Contrast lipocryolysis
Pre- and post-session tempering improves clinical results

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Introduction

The original work that gave birth to lipocryolysis claimed that localized-fat-reduction was the result of local apoptotic adipocyte destruction as a consequence of a heat extraction triggering stimulus.1,2 Since then, this therapy has walked a long way. The empiric results witnessed and the absence of inflammation provided a “keyhole” where apoptosis was the only key that could fit in.3 Still, in every study we performed, we were able to identify non-apoptotic cell death up to some extent, normally in a very small proportion.4,5 These findings opened our eyes to the fact that there were at least two processes coexisting beneath the action of lipocryolysis and that even not fully understood, both where susceptible of modifications in order to achieve better clinical results.

Lipocryolysis is a treatment that combines adipose tissue heat extraction with vacuum. It is a safe technology7,8 that is effective for localized fat reduction.2 Today, much more is known about every aspect of lipocryolysis as pioneer research is opening new gates to promising edges that will improve clinical outcome. One of these new technical developments is the second generation of lipocryolysis, also known as contrast lipocryolysis, which has already proved to be effective in vitro adipocyte models.3 Apoptotic adipocytolysis as a consequence of intracellular changes was the first and most logical action mechanism proposed for lipocryolysis.1,8-10 It was assumed that adipocytolysis was the biological consequence of intracellular lipid crystallization. A number of alternative crystal structures are a characteristic property of all lipids.11 This is due to the fact that there are a number of different possibilities of packing the long hydrocarbon chain into a crystal lattice. This phenomenon is called polymorphism and each different crystal structure is called a polymorphic form of the lipid.12 Iconographic evidence already backed-up the process of natural fat crystallization after lipocryolysis.6 But the kinetics and thermodynamics that drive the formation, growth, stabilization, melting and destruction of lipid crystals are extremely complicated.6 Inter-conversion between the typical three polymorphisms is an extremely appealing process because it implies the possibility of leaning crystal formation toward the most effective polymorphism for adipocyte destruction. If controlled, this should mean an exciting breakthrough toward clinical outcome improvement. Food industry has been tempering lipids for decades. Tempering technology applied to lipocryolysis gave birth to “contrast lipocryolysis”, which involves pre- and post-lipocryolysis fat layer heating as part of a specific tempering protocol. In this study, we evaluated the skinfold thickness of 10 subjects after a single contrast lipocryolysis session and witnessed important and fast reductions.

Results

M1 mean skinfold was 3.79 cm (SD 0.78), M2 mean skinfold was 3.05 cm (SD 0.62), and M3 mean skinfold was 2.80 cm
Thicker panicles showed larger reductions in absolute numbers. The maximum fat layer reduction observed represented a 31% reduction of the original adipose panicle thickness and the minimum fat layer reduction observed represented a 23% reduction of the original adipose panicle thickness. The mean fat layer reduction for the whole sample was 26.6% (SD 2.72). The difference observed between the means of M1 and M3 was statistically significant ($P < 0.01$).

**Discussion**

Contrast lipocryolysis seems to be more effective than conventional lipocryolysis, though further evidence is needed

It seems logical to assume that contrast lipocryolysis will be the natural evolution of conventional lipocryolysis. In a previous study we evaluated 16 women and we found a statistically significant skinfold reduction of 6.95 mm (SD 2.45) after a single conventional lipocryolysis session. In the present study we observed a mean 9.9 mm reduction (SD 6.1) after a single contrast lipocryolysis session. When comparing both studies, the fat layer reduction achieved with contrast lipocryolysis represented a 42.45% improvement toward fat layer reduction observed with conventional lipocryolysis. Still, though both studies were methodologically very similar, comparable experiments using exactly the same conditions and evaluation days for both treatments should be conducted.

Another study conducted in in vitro adipocyte models showed that pre and post lipocryolysis temperature conditioning provided huge increments in adipocyte destruction and in crystal formation. This study compared conventional lipocryolysis to 4 different tempering patterns and concluded that precondition for 5 min at 40 °C followed by 30 min at 8 °C and post-condition at 38 °C for 10 min was the best tried tempering protocol. This remains the actual tempering protocol for contrast lipocryolysis, though further research, with larger samples and exhaust follow-up, should provide more data in order to evaluate and optimize other tempering protocols.

**Fat panicle thickness**

Contrary to intuition, we saw that thicker fat panicles reached the treatment temperature faster. Thicker fat panicles were easily cooled down than thinner ones, probably due to the tissue irrigation differences. This may result in an added challenge for contrast lipocryolysis machines, as fat layer thickness may determine individual protocols and affect session time. Comparable experiments with a larger number of subjects should be conducted, since this fact might be important for the clinical application of contrast lipocryolysis.

**Materials and Methods**

Sample consisted of 10 volunteer women recruited consecutively between November 15, 2013 and December 15, 2013, with a mean age of 48.1 (SD 9.73) years old. This study is in accordance with the standards set by the Helsinki Declaration of 1975. Inclusion criteria were: (1) no systemic pathologies, (2) not under chronic medication protocols, (3) not pregnant nor breastfeeding, (4) with no contraindications for lipocryolysis application, (5) >2 cm skinfold, and (6) body mass index between 22 and 27. Between 30 d prior and 45 d after the session, patients did not follow any other treatment for localized fat reduction neither for body weight reduction. Each session was performed in the lower abdominal area by the same personnel. The application of “contrast lipocryolysis” was performed with Lipocryolysis® (Clinipro). Heat and cold extraction energy was fully and automatically deployed by Lipocryolysis® throughout the whole procedure (Fig. 2), resembling the best tempering protocol according to the results obtained in previous studies.

Skinfold thickness was assessed with a plicometer Harpenden Skinfold Caliper® (Baty International). The baseline plicometry measurement (M1) was taken immediately before the therapeutic session. The second (M2) and the third (M3) measurements were taken 15 and 30 d after the therapeutic session respectively.

Normal distribution assumption was verified with a Shapiro–Wilk test and homocedasticity assumption was verified with a Levene test. M1, M2, and M3 means were compared with a Student $t$ test. Statistical analysis was performed with SPSS version 17 for Windows (IBM Corporation).

**Disclosure of Potential Conflicts of Interest**

H.P. is an external medical advisor to Clinipro SL.

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Figure 2. Contrast lipocryolysis and conventional lipocryolysis. Heating (red line) speed is dual: When temperature is below 36 °C, blood flow restoration naturally enhances heating speed, resulting in a mean heating speed of 8.25 °C/min. When temperature is around 36 °C, blood flow plays a role against further heating, resulting in a mean heating speed of: 2 °C/min. Cooling (blue line) speed is 3 °C/min. Target temperature in adipocytes (black line): 40 °C during 5 min for pre-conditioning, <10 °C during 30 min for conventional lipocryolysis and 38 °C during 10 min for post-conditioning. Whole contrast lipocryolysis procedure lasted 60 min.