

Laser-Assisted Liposuction for Autologous Fat Grafting Following Elective Breast

Explant Surgery

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1. Abstract

1.1. Background: The demand for breast implant removal increased globally. This study assessed an infrared diode laser's intraoperative and immediate postoperative features for fat harvesting when autologous breast lipograft is performed following breast explantation surgery.

1.2. Methods: A prospective analytical nested case-control study was conducted comparing patients submitted to laser-assisted liposuction (cases, n=5) and conventional liposuction (controls, n=10). The analytical variables collected included the duration of surgery, the total volume of aspirated fat, the total volume of fat injected into the breasts, the time elapsed between the end of the surgery and the request for the first dose of analgesia, the total number of analgesics requested in the recovery room, and visual analogue scale for pain administered 6 hours after surgery.

1.3. Results: In the transoperative period, cases have significantly increased rates of surgery time, total volume of aspirated fat, and total volume of fat injected into their breasts. Regarding pain, controls showed significantly higher consumption of analgesics, requested pain medication earlier, and obtained higher rates on the visual analogue scale.

1.4. Conclusion: Patients submitted to laser-assisted liposuction had lower pain scores and used fewer analgesics than patients who did not use intraoperative lasers.

2. Background

Due to the increasing concern from patients about the risks of adverse events following breast augmentation with implants, such as breast implant-associated anaplastic large cell lymphoma and Autoimmune Syndrome Induced by Adjuvants, or simply changes of aesthetic preference, explantation of breast implant surgery

became an emerging surgical field [1-3]. Evidence suggests that breast explantation effectively improves silicone-related complaints and that the body's self-satisfaction increases with the placement of breast implants and remains increased after their removal [4-6].

There are four options available for removing breast implants: (1) explantation only, (2) explantation with volume restoration, (3) explantation with breast contouring, and (4) explantation with both breast contouring and volume restoration [5]. For volume restoration, autologous fat grafting can be safely performed [6] [7]. Breasts of patients who underwent lipoaugmentation following implant removal were considered more attractive, natural, and feminine by physicians and the general population when compared to implants [8].

Compared to the conventional liposuction technique, the One STEP technique described by Centurión using infrared 1210 nm wavelength diode laser shows better preservation of adipocytes and less tissue trauma, thus allowing the use of the aspirated fat for grafting [9-12]. Nevertheless, this procedure for breast reconstruction following explantation of breast implants was not assessed yet. This study aimed to assess an infrared diode laser's intraoperative and immediate postoperative features for fat harvesting when autologous breast lipograft is performed following breast explantation surgery.

3. Methods**3.1. Study Design**

This research was designed as a prospective analytical nested case-control study, with a ratio of 1 case to 2 controls, aiming to identify changes in pain perception in the immediate postoperative period in patients undergoing breast explant surgery and immedi-

ate reconstruction with fat grafting. The Strengthening Reporting of Observational Studies in Epidemiology script for observational studies was followed during the manuscript elaboration. The Helsinki Declaration principles were followed in this research.

3.2. Participants

The study was conducted between November 2021 and May 2022, involving fifteen patients from the senior author's private clinic, five cases, and ten controls matched for age. Inclusion criteria: age between 21 and 69 years and voluntary signature of the informed consent form. Exclusion criteria: incomplete research records.

Patients who underwent breast explantation and laser-assisted liposuction using the Lipo One Step HD device (DMC Equipment, São Paulo, Brazil) were considered cases (n=5). The controls (n=10) were patients who underwent the same surgery, with the same anesthetic technique performed by the same medical staff and in the same hospital, but without laser assistance in the fat harvesting surgery.

3.3. Data collection

Patients undergoing surgery had their demographic variables, surgery details, and evolution in the immediate postoperative period charted in specific medical records for research purposes on Google Forms (Google Inc, California, USA). In addition, analytical values, analgesics use, and visual analogue pain scale were analyzed.

3.4. Variables

The general characteristics of the patients were collected in terms of age, gender, skin color, Body Mass Index (BMI), and time

elapsed between the silicone implant and the explant surgery. The analytical variables collected included the duration of surgery, the total volume of aspirated fat, the total volume of fat injected into the breasts, the time elapsed between the end of the surgery and the request for the first dose of analgesia, the total number of analgesics requested in the recovery room, and visual analogue scale for pain administered 6 hours after surgery.

3.5. Data Analysis

The raw data were exported to the SPSS v.22 statistical package (IBM, New York, USA). The results of continuous quantitative variables were expressed as mean \pm standard deviation. Means of different quantitative factors were compared between cases and controls using the Mann-Whitney U test. Frequencies of different qualitative factors were compared between cases and controls using the chi-square test. Values of $p < 0.05$ were considered significant in the Pearson test. The resulting odds ratios (OR) and their 95% confidence intervals (CI) were calculated (Table 1).

4. Results

All research subjects were female, white, and have been submitted to breast explantation with total capsulectomy and mastopexy. There were no significant differences between cases and controls regarding age, BMI, and previous breast implant features. In the transoperative period, cases have significantly increased rates of surgery time, total volume of aspirated fat, and total volume of fat injected into their breasts. Regarding pain, controls showed significantly higher consumption of analgesics, requested pain medication earlier, and obtained higher rates on the visual analogue scale (Table 2).

Table 1: Characteristics of the case-control population.

