

Endermologie versus Liposuction with External Ultrasound Assist

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Background: Endermologie has been presented as a treatment to reduce cellulite and as a noninvasive method of body contouring.

Objective: The purpose of this study was to (1) evaluate the effectiveness of Endermologie in cellulite reduction and body contouring, (2) compare the results of external ultrasound-assisted liposuction (EUAL) with those of Endermologie with regard to body contouring and cellulite reduction, and (3) determine whether EUAL is as effective in cellulite reduction as it is in body contouring.

Methods: A prospective study comparing 2 closely matched, nonrandomized groups of 36 women each was conducted. Group 1 underwent a 20-week course of Endermologie, concentrating on the abdomen, flanks, hips, and thighs. Group 2 underwent EUAL to the superficial and deep subcutaneous areas of the flanks, hips, and thighs. Methods of evaluation included analysis of standardized 35-mm photography, standardized circumferential body measurements, and body composition. Photographic results were evaluated by objective blind grading from 4 physicians. Patient satisfaction was assessed through use of a questionnaire.

Results: No significant complications were noted in either group. In the EUAL group, the average volume of aspirate was 1900 mL, with a subsequent contour revision required in 11% of cases. The standardized circumferential body measurements of the waist, hips, thighs, and right knees of the EUAL patients demonstrated a reduction greater than that noted in the Endermologie patients; this difference was statistically significant ($P < .05$). The body composition analysis of the EUAL patients demonstrated a greater reduction in the percentage of body fat, fat mass, body weight, lean body mass, and impedance than that seen in the Endermologie group; this difference was statistically significant ($P < .05$). The EUAL patients exhibited an increase in total body water greater than that noted in the Endermologie group; this difference was statistically significant ($P < .05$). In the Endermologie group, the results of objective blind photographic grading demonstrated a mean improvement of 25% in body contour, which was largely proportional to weight loss, and a mean cellulite reduction of 50%. In the EUAL group, a mean improvement of 87% in body contour, which represented a true alteration of body contour rather than a proportional reduction, and a mean cellulite reduction of 0% were noted. Mean patient satisfaction was 92% in the Endermologie group and 96% in the EUAL Group.

Conclusions: EUAL has no role in reducing cellulite. Endermologie is the superior choice when cellulite reduction is the goal, but it is not an effective method of body contouring.

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Endermologie is a system of lifestyle alterations consisting of dietary restriction, exercise, proper water intake, and a series of soft-tissue massage treatments with the ES-1 vacuum/roller device (LPG Systems, Valence, France). The concept of vacuum/roller massage was introduced in the early 1970s by Louis Paul Guitay, a French engineer. Mr. Guitay had suffered burns in a motor vehicle accident that led to soft-tissue contractures and scarring. To facilitate his recovery, he developed a mechanical device that simultaneously lifted subcutaneous tissues using a vacuum and rolled the tissues between a pair of rolling pins. This unique combination of positive-pressure rolling action coupled with negative-pressure suction action was subsequently noted to reduce the appearance of cellulite.¹ Endermologie has become a popular treatment for cellulite reduction and skin toning in Europe, Japan, and South America.

Beginning in 1991, Endermologie was advertised in the United States by LPG USA of Ft. Lauderdale, FL as a treatment for cellulite as well as a noninvasive method of body contouring. Liposuction, whether performed with traditional methods,² tumescent technique,³ external ultrasound assist,^{4,5} or internal ultrasound assist,⁶ has generally been considered by the cosmetic and plastic surgery communities to be the standard treatment for body contouring for the last 20 years. The claim that Endermologie is an alternative body contouring treatment,⁷ which has not been solidly backed by basic scientific research^{8,9} or peer-reviewed journal articles,^{10,11} has been met with open skepticism from many plastic surgeons.¹² Conversely, because most experienced surgeons avoid performing aggressive superficial liposculpture in areas of dense cellulite,^{13,14} the effects of liposuction on the appearance of cellulite have not been objectively studied either.

