Obstetrics & Gynecology: Open Access
Elfaki SH. Gynecol Obstet Open Acc 8: 182.
www.doi.org/10.29011/2577-2236.100182
www.gavinpublishers.com

Review Article

Radiofrequency in Cosmetic Gynecology, Literature Review 2018-2023

Sara Hassan Elfaki ,MD,MRCOG, FRCOG*

Department of Obstetrics and Gynecology, Ain Alkhaleej hospital ,Al Ain, Abu Dhabi, UAE

***Corresponding author:** Sara Hassan Elfaki. Department of Obstetrics and Gynecology, Ain Alkhaleej hospital, Al Ain, Abu Dhabi, UAE email :elfakisara@yahoo.com

Citation : Elfaki SH (2024) Radiofrequency in Cosmetic Gynecology, Literature Review 2018-2023. Gynecol Obstet Open Acc 8: 182. DOI: https://doi.org/10.29011/2577-2236.100182

Received Date: 4 February 2024; **Accepted Date:** 13 February 2024; **Published Date:** 16 February 2024

Abstract

RF technology is a crucial novel innovation that provides nonsurgical cosmetic solutions to skin-related abnormalities, deformities, and disorders. Energy-based treatment options have evolved from traditional invasive procedures, such as perineoplasty, to minimally and non-invasive techniques as healthcare stakeholders enhance patient outcomes in the nonsurgical cosmetic gynecology subspecialty. A critical focus is, however, placed on complicated reproductive healthcare, particularly regarding the genitourinary syndrome of menopause symptoms, with RF application, in this case, emerging as a readily embraced treatment option. In this light, this research paper seeks to review recent literature between 2018 and 2023 on the use of transvaginal RF in the treatment of GUS of menopause, vaginal laxity, and urinary incontinence and to update the knowledge in this area to encourage new research on the same topic. The approach employed is a literature review methodology, where recent literature was reviewed to identify insights and gaps. The discussion focuses on understanding the uses of RF treatment for GUS of Menopause, vaginal laxity and vulval tightening, stress incontinence, its role in cancer patients, and the technology's mechanism of action. From the findings, RF presents significant developments and valuable advancements in nonsurgical cosmetic gynecology, making it an ideal energy-based treatment technology. However, further research is necessary to determine the potential of its long-term benefits and risks.

Keywords: Radiofrequency, RF, Cosmetic Gynecology, Vaginal Rjuvenation, Vaginal laxity, Genitourinary syndrome of Menopause, GSM, Energy-based devices

Introduction

Background

Aesthetic gynecology has seen significant advancements with the uprising of nonsurgical cosmetic gynecology sub-specialty, specifically witnessing a shift from traditional invasive procedures, such as perineoplasty, to minimally and non-invasive techniques, utilizing laser, high-intensity focused ultrasound (HIFU) and the continuously evolving radiofrequency (RF). Considering the sensitivity and importance of the women's health topic, healthcare providers and stakeholders have undertaken to address reproductive-related issues as well as underlying comorbidities through nonsurgical cosmetic gynecology for societal well-being. In this light, cosmetic gynecology is critical given that it readily provides the healthcare solutions that female patients seek for complicated reproductive healthcare problems by eliminating downtimes, high surgery costs, and incision and anesthesia-related risks. Specifically, the remarkable evolution of aesthetic gynecology has advanced the HIFU, RF, and laser therapies to provide female patients with safe and minimally invasive treatment options capable of addressing dyspareunia, post-coital bleeding, reduced lubrication, and urinary incontinence, among other genitourinary syndrome (GUS) of menopause symptoms. While laser, HIFU, and RF technologies eradicate the need for traditional surgical cosmetic gynecology methods in favor of patient-friendly solutions, RF emerges as a superior treatment technology, given its ability to deliver controlled thermal energy for tissue remodeling.

