

Infrared Thermography in Plastic Surgery: A Comparative Study of Pre and Post - Operatory Abdominal Skin Circulation after Different Techniques – The Effect of Undermining

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SUMMARY

The authors related a prospective study of the abdominal skin circulation after three different types of abdominal plastic surgery with infrared thermography (before and after surgery). They conclude that Lipoabdominoplasty was the less aggressive surgery, followed by the Abdominoplasty with preservation of the superficial fascia. The Classic Abdominoplasty, even with poor undermining, was the technique that destroyed the most abdominal perforated vessels, with the biggest rate of complication in the post operatory.

1. INTRODUCTION

Abdominal plastic surgery has suffered many alterations since its beginning. A revolution started in the eighties with the liposuction introduced by Illouz (3) and his posterior Abdominoplasty without undermining. Actually, authors as Avelar (1) and Saldanha (4) have been disseminated the moderns Abdominoplasties, as the Lipoabdominoplasty, with little undermining.

Infrared Thermography is a method that captures heat alterations of the skin with the infrared spectrum, with a special camera, making possible the study of the skin vascularization and function. It can even precede Doppler's sound, and have been developed and studied by many authors, as Brioschi (2), for different medical specialties.

However, there are few references in the literature about studies of the skin micro circulation to compare surgeries.

2. METHODS

In this paper we studied with the infrared thermography twelve patients preliminarily. They had been submitted before into different types of surgeries, with different surgeons, and were compared into their vascular patterns. After, we studied prospectively 4 groups (10 patients each) before and after:

1) Lipoabdominoplasty (LAP),

2) Abdominoplasty with preservation of the superficial fascia (APSF) and

3) Modified Classic Abdominoplasty (CAP), with little undermining. The fourth group was the control (CT).

The patients were studied at the temperature of 20° Celsius, before and after the use of ice over the skin to suppress the hot spots, that are the images of the perforated vessels of the abdominal wall. The camera had a sensibility of 0.08° Celsius and collected the images sequentially.

In the prospective group, the examination was made before and after each surgery (never before 3 months post operatively).

The IR camera used is shown in fig. 1.



Fig. 1 - Infrared photographic camera - (IR) T400 (FLIR® Co, Boston, USA). Software ThermoCam Reporter (FLIR Co, Boston, USA).

The perforated vessels were marked in the abdominal wall (Fig. 2) and compared before and after surgery (number and position).

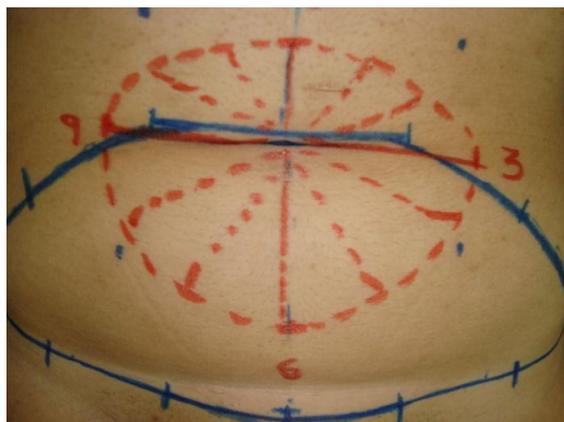


Fig. 2 - Abdominal wall marked before surgery, with the perforated vessels showed.

The results were evaluated quantitatively (number of perforator vessels) and qualitatively (capacity of maintaining skin thermoregulatory function by the termogram pattern) with the control group and between the groups.

For the quantitative results, the statistic tests used were ANOVA and Tukey. For the qualitative results, the spectrum of the color was used to classify each patient (decreasing order: red, yellow, green, sky blue, dark blue and pink).

3. RESULTS

At the preliminary study there was no possibility to establish a circulatory pattern, probably because the first groups were heterogeneous and very small. At the prospective study the 3 groups were homogeneous with the control pre operatively ($F=1.6683$ and $p = 0.1910$) and heterogeneous post operatively ($F = 22.0968$ and $p = 0.0000$). This means that the surgery was the agent of the changes.