The goals of the present study were 3-fold: (1) to evaluate the effectiveness of Endermologie in cellulite reduction and body contouring, (2) to compare the results of Endermologie and external ultrasound-assisted liposuction (EUAL) with regard to body contouring and cellulite reduction, and (3) to determine whether EUAL is as effective in cellulite reduction as it is in body contouring.

Materials and Methods

In this prospective study, a series of women ($n = 36$) who underwent a full course of treatment with Endermologie was compared with a series of women ($n = 36$) who

underwent treatment with EUAL alone. Improvement in body contour and cellulite reduction were the goals of both treatments. Patient age, height, and weight were closely matched between the 2 groups, which were not randomized.

Each member of the Endermologie group underwent 20 weekly treatments, each lasting 40 minutes; all were performed by the same registered nurse technician. Patients wore body stockings during all treatments. The Endermologie device used in this study was the ES-1 vacuum/roller device, which was operated in accordance with the recommendations of the manufacturer throughout the course of the study. Power settings were gradually increased over the course of the study according to patient comfort level. The main areas of treatment included the trunk and lower extremities, especially the flanks, buttocks, hips, and thighs. Measurements were taken during the week before the first treatment and immediately after the twentieth session. Proper diet, exercise, and appropriate water intake were strongly encouraged throughout the course of treatment.

All women in the EUAL group underwent treatment with the superwet technique under local standby anesthesia.¹⁵ After local anesthetic was injected, the Silberg External Ultrasound Assist (EUA) device (Wells Johnson Corp., Tucson, AZ) was used for 10 minutes per area at 30 W/cm² in continuous mode.^{4,5} Superficial and deep subcutaneous layers of the flanks, hips, and thighs were treated in all EUAL group members. Liposuction in the hip and thigh region was circumferential.¹⁶ Additional sites treated in some patients included the abdomen ($n = 18$), knees ($n = 15$), and ankles ($n = 2$). The volume aspirated equaled the amount of supernatant fluid after 15 minutes of settling. All patients in this treatment group wore compression garments postoperatively for 2 weeks. Measurements were taken during the week before surgery and again at 4 months postoperatively. Proper diet, exercise, and appropriate water intake were strongly encouraged during the course of treatment.

Methods of evaluation included standardized 35-mm photography, standardized circumferential body measurements, and body composition analysis, which was performed using a Tanita BFA-305 Bioelectrical Impedance Analyzer (Tanita Corporation of America, Skokie, IL). Body composition measurements included percent body fat, fat mass, total body water, lean body mass, body weight, and impedance. Measurements of weight and mass were made in pounds.

Table 1. Characteristics of Endermologie and EUAL treatment groups

| | Value (\pm SD) | | P* |
|------------------|-----------------------------|---------------------|-----|
| | Endermologie group (n = 36) | EUAL group (n = 36) | |
| Mean age (y) | 30.12 \pm 7.31 | 29.76 \pm 6.93 | .81 |
| Mean height (in) | 64.53 \pm 2.21 | 65.03 \pm 2.41 | .73 |
| Mean weight (lb) | 129.12 \pm 21.33 | 131.28 \pm 23.98 | .77 |

*Determined through use of paired *t* tests.

Table 2. Results of circumferential body measurements (in)

| | Mean change* (\pm SD) | | P† |
|-------------|-----------------------------|---------------------|-------|
| | Endermologie group (n = 36) | EUAL group (n = 36) | |
| Waist | -0.53 \pm 0.15 | -1.21 \pm 0.35 | .001‡ |
| Hip | -0.7 \pm 0.18 | -1.8 \pm 0.50 | .001‡ |
| Right thigh | -0.63 \pm 0.13 | -1.11 \pm 0.38 | .005‡ |
| Left thigh | -0.57 \pm 0.14 | -1.06 \pm 0.33 | .005‡ |
| Right knee | -0.32 \pm 0.11 | -0.48 \pm 0.14 | .04‡ |
| Left knee | -0.41 \pm 0.13 | -0.45 \pm 0.15 | .20 |
| Right calf | -0.21 \pm 0.04 | -0.28 \pm 0.08 | .25 |
| Left calf | -0.20 \pm 0.05 | -0.26 \pm 0.06 | .34 |
| Mean | -0.446 | -0.837 | |

*Results include measurements for all patients. Not all patients were treated in each area listed.
†Determined through use of paired *t* tests.
‡Statistically significant.

