J Turgut Ozal Med Cent
DOI: 10.5455/jtomc.2017.04.054 2017;24(3):274-8

Original Article

Efficacy of monopolar radiofrequency in middle and lower face laxity

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Abstract

Aim: In recent years, radiofrequency (RF) systems have become one of the most commonly used rejuvenation methods, especially in the skin of the mid-lower face. In this study, the efficacy of monopolar RF energy in mid-lower face skin sagging was evaluated.
Material and Methods: A total of 42 patients between the ages of 34 and 67 were included in this study. All patients underwent monopolar RF and were followed for 6 months. The monopolar RF energy level was determined based on the maximum level that each patient could tolerate. Patients were photographed with a digital camera before and 6 months after the procedure. The sagging grade of the mid-lower face before and after treatment was determined using the Merz skin laxity scale (MSLS). According to the MSLS, the level of laxity was divided into 5 groups: none, mild, moderate, severe, and very severe. The patient satisfaction levels were grouped into the following categories: not satisfied, minimally, well, and perfectly satisfied. Patients were monitored for side effects.
Results: After the RF treatment, the mean MSLS score decreased from 2.60±0.80 to 1.86±0.87. The decrease in skin laxity after treatment was statistically significant (p=0.0001173). Patient satisfaction was correlated with treatment response (p=3.7x10-7). Erythema and edema were observed in all 42 patients; two patients complained of fat tissue reduction.
Conclusion: Monopolar RF is an effective method for treating mid-lower face skin laxity. However, RF energy applied at high energy parameters may lead to thinning in the subcutaneous fat layer.

Keywords: Radiofrequency; Monopolar Radiofrequency; Laxity; Rejuvenation.

INTRODUCTION

Skin aging is a gradual process caused by both intrinsic and extrinsic factors. Many technologies have been developed to slow down and revert this process in recent years. Radiofrequency (RF) systems constitute an important part of these technologies and are especially used for laxity of the mid to lower face.

There are currently many RF systems available such as monopolar, unipolar, multipolar and fractional and many RF devices incorporating these systems. RF devices generally generate electrical current using electromagnetic radiation in the 3-300 GHz frequency range (1,2). This electrical current is converted to thermal energy in the tissue and causes volumetric tissue heating and subsequent collagen fiber contraction and thickening. Additionally, the fibroblasts stimulated by RF energy increase the production of the proteins forming

the dermal structure and especially collagen (3,4). Collagen-based fibrous septa separating fat lobules in the subcutaneous tissue are heated and cause more collagen denaturation and subcutaneous tissue contraction. Skin tightening and stretching are observed immediately after the procedure as a result of the contraction of the subcutaneous tissue. It has also been suggested that stem cell migration to the region where RF is administered occurs and that these stem cells differentiate into fibroblasts and increase the amount of collagen (5,6). The epidermis is heated to a maximum of 400C with cryogenic cooling systems during the procedure while the dermis is heated to 650C-750C for collagen denaturation. Heating to under 650C does not cause a significant decrease in laxity and wrinkles while significant heating can lead to erosion, atrophy, scar and pigmentation (7-10).

The neocollagenesis triggered by RF energy continues for an average of 3-6 months after the procedure. One should therefore wait for this period to pass for the maximum effect (11-14). RF energy especially decreases mild to moderate skin laxity but does not affect epidermal melanin as it is not specific to the chromophore. It can therefore be used for all skin types (1).

The applications vary based on the RF system used. One electrode emits RF while the other acts as the ground in monopolar RF technology (15). The effect of monopolar

Received: 04.04.2017 **Accepted:** 17.04.2017
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RF on laxity depends on all the factors above but mainly occurs as a result of uniform volumetric heating of the dermis (12).

We evaluated the long-term effectiveness of monopolar RF energy on mid and lower face laxity in this study.

