

# Liposuction is an effective treatment for lipedema – results of a study with 25 patients

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## Keywords

- lipedema
- lipolymphedema
- lipohypertrophy
- liposuction
- life quality
- surgery
- lipomatosis

## Summary

**Background:** Lipedema is a painful, genetically induced abnormal deposition of subcutaneous fat in the extremities of almost exclusively women. The pathogenesis is unknown and no curative treatment is available. Conservative therapy consisting of lymphatic drainage and compression stockings is often recommended, but is only effective against the edema. Some patients show a short-term improvement when treated in this way. The removal of the increased fat tissue of lipedema has become possible by employing advanced liposuction techniques which utilize vibrating microcannulas under tumescent local anesthesia. The effectiveness of this approach to lipedema is the subject of this study.

**Patients and Methods:** 25 patients were examined before liposuction and six months thereafter. The survey included the measurement of the volume of the legs and several parameters of typical pain and discomfort. The parameters were measured using visual analogue scales (VAS, scale 0–10).

**Results:** The volume of the leg was reduced by 6.9%. Pain, as the predominant symptom in lipedema, was significantly reduced from  $7.2 \pm 2.2$  to  $2.1 \pm 2.1$  ( $p < 0.001$ ). Quality of life as a measure of the psychological strain caused by lipedema improved from  $8.7 \pm 1.7$  to  $3.6 \pm 2.5$  ( $p < 0.001$ ). Other parameters also showed a significant improvement and the over-all severity score improved in all patients.

**Conclusion:** Liposuction reduces the symptoms of lipedema significantly.

## Introduction

Lipedema is a painful, hereditary disorder usually affecting women that involves accumulation of excess fatty tissue on the extremities [1–3]. Characteristic symptoms include pain as well as sensitivity to touch and pressure. Patients also tend to bruise easily after minimal trauma. Over time, the disorder progressively worsens. Synonyms for lipedema include lipalgia, adiposalgia, adipositas dolorosa, lipomatosis dolorosa, lipohypertrophia dolorosa, and painful fat syndrome.

The diagnosis is based on clinical appearance. Lipedema should be differentiated from lipohypertrophy and lym-

phedema. Lipedema may be divided into three types: whole leg, thigh, and lower leg lipedema. In about 30% of patients, there is also involvement of the arms [4]. The disorder occurs in three stages:

- **Stage I:** Thickening and softening of the subcutis with small nodules; skin is smooth.
- **Stage II:** Thickening and softening of the subcutis with larger nodules; skin texture is uneven.
- **Stage III:** Thickening and hardening of the subcutis with large nodules, disfiguring lobules of fat on the inner thighs and inner aspects of the knees.

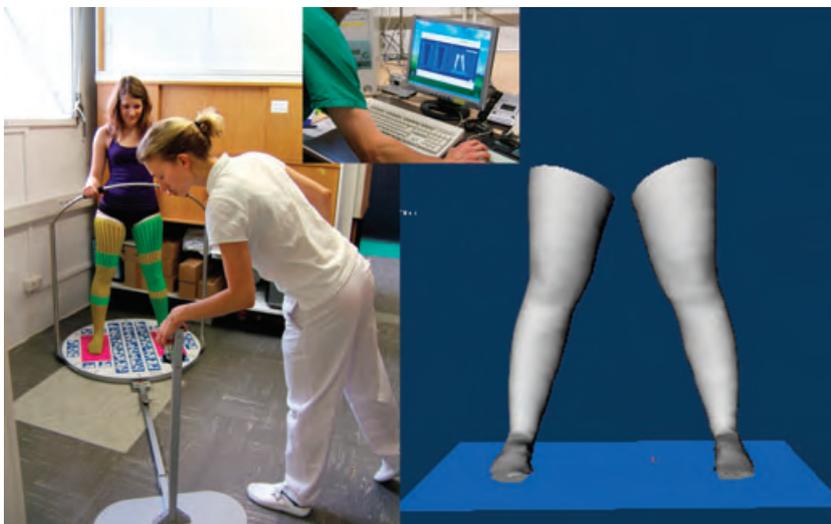
The cause of lipedema is unknown. Hormones are certainly one factor, as lipedema occurs virtually exclusively in women. In addition, early signs of disease tend to appear with the onset of puberty or after pregnancy. During these stages, the disease may also be referred to as lipohypertrophy which may develop into lipedema. Full-blown symptomatic disease usually manifests in the third or fourth decade of life. In addition to hormonal factors, a genetic disposition may be presumed, as the disease often affects several women in the same family (Figure 1). An important factor in the pathophysiology of lipedema is increased capillary



