is a familiar technology in most fields of medicine (ie, orthopedics, cardiology, oncology, etc.). Its first use was in the 1920s for electrocautery.[13] RF consists of an electromagnetic current that is applied through tissue (ie, skin, muscle, collagen). RF generates heat as a result of different tissue resistance or impedance to the electromagnetic current; this follows Ohm's law: Energy (J) = Current^2 x Resistance x Time.[14] For example, collagen has a higher tissue impedance than muscle and will preferentially generate more heat for a given amount of time.[15] For example, when RF energy is directed to the subdermal adipose tissue, it has been shown to generate temperatures 7X higher than those generated by the dermis, leaving to fat necrosis with epidermal preservation.[16]

Modern minimally invasive and noninvasive radiofrequency devices have shown promise in vulvovaginal restoration. Over the past 10 years, radiofrequency devices have advanced to deliver RF in a bipolar fashion (vs monopolar) with continuous temperature control, both elements that are important to controlled volumetric heating over the duration of treatment.[17] Early monopolar radiofrequency devices delivered energy to tissue with the electrical current moving toward a remote grounding pad. Many of these devices lacked temperature control or measured tissue surface temperature as a surrogate for internal temperature, which led to treatments that were either underpowered or reached temperatures in an uncontrolled fashion, increasing the risks of complications such as burn injuries. The use of bipolar radiofrequency avoids the need for a remote grounding pad and thus allows for volumetric heating of tissue.[18] The bipolar devices use continuous internal and external temperature monitoring, which have significantly improved the safety and efficacy of vulvovaginal RF treatments.

DISCUSSION

In our practice, both minimally invasive and noninvasive bipolar radiofrequency devices are used for treatment of the vulvovaginal region. Laxity of the vulvovaginal tissue can occur for a variety of reasons, including natural aging, childbirth, genetics, and trauma. These events can lead to generalized symptoms such as stress urinary incontinence, atrophic vaginitis, dyspareunia, or aesthetic dissatisfaction. Stress urinary incontinence is a prevalent problem affecting up to 35% of all adult women.[3] Further, an estimated 76% of women have symptoms of sexual dysfunction that significantly affect their quality of life.[19,20]

Treatment of the Labia Majora and Minora

Both labia majora and minora are treated with a combination of minimally invasive bipolar radiofrequency (Aviva, InMode Lake Forest, CA, USA) as well as fractional radiofrequency (Morpheus, InMode, Lake Forest CA, USA)[21,22] (**Figs. 1** and **2**). These procedures both can be performed comfortably under local anesthesia. First, a detailed medial history and physical is obtained including patient expectations. The distance from midline to free edge of the labia minor when extended laterally is measured to assess pretreatment and posttreatment labia hypertrophy. Labia minora hypertrophy is determined at a distance of greater than 5 cm. Patients are typically premedicated with 10 mg of oral diazepam and 5/325 mg of hydrocodone with acetaminophen. One dose of oral antibiotics is given preoperatively (cephalexin or ciprofloxacin). The patient is standardly prepped and draped and placed in stirrups. Access points at the caudal aspect of the labia minora and majora on each side are injected with 3 to 5 cc of 1% lidocaine with epinephrine. Next a 14-gauge needle is used to create a puncture site for access. A 20-gauge spinal needle is then used to infiltrate 20 to 40 cc of tumescent solution (50 cc of 2% lidocaine, 12 cc sodium bicarbonate, 1.5 mg epinephrine per liter of lactate ringers) per treatment site. Water-soluble ultrasound gel is then placed over the treatment areas to allow for bipolar radiofrequency conduction. Next the bipolar radiofrequency internal cannula is placed through the access port with the external electrode on the surface of the labia. The device is activated with target temperatures of 38 C externally and 60 C internally. The device is moved in a craniocaudal motion until the targets reach these target temperatures and maintain them for approximately 30 to 45 seconds. Next the fractional RF device was used to treat the labia majora and minora at depths of 4, 3, and 2 mm and an energy of 20 to 30; this was done in double pulse fashion and 50% overlap of pulses.

In our studies evaluating this treatment, preoperative measurements of labia hypertrophy and protrusion had a mean of 4.4 cm (+/− 1.3) and 3.9 (+/− 2.3) respectively. Measurements at

Fig. 1. Bipolar radiofrequency device for soft tissue contraction of labia majora and minora (Aviva). (*Courtesy of* InMode, Lake Forest, CA.)

6 months postprocedure showed an average improvement of 2.7 (+/− 2.2) and 3.1 (+/− 2.3), representing a 38.6% (STD ± 15.3) and 20.5% (STD ± 17.4) change.

Treatment of the Vaginal Canal

In our practice, for internal pelvic floor treatment we use a combination of noninvasive bipolar radiofrequency (Votiva, InMode Lake Forest, CA, USA) and fractional radiofrequency (MorpheusV InMode, Lake Forest, CA, USA) in combination with an internal electrical muscle stimulation device (EmPower Inmode Lake Forest, CA, USA)[21,22] (**Fig 3**). RF applied to the vaginal wall has been shown to stimulate proliferation of glycogen-enriched epithelium, neovascularization, and collagen formation.[4] Once the noninvasive bipolar device reaches temperatures between 40 and 45 C, an inflammatory cascade is initiated and heat shock proteins induce fibroblasts, which leads to neocollagenesis and estogenesis.[4,23] In a previous study that our group conducted with this technology objectively measuring pelvic muscle contraction (Urostym, Portsmouth, NH), there was a direct correlation between treatments and improved pelvic muscle floor contraction. Histologic biopsies of vaginal mucosa at 3 months posttreatment demonstrate increase in elastic fiber density compared with baseline biopsy. The biopsies also find no damage to the submucosal collagen layer and no scar tissue formation in posttreatment, verifying no adverse effect of the fractional RF treatment. Although data are currently being collected to evaluate the objective contribution of electrical muscle stimulation of the pelvic floor, there is evidence of show that a synergy exists.

Fig. 2. Fractional radiofrequency device for treatment of labia majora and minors. (*A*) Morpheus8 and (*B*) Morpheus8V. (*Courtesy of* InMode, Lake Forest, CA.)

Fig. 3. Internal bipolar radiofrequency device for pelvic floor restoration (Votiva, Lake Forest, CA). (*Courtesy of* InMode, Lake Forest, CA.)

SUMMARY

- The use of bipolar radiofrequency is safe and effective for the treatment of both functional and aesthetic concerns in the vulvovaginal area.
- Temperature control has been the major advance to allow for volumetric heating without complications.
- Combination therapies (ie, addition of electrical muscle stimulation) may prove to be synergistic with radiofrequency for vulvovaginal restoration.

DISCLOSURE

Consultant/Investigator: InMode. Book Royalties: Elsevier, Thieme. Co-Founder: Core Aesthetics LLC.

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