MATERIALS and METHODS

We retrospectively evaluated 57 patients treated with monopolar RF for mid and lower face sagging. We included 42 patients followed-up for 6 months in the study. Pregnant and lactating women, and patients with collagen tissue disease, diabetes or heart failure, a pacemaker or metal implant in the body and active infection were excluded. This study was conducted in accordance with the principles of the 2008 Helsinki Declaration and informed consent was obtained from all patients before the procedure. All patients were administered topical anesthesia (EMLAR; Astra-Zeneca, Södertalje, Sweden) for 40 minutes before the procedure. They all then underwent a single session of monopolar RF (Thermage CPT, Solta Medical, Hayward, CA, USA) with a facial tip of 3 cm2. The monopolar RF energy grade was performed at the maximum severity that the patient could tolerate. Patients were photographed with a digital camera before and 6 months after the procedure. The degree of sagging in the mid and lower face before and after treatment was determined using the Merz skin laxity scale (MSLS). Accordingly, the laxity level was divided into 5 groups as (0) none; (1) mild; (2) moderate; (3) severe and (4) very severe (Figure 1).

Figure 1. Merz Skin Laxity Scale

Patients were also divided into two groups by age as 34-50 years and 51-67 years to evaluate the age-related effectiveness of the treatment. The treatment satisfaction level was evaluated as 1: not satisfied (0%-24%); 2: minimally satisfied (25%-49%), 3: well satisfied (50%-74%) and 4: perfectly satisfied (>75%). The pain levels were identified by using a pain scale between 0 and 10. The side effects developing in the acute and chronic period were also evaluated.

Statistical analysis

All statistical analyses were performed with R 3.3.0. Pre and post-treatment Merz laxity values were calculated with Welch's t-test. Similarly, Welch's t-test was used to compare the response to treatment between the two age groups. The relationship between response to treatment and patient satisfaction was calculated with linear regression analysis.

RESULTS

The patients consisted of 31 (73.8%) females and 11 (26.2%) males. The mean age was 51.9±9.6 (34-67) years. The pre-treatment MSLS evaluation values were mild in 4 (9.5%), moderate in 13 (31%), severe in 21 (50%) and very severe in 4 (9.5%). Mean pre-treatment MSLS value was 2.60±0.80. There was no laxity in 3 patients (7.14%), while it was mild in 10 (23.81%), moderate in 19 (45.23%) and severe in 10 patients (23.81%) at the evaluation 6 months after the treatment. There was no patient with very severe laxity at the post-treatment 6th month and the mean MSLS value had regressed to 1.86±0.87 (Figure 2-4). A statistically significant decrease was present in laxity values after RF use (p=0.0001173) (Table 1). The response to treatment of the 19 patients aged below 51 years and the 23 patients aged 51 or older showed no statistically significant difference (p=0.4984).

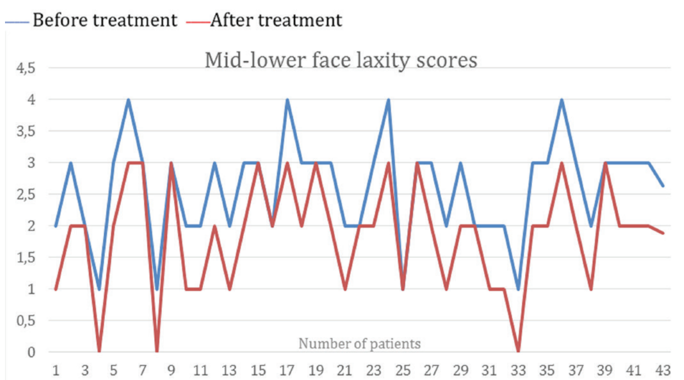
Figure 2. a) Pre-treatment b) Decrease in nasolabial sulcus prominence together with increase in mid-face volume after the treatment.

