

Improvements in patients with lipedema 4, 8 and 12 years after liposuction

Phlebology
0(0) 1–8
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DOI: 10.1177/0268355520949775
journals.sagepub.com/home/phl



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Abstract

Background: Long-term results following liposuction in patients with lipedema were available only for an average period of 8 years.

Objective: To find out whether the improvements persist for a further 4 years.

Methods: In 60 patients with lipedema a single-centre study with a mail questionnaire – often in combination with clinical controls – was performed after an average period of 12 years following liposuction(s). All patients in this group had already been surveyed 4 and 8 years after surgery.

Results: Compared with the earlier results improvement persisted with regard to spontaneous pain, sensitivity to pressure, edema, bruising and restriction of movement; similar outcomes were observed for self-assessment of cosmetic impairment, reduction in quality of life and overall impairment. While in the period from 4 to 8 years postoperatively complaints slightly increased, this was not the case for the period 8 to 12 years postoperatively. In addition a similar reduction of conservative treatment (decongestive therapy, compression garments) was observed as after 4 and 8 years postoperatively. Compared with the body weight before liposuction, 55% of the patients showed a reduction of 6.2 kg on average and 43.3% had a weight increase with an average of 7.9 kg.

Conclusion: The results show, that the positive effects of liposuction last 12 years postoperatively without relevant worsening. They imply that liposuction for lipedema leads to a permanent reduction of symptom severity and need for conservative therapy.

Keywords

Lipedema, liposuction, improvement, 12-years follow-up, long-term results

Introduction

Liposuction is a safe and effective treatment for lipedema not responding to or improving from conservative therapy.¹ Most studies investigating the period of effectiveness of this surgical procedure were conducted with relatively short follow-up periods of only a few years.^{2–5} Long-term results of our own working group's studies after an average of up to 8 years showed significant reduction in complaints typical of lipedema, including significant improvement in morphology (reduced volume, elimination of disproportion).⁶

Objective

The objective of this study was to monitor the persistence of the therapeutic success recorded to date. To this end, in 2019 we wrote to the patients we had

studied in 2010 and 2014, an average of 12 years postoperatively, and sent them questionnaires with the same items. The objective was to find out whether any relevant changes had occurred in the past 4 years with regard to the improvement in complaints described in the previous years. We were also interested in finding out whether the reduction in conservative treatment measures (compression, manual lymph drainage) had continued.

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Patients and methods

All of the 112 female patients (undergoing liposuction (s) between 2003 and 2009 at the Hanse Clinic) who were evaluated by means of a questionnaire in 2010 and 2014, were written to again in early 2019. Due to changes in address, 14 patients could no longer be reached. 27 patients did not respond. 71 patients completed and returned the questionnaires, which corresponds to a return rate of 63.3%.

For our study, among the 71 patients, we selected the patients who had participated both after 4 and 8 years as well as now after 12 years. This amounted to 60 patients with an average age of 54.1 years (35 to 80 years). Their average age at the time of the first procedure was 41.9 years (22 to 68 years). This group comprised 53.6% of the participants of the initial survey (after 4 years) and 70.6% of the second survey participants (after 8 years).

Their postoperative time interval was 13 years and 3 months on average after the first procedure and 12 years and 4 months after the last procedure. Of the 60 patients in the current study (2019), 18 (= 30%) had stage I lipedema and 42 (= 70%) had stage II lipedema prior to liposuction. There were no women with stage III who had taken part in all three questionnaires. This group was – due to comorbidities and adiposity - in general underrepresented.

The questionnaire that had already been used in previous surveys was used for the quantitative recording of treatment outcome from the patients' perspective.⁶ For seven aspects of impairment, patients indicate the extent to which they currently suffer from these: spontaneous pain, sensitivity to pressure, edema, bruising, restriction of movement, cosmetic impairment, reduction in quality of life. The assessment is carried out with 5-step Likert scales (0 = none, 1 = minor, 2 = medium, 3 = strong, 4 = very strong). In addition to these seven impairment scales, an overall value (mean value from all seven scales) was also evaluated. This subtest is called "overall impairment". For the overall impairment, reliability was determined (Cronbach's Alpha).

