

Thermage: Monopolar Radiofrequency

Monopolar radiofrequency treatment may be appropriate for patients who desire skin tightening but will not tolerate surgery and/or downtime. Patients generally can expect a 5% to 20% improvement, but results in any particular group are unpredictable. Key to this treatment is providing patients with detailed information to ensure that expectations are realistic. (*Aesthetic Surg J* 2005;25:638-642.)

As a plastic surgeon, my first choice in treating skin laxity is using standard aesthetic surgery techniques. However, for patients who do not want to undergo surgery and cannot or will not tolerate any downtime, monopolar radiofrequency (MRF) may be a useful treatment. Here, I write exclusively about the Thermage ThermaCool device (Thermage Inc., Hayward, CA).

Thermage MRF, as discussed in multiple peer-reviewed scientific and clinical studies, has proven to be the best option for nonsurgical tissue tightening. Other radiofrequency (RF) devices on the market claim effectiveness but, being bipolar, cannot produce a uniform volumetric heating that is at all comparable with MRF. Further, the bipolar RF devices are frequently combined with other light-based technologies, making it difficult to assess what role, if any, bipolar RF plays in treatment outcomes.

The goal of this article is neither to endorse nor criticize Thermage ThermaCool treatment, but to discuss how this technology may be used in an aesthetic surgery practice. In considering its use, it is important to understand some basic RF concepts as well as its mechanism of action (see sidebar and Figure 1).

Treatment Protocol

When Thermage initially came on the market, the treatment protocol favored maximum tolerable energy applied in a single pass. The problems resulting from this approach were high variability in effectiveness and painful treatments. In addition, an infrequent but worrisome number of tissue depressions were reported,

occurring primarily over the thin skin of the temple and the mid cheek. The only occurrence of this complication in my practice can be seen in Figure 2. The problem was corrected with a single fat graft.

The new treatment protocol is not only recommended by Thermage but also by a consensus conference sponsored by Thermage (Orlando, FL, April 2005) of frequent Thermage users from multiple specialties. This new protocol is based on the science demonstrating greater effect on tissue with multiple passes at lower energies and also on research by Ross¹ showing the special tissue effect on fibrous septae:

1. *Patient feedback about heat sensation is a valid and preferred method for selecting the optimal amount of energy to use, and the target is between 2 and 2.5 on a pain scale of 1 to 4, with 1, none to mild; 2, mild to moderate; 3, moderate to severe; and 4, intolerable.* Although pain is used as feedback, severe pain must be avoided, not only for reasons of patient comfort but, more importantly, for patient safety. Excessive pain indicates excessive heating of the tissues. It is important to note that local tissue impedance varies from patient to patient; therefore, attention to the pain level of each patient should be the utmost priority.
2. *Multiple passes at moderate energy settings yield substantial and consistent efficacy.* In my practice, an average of 150 to 300 high-energy pulses laid down with 1 or 2 passes were used per patient with the original protocol. With the new protocol, we now average 700 to 850 moderate-energy pulses, using as many as 5 to 6 passes over selected areas.
3. *Treating to a clinical end point of visible tightening and contouring maximizes predictability and long term results.* I treat half of the face to the point of visible tightening. When this immediate end point is



Jay A. Burns, MD, Dallas, TX,
is a board-certified plastic surgeon and an ASAPS member.

Radiofrequency Technology and Mechanism of Action

Heat is generated because of the natural resistance of tissue to the movement of electrons within an RF field (Ohm's Law). This resistance, called *impedance*, creates heat relative to the amount of current (amps) and time (seconds). With RF, one must consider not only the depth of energy penetration, but also that the soft tissue is made up of multiple layers, including dermis, fat, muscle, and fibrous tissue, all with varying resistance to the movement of RF energy. This mechanism is quite different from the photothermal effect produced by lasers.

The clinical application of monopolar radiofrequency (MRF) may be simply described. An electrical current is passed from the RF energy source through a monopolar electrode in the handpiece; the current then continues through the patient to the grounding pad, which completes the circuit.