Figure 3. a) Pre-treatment b) Improvement in chin contour together with decrease in submental fat tissue and lines in the neck after the treatment

Patient satisfaction was similar to response to treatment (p=3.7x10-7). Accordingly, 3 (7.14%) patients were not satisfied with the treatment, 11 (26.19%) were minimally satisfied, 20 (47.61%) were well satisfied and 8 (19.04%) were perfectly satisfied. Mean pain level reported was 6.3±2.1 (0-10) on pain evaluation, despite the local anesthesia. The most common side effects were erythema and edema that regressed within one day on average. Edema regressed on the third day in a patient who also reported photosensitivity. Two patients reported a decrease in facial fat tissue at the 6th month evaluation.

Figure 4. a) Pre-treatment b) Improvement in chin contour together with increase in mid-face volume after the treatment.

Table 1. Mid-lower face laxity scores before and after treatment



DISCUSSION

The elasticity and tightness of the skin is mainly determined by the complex network between collagen and elastin fibers. This complex fiber network decreases and the appearance and function of the skin changes as the skin ages with time (1, 8). Fine lines, skin folds, distinctive sulci, deep wrinkles and laxity are all among the signs of skin aging. While superficial laxity signs are mainly thin lines and wrinkles, soft tissue laxity appears as deep folds and sagging. Signs that have the most effect on making the person appear aged have been determined as mid and lower face laxity and wrinkles in studies. New non-invasive technologies have therefore recently been developed especially for mid and lower face signs of aging (14,16). RF technology is one of these systems. Although RF energy has been used for many years in many fields of medicine for various purposes, FDA approved use for rejuvenation has only been for the past decade. Despite being a new technology, it has become the most commonly used non-invasive method for mild to moderate skin sagging (1). RF treatment has been useful for tightness of the cheek and jaw, jaw line prominence, skin surface improvement, eyelid elevation, and regression of fine lines (17-19). Kushikata et al. found a gradual improvement in the majority of patients when they evaluated the effectiveness of RF for lower cheek and jaw sagging. They reported the most appropriate time for evaluating the maximum effectiveness of RF energy to be 5-6 months after the treatment. They found the most important indicator for determining the surgical RF energy level to be the pain threshold of the individual (20). We planned our treatment by considering the recommendations of Kushikata et al. regarding energy level selection and evaluation of treatment effectiveness. We used moderate to high energy parameters according to the pain threshold of the patients.

Adults are thought to lose an average of 1% of the amount of collagen each year due to increased collagen breakdown and decreased collagen synthesis (1). Collagen denaturation, fibril contraction and tissue thickening are observed in the tissue that has been warmed in the acute phase with RF energy. Zelickson et al. have shown collagen mRNA synthesis in the skin to increase after RF treatment. They reported this increase to be 2.4 times higher on the first day after treatment and 1.7 times higher one week later when compared with the control group (21). Besides, neocollagenesis related to the inflammatory wound recovery response has also been shown to usually continue for more than one year (22).

Radiofrequency technology is based on the heating of the specific layers of the skin to obtain the desired effect. These systems where more superficial layers are targeted for applications to the face and neck are also used in body shaping. The dermis is the primary target for face and neck applications but deeper tissues are targeted to affect subcutaneous fat tissue in body shaping (7,14). Monopolar, unipolar, multipolar and fractional RF systems according to the number of electrodes used are currently available together with a large number of devices using these systems (16). Unfortunately, no general treatment protocol can be established for these devices with various systems and energy parameters due to the lack of comparative studies with extensive series. Each system has particular advantages and disadvantages. The main advantage of monopolar RF systems is that they can be applied to the electrode surface with high energy parameters. A single session could therefore be sufficient for the desired effect. However, it has been reported in recent years that a second session performed about two months after the first one could increase treatment effectiveness (7,16,23). These effects have been suggested to continue for an average of 18 to 36 months depending on the natural aging process of the person and the environmental factors (7,14). Repeating the monopolar RF applications two years later on is usually recommended and there is no obstacle to a surgical procedure. RF can also be combined with most of the other non-invasive procedures (7,24).

