Use of Minimally Invasive Radiofrequency-Assisted Lipolysis as a Novel Treatment of Grade 2 and Grade 3 Cellulite

Mark H. Peters, M.D.

Germantown, Tenn.

Summary: Cellulite is a common condition, and laxity in the superficial fascial system contributes significantly to its appearance in the thigh and buttock areas. Components of the superficial fascial system such as the fibrous septae and adipose tissue are targets for an effective treatment to improve the appearance of cellulite. This preliminary report demonstrates the use of radiofrequency-assisted lipolysis as a novel treatment approach to improve the appearance of cellulite by tightening the superficial fascial system. Ten female patients with grade 2 and grade 3 cellulite of the thighs or buttocks were included in this study. Minimally invasive application of bipolar radiofrequency energy to the affected areas was performed. Predetermined internal thermal endpoints at multiple tissue levels and different directions were reached in the treated tissues. Aspiration of the coagulated adipose tissue was performed using a small-diameter cannula to minimize damage to the connective tissues. Pretreatment and 6-month postoperative photographs of 70 different body areas were randomized and scored by five blinded evaluators. Using the Photonumeric Cellulite Severity Scale, scoring of preoperative and postoperative photographs revealed statistically significant differences in all body area comparisons. The magnitudes of the differences in all scored body areas were considered large, and mean differences were all positive, indicating an improvement across time. Grade 2 and grade 3 cellulite of the thighs and buttocks can be effectively treated using radiofrequency-assisted lipolysis technology to decrease the laxity of the superficial fascial system. (*Plast. Reconstr. Surg.* 150: 809, 2022.)

Cellulite produces an undesirable cosmetic appearance and a negative impact on self-esteem and quality of life.[1,2] The topographic changes associated with cellulite can be explained by changes to the connective tissue network, or superficial fascial system, that is responsible for a variety of contour landmarks on the body surface depending on its anatomical relationship to fat and muscle fascia. The primary change is laxity, which is most pronounced in areas where the superficial fascial system is least adherent in areas such as the upper outer thigh. This cellulite of laxity is the result of gravitational forces on the vertical and oblique fibrous septae extending from the superficial fascial layer to the overlying dermis.[3,4] Surgical lifting techniques designed to tighten the superficial fascial system have been effective in correcting the laxity and treating cellulite.[3]

BodyTite (InMode Ltd., Irvine, Calif.) is a minimally invasive platform using radiofrequency-assisted lipolysis to produce three-dimensional tissue contraction and lipocoagulation.[5,6] Although other energy-based systems using noninvasive radiofrequency or laser have demonstrated effective tightening abilities and clinical outcomes,[7–9] they are much less efficient in correcting the superficial fascial system laxity. The purpose of this preliminary report is to present BodyTite as a novel treatment of grade 2 and grade 3 cellulite on the thighs and buttocks using radiofrequency-assisted

From private practice.
Received for publication September 21, 2020; accepted November 11, 2021.

DOI: 10.1097/PRS.0000000000009567

Disclosure: *The author has no financial interest to declare in relation to the content of this article.*

Related digital media are available in the full-text version of the article on www.PRSJournal.com.

lipolysis technology to correct laxity of the superficial fascial system.

PATIENTS AND METHODS

Patients and Study Design

Ten healthy female patients with localized lipodystrophy in the medial or lateral thigh and grade 2 or grade 3 cellulite in the lower extremity or buttocks were included in this report. The average patient age was 49 years and the average baseline weight and body mass index were 146 pounds and 28 kg/m^2, respectively.

Results were evaluated using photographic assessment of cellulite in the area treated with BodyTite and adjacent areas. Preoperative and 6-month postoperative photographs were taken of each patient then matched for lighting and content. Paired areas were scored by five medical professionals trained to evaluate the photographs based on the Photonumeric Cellulite Severity Scale.[10] The statistical testing used the standard value of $p = 0.05$. A series of tests were conducted including the Shapiro-Wilk test to determine the normality of the distributions, a paired samples t test, and a related-samples Wilcoxon signed rank test where appropriate. All statistical and descriptive analyses were conducted using IBM SPSS Version 22 software (IBM Corp., Armonk, N.Y.).

Device and Treatment

The single-use handpiece is configured with an internal electrode that delivers radiofrequency current with a coagulative density directed to a larger external electrode with a noncoagulative transepidermal radiofrequency current density. The external electrode moves along the surface of the skin directly above the internal probe tip and radiofrequency energy flows between the two electrodes in a localized, confined manner. Both the internal and external electrodes have sensors to control radiofrequency emission and cutoff, using real-time temperature and impedance monitoring to achieve effective internal thermal endpoints and ensure skin safety.