The nonsurgical cosmetic gynecology subspecialty has also witnessed a surge in research and clinical explorations inclined toward refining energy-based equipment and treatment

technologies. In particular, the research on RF technology between 2018 and 2023 delineates multiple clinical, equipment, and training advances, with the efficacy and safety of RF in nonsurgical cosmetic gynecology underlying the increased interest to pursue the subspecialty and ascertain RF effectiveness. Based on the developments and achievements today, RF offers versatile advantages, including precision, non-reuse of the handpiece, safety, and reduced downtimes over laser, HIFU, and other energy-based devices. Over this duration, RF devices have evolved to enhance controlled and localized treatment delivery as their ease of use allows reach to specific and targeted depths within tissue layers. Given that cosmetic gynecology patients often raise concerns about precision, RF application in gynecology has been designed to offer precise tissue remodeling and rejuvenation for the treatment of vaginal laxity, stress incontinence, and vulval tightening [1]. RF is non-ablative, making it suitable for varying skin tones and avoiding hypopigmentation and hyperpigmentation [2]. At the same time, its development has seen it accommodate individual patient characteristics. While other modes of surgical and nonsurgical gynecology treatment techniques present significant invasion with elevated cost, complication, downtime, and scarring risks, RF technology is rapidly gaining attention and adoption in the subspecialty of nonsurgical cosmetic gynecology.

Nonsurgical cosmetic gynecology, mainly RF, provides the most feasible healthcare solution to female patients, considering the complexity and management of the GUS of menopause. Irritation, burning, dysuria, impaired sexual function, stress incontinence, and pain, among other indications, exemplify the complexity associated with the GUS of menopause and broader medical problems facing women. Although the elective surgery subspecialty comprises insufficient medical professionals available to address these problems [3-5], its growth rate is considerably high as more gynecology specialists advance their qualifications to offset the patient demand. Despite being a relatively new field with fewer fellowship programs, the availability of reputable preceptorship programs for surgeons willing to start this career inspires growing interest [2]. Besides physician interest and training, technological advancements underpinning innovative nonsurgical equipment have continued to evolve, enhancing the efficacy of cosmetic gynecology procedures. RF's evolution has primarily resulted in the manufacture of non-invasive RF devices that deliver controlled radiofrequency waves to induce collagen secretion and address dryness, burning, irritation, lubrication, and dysuria [6]. The stark difference between laser and HIFU is that laser utilizes controlled laser energy to stimulate new collagen growth and improve the mucosal lining. HIFU's precise ultrasound waves promote collagen synthesis.

Objectives

The objective of this research paper is twofold, including reviewing recent literature between 2018 and 2023 on the use of transvaginal RF in the treatment of GUS of menopause, vaginal laxity, and urinary incontinence and to update the knowledge in this area to encourage new research on the same topic. Firstly, I will examine the latest studies, clinical trials, and RF advancements. This objective aims to identify critical and up-to-date insights into RF technology's study, use, and findings in elective surgery's nonsurgical cosmetic gynecology subspecialty. The anticipated insights include but are not limited to the efficacy, safety, and satisfactory patient outcomes in managing GUS of menopause. In this light, i intend to employ an objective analysis and synthesize various articles to offer a comprehensive understanding of the state of research in nonsurgical cosmetic gynecology and the application of RF to manage different gynecological conditions to facilitate informed clinical practice and decision-making. The second objective of this paper is to contribute to advancing knowledge in the broader cosmetic gynecology field.

I intend to synthesize the existing literature, update the knowledge to encourage new research, and further contribute to the already established findings in applying nonsurgical RF technology. The literature between 2018 and 2023, while critical in the development of this research, might present significant gaps besides insights that will need the intervention of other stakeholders' contributions. In this regard, it was important to consolidate evidence from different works that present these insights to inspire and encourage the researchers to undertake an initiative in this evolving field, with a critical focus on RF. While various protocols already established are significant, I do not seek to overwrite the works of previous researchers but rather elucidate and share their views, highlighting the benefits and limitations of transvaginal RF treatment while encouraging peers to contribute to this new field by synthesizing the current treatment protocols, cases of RF application, and patient outcomes.

Methodology

The literature review process excluded and included research criteria critical of the research topic. Aimed to eliminate bias, increase reliability, enhance objectivity, and create new insights, considering the relatively new RF procedure without readily available long-term data. Firstly, the research defined the target population as female patients with the genitourinary syndrome of menopause and the intervention as an RF treatment procedure in the nonsurgical cosmetic gynecology subspecialty of cosmetic surgery. Secondly, inclusion criteria targeted articles published between 2018 and 2023 and excluded those with older publications, utilizing PubMed and Google Scholar. This approach guided the initial screening and established the foundation of the refined research process.