When comparing the study cohort (n = 60) with the patients not considered in this study (drop-out analysis), it was striking that the patients in the initial sample of 2010 who did not participate in the studies 2014 or 2019 were younger than the analysis sample taken in 2019 (35.2 years compared to 41.8 years, $p = 0.001$). There were no differences between the groups regarding the number of procedures, the stage or the overall impairment prior to liposuction and in the survey conducted in 2010.

Statistical analysis

The results are reported either by mean values and standard deviations or by case numbers and

percentages, depending on the scale level. For the drop-out analysis, t-tests for independent groups or chi-square tests for categorical data were calculated.

Changes in impairments over time were tested for significance using one-way repeated-measures ANOVA with repeated measurements for the four measurement points. To show the magnitude of changes between measurement points, effect sizes were calculated for dependent groups. The correlation between the measurement points is taken into account. Effect sizes illustrate standardized differences.⁷ Effect sizes indicate the extent of an effect and, in contrast to statistical significance, it shows clinical relevance. According to Cohen (1988), effect sizes of 0.20–0.50 are considered "small" group differences, those between 0.50–0.80 are "medium" and effect sizes >0.80 are "strong" differences.⁸

Differential analyses of the significance of "age" and "chronification stage" were carried out using ANOVA mixed design with time as repeated measures and group as between-factor. $P < 0.05$ was considered significant.

Results

Postoperative changes in complaints

For all items, there were highly significant differences between the preoperative and postoperative responses. Table 1 shows the mean values with standard deviations of respective parameters preoperatively (between 2003 and 2009), after 4 years (2010), after 8 years (2014) and after 12 years (2019) and the results of the repeated-measured ANOVA. Figures 1 to 7 present these values graphically as bar graphs with a mean value and standard deviation.

In addition to these seven items, the overall score (overall impairment = mean value from all seven parameters) was also re-evaluated. Figure 8 presents the reduction in this overall impairment over time as box plots. The subtest "overall impairment" is considered to be an especially reliable value for measuring treatment success. The reliability determinations according to Cronbach's alpha (internal consistency): reliability determination before liposuction(s): $r_{tt} = 0.74$; reliability determination after liposuction(s) in 2010: $r_{tt} = 0.79$; reliability determination liposuction (s) in 2014: $r_{tt} = 0.79$; reliability determination liposuction(s) in 2019: $r_{tt} = 0.83$. The reliability of the test overall impairment for group analyses is therefore good.

In all seven items and in the subtest "overall impairment", the patients' assessments before liposuction were significantly higher than at the following survey dates 2010, 2014 and 2019. Lower values indicate less discomfort and thus better well-being. All

Table 1. Complaints before and after liposuction after an average of 4 years (2010), 8 years (2014) and 12 years (2019) in 60 patients.

	Before liposuction	2010	2014	2019	ANOVA (F-value)	p-value
Spontaneous pain	1.76+/-1.41	0.33+/-0.55	0.31 +/-0.51	0.37+/-0.49	45.33	<0.001
Sensitivity to pressure	2.88+/-1.06	0.88+/-0.91	1.02+/-1.03	0.98 +/-0.94	78.8	<0.001
Edema	3.05+/-1.06	1.42+/-0.91	1.51+/-0.93	1.35+/-0.88	75.98	<0.001
Bruising	3.04+/-0.98	1.16+/-0.98	1.47+/-1.23	1.40+/-1.08	58.28	<0.001
Restriction of movement	2.13+/-1.32	0.20+/-0.40	0.59+/-0.71	0.52+/-0.81	72.7	<0.001
Cosmetic impairment	3.46+/-0.91	1.00+/-0.82	1.46+/-1.15	1.48+/-1.08	101.7	<0.001
Reduction in quality of life	3.49+/-0.77	0.69+/-0.81	1.00+/-1.04	0.96+/-0.90	179.5	<0.001
Overall impairment	2.81+/-0.69	0.84+/-0.58	1.05+/-0.70	0.99+/-0.66	182.6	<0.001

Values are arithmetic mean+/-standard deviation. Scale: 0 = none, 1 = minor, 2 = medium, 3 = strong, 4 = very strong. F-value and p-value according to one-way repeated-measures ANOVA. ***p<0.001