**Figure 1:** Mother and her daughters with lipedema.



**Figure 2:** Lower legs after tumescent anaesthesia and before liposuction by vibrating cannulas with 4 mm diameter.



**Figure 3:** Volume of the legs measured by Image-3D-system (Fa. Bauerfeind). A digital camera takes photos of the leg at different points. A computer calculates an exact 3D model of the leg with the corresponding measurements.

permeability leading to orthostatic edema. This, and not the amount of adipose tissue, is responsible for the increased sensitivity of the tissue to touch and pressure. The increased capillary fragility also explains the tendency to hematoma development.

Lymph drainage is undisrupted. Indeed, it is even increased in the early stages of lipedema. In later stages, the capacity of the lymphatic system is exhausted and can no longer ensure adequate drainage. This results in dynamic insufficiency. With decompensation of the lymphatic system, secondary lymphedema develops. In clinical terms this is known as lipolymphedema – with all related sequelae including leg ulcers. There are no characteristic histological changes associated with the disease.

The incidence of disease among women is estimated at 11 %. Among patients hospitalized for lymphatic disease, the proportion is reportedly 8–17 % [3, 5, 6].

Complex physical therapy (CPT), which is widely recommended, is only effective against the edema. Only some patients actually experience an improvement in symptoms, and then only for a short period of time following each treatment session [6–10].

The removal of excess fatty tissue using liposuction has been made possible by microcannulae and – in a more advanced form – with vibrating cannulae under tumescent local anaesthesia (Figure 2) [6, 11–17]. This method, which has been used for more than 15 years at the Department of Dermatology at Darmstadt Hospital, is the focus of this study. Various measurement parameters were used to assess the status of disease before liposuction and 6 months after to evaluate its effectiveness in lipedema.

### Patients and methods

Between April 2006 and July 2008 (27 months), 105 patients with lipedema were treated in our dermatology unit. The diagnosis of lipedema was confirmed in all patients included in the study on the basis of guideline criteria [2]. Of the 105 patients, 25 could be followed-up at 6 months after the last liposuction procedure and the results evaluated.

Among the remaining 80 patients, various reasons made it impossible to include their results in the final evaluation. In some, therapy had not been concluded at the time of evaluation, or the

Questionnaire		Results		
Rate the level of pain on a scale of 1-10 (no pain to very severe pain)	keine  -----x-----  0 1 2 3 4 5 6 7 8 9 10 sehr starke	Mean VAS before liposuction	Mean VAS 6 months after liposuction	Significance
Are the affected areas painful?	keine  -----  0 1 2 3 4 5 6 7 8 9 10 sehr starke	7.2	2.1	p < 0.001
Are the affected areas sensitive to touch or pressure?	keiner  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	6.4	1.9	p < 0.001
Do you bruise easily (hematoma)?	keine  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	7.9	4.2	p < 0.001
Do you feel tension in your legs?	keines  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	7.7	2.3	p < 0.001
Do you feel excessive warmth in the legs?	keines  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	3.0	1.4	p < 0.008
Do you legs feel cold?	keines  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	3.8	2.1	p < 0.120
Do you have muscle cramps?	keine  -----  0 1 2 3 4 5 6 7 8 9 10 sehr häufig	2.7	1.3	p < 0.043
Do your legs feel heavy?	keines  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	8.4	3.6	p < 0.001
Do your legs feel tired?	keines  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	8.4	3.5	p < 0.001
Do you something have swelling?	keine  -----  0 1 2 3 4 5 6 7 8 9 10 sehr starke	6.9	3.3	p < 0.001
Is there skin involvement?	keine  -----  0 1 2 3 4 5 6 7 8 9 10 sehr starke	3.5	1.3	p < 0.001
Is there itching?	keiner  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	4.2	1.9	p < 0.001
Do you have difficulty walking?	gar nicht  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	4.6	1.6	p < 0.001
How much does the condition affect your quality of life?	keine  -----  0 1 2 3 4 5 6 7 8 9 10 sehr stark	8.7	3.6	p < 0.001
How satisfied are you with the appearance of your legs?	sehr zufrieden  -----  0 1 2 3 4 5 6 7 8 9 10 sehr unzufrieden	9.5	5.0	p < 0.001
<b>Total score</b>	(maximum 150)	<b>92.0</b>	<b>39.0</b>	<b>p &lt; 0.001</b>