The LAP patients had the biggest preservation in number of perforated vessels (mean 11.8 before surgery and 10.8 after surgery). They also had the best quality of thermographic images and were the only group that could be compared with the control (mean 12.1), with low rates of complications. They maintained 91.52% of the perforated vessels.

The APSF group had few complications too, compared with LAP group. They maintained a reasonable thermoregulatory function (color spectrum), although the number of the perforator had decreased, maintaining 65.46% of the perforator (mean 10.4 before and 6.6 after surgery)

The CAP group had the biggest destruction in perforator vessels and the worst thermoregulatory

function, with the highest complication rate. They only maintained 49.01% of the perforated vessels in the post operatively (mean 10.2 pre and 5 post operatively). In the figs. 3 and 4 we can see an example of the decreasing perforator vessels number observed at this group after the surgery.

The general results, as the complications, are showed at the fig. 5 and table 1.



Fig. 3 - Pre-operative patient with the perforated vessels marked at the abdominal wall.



Fig. 4 - Post operative patient after a Classical Abdominoplasty, with the perforated vessels marked.

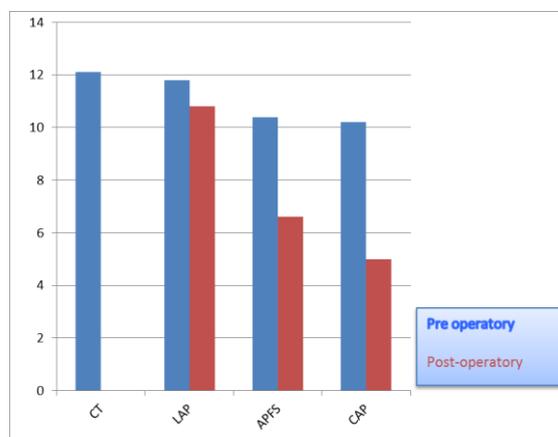


Fig. 5 - Average distribution of perforated vessels for each group studied before and after the surgeries, comparing with the control group (CT).

Pre operatively – first column, Post-operatively – second column

LAP= Lipoabdominoplasty

APFS= Abdominoplasty with preservation of the superficial fascia

APC= Classic Abdominoplasty with little undermining

Table 1. Distribution of the complications for each group studied.

COMPLICACIONES	LAP	APFS	APC
Hematoma	0	0	0
Serome	0	0	3
Open wound	0	1	0
Infection	0	0	0
Reoperation	0	0	1
Hypertrophic scar	0	1	1
Fibrosis	1	0	1
Bad position of the scars	1	0	0
Necrosis	0	0	0
Insensibility	0	0	2

LAP= Lipoabdominoplasty

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Statistically, also, only the groups LAP and control (CT) were similar ($p=0.5797$).

The group APFS was closer the group CAP ($p=0.4033$), although it have been better aesthetic and functional results.

The group CAP was the most different than the control ($p=0.0001$)

These results can be observed at the table 2.

Table 2. Statistic Test (Tukey) used for comparing groups.

Tukey 's TEST				
Group	{1} 12,100	{2} 10,800	{3} 6,6000	{4} 5,0000
CT		0.579735	0.000181	0.000159
LAP	0.579735		0.001210	0.000165
APFS	0.000181	0.001210		0.403304
CAP	0.000159	0.000165	0.403304	

LAP= Lipoabdominoplasty

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4. CONCLUSIONS

The infrared thermography is an objective, simple and useful method of the evaluation of the abdominal skin vascularization and function.

There were decrease in perforator vessel's number and thermoregulatory function, crescent in the groups: LAP, APSF y CAP.

The only group compared with the control was the LAP that preserved the most vessels and the skin function.

The CAP group had the biggest complication rate, whereas the others were comparable and low.

The APSF is an alternative to the patients who cannot have a LAP, with good preservation of the

circulation and thermoregulatory function, with low complication rates.

Other studies are necessary to evaluate the aesthetic or not aesthetic possible changes after functional post-operative modifications, even though the LAP group had showed the best results and the thermography could measures indirectly its best skin metabolism.

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