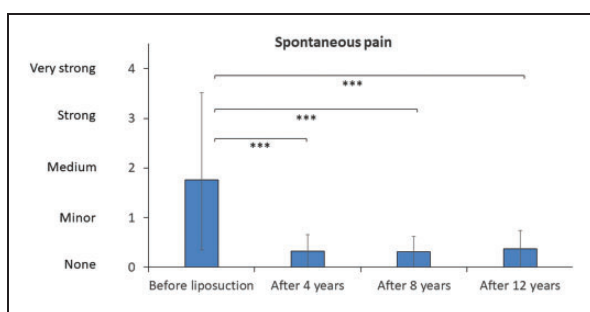


Figure 1. Spontaneous pain prior to liposuction and an average of 4, 8 and 12 years after surgery in n = 60 patients with lipedema (***p<0.001).

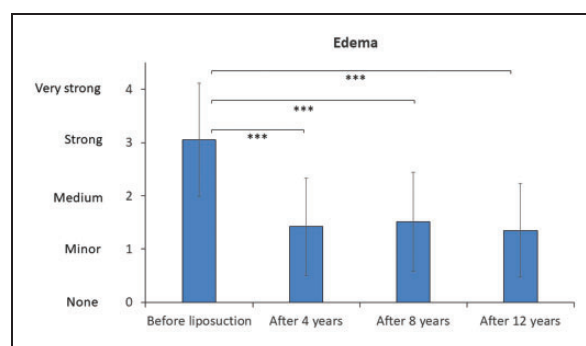


Figure 3. Edema (***p<0.001).

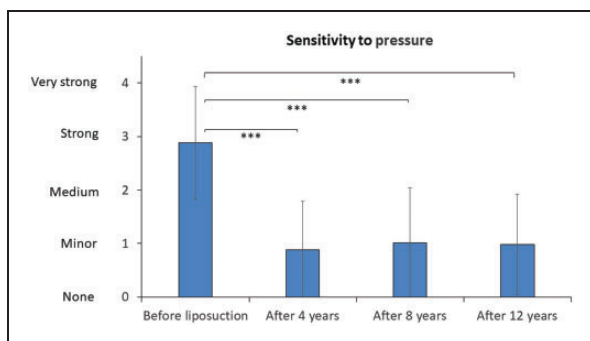


Figure 2. Sensitivity to pressure over time (***p<0.001).

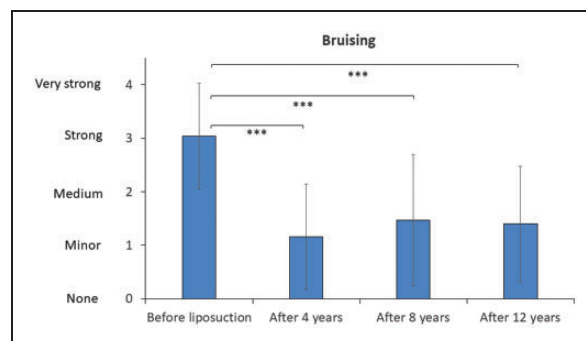


Figure 4. Bruising (***p<0.001).

descriptions after liposuction indicate an improved condition after the intervention. This is also evident for the last measurement in 2019.

As Table 2 shows, all effect sizes for the comparison of complaints between each measurement time and before surgery are significantly above 0.8 (= “strong”), indicating the pronounced effect of liposuction even after 12 years. The comparison between the first (2010) and the second (2014) evaluation resulted in very low effect sizes for the items spontaneous pain, sensitivity to pressure and edema, meaning no relevant

changes had occurred. The effect sizes regarding the items bruising, restriction of movement, cosmetic impairment, reduction in quality of life and overall impairment however were slightly higher, but still evaluated as low, displaying a slight increase of these complaints. Most important however is, that the comparison between the second (2014) and the current measurement (2019) resulted in very low effect sizes for all items showing no significant further changes in the past four years.