Figure 4: Questionnaire for measuring disorders of lipedema by visual analogue scales and results.

follow-up visit at 6 months after the procedure had not yet taken place, or liposuction therapy was not performed due to insurance coverage issues.

At the time of the first liposuction session, all patients were between the ages of 22 and 65 years (mean 38.0 ± 12.5 years, median 34.0 years). Twenty patients had lipedema affecting the whole leg, 3 had lipedema of the thigh, and 2 had lower leg involvement only [4, 5, 18].

Clinical examination included height, weight, waist circumference, leg volume measurement using 3D imaging (Figure 3), and a self-assessment of symptoms (Figure 4). The self-assessment was based on a quality of life survey for patients with lymphatic diseases (FLQA-I survey

on quality of life in patients with lymphatic diseases, Version 1.1, Augustin, Zschocke et al. 1998). This was modified to include 15 criteria that were assessed by the patient using a visual analogue scale (VAS) of 0 to 10. The survey was completed prior to beginning therapy and again at 6 months after the final liposuction treatment.

Liposuction was performed with under tumescent local anesthesia with vibrating cannulae with a 4 mm diameter (Figure 2) and a handpiece (VibraSat®, Möller Medical, Fulda). The tumescence solution used was based on Sattler [17] as follows: prilocaine: 1 % solution 50 ml, suprenin: 1 : 1 000 1 ml, sodium bicarbonate: 8.4 % 6 ml, triamquinolone: 10 mg/ml 1 ml, sodium chloride solution

0.9 % 1 000 ml. The prilocaine concentration in this preparation was about 0.05 %. In most patients, about 6 000 ml tumescence solution were infiltrated per session, with a maximum of 7 000 ml, and a minimum of 2 000 ml. The mean was 5 155 ± 1 304 ml. The infiltration was with a roll pump with a closed tube system (LipoSat®, Möller Medical, Fulda) and an adaptor for 6 cannulae (No. 1, long). The rate of infiltration was, depending on the region, severity, and individual tolerance to pain, between 120 and 200 ml per minute. Sedation was used if necessary, and consisted of 5–10 mg diazepam i.v. For aspiration, vibrating cannulae with 3 blunt openings at the tip in a Mercedes star shape (Figure 2) were used.