All procedures were performed using local anesthesia with oral diazepam as necessary. Each patient was marked in the standing position. The patients were placed in the lateral decubitus position using a Midine Positioning Pillow (HK Surgical, San Clemente, Calif.) and then prepared and draped using sterile technique. The outlined treatment areas were infiltrated using tumescent fluid containing 800 to 1000 mg of lidocaine and 1 cc of 1:1000 epinephrine in 1 liter of lactated Ringer solution. Radiofrequency-assisted lipolysis 20-W disposable handpieces were used in all cases. Thermal endpoints were set at 38°C externally and 70°C internally.

Treatment areas were divided into zones. Two 3-mm access incisions were placed to allow each zone to be treated in a vertically sequential multilevel treatment fashion starting with the deepest layer. Internal thermal endpoints of approximately 70°C were attained before proceeding to more superficial layers. Cross-hatching of the intermediate and superficial layers in each zone to the same internal thermal endpoint was then performed. The amount of energy applied to each zone ranged from 0.110 to 0.150 kJ/cm^2. The buttock was treated only in the superficial layers of the superficial fascial system to avoid loss of projection or contour defects. [**See Figure, Supplemental Digital Content 1**, which shows an illustration of the BodyTite handpiece and cross-hatching of the lateral thigh using two access incisions (© 2020 Emily Ullo Steigler), ***http://links.lww.com/PRS/F355***. **See Figure, Supplemental Digital Content 2**, which shows an illustration of the BodyTite handpiece position for applying radiofrequency-assisted lipolysis to the lateral thigh from the lateral thigh access incision (© 2020 Emily Ullo Steigler), ***http://links.lww.com/PRS/F356***. **See Figure, Supplemental Digital Content 3**, which shows an illustration of the BodyTite handpiece position and cross-hatching of the lower buttock area (© 2020 Emily Ullo Steigler), ***http://links.lww.com/PRS/F357***. **See Figure, Supplemental Digital Content 4**, which shows an illustration of the BodyTite handpiece position when applying radiofrequency-assisted lipolysis to the lower buttock from the lateral thigh access incision (© 2020 Emily Ullo Steigler), ***http://links.lww.com/PRS/F358***.]

Aspiration of fat in the deep layer was performed using a standard single-hole, 4-mm cannula. The intermediate and superficial fatty layers were contoured using a standard single-hole, 3-mm cannula to minimize disruption of the connective tissue within the superficial fascial system, theoretically reducing the tightening and lifting effects on the tissues.[11] [**See Video 1 (online)**, which demonstrates the technique to treat lateral thigh cellulite using BodyTite radiofrequency-assisted lipolysis. **See Video 2 (online)**, which demonstrates the technique to treat lateral thigh cellulite using BodyTite radiofrequency-assisted lipolysis.]

RESULTS

Using the parameters of the Photonumeric Cellulite Severity Scale,[10] a total of 70 different body areas (right and left anterior, medial, lateral thighs and buttocks) from 10 patients were independently scored by five blinded evaluators. Scoring results were evaluated using statistical analysis of the difference between scores at baseline compared to 6 months after treatment and concordance between the evaluators. Figure 1 shows sample preoperative and postoperative photographs scored by evaluators. [**See Figure, Supplemental Digital Content 5**, which shows paired photographs obtained preoperatively (*left*) and 6 months postoperatively (*right*) following radiofrequency-assisted lipolysis treatment of the buttocks, ***http://links.lww.com/PRS/F359***. **See Figure, Supplemental Digital Content 6**, which shows paired photographs obtained preoperatively (*left*) and 6 months postoperatively (*right*) following radiofrequency-assisted lipolysis treatment of the medial thigh, ***http://links.lww.com/PRS/F360***. **See Figure, Supplemental Digital Content 7**, which shows paired photographs obtained preoperatively (*left*) and 6 months postoperatively (*right*) following radiofrequency-assisted lipolysis treatment of the lateral thigh, ***http://links.lww.com/PRS/F361***.]

To determine whether any of the paired data had nonnormal distributions, the Shapiro-Wilk test for normality was computed for all before-and-after photographic measures. (**See Table, Supplemental Digital Content 8**, which shows the results of the Shapiro-Wilk test for normality. A value of $p < 0.05$ indicates a nonnormal distribution, which was found in the right and left buttock areas, ***http://links.lww.com/PRS/F362***.) The results revealed nonnormal distributions in two areas, the left and right buttocks. A Wilcoxon signed ranks test was then conducted for these two pairs, which shows a statistically significant decrease of median values from preoperative to postoperative measurements of the right and left buttocks. Table 1 demonstrates the median and interquartile range scores for these two tests.