The mechanism of action is 2-fold in nature: an initial immediate collagen contraction and a secondary wound healing response, which involves collagen deposition and remodeling with tightening over time. A sparse pattern of collagen denaturation contributes to the immediate skin contraction, while leaving enough healthy tissue to ensure healthy wound healing. Furthermore, multiple passes at lower energy levels appear to elicit a more substantial tissue effect than a single pass at higher energy levels (Figure 1).

It is important to understand that fibrous septa are heated more than the surrounding fat; both clinical and mathematical models support this concept. The estimate of the temperature rise for fibrous septa is between 1.4 and 3.0 times that of fat, as a significant part of the RF energy moving through fat moves along the fibrous septa as the path of least resistance. This increased amount of current coursing through the fibrous septa is responsible for the selective heating of these septae.

Therefore, when visualizing the effect of RF skin tightening, visualize tightening in the *x-y* axis within the dermis; however, this unique selective tightening to the fibrous septa can create tightening in a *z* dimension as well, without damaging the fat if ideal parameters are used. Histologic studies by Barba and Esparza demonstrated that there is new collagen formation in dermal remodeling that is carried out over several months. Four months posttreatment there is noticeably increased dermal density. The epidermis has also thickened, secondary to the wound-healing process.

achieved, effectiveness is enhanced and variability is reduced (Figure 3).

Results

Using these new guidelines, the consensus conference advisory panel reported greatly enhanced results. The percentage of patients who saw any change at all at 6 months increased from 54% to 92%, respectively. Although these results were not peer-reviewed, there have been many peer-reviewed publications that support improvement with Thermage in almost all skin parameters measured.

The amount of clinical improvement with Thermage continues to vary. I have been unable to predict treatment results in any particular patient group. Figure 4 represents one of the best published results I have seen.² I have not been able to achieve a comparable result. Although this kind of dramatic result is possible, it should not be expected in most patients. The patient in Figure 5, B is more representative of the *noticeable* result from Thermage that I commonly see in my practice. This result, although subtle, is nevertheless achieved without significant downtime. In an effort to avoid overselling the

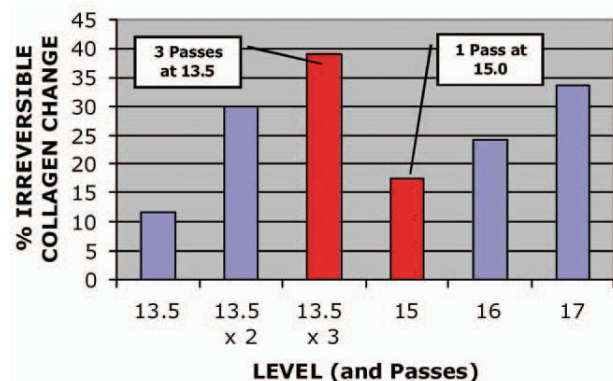


Figure 1. Immediate collagen change with 3 passes at moderate treatment levels exceeds that of a single pass at a higher treatment level. Three passes at 13.5 (97 J) denatured more than twice as much collagen as a single pass at level 15 (124 J). This study helps explain why a greater efficacy is now observed with the new multiple-pass treatment algorithm. Reprinted with permission from Thermage.

treatment, and to give patients realistic expectations, I show patients similar results.

The keys to success with Thermage are patient selection and management of patient expectations. In my practice, any patient who desires tightening but refuses



Figure 2. **A**, Pretreatment view of a 55-year-old woman. **B**, Posttreatment view 6 months after treatment at level 16 (144 J) to 17 (166 J), on brow only, to correct surface irregularities. **C**, Posttreatment view 1 year following fat injections to correct dimpling on left lateral brow, 2.5 years post-Thermage.



Figure 3. **A**, Untreated facial half in a 54-year-old woman. **B**, Treated facial half, used for assessment after Thermage treatment with 250 repetitions, up to 5 passes, with levels between 61.5 (75 J) and 63.5 (107 J) with 1.5 cm² medium-depth tip in the lower periorbital region, mid/lower face, and neck. Reprinted with permission from Thermage.