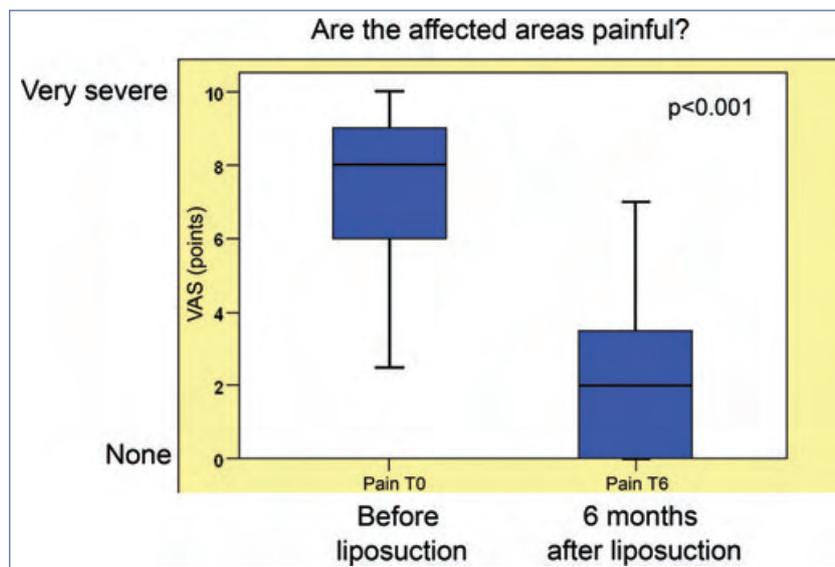


Figure 5: Significant reduction of pain before and 6 month post liposuction.

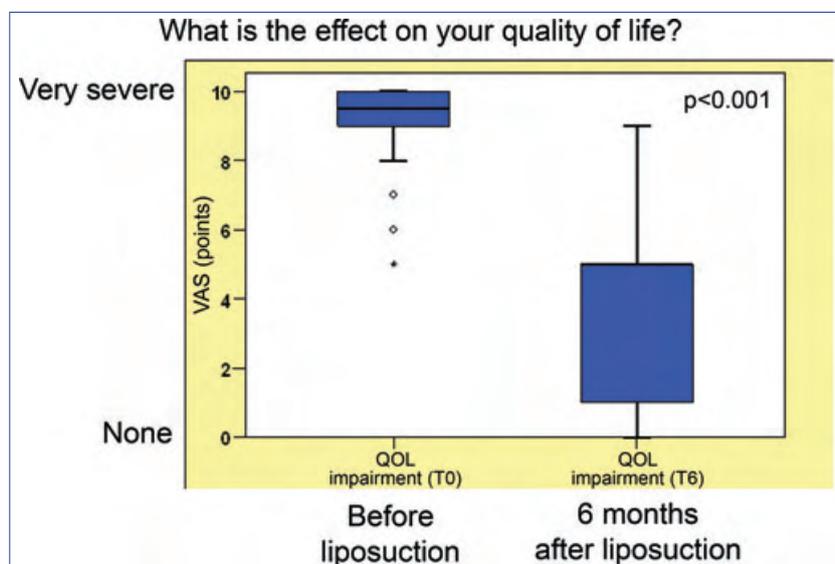


Figure 6: Significant improvement of quality of life before and 6 month post liposuction.

Patients were treated in 1 to 5 sessions (mean  $2.5 \pm 1.1$ , median 2).

The following regions on the body were combined and treated symmetrically:

- Medial aspects of the thighs and inner aspects of the knees
- Lateral aspects of the thighs and hip in the same or an additional session
- For larger-volume thighs, the anterior aspects were also treated
- Lower legs

Three sessions at 4-week intervals were generally needed. For larger-volume thighs, 4 sessions (3 patients) or 5 sessions (1 patient) were required. The number of necessary sessions was determined by the mass of adipose tissue that

could be treated in a single session with 6 000 ml tumescence solution in relation to the entire affected area.

Therapy usually began with the medial aspects of the thighs and knees or with the area that was causing the greatest discomfort.

Two patients received inpatient treatment, and 23 patients were treated on an outpatient basis. For each session, the aspiration volume was an average of  $2\,482 \pm 968$  ml and the pure fat component was on average  $1\,909 \pm 874$  ml, or 77 %.

Following liposuction, patients were given antibiotic prophylaxis for 3 days consisting of ciprofloxacin  $2 \times 250$  mg

or cefuroxime  $2 \times 250$  mg as well as thrombosis prophylaxis consisting of enoxaparin  $1 \times 40$  mg injected subcutaneously for 5 days. For patients who underwent treatment of the lower legs, as well as those with a history or family history of thrombophilia, a 10-day regimen of enoxaparin  $1 \times 40$  mg was administered (subcutaneous injection).