Monopolar RF systems that apply RF energy at high frequency cause pain at relatively high intensity (1). Our patients similarly described moderate to high degree of pain despite topical anesthesia. The most common side effects observed with monopolar RF procedures in the acute period are erythema and edema (18). We also observed erythema and edema that did not affect social and business life in almost all our patients. Another handicap of single-session RF treatment at high frequencies is subcutaneous tissue melting at various rates. Decreasing the energy level and using multiple passes have been recommended to prevent these side effects (21,25). Two patients in our study complained of subcutaneous tissue reduction and collapse of the face after the procedure. However, both patients had lost about 10% of their body weight within the 6 months after the procedure. Therefore, the reduction of facial fat tissue was not specifically linked to the RF procedure.

The collapse of the face may be a synergistic effect of the RF energy and weight loss. In general, temporary and/or permanent skin surface defects appear as skin collapse, notching and pitting. It has been reported to develop most commonly after monopolar RF treatment with high energy levels and with focused ultrasound systems. However, atrophy of the subcutaneous fat tissue may develop after cold application (9,26).

Treatment is difficult in cases with marked collagen damage. There may be a partial improvement in time but dermal fillers or autologous fat injections are required in resistant cases. We recommended fillers to patients who describe fat melting. We observed that the level of satisfaction increased significantly after filler use in a patient who accepted the procedure.

The effect of RF can vary according to the degree of skin laxity. RF energy was found to be more effective in patients who are younger and have less laxity (7,27).

The reasons are thought to be slowing of wound healing and low neocollagenase levels due to the aging process. Skin laxity increased in proportion to age in our study, but we observed no statistically significant difference between the age groups in terms of response to the treatment. There was no significant decrease in the laxity level with treatment in patients older than 65 years and patients with severe skin laxity. The MSLS value decreased from very severe before treatment only to severe after treatment in 4 patients. This patient group should therefore be informed that surgical procedures could be more beneficial. Patients who do not want to undergo surgery and do not have high expectations can be treated with RF by itself or combined with other non-invasive procedures.

CONCLUSION

Although treatment with RF energy is not as successful as surgical procedures, it is often used for rejuvenation as it does not require a recovery period and the complication risk is low. Many problems encountered with surgical procedures can be avoided with RF systems and these systems are especially effective for mild to moderate skin sagging. Usage at high frequencies can cause atrophy of fat tissue, especially in patients with a thin skin structure. Suitable patients should therefore be selected and the treatment individually planned. The surgical option should be considered in individuals with advanced age, significant laxity, and high expectations.