Four physicians objectively graded the standardized 35-mm photographic results in blind fashion, focusing on body contour improvement and reduction of cellulite. The graders were asked to rate improvement as 0%, 25%, 50%, 75%, or 100%. Patient satisfaction was assessed through use of a questionnaire. Each patient was asked to provide a "yes" or "no" answer as to (1) whether she was pleased with the results, (2) whether she would do it again, and (3) whether she would recommend the treatment to her friends. Only a "yes" answer to all 3 questions constituted patient satisfaction. Overall assessment of results was performed by analyzing the percentage of improvement noted from the objective blind photographic grading and the results of the patient questionnaire. Means and SDs are presented throughout this study. Student *t* tests at the level of $P < .05$ were accepted for statistical significance.¹⁷ All statistics were analyzed and reviewed with the assistance of the New York Presbyterian Hospital Academic Computing Center.

Results and Complications

The composition of the 2 study groups is presented in Table 1. The average age of the Endermologie patients was 30.12 years, with an average height of 64.53 in and an average weight of 129.12 lb. The average age of the EUAL patients was 29.76 years, with an average height of 65.03 in and an average weight of 131.28 lb. No statistically significant difference was found between the 2 groups in any of these categories.

The only complications noted in the Endermologie group were occasional bruises that resolved within 48 hours. In the EUAL group, the average volume of aspirate was 1900 mL. A subsequent contour revision was required in 11% of the EUAL patients. No other complications were noted in the EUAL group.

The results of the standard circumferential body measurements for the Endermologie and EUAL groups are shown in Table 2. The standardized circumferential body

Table 3. Results of body composition analysis

| | Mean change (\pm SD) | | P* |
|------------------------|-----------------------------|---------------------|-------------------|
| | Endermologie group (n = 36) | EUAL group (n = 36) | |
| Body fat (%) | -0.8 \pm 0.18 | -2.1 \pm 0.58 | .005 [†] |
| Fat mass (lb) | -1.0 \pm 0.3 | -2.15 \pm 0.61 | .005 [†] |
| Total body water (lb) | +1.21 \pm 0.41 | +0.48 \pm 0.16 | .005 [†] |
| Lean body mass (lb) | -0.59 \pm 0.18 | -2.11 \pm 0.60 | .005 [†] |
| Body weight (lb) | -0.45 \pm 0.11 | -5.49 \pm 1.92 | .001 [†] |
| Impedance (Ω) | -4.8 \pm 1.63 | -16.9 \pm 6.82 | .001 [†] |

*Determined through use of paired t tests.

[†]Statistically significant.

Table 4. Results of objective blind photographic grading and patient satisfaction

| | Result (\pm SD) | | P* |
|------------------------------|-----------------------------|---------------------|-------------------|
| | Endermologie group (n = 36) | EUAL group (n = 36) | |
| Photographic grading | | | |
| Cellulite reduction (%) | 50 \pm 16.9 | 0 \pm 0.0 | .001 [†] |
| Body contour improvement (%) | 25 \pm 10.3 | 87 \pm 12.3 | .001 [†] |
| Patient satisfaction (%) | 92 \pm 4.9 | 96 \pm 3.2 | .500 |

*Determined through use of paired t tests.

[†]Statistically significant.

measurements of the waist, hips, thighs, and right knees of the EUAL patients demonstrated a reduction greater than that noted in the Endermologie patients; this difference was statistically significant.