Consequently, eight paired sample t tests were computed to determine whether evaluation of preoperative and postoperative photographs indicated improvement over time. The paired sample t test was selected to evaluate the data not only because of its ability to withstand nonnormal distribution violations but because the two pairs found to have nonnormal distributions were found to be statistically significant using the Wilcoxon signed rank test. The paired t tests revealed that all eight of the comparisons were statistically significant and the mean differences were all positive. These results indicate an improvement in evaluator scores of cellulite parameters of each body area across time. Of

Fig. 1. Preoperative (*left*) and 6-month postoperative (*right*) photographs of the lateral thigh following radiofrequency-assisted lipolysis treatment and liposuction of the area.

Table 1. Results of the Related Wilcoxon Signed Ranks Test Performed on the Areas with Nonnormal Distributions

Pair (before and after)	Md1	IQR1	Md2	IQR2	Median Decrease (%)	Test Statistic	*p*
Right buttock	9.3	10.6	4.1	5.5	5.2 (56)	2.37	<0.02
Left buttock	9.5	11.9	3.5	6.4	6.0 (63)	2.37	<0.02

Md, median; IQR, interquartile range.

Table 2. Results of the Paired Samples *t* Test and Effect Size on All Areas

Pair (Before and After)	M1	SD1	M2	SD2	Mean Decrease (%)	*t*	*p*	*D*
Right buttock	6.9	5.1	3.3	2.4	3.5 (52)	3.9	<0.01	1.2
Left buttock	7.3	5.4	3.6	3.3	3.7 (51)	4.2	<0.01	1.3
Right lateral thigh	9.6	2.7	3.7	2.7	6.0 (62)	9.2	<0.001	2.9
Left lateral thigh	9.1	2.3	2.8	1.9	6.3 (70)	8.2	<0.001	2.6
Right posterior thigh	8.9	3.9	3.3	1.9	5.6 (63)	5.9	<0.001	1.9
Left posterior thigh	7.8	3.7	3.2	2.2	4.6 (59)	6.8	<0.001	2.2
Right anterior thigh	7.9	3.8	3.2	2.3	4.7 (59)	6.4	<0.001	2.0
Left anterior thigh	8.0	4.2	3.8	2.5	4.2 (53)	6.8	<0.001	2.1

M, mean; SD, standard deviation; *t*, test statistic; *D*, differences between two paired samples.

note, all eight effect sizes were considered large ($D \geq 0.8$),[12] suggesting the procedure had a significant impact on how the evaluators scored the photographs preoperatively and postoperatively. Table 2 demonstrates the relevant statistics related to the paired samples *t* test results.

DISCUSSION

A wide variety of methods to treat cellulite have been described in the literature.[13] Traction forces along fibrous septa as a result of superficial fascial system laxity contribute to the appearance of cellulite on the thighs.[3,4] Techniques such as manual subcision release the traction vector and redistribute subcutaneous forces; however, results are operator dependent and associated with complications such as hemosiderin deposits.[14,15] Studies using laser-based systems use thermal subcision and demonstrated contraction of the subdermal connective tissue. The temperatures required to induce tissue contraction, however, can also potentially damage the subdermal plexus, resulting in skin injury.[16] Radiofrequency-assisted lipolysis, in contrast, avoids damage to the subdermal plexus, safely reaching thermal endpoints required to produce contraction of the superficial fascial system and skin. To this author's knowledge, this application of Lockwood's concept of superficial fascial system tightening to correct cellulite using minimally invasive radiofrequency-assisted lipolysis technology has not been previously described in the literature.

Radiofrequency energy possesses unique biological properties that allow the flux of electric current to easily travel along the fibrous septae. The BodyTite handpiece uses a bipolar configuration to emit radiofrequency energy from an internal electrode, allowing conduction along all superficial fascial system fibrous septa, particularly the vertically oriented fibers associated with cellulite. At approximately 70°C, the length of the collagen fibers in the fibrous septae shorten significantly.[17] Reports have demonstrated up to 35 percent three-dimensional contraction of the treated tissues[5,18] providing the necessary tightening and lifting required to correct superficial fascial system laxity.

There are several limitations such as the small number of patients in the study, short follow-up period, and results being attributed to a single surgeon. Because this report is retrospective, it lacks prospective data or use of a comparison control group. Despite these limitations, the report demonstrates photographic improvement of grade 2 and grade 3 cellulite using BodyTite.