I have selected and combined keywords such as

"radiofrequency, RF, cosmetic gynecology, vaginal rejuvenation, vaginal laxity, genitourinary syndrome of menopause, energy-based devices, and GSM" and refined them with the Boolean operators. Then selected and reviewed seventeen peer-reviewed articles before picking ten that met the criteria. The studies of the included articles compared RF, HIFU, and laser nonsurgical cosmetic treatment procedures, further delineating the inclusion criteria dictated by the research question on the application of RF in cosmetic gynecology, particularly in treating GSM. Studies that used observational design and those published in languages other than English were also excluded. This research approach adhered to the predefined criteria and helped to select articles with consistent, reliable, and objective data regarding RF nonsurgical application in cosmetic gynecology.

Discussion

Uses of Radiofrequency in Transvaginal RF Technology

Treating GUS of Menopause

The RF modality in treating GUS of menopause addresses multiple indications, including genital, sexual, and urinary tract symptoms. Based on numerous prospective cohort studies, RF, precisely the bipolar type, has demonstrated effectiveness in treating GUS of menopause [4,7,8]. This assertion delineates the extent of RF technology developments within the nonsurgical cosmetic gynecology subspecialty as stakeholders strive to counter underlying physiological changes associated with GUS of menopause. The study reiterates that menopausal women whose urinary tract, sexual, and genital symptoms, such as stress urinary incontinence, loose pelvic muscles, and discomfort, can improve these indications safely and effectively without resorting to slightly invasive and invasive procedures. RF's minimal discomfort, infection, and burn risks make it a better alternative with practical solutions for GUS-related symptoms. In this regard, energy-based devices, mainly RF, are well-tolerated with limited complications while achieving patient outcomes.

Vaginal Laxity and Vulval Tightening

In the treatment of vaginal laxity, RF delivers controlled thermal energy to target tissues to stimulate collagen production, synthesis, and tissue remodeling. As established in a study, RF, just like laser technology, is one of the most commonly utilized energy-based devices, authorized by the Food and Drug Administration (FDA) agency for various gynecological applications, including the treatment of abnormal cervical muscles, vaginal tissues, and genital warts [5,10]. The efficacy of this technology underlies multiple prospective cohort studies which have demonstrated that RF therapy is a promising and effective treatment for vaginal laxity [4]. In another study on an animal model of multiparous swine, administering RF treatment once per week for three weeks showed an increased density of elastin and collagen fibers in vulvovaginal tissue [4]. This suggestion indicates that RF treatment may positively affect the structural integrity and elasticity of the vulvovaginal tissue, which is beneficial for tissue laxity or damage-related conditions. Figure 1 illustrates RF treatment for vaginal rejuvenation, with the thermal energy penetrating through the epidermis and dermis. The white device, an RF technology, delivers controlled thermal energy depicted by red arrows to the vulval area tissues to stimulate collagen production and promote tissue contraction.

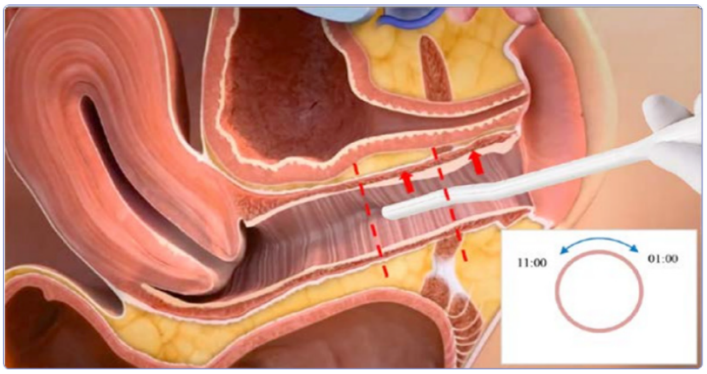

Figure 1: An illustration of RF treatment for vaginal rejuvenation.