The results of the body composition analysis for the Endermologie and EUAL groups are presented in Table 3. The body composition analysis of the EUAL patients demonstrated a greater reduction in the percentage of body fat, fat mass, body weight, lean body mass, and impedance than that seen in the Endermologie group; this difference was statistically significant. In addition, the EUAL patients exhibited an increase in total body water greater than that noted in the Endermologie group; this difference was also statistically significant.

Analysis of the objective blind photographic evaluation and the patient satisfaction survey are presented in Table 4. The results demonstrate a mean improvement of 25% in body contour in the Endermologie group and a mean

improvement of 87% in the EUAL group, which represents a statistically significant difference. The results also demonstrate a mean cellulite reduction of 50% in the Endermologie group and a mean cellulite reduction of 0% in the EUAL group, also a statistically significant difference. Mean patient satisfaction was 92% in the Endermologie group and 96% in the EUAL group, a difference that is not statistically significant.

Average patients from each of the treatment groups are shown in Figures 1 and 2. An Endermologie patient who lost 10 lb and demonstrated significant improvement in body contour is shown in Figure 3.

Discussion

Recent basic science research in the porcine model has demonstrated that Endermologie can produce profound physiologic⁸ and moderate anatomic⁹ local effects. In a physiologic study carried out at the University of California at Los Angeles,⁸ laser Doppler, color-flow

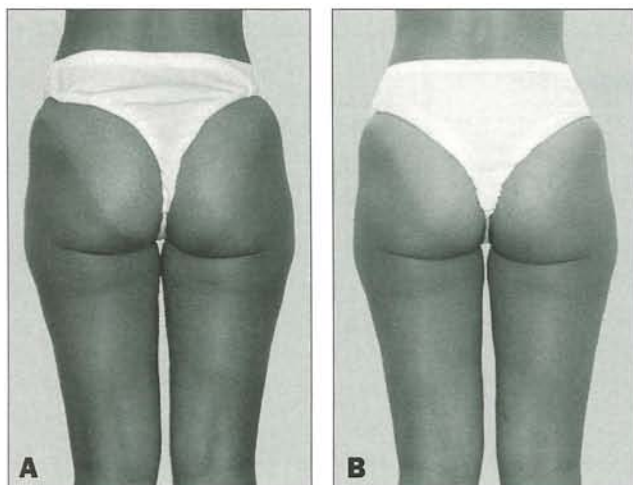


Figure 1. A, Pretreatment view of a 24-year-old woman complaining of cellulite and saddle bags and refusing liposuction. **B,** Posttreatment view shows the average results of Endermologie treatment for the present study. The patient lost 2 lb, 1% body fat, 2 in from her waist, and 1 in from her hips and each thigh. She was judged to have a 50% reduction in cellulite and a 25% improvement in body contour.

Doppler, lymphoscintigraphic, and endoscopic studies were performed. Cutaneous blood flow was increased 4-fold for more than 6 hours after Endermologie treatment. Flow velocity increased in the subcutaneous adipose veins and decreased in the deep muscular veins for at least 6 hours after treatment. Lymphatic flow increased more than 3-fold for at least 3 hours after treatment.

Autologous free-fat injections were readily redistributed during treatments, but in vivo redistribution of fat was not demonstrated. In a Vanderbilt anatomic study,⁹ post-treatment tissue samples demonstrated an accumulation of dense, longitudinal collagen bands in the mid and deep subdermis with distortion and disruption of adipocyte cell membranes. The degree of tissue alteration was dependent on the number of treatments performed. Endermologie did not elicit a classic wound-healing or inflammatory response. Subcutaneous tissue thickness remained constant, and no evidence of skin or muscle injury was noted. Neither of these studies could determine whether the changes produced by Endermologie were short-term or permanent.