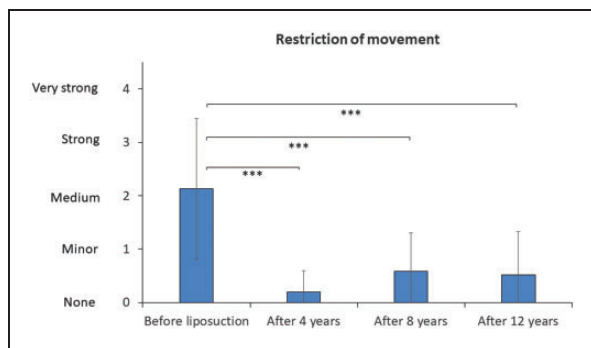


Figure 5. Restriction of movement ($***p < 0.001$).

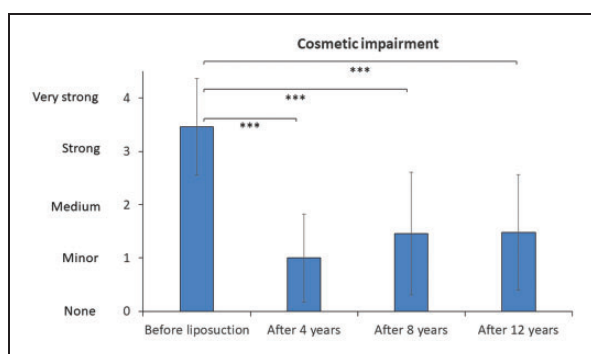


Figure 6. Cosmetic impairment ($***p < 0.001$).

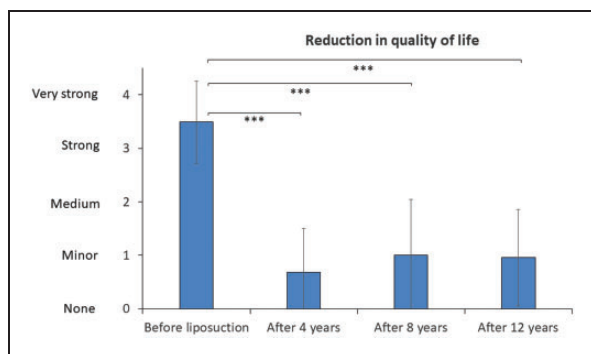


Figure 7. Reduction in quality of life ($***p < 0.001$).

In addition, the reduction in overall impairment was also evaluated differentially (Table 3), using a mixed design ANOVA. The between-group factor was age or stage and the repeated-measures variables were year of measurement. The outcome shows that age is insignificant for the success of the intervention. The interaction between the measurement and the age group is not significant. With regard to the disease stage, women with stage II lipedema tended to report higher overall impairment than those with stage I

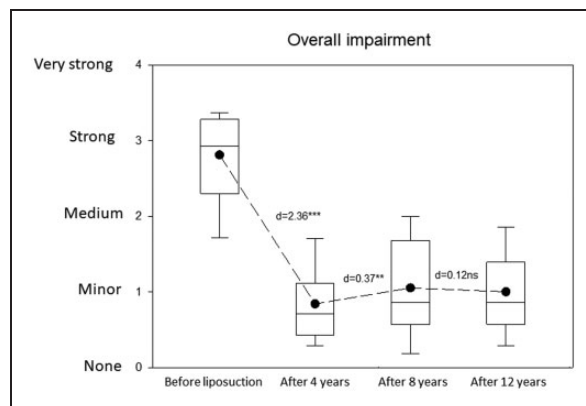


Figure 8. Overall impairment (summary of all parameters) over time. Box plots with 10th, 25th, 50th (median), 75th and 90th percentile and arithmetic mean. d = effect size of the change. $***p < 0.001$; $**p < 0.01$.

lipedema. This is especially remarkable in the preoperative starting situation; however, this was also the case in 2014 and 2019.

Changes in conservative treatment after liposuction

Of the 60 patients in this study, 37 (61.7%) underwent combined decongestive therapy (CDT) with manual lymph drainage (MLD) plus compression garments before surgery. Twelve patients (20%) were treated only with compression garments and 2 (3.3%) underwent only MLD without subsequent compression. Nine patients (15%) did not undergo CDT.

The first group ($n = 37$), with previous CDT, was separately evaluated as a sub-group in order to assess treatment success. Figure 9(a) to (d) show the changes (in per cent) related to the conservative treatment forms at the different study intervals.