Compression was performed during the first 7 days after liposuction for 24 hours. Afterward, compression therapy continued during the daytime only for 4–6 weeks. This consisted of wearing compression stockings which the majority of patients already owned (76 % of patients; see below). The remainder were provided with stockings prior to the operation. For liposuction of the lower legs, during the first 2–3 days a circumferential compression dressing was applied. Starting on the third day after liposuction, manual lymph drainage was performed 2–3-times per week for at least 6 weeks.

#### Statistical methods

Statistical analysis was performed with SPSS for Windows, Version 15.0 (SPSS Inc., U.S.A.). Continuous variables were displayed as averages; standard deviation was used for dispersion.

The continuous variables were tested for normal distribution using the Shapiro-Wilk tests. The vast majority of tested variables did not have a normal distribution (Shapiro-Wilk test:  $p < 0.05$ ). When comparing the samples, non-parametric tests were chosen in every case for samples that did not have normal distribution.

For comparing more than two independent samples with abnormal distribution we used the H-test after Kruskal and Wallis. Wilcoxon tests were used to assess statistically significant differences in paired samples with abnormal distribution. The correlation between 2 parameters was calculated with the correlation coefficient after Spearman-Rho. The correlation coefficient was evaluated as follows:  $r < 0.2$ : very low correlation;  $r = 0.2$ – $0.5$ : low correlation;  $r = 0.5$ – $0.7$ : moderate correlation;  $r = 0.7$ – $0.9$ : high correlation;  $r = > 0.9$ : very high correlation.

In all of the tests performed, we also did two-sided significance testing. A p-value  $< 0.05$  for statistical significance was used in all tests.

In the graphics, which were also created using SPSS, error bars were used to show

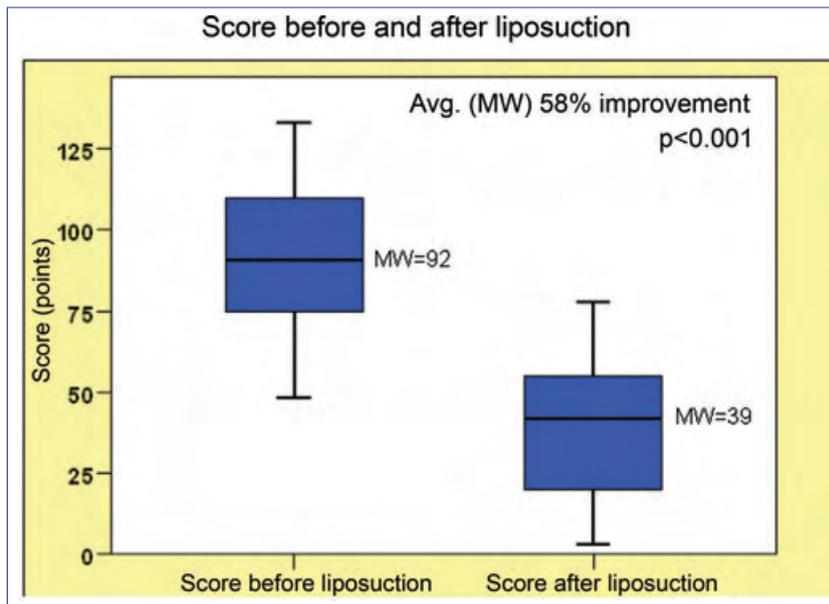


Figure 7: Significant improvement of the disorder score before and 6 month post liposuction.