Clinical research documenting the effects of Endermologie alone has reported either preliminary or anecdotal results.^{7,10,11} In a preliminary clinical outcome study of the effects of 7 Endermologie sessions on 22 women between the ages of 24 and 48 years, Ersek et al⁷ found that patients lost a mean weight of 1.35 lb and a mean

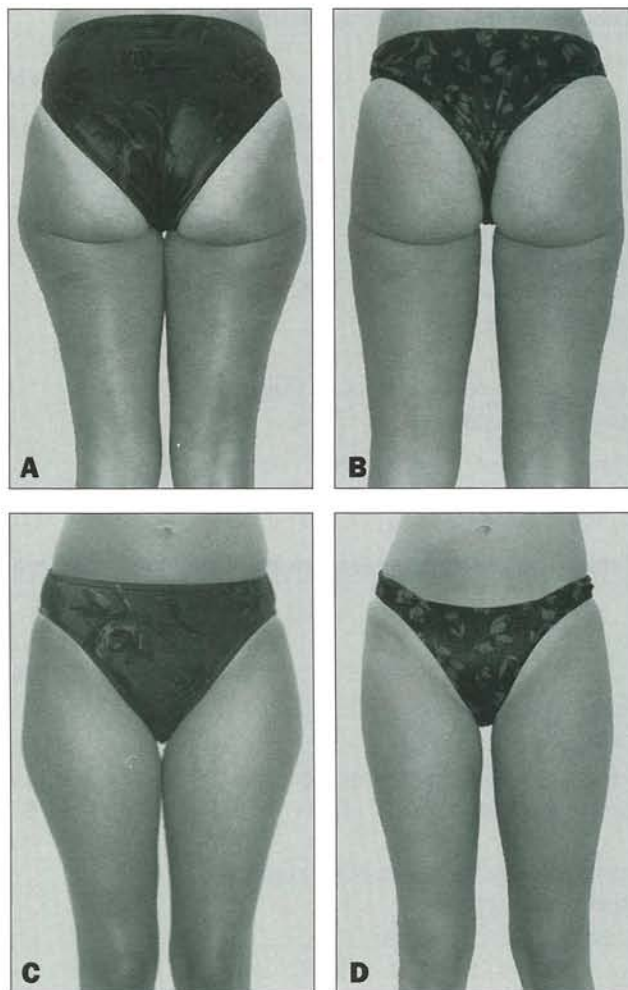


Figure 2. A and C, Pretreatment views of a 25-year-old woman complaining of saddlebags and cellulite and desiring liposuction. **B and D,** Posttreatment views show the average results of EUAL for this study. After 2200 mL was aspirated from the patient's hips and thighs, she had lost 5.5 lb, 2.1% body fat, 1 in from her waist, 2 in from her hips, and 1 in from each of her thighs. She was judged to have a 90% improvement in body contour and 0% reduction in cellulite.

body circumference of 0.54 in. In 6 patients who underwent 14 Endermologie sessions, the patients lost a mean weight of 0.71 lb and a mean body circumference of 1.12 in. The findings of the Ersek et al⁷ study are similar to the trends noted in my study. In the present investigation of 36 patients who underwent 20 Endermologie sessions each, the mean weight loss was 0.45 lb and the mean loss of body circumference was 0.446 in. Ersek et al⁷ concluded that Endermologie was mildly effective for fat mobilization and body contouring and that the effects of Endermologie were maximized by weight loss. In the present study, a 25% improvement in body contour was noted by blind photographic grading of the

Endermologie patients, but all Endermologie patients who demonstrated significant improvements in body contour had weight loss of greater than 7.5 lb.

Matarasso et al¹⁸ reported in a series of 51 women treated consecutively by 1 surgeon with large-volume (>1000 mL) liposuction that superwet aspiration of 1.5 kg of lipid removed 9.2% of body fat. If it is calculated that lipid content constitutes a mean of 75% to 80% of the aspirated adipose tissue,¹⁹ the present study's average of 1900 mL aspirate equals 1.425 kg of lipid. The percentage of body fat of the patients in the study by Matarasso et al¹⁸ was estimated by comparing subjects index-matched for sex, age, and body mass to those in a series by Wellens et al.²⁰ If a similar index-matched approach were used in the present study, a superwet aspiration of 1.425 kg of lipid removal would equal 8.74% body fat. In fact, in the present study, in which a Tanita Bioelectrical Impedance Analyzer was used instead of an index-matched approach for body composition measurements, the actual decrease in body fat was found to be only 2.1%. It is unclear whether this discrepancy is due to the extrapolation index-matched method of Matarasso et al¹⁸ or the use of the bioelectric impedance analyzer used to measure the percentage of body fat in the present study.