Mean	Laser (n=5)	Control (n=10)	p value
Age \pm SD, yr	39.6 \pm 8.9	41.1 \pm 9.8	0.34
BMI \pm SD, kg/m ²	23.9 \pm 1.9	24.1 \pm 2.2	0.53
Years since implant \pm SD	7.5 \pm 7.8	10.3 \pm 9.1	0.37

Table 2: Transoperative features.

Mean	Laser (n=5)	Control (n=10)	p value
Surgical duration skin to skin \pm SD, min	222.7 \pm 36.1	179.3 \pm 48.2	0.04
Total aspirated fat \pm SD, cc	4150.2 \pm 490.3	2941.9 \pm 365.8	0.01
Total injected fat \pm SD, cc	417.1 \pm 83.1	238.4 \pm 55.3	0.01

5. Discussion

Despite decades of silicone implant use worldwide, breast implant illness remains a poorly understood condition that plagues patients and physicians alike [13]. The demand for breast implants removal increased globally among symptomatic and asymptomatic patients [14]. It seems clear, therefore, that plastic surgeons must provide breast implant removal surgery, either to attempt to improve mental well-being, and physical health, or simply to respect patients' wishes [15].

Autologous fat grafting is a powerful tool in breast reconstruction

[16]. After breast augmentation with fat grafting, the complication rates are low and support fat grafting as an alternative to breast augmentation with implants [17]. Thus, better methods for fat removal started to be considered since it is a factor that could further improve the results of this procedure [18]. Laser-assisted liposuction is growing as a surgical procedure, recognized as effective and safe for redistributing large amounts of body fat to obtain a more balanced figure [19] (Table 3).

The One STEP laser technique for liposuction was recently developed and used in plastic surgery, the fat graft obtained with this

novel technique is homogenous, without lumps, and has high concentration of viable stimulated aspirate adipose-derived stem cells and a high number of viable adipocytes [20]. Therefore, there is a lack of studies regarding this subject, especially comparisons between the outcomes of laser-assisted liposuction and conventional liposuction [21].

The main disadvantages of conventional liposuction are blood loss, bruising, postoperative pain, and skin laxity [22-24]. Meanwhile, laser surgery generates thermal energy that melts connective tissue and can induce thrombosis of blood vessels, which would explain the better results regarding the patient recovery, the postoperative pain, and minor tissue trauma [25].

The present study results showed that patients who underwent laser surgery took more time to request analgesics when compared to the control group (258.8 min vs. 143.3 min; $p < 0.01$). Besides, they needed a smaller number of analgesic doses (1.3 vs. 2.8; $p < 0.01$) and had better results in pain self-assessment (visual analogue scale 3.8 cm vs. 6.1 cm; $p < 0.01$). These tests highlighted that laser-assisted liposuction reduces immediate post-operative pain.

Plastic surgery pain is an important patient concern. Many efforts must be directed to give a pain-free experience following liposuction [26]. Researchers have always seen laser-assisted liposuction as an effective tool for pain reduction [27-32]. In our research, there was a significant positive correlation between the use of One STEP Lipo and pain reduction following liposuction, and this finding is according to the current medical knowledge [28, 30, 32].

The present study corroborates data that have been presented in the medical literature.

Arturo Prado et al. analyzed the use of the two techniques in com-

parable topographical areas of the same body [33]. The pain was lower on the laser side. In a prospective study, Olmedo et al. compared postoperative pain between traditional and laser liposuction in 7 different body regions. Laser liposuction resulted in pain reduction compared to the traditional technique in only one area; in the others, there was no significant difference in pain between the techniques [34].

It was also found that the laser group had a larger amount of aspirated fat (4150.2 cc vs. 2941.9 cc; $p < 0.01$), as well as a greater amount of injected fat (417.1 cc vs. 238.4 cc; $p < 0.01$). These findings might suggest several courses of action to solve the lack of fat grafting in breast explantation reconstructive surgery.

Regarding surgical duration, the patients undergoing laser-assisted liposuction had a longer time (222.7 ± 36.1 vs. 179.3 ± 48.2 ; $p < 0.04$). This prolongation of anesthesia time is a problem compared to the conventional technique.

In the study of Brañas and Moraga, all patients who submitted to the laser technique returned to their daily activities within two days, while those who submitted to the traditional technique took seven days to return to activities.³⁵ Among the patients submitted to laser, 85% had minimal ecchymosis that disappeared within ten days, and after four weeks, it was not observed in any patient. In all patients of the traditional liposuction group, the ecchymosis was more severe and lasting, with 80% having ecchymosis at 2 weeks and 26% of the group at 1-month follow-up. The present study did not study these variables, but the authors deferred these topics for future work.

The great limitation of the current study was that it did not specifically measure aesthetic outcomes. Further research should be focused on this feature.

Table 3: Recovery room aspects.

Mean	Laser (n=5)	Control (n=10)	p value
Time from surgery to first requested analgesic \pm SD, min	258.8 \pm 55.7	143.3 \pm 50.1	0.01
Number of analgesic dosis \pm SD	1.3 \pm 0.4	2.8 \pm 0.9	0.01
Visual analogue scale \pm SD, cm	3.8 \pm 1.9	6.1 \pm 2.5	0.01

6. Conclusion

The evidence from this study points towards the idea that patients submitted to laser-assisted liposuction had lower pain scores and used lesser analgesics than patients who did not use intraoperative lasers. Additionally, patients submitted to an infrared diode laser for fat harvesting underwent higher averages of surgery time, a greater total volume of aspirated fat, and a most significant total volume of fat injected into the breasts.

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