Figure 4. **A**, Pretreatment view of a 37-year-old woman. **B**, Posttreatment view 2 months after a second Thermage treatment. Reprinted with permission of Wiley-Liss Inc., a subsidiary of John Wiley & Sons, Inc.²

surgery is a potential candidate for Thermage. I emphasize to patients the variability of results and express that 80% to 85% will see some improvement, but improvement may be subtle. One can expect a 5% to 20%

improvement in tightening. A lucky few may receive more improvement, and an unfortunate few may see no appreciable tightening. I discuss this with my patients in great detail. Presented with frankness and honest



Figure 5. A, Pretreatment view of a 35-year-old woman. **B,** Posttreatment view 3 months after undergoing Thermage treatment of midlower face and neck at 13 (89 J) to 15 (124 J) with 1-cm tip.



Figure 6. A Pretreatment view of a 74-year-old woman. **B,** Posttreatment view 6 months after undergoing multiple passes. Each leg was treated at 13.5 (97 J) to 14 (106 J), 300 pulses, up to 3 passes on the upper thigh and knee using the grid.

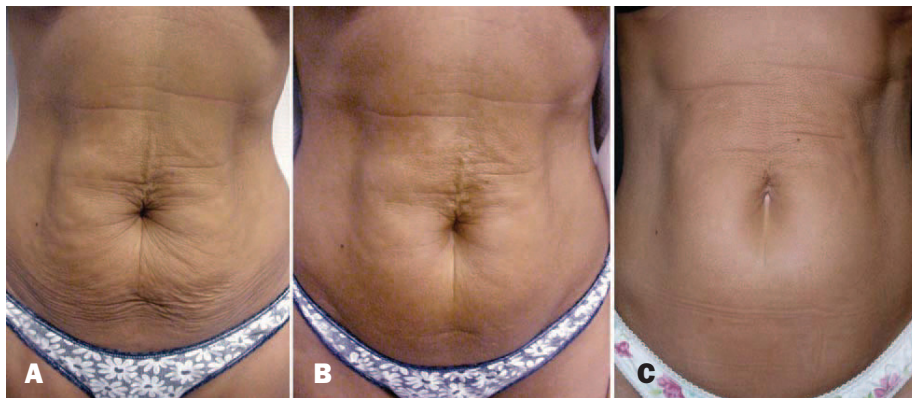


Figure 7. A, Pretreatment view of a 51-year-old woman. **B,** Posttreatment view immediately after a single Thermage treatment with multiple passes. **C,** View 2 months after treatment. Reprinted with permission from Thermage.

informed consent, Thermage MRF has earned a credible role in my practice.

Currently, you can target different tissue depths by altering treatment tip sizes and pattern of the dielectric thermocouple. In the future, larger tips will also expedite treatment times. Use of the device in areas other than the face has been accomplished with some success (Figures 6 and 7). There is great interest in combining Thermage with other modalities, such as superficial and standard laser resurfacing, Fraxel, Botox, and fillers. Recent porcine studies have demonstrated the safety of using Thermage MRF with fillers.¹

Discussion

My practice consists of a full array of services, ranging from basic skin care, to comprehensive nonsurgical technology, to aggressive surgical options. Thermage may be useful to the clinician who wants to offer a full-service practice to patients who absolutely refuse surgery and have realistic expectations about this treatment.

However, for the surgeon with a more conservative approach, Thermage may not offer enough benefit to warrant its use. It does require time and effort to manage expectations, providing high quality and detailed information to guarantee informed consent. In my practice, many patients who have been treated with Thermage have then undergone appropriate surgical procedures, satisfied that they had first explored all nonsurgical options. Thermage has also played a role for postsurgical patients who want no further surgery but welcome nonsurgical tightening. Further refinements in this protocol and technology will greatly enhance the effectiveness and predictability of this treatment.