In this prospective study, all patients who underwent a full course of treatment with Endermologie demonstrated softening of superficial skin surface irregularities and cellulite. Endermologie was found to be a safe treatment modality. Cellulite reduction with a full course of Endermologie was noted by objective blind photographic grading to be 50%. Patient satisfaction with Endermologie was also found to be quite high (92%), and the average Endermologie patient lost 0.5 to 0.75 in from her hips, thighs, and waist. The average Endermologie patient lost almost 1% body fat with this noninvasive technique. These findings partially substantiated some of the manufacturer's claims. Objective measures of body contouring results, however, did lag well behind subjective measures of patient satisfaction. In general, the body contouring results achieved by Endermologie were found to be minimal and proportional to weight loss. The Endermologie patients who demonstrated significantly improved body contour had concurrent weight loss of more than 7.5 lb (Figure 3). It can be argued that these patients did not truly alter the basic contours of their bodies but rather reduced their body forms proportionally, as is seen in patients who lose significant amounts of weight. Therefore, Endermologie alone should not be considered an effective method of body contouring.

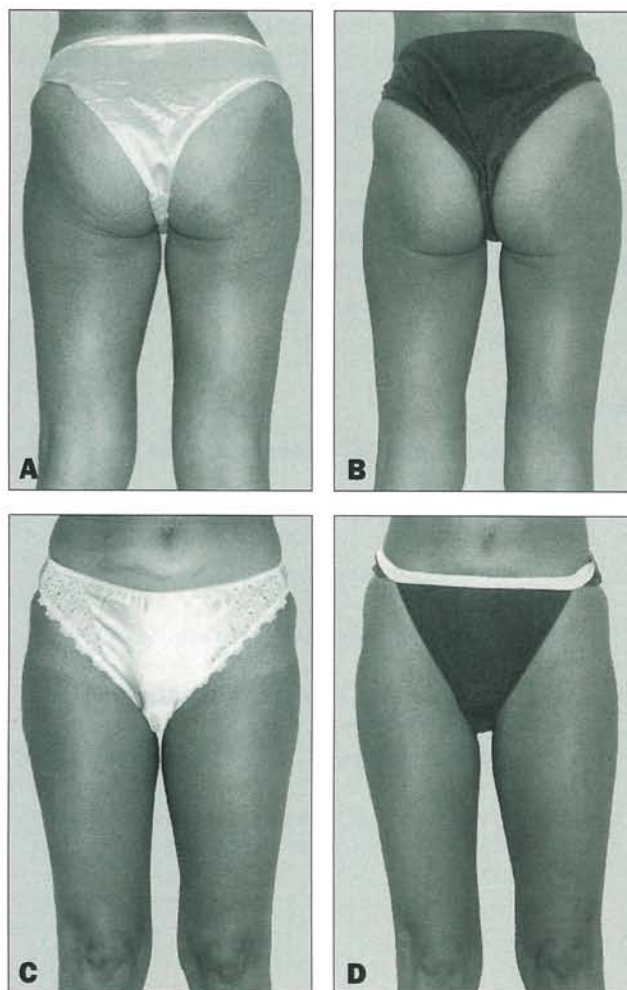


Figure 3. **A** and **C**, Pretreatment views of a 38-year-old woman complaining of cellulite and fat bulges in the abdomen, hips, flanks, and thighs and refusing liposuction. **B** and **D**, Posttreatment views show unusually good body contouring results in a patient from the Endermologie group. The patient lost 10 lb, 2% body fat, 2 in from her waist, 3 in from her hips, and 2 in from each of her thighs. She was judged to have a 50% reduction in cellulite and a 50% improvement in body contour.