When asked about their conservative therapy, 20 patients (54%) reported in 2019, i.e. 12 years postoperatively, that they still underwent MLD and wore compression garments. Seven (19%) patients required fewer conservative treatments than before – in other words, they now needed either only MLD or only compression – and 10 patients (27%) no longer needed either MLD or compression therapy.

Body weight

The patients' weight indicated in the initial findings is based on the values we measured directly before the first liposuction procedure. For the current comparative data we had to rely on the current (unverifiable) values reported by the patients in the questionnaires.

The average starting weight prior to the first liposuction was 79.7 (50 to 116) kg. An average of 12 years

Table 2. Effect size for comparison of complaints between various measurement times.

	Preoperative to 2010	Preoperative to 2014	Preoperative to 2019	2010 to 2014	2010 to 2019	2014 to 2019
Spontaneous pain	1.24***	1.03***	1.04***	0.03	0.06	0.11
Sensitivity to pressure	1.70***	1.46***	1.46***	0.12	0.08	0.05
Edema	1.37***	1.40***	1.49***	0.08	0.07	0.21
Bruising	1.38***	1.04***	1.27***	0.38**	0.27*	0.08
Restriction of movement	1.48***	1.24***	1.29***	0.56**	0.44**	0.08
Cosmetic impairment	2.01***	1.48***	1.43***	0.49**	0.45**	0.02
Reduction in quality of life	2.54***	1.97***	2.18***	0.43**	0.31*	0.05
Overall impairment	2.36***	1.93***	2.06***	0.37**	0.22	0.12

***p < 0.001; **p < 0.01; *p < 0.05 (significance according to paired t-test).

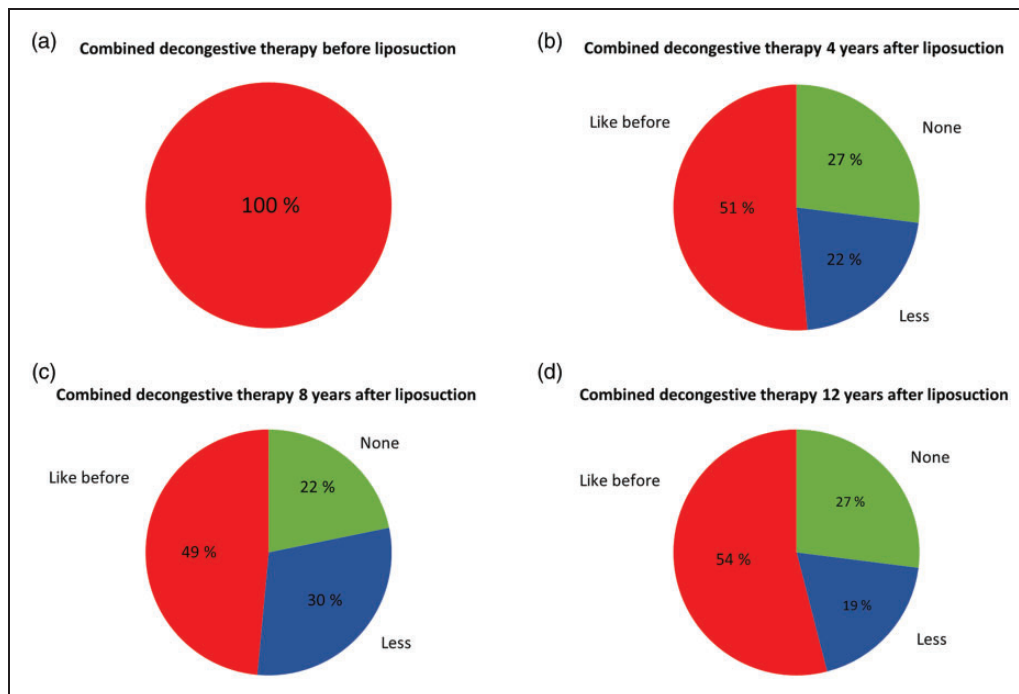
Table 3. Differential analysis of 'overall impairment' using age and stage as factors in addition to time effects.