Stress Incontinence

In treating stress incontinence, RF technology delivers controlled thermal energy to the sub-urethral area to induce tissue contraction and strengthen pelvic floor support, critical in regulating urine flow [2]. According to a review of energy-based treatments for GUS of menopause involving multiple medical specialists, such as urogynecologists and gynecologists, RF resulted in 30% shrinking in the sub-urethral area of the vagina, with a significant improvement reported in stress urinary incontinence symptoms [11]. This study reflects the presence of the modal of action of RF through which the stimulation of new collagen, elastin, and angiogenesis firms and revitalizes wilting tissues [10,11]. Therefore, despite being introduced recently, RF is an effective treatment technology for GUS of menopause, considering its significant effect in reducing genitourinary menopausal symptoms.

Role in Cancer Patients

Besides the broad application of RF in the treatment of GUS of menopause, cancer is an intersection underlying this treatment modality in nonsurgical cosmetic gynecology. Recently, there has been progressive use of laser and RF therapies to address GUS of menopause, targeting women who are not suitable candidates for hormone therapy, particularly cancer patients [12,13]. RF, with the approval of the FDA, has been in application targeting the treatment of precancerous lesions [5,10]. Given its nature of not altering hormonal balance, the technology emerges as the better alternative

for treating dyspareunia and vaginal dryness safely. Moreover, the effectiveness of RF therapy in treating sexual dysfunction has been confirmed in studies involving both menopausal women without cancer and female cancer survivors [12,13]. This finding indicates that despite the conditions of gynecology cosmetic patients with underlying comorbidities, RF provides the suitable management option to address the GUS of menopause during and after cancer treatment.

Mechanism of Action

The basic principle of application in RF is the delivery of electromagnetic energy at specific frequencies to generate heat within tissues. Primarily, RF devices release thermal energy from the RF electrode through a skin surface to stimulate collagen production, enhance blood flow, and activate fibroblasts. According to Görgü et al., RF technology induces tightening and suppresses dermal contours by remodeling dermal collagen without compromising the epidermis. Although there is tissue electrical resistance when applying the technology, RF generates deep heat at different levels and magnitudes, causing collagen denaturation and subsequent rejuvenation due to fibroblast stimulation, enhancing skin density [6]. As the process continues, temperature variations increase with increased penetration depths and frequency. The high RF thermal effect degrades the triple helix structure and contraction of collagen fibers, burning the tissues and ultimately prompting shrinkage at the ideal timed 57^0C to 61^0C temperatures.[6] At 43°C for 10 minutes, there is delayed adipocyte cellular death, while at 45°C for 3 minutes, 60% of adipocytes lose viability. This procedure allows the RF device to move clockwise and counterclockwise, covering the middle and distal areas and inducing heating that enhances microcirculation, promotes uniformity in subdermal fat distribution, and resultantly prompts skin tensioning and tightening.

Depth of Tissue Penetration: A Comparison of RF, Laser, and HIFU

As demonstrated in Figure 2, the depth of RF, laser, and HIFU penetration, among other energy-based devices in skin rejuvenation, is starkly different. In this light, different penetration levels denote the efficacy and suitability of various treatment modalities. Laser, for instance, penetrates and only rejuvenates the epidermis with minimal penetration into deeper tissue layers (see Fig. 2). A cooling effect occurs at the target site, particularly on the epidermis, implying the technology's ability to protect the upper skin layer from burns. However, the penetration depth is the least compared to other treatment options, making it unsuitable for nonsurgical cosmetic procedures requiring deep penetrations. Similarly, HIFU's penetration depth is the lengthiest. However, this treatment technology lacks a protective mechanism for the skin given that the delivery of its energy lacks precision, as it is distributed unevenly (see Fig. 2). As illustrated, patients are likely to receive uneven treatment outcomes and risk burns considering that HIFU lacks a cooling mechanism on the epidermis, present in other treatment options. Therefore, while its penetration capabilities make it an ideal technology for massive skin problems in cosmetic surgery, the risk of burning the superficial musculoaponeurotic system (SMAS) and irregular outcomes negates this potential. RF (see Fig. 2) is the best skin rejuvenation technology. This procedure boasts precision as it penetrates the targeted skin parts, including the epidermis, dermis, and subcutaneous fat. It has a cooling system to avert the risk of burns, with the penetration depth deep enough to avoid injury to the SMAS.