REFERENCES

1. Elsaie ML. Cutaneous remodeling and photorejuvenation using radiofrequency devices. Indian J Dermatol 2009;54(3):201-5.
2. Korkmaz S. Kozmetik Dermatolojide Radyofrekans. Turkiye Klinikleri J Cosm Dermatol-Special Topics 2016;9(1):39-43.
3. Suh DH, Byun EJ, Lee SJ, Song KY, Kim HS. Clinical efficacy and safety evaluation of a novel fractional unipolar radiofrequency device on facial tightening: A preliminary report. J Cosmet Dermatol 2017;13(1):1-6.
4. Fitzpatrick R, Geronemus R, Goldberg D, Kaminer M, Kilmer S, Ruiz-Esparza J. Multicenter study of noninvasive radiofrequency for periorbital tissue tightening. Lasers Surg Med 2003;33(4):232-42.
5. Yokoyama Y, Akita H, Hasegawa S, Negishi K, Akamatsu H, Matsunaga K. Histologic study of collagen and stem cells after radiofrequency treatment for aging skin. Dermatol Surg 2014;40(4):390-7.
6. Mvula B, Mathope T, Moore T, Abrahamse H. The effect of low level laser irradiation on adult human adipose derived stem cells. Lasers Med Sci 2008;23(3):277-82.
7. Polder KD, Bruce S. Radiofrequency: thermage. Facial Plast Surg Clin North Am 2011;19(2):347-59.
8. Weiss RA, Weiss MA, Munavalli G, Beasley KL. Monopolar radiofrequency facial tightening: a retrospective analysis of efficacy and safety in over 600 treatments. J Drugs Dermatol 2006;5(8):707-12.
9. Narins RS, Tope WD, Pope K, Ross EV. Overtreatment effects associated with a radiofrequency tissue-tightening device: rare, preventable, and correctable with subcision and autologous fat transfer. Dermatol Surg 2006;32(1):115-24.
10. de Felipe I, Del Cueto SR, Pérez E, Redondo P. Adverse reactions after nonablative radiofrequency: follow-up of 290 patients. J Cosmet Dermatol 2007;6(3):163-6.
11. Lolis MS, Goldberg DJ. Radiofrequency in cosmetic dermatology: a review. Dermatol Surg 2012;38(11):1765-76.
12. Alster TS, Lupton JR. Nonablative cutaneous remodeling using radiofrequency devices. Clin Dermatol 2007;25(5):487-91.
13. Gold MH, Goldman MP, Rao J, Carcamo AS, Ehrlich M. Treatment of wrinkles and elastosis using vacuum-assisted bipolar radiofrequency heating of the dermis. Dermatol Surg 2007;33(3):300-9.
14. Abraham MT, Vic Ross E. Current concepts in nonablative radiofrequency rejuvenation of the lower face and neck. Facial Plast Surg 2005;21(1):65-73.
15. Acar EM, Aksakal AB. Radyofrekans ile Gençleşme ve Selülit Tedavisi. Turkiye Klinikleri J Cosm Dermatol-Special Topics 2012;5(4):5-7.
16. Jiang Y, Zhang X, Lu Z, Gold MH. Assessment of efficacy and safety of a fractionated bipolar radiofrequency device for the treatment of lower face wrinkles and laxity. J Cosmet Laser Ther 2016;21(1):1-20.
17. Kerwin LY, El Tal AK, Stiff MA, Fakhouri TM. Scar prevention and remodeling: a review of the medical, surgical, topical and light treatment approaches. Int J Dermatol 2014;53(8):922-36.
18. Beasley KL, Weiss RA. Radiofrequency in cosmetic dermatology. Dermatol Clin 2014;32(1):79-90.
19. Adatto MA, Adatto-Neilson RM, Morren G. Reduction in adipose tissue volume using a new high-power radiofrequency technology combined with infrared light and mechanical manipulation for body contouring. Lasers Med Sci 2014;29(5):1627-31.

20. Kushikata N, Negishi K, Tezuka Y, Takeuchi K, Wakamatsu S. Non-ablative skin tightening with radiofrequency in Asian skin. Lasers Surg Med 2005;36(2):92-7.
21. Zelickson BD, Kist D, Bernstein E, Brown DB, Ksenzenko S, Burns J, et al. Histological and ultrastructural evaluation of the effects of a radiofrequency-based nonablative dermal remodeling device: A pilot study. Arch Dermatol 2004;140(2):204-9.
22. Goldman MP, Alster TS, Weiss R. A randomized trial to determine the influence of laser therapy, monopolar radiofrequency treatment, and intense pulsed light therapy administered immediately after hyaluronic acid gel implantation. Dermatol Surg 2007;33(5):535-42.
23. Taub AF, Tucker RD, Palange A. Facial tightening with an advanced 4-MHz monopolar radiofrequency device. J Drugs Dermatol 2012;11(11):1288-94.
24. Greene RM, Green JB. Skin tightening technologies. Facial Plast Surg 2014;30(1):62-7.
25. Fritz M, Counters JT, Zelickson BD. Radiofrequency treatment for middle and lower face laxity. Arch Facial Plast Surg 2004;6(6):370-3.
26. Bogle MA, Dover JS. Tissue tightening technologies. Dermatol Clin 2009;27(4):491-9.
27. Carruthers J, Fabi S, Weiss R. Monopolar radiofrequency for skin tightening: our experience and a review of the literature. Dermatol Surg 2014;40(12):168-73.