Groups	n	Preoperative	Postoperative 2010	Postoperative 2014	Postoperative 2019	Source of variation	p-value
Age (years)							
22–34	16	2.7+/-0.9	1.0+/-0.8	1.0+/-0.7	1.0+/-0.7	Group (g)	0.80
35–47	28	2.9+/-0.6	0.8+/-0.4	1.0+/-0.7	0.9+/-0.7	Time (t)	<0.001***
48–68	16	2.7+/-0.6)	0.9+/-0.5	1.2+/-0.8	1.1+/-0.6	g x t	0.50
		p = 0.62	p = 0.49	p = 0.66	p = 0.55		
Stage							
I	18	2.5+/-0.8	0.8+/-0.7	0.9+/-0.8	0.7+/-0.6	Group	0.06
II	42	2.9+/-0.6	0.8+/-0.5	1.1+/-0.7	1.1+/-0.7	Time	<0.001***
		p = 0.02*	p = 0.98	p = 0.38	p = 0.04*	g x t	0.17

Values are arithmetic mean+/-standard deviation. ***p < 0.001; *p < 0.05.

p-values on the right side according to ANOVA mixed design.

p-values in the columns of measurement points according to ANOVA with independent groups.

**Figure 9.** (a) Preoperative CDT in per cent (n = 37). (b) CDT an average of 4 years postoperatively. (c) CDT an average of 8 years postoperatively. (d) CDT an average of 12 years postoperatively.

postoperatively, body weight was 0.5 kg more, at 80.2 (40 to 130.2) kg. One patient (1.7%) weighed the same as before. 33 patients (55%) lost weight and 26 (43.3%) gained weight. Weight loss in the group losing weight was 6.2 (0.2 to 41.7) kg on average. This group's average age was 34.2 years and their average postoperative weight was 79.5 kg. The group that gained weight gained an average of 7.9 (0.5 to 39.5) kg. This group's average age was 43.5 years and their average postoperative weight was 84 kg.

Improvements of morphology

As an example we present the findings of one patient before and 12 years after liposuction demonstrating the improved cosmetic appearance with abolishment of disproportion (Figure 10(a) and (b)).

Discussion

Return rate

The goal of this study was to determine the reduction in complaints in patients with lipedema undergoing liposuction procedure(s) after an average of 12 years. To the best of our knowledge, this is the longest documented postoperative period observed to date in patients with this indication using this method. Of the study cohort initially

contacted in 2010, for which 112 questionnaires were submitted that could be evaluated, 71 patients returned a questionnaire in 2019. With a response or return rate of 63.3%, which is considered to be good in the literature, the data collected for the surveyed group is representative.⁸ Related to the group of 84 patients who participated in the last follow-up study in 2014 (after 8 years), the return rate of 71.8% was even "very good". The 60 patients who had completed the questionnaires at all study intervals were included in this study.

Pathophysiology

The etiopathogenesis of the key clinical findings (core symptoms) such as spontaneous pain and sensitivity to pressure in the context of lipedema is still unclear.⁹ Key aspects such as the tendency to develop edema have been assessed differently and the bruising tendency is also still not understood in terms of pathogenesis.^{10,11} In addition, when it comes to the inflammatory changes described in the literature, it remains unclear whether these are primary triggers or simply unspecific secondary changes.¹² The explanation for why the surgical removal of the subcutaneous fatty tissue responsible for this disproportion alone can bring about pronounced and persistent improvement is



Figure 10. Stage II lipedema. Course after three liposuctions with removal of 13,950 ml of fatty tissue from the hips, thighs and lower legs. (a) 2007: initial findings, preoperative at the age of 34. Feeling of heaviness, sensitivity to pressure and tightness, 111 kg body weight. (b) 12 years postoperatively. Symptom-free, 101 kg body weight.

also unsatisfactory to date. The improvements in mobility, the cosmetic aspects and the resulting enhanced quality of life after liposuction are understandable, however.¹³

Improvements in complaints

In general, the improvements achieved after an average of 4 years (2010) and after 8 years (2014) were still in place after an average of 12 years postoperatively (2019).

For all seven individual parameters investigated, as well as for overall impairment, considerable clinical and highly significant differences between the initial and end findings were observed. The decrease in the severity score reported 4 years and 8 years earlier was unchanged for all parameters in the following period. For methodological reasons – it is not a randomized controlled trial (RCT) – the findings may not be interpreted causally in the sense of proof of efficacy.