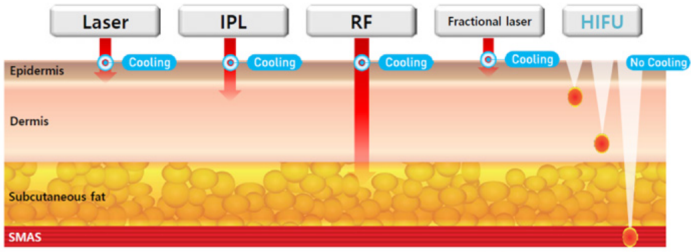

Figure 2: An illustration of the penetration depths of RF against other technologies.

Types of RF and Devices

Types

RF includes non-invasive and minimally invasive treatment options. Under the non-invasive type, heads that are monopolar, bipolar, multipolar, or non-ablative monopolar are used. In the fractional minimally invasive type, ablative fractional bipolar, ablative microneedles, and subcutaneous probes are used [11,12]. Monopolar RF delivers RF energy via a single electrode, while bipolar RF uses two electrodes concurrently. Multipolar RF distributes multiple RF energy waves in case a deeper tissue penetration is required [6]. Fractional RF creates microthermal zones with the energy dispensed at the measured portion [6]. Some of the devices used in this technology include Thermage, Pelleve, Endymed microneedle, VR52, Exilis, and INFINITIM RF machines [6]. Thermage uses a monopolar head, Exilis combines RF thermal energy with ultrasound technology, while INFITINIM combines RF energy with microneedling targeting the dermis. Based on this illustration, RF technology advancements demonstrate the significant progress made toward providing cosmetic solutions that benefit patients without the need for traditional surgical methods and other risky or ineffective energy-based treatments.

North American Menopause Society Statement

The North American Menopause Society has continuously made

significant statements regarding the use of energy-based devices in the treatment of GUS of menopause and related female reproductive comorbidities. Specifically, in 2020, the society highlighted that GUS of menopause encompasses estrogen deficiency-related symptoms affecting the genital and urinary structures [10]. In this statement, the society expressed diminishing confidence in conventional therapies involving prolonged use of topical estrogen, with patients' relapsing compliance leading to recurrent symptoms [10]. The society made this statement supporting novel light and energy-based technologies, revealing the interest and acceptance of treatment modalities that prioritize life-long patient outcomes.

Conclusion and Recommendations for Future Research

RF presents significant developments and valuable advancements in nonsurgical cosmetic gynecology from this literature review. Considering the fears of stakeholders in this subspecialty, particularly women, RF provides the most sought-after treatment approach, given its non-invasive nature compared to HIFU, laser-based technologies, and other procedures. With the bipolar type demonstrating effectiveness in treating GUS of menopause, the FDA's approval of this commonly used technology, the promising results for vaginal laxity, and vulval tightening treatment, RF emerges as novel skin rejuvenation technology with immense potential. Moreover, the reported improvement in stress urinary incontinence symptoms and the offer of a safer alternative in treating dyspareunia, vaginal dryness, and sexual dysfunction, as confirmed in studies involving both menopausal women without cancer and female cancer survivors, RF eliminates the uncertainty that other treatment modalities present regarding hormonal therapy alteration risks. The state-of-the-art equipment, including Thermage, Pelleve, and INFINITIM RF devices, complement the advancements of this technology, offering a range of solutions that match the type of RF treatment and patient expectations and improve outcomes.

Recommendations

Despite the promising developments in the advancement of RF technology, further studies are necessary to evaluate its long-term benefits and risks. In this regard, research examining the effectiveness of RF therapy for treating GUS of menopause is essential, considering that existing studies predominantly focus on evaluating the efficacy of other technologies, such as laser therapy, with limited or no details about RF [12]. In this light, this literature review cannot rule out the potential theoretical risk of long-term effects for non-ablative RF therapy, given that this effect is yet to be investigated in the studies consulted. Specifically, the theoretical risk involves the potential of RF thermal energy to promote the growth of tumor cells since the electromagnetic field generated during RF treatment can induce temperature elevation and increase blood circulation in the treated area, potentially facilitating cell proliferation, including malignant cells [14].