In the present study, all EUAL patients demonstrated at least a moderate improvement in body contour. The average EUAL patient lost 1 to 2 in from her hips, thighs, and waist, as well as 2.1% body fat and 5.5 lb of body weight. In addition, true alteration of body contour, not just proportional reduction, was achieved by means of EUAL. This clearly makes EUAL the superior choice when body contouring is desired. Patient satisfaction with EUAL was found to be extremely high (96%). However, no cellulite reduction was noted by objective photographic analysis in any EUAL patient. No EUAL patient noted that her cellulite had worsened upon completion of the study.

Clearly, Endermologie is the superior technique for cellulite reduction, but it is still far from ideal, and considerable room for improvement in the modality has been noted in this study. The high rate of patient satisfaction achieved by Endermologie and the moderate improvement in cellulite is offset by the lack of significant alteration in body contour achieved by this technique alone. Any significant body contour alteration achieved by Endermologie has been found to be proportional to weight loss. ■

References

1. Daver J. A new instrument for the treatment of cellulite. *Medecine au Feminine* 1991;39:25-34.
2. Illouz Y. Body contouring by lipolysis: a 5-year experience with over 3000 cases. *Plast Reconstr Surg* 1983;72:591-599.
3. Klein J. The tumescent technique for liposuction surgery. *Am J Cosmetic Surg* 1987;4:263.
4. Wilkinson T. External ultrasound-assisted lipoplasty. *Aesthetic Surg J* 1999;19:124-129.
5. Silberg B. The use of external ultrasound assist with liposuction. *Aesthetic Surg J* 1998;18:284-285.
6. Zocchi M. Ultrasonic liposculpturing. *Aesthetic Plast Surg* 1992;16:287-298.
7. Ersek RA, Mann GE, Salisbury S, Salisbury AV. Noninvasive mechanical body contouring: a preliminary clinical outcome study. *Aesthetic Plast Surg* 1997;21:61-67.
8. Watson J, Fodor P, Cutcliffe B, Sayah D, Shaw W. Physiologic effects of Endermologie: a preliminary report. *Aesthetic Surg J* 1999;19:27-33.
9. Adcock D, Paulsen S, Davis S, Nanney L, Shack R. Analysis of the cutaneous and systemic effects of Endermologie in the porcine model. *Aesthetic Surg J* 1998;19:414-420.
10. Fodor P. Endermologie (LPG): does it work? *Aesthetic Plast Surg* 1997;21:68.
11. Fodor P, Watson J. Endermologie and Endermologie-assisted lipoplasty update. *Aesthetic Surg J* 1998;18:302-304.
12. Lambruschi P. Endermologie revisited. *Aesthetic Surg J* 1999;19:136.
13. Pitman GH, Grazer FM, Lockwood TE, Teimourian B, Toledo LS. Liposuction: problems and techniques. *Perspect Plast Surg* 1993;7:73-119.
14. Matarasso A. Superficial suction lipectomy: something old, something new, something borrowed. *Ann Plast Surg* 1995;34:268.
15. Matarasso A. Superwet anesthesia redefines large volume liposuction. *Aesthetic Surg J* 1997;17:358-365.
16. Pitman J. Liposuction: refinement in technique for improved cosmetic results and increased safety. *Aesthetic Surg J* 1998;18:455-457.
17. Snedecor G, Cochran W. The comparison of two samples. In: *Statistical methods*. Ames, IA: Iowa State University Press; 1967. p 91.
18. Matarasso A, Kim R, Kral J. The impact of liposuction on body fat. *Plast Reconstr Surg* 1998;102:1686-1689.
19. Kral J. Surgical reduction of adipose tissue hypercellularity in man. *Scand J Plast Reconstr Surg* 1975;9:140.
20. Wellens R, Roche A, Khamis H, Jackson A, Pollock M, Siervogel R. Relationships between the body mass index and body composition. *Obes Res* 1996;4:35.

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