For all patients undergoing liposuction, a pronounced improvement of complaints is unchanged, with highly significant differences compared to the preoperative findings.

This has been described by other authors as well, but with smaller patient groups and shorter follow-up periods.²⁻⁵ The slight – but clinically non-relevant – increase in impairment (bruising tendency, restricted movement, cosmetic impairment, reduced quality of life and overall impairment) proven 4 years earlier (2014) did not additionally increase now after 12 years. This is even more significant, because the patients were now considerably older. Of the 60 patients undergoing liposuction evaluated in the study, 16% were between 50 and 59 years old at the time of the first procedure and 6% were between 60 and 69 years old. At the current point in time, 37% of all participants were between 50 and 59 years old and 21% were between 60 and 69.

Changes in conservative treatment

For the patients, in addition to less complaints, the decrease in or elimination of still necessary conservative treatments after liposuction is of great practical relevance. An average of 12 years postoperatively, findings showed that 27% of the patients undergoing liposuction still did not require compression or decongestion. This number is at the same proportion as in our last studies conducted in 2010 (23%) and 2014 (30%).⁶

The share of “improved” patients, who no longer underwent manual lymph drainage or compression, was 19% in 2019. It is also noteworthy that many of the patients who continued CDT – as was the case preoperatively – reported a reduction in the number

of treatments or shortened treatment periods. Though this has been mentioned in the literature before,⁴ such long-lasting efficacy of liposuction with respect to the type and frequency of conservative treatment was previously unknown.

However, we do emphasize that the overall numbers are low due to the selection with respect to the homogeneity of the groups in the study and also due to the very long periods. The data and outcomes are therefore presented for orientation only.

Weight changes

The postoperative weight changes are difficult to interpret. After our first study conducted an average of 4 years after liposuction, two contrary trends were observed: one sub-group lost an average of 8 kg and another sub-group gained 4 kg.¹⁴ Now, 8 years later, i.e., an average of 12 years post liposuction, the same trends are observed: an average weight loss of 6.2 kg in one group and a weight gain of 7.9 kg in another group. The group that gained weight was over 9 years older and their starting weight was 3.5 kg higher prior to liposuction. The weight gain occurring postoperatively may be an expression of the “normal” changes women experience during menopause, the life phase most of the participants are in. Menopause is characterized by an age-related lower metabolism with muscle atrophy and storage of excess calories in the fatty tissue, in particular in the abdomen.

The weight loss occurring after liposuction may be the consequence of lifestyle changes on the part of the patients – due to the improvement in findings brought about by liposuction. For example, patients often report that they have – finally – managed to lose weight by modifying their eating and exercise habits (sports), something that had previously been impossible. In the literature on liposuction, no relevant follow-up studies were found.

However, it is not clear when or in which patients which of the two trends described here “prevail”. In general, weight does not appear to play a key role in the postoperative course. However, it is not possible to study the correlation between weight change and improvement in symptoms after liposuction due to the small number of cases in our study and due to the fact that the current weights were not verifiable.

Conclusions

As was already the case after 4 and 8 years, all patients with lipedema still describe pronounced improvements in their findings and symptoms after an average of 12 years after liposuction procedure(s) with highly significant differences to the initial findings. The clinically

relevant improvement is also demonstrated based on the largely unchanged rate of patients who no longer need conservative treatment. The astonishingly long-lasting effect of the surgical procedure impressively demonstrates the outstanding significance of liposuction for the treatment of stage I lipedema and stage II lipedema. This implies that liposuction for lipedema leads to permanent reduction of symptom severity and need for conservative therapy. The lack of stage III patients and the assessment of only subjective results in our study may be regarded as a possible limitation.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical approval

This study was approved by the ethics committee of the University of Schleswig-Holstein, Campus Luebeck, Germany, (reference number 14-021).

Guarantor

AB.

Contributorship

A.B. led the trial; he researched literature, and wrote the first draft of the manuscript. M.H. performed the analysis. I.M.-V. recruited the patients and reviewed the technical and trial output. W.S. was the senior researcher and trial lead; he reviewed, edited and submitted the final manuscript. All authors reviewed and edited the manuscript and approved the final version.

Acknowledgements

Not applicable.

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