The FDA has also warned about the widespread and indiscriminate use of lasers and other energy-based devices for cosmetic procedures [10]. The agency fears a heightened risk, particularly in the application of RF for vaginal rejuvenation outside the certified and authorized cosmetic surgery field [10], given that GSM treatment depends on the severity of symptoms [15]. The concern stems from the significant increase in the use of these devices by both medical professionals and non-physicians without clear medical indications, leading to a heightened risk of serious adverse events, such as vaginal burns, scarring, painful sexual experiences, and chronic pain. This cautionary position further informs the need for future research to establish RF's long-term benefits and risks and the implications arising from the potential unregulated use of RF devices without precise medical indications or professional oversight [5].

Acknowledgement: Layla ali and Marya ali for their administrative assistance as well as their medical artistry and illustration included in this paper.

No conflicts of interest to declare

No financial support for this review

peer review : externally peer reviewed

References

1. Kolczewski P, Parafiniuk M, Zawodny P, et al. (2022) Hyaluronic Acid and Radiofrequency in Patients with Urogenital Atrophy and Vaginal Laxity. Pharmaceuticals 15: 1571-1571.
2. Mohammad S, Joshi KS, Mohammad S, Acharya N (2023) Aesthetic Gynaecology: What Women Want? Cureus 15.
3. Angelou K, Grigoriadis T, Diakosavvas M, Zacharakis D, Athanasiou S (2020) The Genitourinary Syndrome of Menopause: An Overview of the Recent Data. Cureus 12
4. Bujnak A, Crowder CA, Krychman ML (2021) Energy-Based Devices for Functional Vaginal Problems: Issues and Answers. Current Sexual Health Reports 13: 1-13.
5. Palacios S, Combalia J, Emsellem C, Gaslain Y, Khorsandi D (2019) Therapies for the Management of Genitourinary Syndrome of Menopause. Post Reproductive Health 26: 32-42.
6. Görgü M, Gökkaya A, Kizilkan J, Karanfil E, Dogan A (2019) Radiofrequency: Review of Literature. Turkish Journal of Plastic Surgery 27: 62.
7. Sarmento ACA, Lírio JF, Medeiros KS, et al. (2021) Physical Methods for the Treatment of Genitourinary Syndrome of Menopause: A Systematic Review. International Journal of Gynecology Obstetrics 153: 200-219.

8. Romero-Otero J, Lauterbach R, Aversa A, et al. (2020) Radiofrequency-Based Devices for Female Genito-Urinary Indications: Position Statements from the European Society of Sexual Medicine. The Journal of Sexual Medicine 17: 393-399.

9. Mezzana P, Garibay I, Fusco I (2022) Vaginal Bipolar Radiofrequency Treatment of Mild SUI: A Pilot Retrospective Study. Medicina 58: 181.

10. Soares-Júnior JM, Alves T, Aguiar LM, et al. (2021) Energy-Based Devices in Gynecology: The New Frontier for the Treatment of Genitourinary Syndrome of Postmenopause? Clinics 76: e3066.

11. Kamilos MF, Paula A, Alves C, Eleutério J, Gonçalves AK (2021) Microablative Fractional Radiofrequency as a Therapeutical Option for Genitourinary Syndrome of Menopause: Perspectives. Frontiers in reproductive health.

12. Arab M, Vasef M, Talayeh M, Hosseini MS, Farzaneh F, et al. (2023) The Effect of Radiofrequency Therapy on Sexual Function in Female Cancer Survivors (Gynecologic and Breast) and Non-Cancer Menopausal Women: A Single-Arm Trial. Journal of lasers in medical sciences 14: e32.

13. Wańczyk-Baszak J, Woźniak S, Milejski B, Paszkowski T (2018) Genitourinary Syndrome of Menopause Treatment Using Lasers and Temperature-Controlled Radiofrequency. Menopausal Review 17: 185-189.

14. Pinheiro C, Costa T, Amorim de Jesus R, et al. (2021) Intravaginal Non-ablative Radiofrequency in the Treatment of Genitourinary Syndrome of Menopause Symptoms: A Single-Arm Pilot Study. BMC Women's Health 21.

15. Kolczewski P, Kozłowski M, Cymbaluk-Płoska (2022) Micro-Focused Ultrasound Therapy in Patients with Urogenital Atrophy and Vaginal Laxity. Journal of Clinical Medicine 11: 6980.