CONCLUSIONS

This preliminary report demonstrates an effective and novel approach for the treatment of grade 2 and grade 3 cellulite on the thighs and buttocks targeting the laxity in the superficial fascial system using radiofrequency-assisted lipolysis technology. Using a patterned energy application and achieving thermal endpoints maximizes the tissue contraction following the Arrhenius equations that directly correlates tissue effects to the temperature achieved stimulus duration. The BodyTite system allows the user to optimize application of radiofrequency energy to large areas of tissue necessary to produce changes in the appearance of cellulite.

Mark H. Peters, M.D.
Nubody Concepts Cosmetic Surgery Center
9037 Poplar Avenue, Suite 101
Germantown, Tenn. 38138
mark.peters@nubodyconcepts.com
Instagram: @nubody_concepts

ACKNOWLEDGMENTS

The author thanks Joseph J. De Simone for statistical analysis and Emily Steigler for artwork. The author also thanks Tona Savoie, R.N., Hope Bagala, R.N., Brandi Porche, and Maria Schexnayder, R.N., for contributing to this report.

REFERENCES

1. Soares JL, Miot HA, Sanudo A, Bagatin E. Cellulite: Poor correlation between instrumental methods and photograph evaluation for severity classification. *Int J Cosmet Sci.* 2015;37:134–140.
2. Hexsel D, Hexsel CL, Weber MB. Social impact of cellulite and its impact on quality of life. In: Goldman MP, Hexsel D, eds. *Cellulite: Pathophysiology and Treatment (Basic and Clinical Dermatology).* 2nd ed. Boca Raton, Fla: CRC Press; 2010:1–5.
3. Lockwood TE. Superficial fascial system (SFS) of the trunk and extremities: A new concept. *Plast Reconstr Surg.* 1991;87:1009–1018.
4. Hexsel D, Siega C, Schilling-Souza J, Porto MD, Rodrigues TC. A comparative study of the anatomy of adipose tissue in areas with and without raised lesions of cellulite using magnetic resonance imaging. *Dermatol Surg.* 2013;39:1877–1886.
5. Paul M, Mulholland RS. A new approach for adipose tissue treatment and body contouring using radiofrequency-assisted liposuction. *Aesthetic Plast Surg.* 2009;33:687–694.
6. Paul M, Blugerman G, Kriendel M, Mulholland R. Three-dimensional radiofrequency tissue tightening: A proposed mechanism and application for body contouring. *Aesthetic Plast Surg.* 2011;35:87–95.
7. DiBernardo BE, Sasaki GH, Katz BE, Hunstad JP, Petti CP, Burns J. A multicenter study for cellulite using a 1440-nm Nd:YAG wavelength laser with side-firing fiber. *Aesthet Surg J.* 2016;36:335–343.
8. Alster TS, Tanzi EL. Cellulite treatment using a novel combination radiofrequency, infrared light, and mechanical tissue manipulation device. *J Cosmet Laser Ther.* 2005;7:81–85.
9. Petti C, Stoneburner J, McLaughlin L. Laser cellulite treatment and laser-assisted lipoplasty of the thighs and buttocks: Combined modalities for single stage contouring of the lower body. *Lasers Surg Med.* 2016;48:14–22.
10. Hexsel DM, Dal'forno T, Hexsel CL. A validated photonumeric cellulite severity scale. *J Eur Acad Dermatol Venereol.* 2009;23:523–528.
11. Mulholland RS. *The BodyTite Book: Surgical Results without the Large Scars.* Toronto, Ontario, Canada: Marquis; 2018.
12. Cohen J. *Statistical Power Analysis for the Behavioral Sciences.* 2nd ed. Hillsdale, NJ: Erlbaum; 1988.
13. Zerini I, Sisti A, Cuomo R, et al. Cellulite treatment: A comprehensive literature review. *J Cosmet Dermatol.* 2015;14:224–240.
14. Amore R, Amuso D, Leonardi V, et al. Treatment of dimpling from cellulite. *Plast Reconstr Surg Glob Open* 2018;6:e1771.
15. Hexsel DM, Mazzuco R. Subcision: A treatment for cellulite. *Int J Dermatol.* 2000;39:539–544.
16. Kenkel JM. Evaluation of skin tightening after laser-assisted liposuction, commentary. *Plast Reconstr Surg.* 2009;29:407–408.
17. Jimenez Lozano JN, Vacas-Jacques P, Anderson RR, Franco W. Effect of fibrous septa in radiofrequency heating of cutaneous and subcutaneous tissues: Computational study. *Lasers Surg Med.* 2013;45:326–338.
18. Duncan D. Nonexcisional tissue tightening: Creating skin surface area reduction during abdominal liposuction by adding radiofrequency heating. *Aesthet Surg J.* 2013;33:1154–1166.