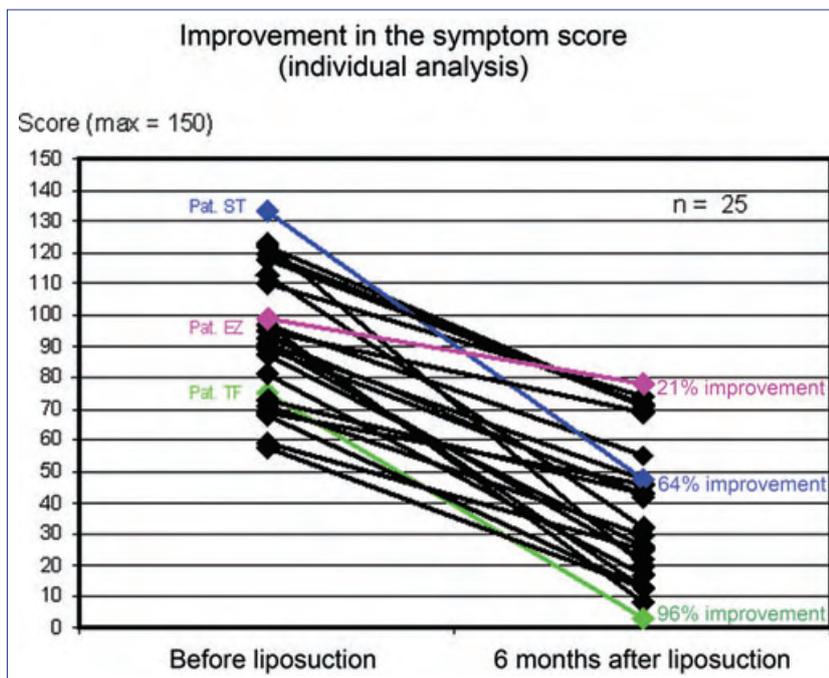


Figure 8: Different improvement of the disorder score: analysis of exemplary cases.

the means in samples with normal distribution. Given the large distribution range, the standard error was used as the distribution measure. Box plots were used to show the median values and quartiles in samples with abnormal distribution. In the boxes, the median as well as 25th-75th percentile is shown. The T-bars correspond to the smallest and largest values (as long as they were not outliers or extremes). Outliers are any values  $1\frac{1}{2}$ –3 box lengths outside of

the box. They are depicted in the graphics as circles, while extremes that are more than 3 box lengths outside of the box are shown as small crosses. The data were displayed using simple and grouped bar graphs.

## Results

### Leg volume

In 25 patients studied, 3D imaging of leg volume showed a reduction in leg volume of  $18.0 \pm 3.8$  to  $16.8 \pm 3.5$  l. This

corresponds to an average reduction of leg volume of  $1.2 \pm 1.0$  l, or 6.9 %. The starting values for leg volume ranged widely from 13.0 to 28.7 l. The reduction in volume was between 0.16–4.0 l, corresponding to a relative volume reduction of 0.9 to 19.8 %.

### Symptoms

The results of self-assessment of symptoms (Figure 4) indicate a significant or highly significant improvement in all areas. With regard to pain, the chief symptom of lipedema, there was an improvement of  $7.2 \pm 2.2$  to  $2.1 \pm 2.1$ . At  $p < 0.001$  the improvement is highly significant (Figure 5). There was also significant improvement in sensitivity to pressure, which is typical of lipedema, and bruising.

The patient burden was described in part using the question on quality of life impairment (Figure 6). Results showed a highly significant improvement from  $8.7 \pm 1.7$  to  $3.6 \pm 2.5$ . Patient satisfaction with the appearance of the legs also improved notably.

The 15 symptoms parameters were combined for a total score (highest value of 150). The averages before liposuction were  $92.0 \pm 21.3$ , and 6 months afterward they were  $39.0 \pm 23.2$  ( $p < 0.001$ ). This corresponds to about a 58 % improvement (Figure 7).

In the individual analysis (Figure 8), the patient we will refer to as “TF” (Figure 9) experience the greatest improvement (96 %) in symptoms. The severest symptoms (baseline score of 133) were reported by “ST” (Figure 10) who had about a 64 % improvement after liposuction. The smallest improvement was reported by “EZ” (Figure 11) who had a score of 21 %. The greatest reduction in pain, from 8 to 0 on the VAS, was reported by “PA” (Figure 12) with a relatively small aspiration volume of 1 700 ml from the lower legs.