Each aesthetic surgery practice has a unique personality and its own biases. It is unfortunate that some physicians have misled the public by presenting Thermage as a "nonsurgical face lift." This position is false, misleading, and strongly opposed by the company itself. ■

Editor's note: Dr. Burns is a member of the scientific advisory board of Thermage and Cutera. He has received speaking honorariums and research funding from Thermage. He has also received teaching honorariums from Thermage, Lumemis, Reliant, and Sciton. He owns no stock in Thermage.

Reprint requests: Jay A. Burns, MD, 411 N. Washington, Suite 6000, Dallas, TX 75246.

Copyright © 2005 by The American Society for Aesthetic Plastic Surgery, Inc. 1090-820X/\$30.00

doi:10.1016/j.asj.2005.09.017

References

1. Abraham M, Ross EV. Current concepts in nonablative radiofrequency rejuvenation of the lower face and neck. *Facial Plast Surg* 2005;21:65-73.
2. Weiss RA, Weiss MA, Beasley KL, Munavelli G. Our approach to nonablative treatment of photoaging. *Lasers Surg Med* 2005;37:2-8.

Bibliography

Abraham M, Chiang S, Keller G, Rawnsley J, Blackwell K, Elashoff D. Clinical evaluation of nonablative radiofrequency facial rejuvenation. *J Cosmet Laser Ther* 2004;6:136-144.

Alster TS, Tanzi E. Improvement of neck and cheek laxity with a nonablative radiofrequency device: a lifting experience. *Dermatol Surg* 2004;30:503-507. Hughes P, comment in *Dermatol Surg* 2004;30:1430.

Bassichis BA, Dayan S, Thomas JR. Use of a nonablative radiofrequency device to rejuvenate the upper one-third of the face. *Otolaryngol Head Neck Surg* 2004;130:397-406.

Fitzpatrick TB. The validity and practicality of sun-reactive skin types I through VI. *Arch Dermatol* 1988;124:869-873.

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;33:232-242.

Fritz M, Counters JT, Zelickson BD. Radiofrequency treatment for middle and lower face laxity. *Arch Facial Plast Surg* 2004;6:370-373.

Hsu TS, Kaminer MS. The use of nonablative radiofrequency technology to tighten the lower face and neck. *Semin Cutan Med Surg* 2003;22:115-123.

Iyer S, Suthamjariya K, Fitzpatrick RE. Using a radiofrequency energy device to treat the lower face: a treatment paradigm for a nonsurgical facelift. *Cosmet Dermatol* 2003;16:37-40.

Jacobson LG, Alexiades-Armenakas M, Bernstein L, Geronemus RG. Treatment of nasolabial fold and jowls with a noninvasive radiofrequency device. *Arch Dermatol* 2003;139:1371-1372.

Koch RJ. Radiofrequency nonablative tissue tightening. *Facial Plast Surg Clin North Am* 2004;12:339-346.

Nahm WK, Su TT, Rotunda AM, Moy RL. Objective changes in brow position, superior palpebral crease, peak angle of the eyebrow, and jowl surface area after volumetric radiofrequency treatments to half of the face. *Dermatol Surg* 2004;30:922-928.

Narins DJ, Narins RS. Non-surgical radiofrequency facelift. *J Drugs Dermatol* 2003;2:495-500.

Ruiz-Esparza J. Noninvasive lower eyelid blepharoplasty: a new technique using nonablative radiofrequency on periorbital skin. *Dermatol Surg* 2004;30:125-129.

Ruiz-Esparza J, Gomez JB. The medical face lift: a noninvasive, nonsurgical approach to tissue tightening in facial skin using nonablative radiofrequency. *Dermatol Surg* 2003;29:325-332.

Ruiz-Esparza J, Gomez JB. Nonablative radiofrequency for active acne vulgaris: the use of a deep dermal heat in the treatment of moderate to severe actinic acne vulgaris (thermo-therapy): a report of 22 patients. *Dermatol Surg* 2003;29:333-339.

Zelickson BD, Kist D, Bernstein E, et al. Histological and ultrastructural evaluation of the effects of a radiofrequency-based nonablative dermal remodeling device: a pilot study. *Arch Dermatol* 2004;140:204-209.