### Results and complications

All patients reported improvement in symptoms after liposuction therapy. Disproportion of the legs also improved. Despite preventive measures one patient experienced deep vein thrombosis (DVT) of the lower leg one week after the procedure. This was treated promptly and there were no further



**Figure 9:** Patient TF with highest improvement of 96 %.



**Figure 10:** Patient ST with highest initial disorder score.

complications. This patient had already had DVT of the lower leg. There were otherwise no complications or worsening of the condition. In particular, there was no new incidence of lymphedema.

#### *Correlation between leg volume and symptoms*

There was no statistical correlation between the reduction of measured volume and improvement of symptoms.

#### *Conservative therapy*

Fifteen out of 25 patients (60 %) received manual lymph drainage (MLD) before liposuction. Two patients (8 %) were also treated following the procedure. Nineteen patients reported regular use of compression therapy prior to liposuction therapy (76 %). Six months after the final liposuction session, 4 (16 %) patients reported continuing compression therapy.

#### **Discussion**

The results demonstrate the effectiveness of liposuction against lipedema. All of the parameters measured were highly significant. Although the results are based on subjective, self-assessment by the patient, the VAS represents the best available instrument at this time for a quantitative assessment of symptoms and for documenting any change due to therapy. One goal of treatment is to improve the sometimes significantly impaired quality of daily life for the patient. The lacking correlation with the reduction in leg volume confirms the experience of the author in everyday clinical practice: a young woman with lipedema of the lower leg will have a relatively high level of distress and high symptom scores on a VAS. In liposuction of the lower legs, as performed in “PA”, a relatively small volume of fat is aspirated (Figure 12). The effect on symptoms experienced, however, is large: the patient is virtually symptom-free following the procedure. In an older woman (such as in “EZ”) with a larger leg volume and possibly even sclerotic edema, the aspiration volume may be large, but the effect on symptoms is smaller (Figure 11). The risk of complications due to liposuction is very low despite one instance of deep vein thrombosis in our patients [15]. In 15 years of experience, this was the first time that DVT occurred. Nevertheless, it must be reported given that it occurred within the framework of this study.

About two-thirds of patients were treated with manual lymph drainage and compression prior to liposuction. Six months after the last liposuction session, 8 % of patients reported that they still required MLD, albeit less frequently. After the procedure, 16 % reported occasionally or regularly wearing compression stockings. This confirms the results of a study by Schmeller and colleagues in



Figure 11: Patient EZ with lowest improvement of 21 %.



Figure 12: Patient PA with maximum improvement of pain from 8 to 0.

2007 [10], which found that the majority of patients no longer require prolonged further therapy after liposuction. After liposuction, combination therapy with MLD and compression therapy [2, 6–8, 10] is an essential part of the healing process and treatment success.

Without a doubt, many lipedema patients benefit from compression therapy if the edema is symptomatic. The effect only persists as long as it is used, however, and this means patients require lifelong therapy. Liposuction offers the possibility of being able to go without

CPT for longer periods of time, as it reduces both the edema and pathologically altered adipose tissue [19].

Still, liposuction can only reduce the amount of fatty tissue, but not completely remove it. Given that lipedema is a chronic disease, depending on the amount of remaining fatty tissue, the disease may continue to progress. Nevertheless, liposuction for lipedema is the only therapy known until now that succeeds in reducing edema and symptoms such as pain.

It is still too soon to assess long-term recurrence. The follow-up period of 6 months in this study is too short for this. Further studies are needed to address this issue. In our own experience [14] the results may be expected to last for at least 8 years.

#### Conclusions for clinical practice

When performed by an experienced practitioner, tumescent liposuction is a safe and effective method of treatment for lipedema. The results of therapy are better in younger patients with early-stage disease compared with more severe disease in older patients. CPT, before and after liposuction, is an important part of therapy. <<<

#### Conflict of interest

None.

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