Published in final edited form as:

Plast Reconstr Surg. 2013 August ; 132(2): . doi:10.1097/PRS.0b013e3182958be1.

Returning Fat Grafts to Physiological Conditions Using Washing

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Autologous fat grafting is a widely used technique in plastic and reconstructive surgery. Despite decades of clinical practice, a standardized procedure has yet to be adopted by all practitioners. One of the most critical disadvantages of this technique is the unpredictable post-surgical volume loss over time (1).

Among the variables that remain to be standardized, harvesting technique, processing method, and injection technique are considered the most critical. The loss of grafted tissue could be explained by the lack of adequate vascularization, the lack of regenerative cells within the fat graft, the traumatic handling of the fat during preparation and implantation, immune system-mediated cellular phagocytosis in the pro-inflammatory environment after grafting, or likely a combination of all of these effects (2).

Various methods for harvesting and processing of autologous fat grafts have been described and analyzed in the literature. One of the standard procedures, the Coleman technique (3-4), uses aspiration at reduced vacuum levels and centrifugation to concentrate adipose tissue. Other techniques use straining through a mesh to obtain the adipose tissue. However, none of these methods utilize an efficient washing system to remove red blood cells, free oils, cellular breakdown products such as LDH (lactate dehydrogenase), or anesthetic substances.

The rationale for performing this study is to obtain data which address questions regarding the adipose tissue physiological conditions as harvested (raw lipoaspirate) and after washing using isotonic saline solution.

Adipose samples were collected with standard liposuction technique from 5 healthy females donors after signing informed consent. One half of the samples were decanted without washing, while the other half were washed using a CE-marked device that had been developed to process large volumes of human lipoaspirates (GID Group, Inc, Louisville, CO). The aqueous phase of the tissues were quantitatively analyzed for triglyceride content (TGC), LDH, hematocrit, and osmolarity using an automated analyzer (Dimension RxL Max analyzer, Siemens). All results are expressed as means $\pm$ SEM (n = 5). The unpaired

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Financial Disclosure and Products Page: Severiano Dos Anjos Vilaboa: Employee at Stem Center, he holds no financial interests or stock in the GID Group.

Thomas A. Mendel: Thomas's internship at Stem Center Mallorca was funded by the University of Virginia Biotechnology Training Grant (NIH T32 GM08715). He holds no financial interests or stock in the GID Group or Stem Center.

Ramon Llull Cerdá: Director at Stem Center. Ramón Llull maintains a consulting relationship and stock interest in The GID Group, Inc.

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Student's t-test was used to compare the different values analyzed between the decanted and washed adipose tissue.

Compared to decanted adipose, washed adipose demonstrated marked and significant reductions in triglycerides (6.4 fold increase of triglyceride content in the unwashed lipoaspirate sample), LDH (unwashed lipoaspirate produced 3-4 fold more LDH than GID washed) and hematocrit (unwashed lipoaspirate produced almost 8 fold more hematocrit than GID washed). The levels of TGCs and free hemoglobin have been previously described to promote inflammation and mediate different pathways that lead to nitric oxide depletion and reactive oxidative species generation (5). Importantly, washing the adipose resulted in a restoration of adipose graft osmolarity to within a normal physiological range. (See figures 1 and 2).

The raw lipoaspirate is subjected to hyperosmolar conditions (more than 300 mOsm/L) and is contaminated with red blood cells, free hemoglobin and free oils. In this study we demonstrate that the use of a fast and efficient washing system allows the fat graft to be returned to optimal physiological conditions for reimplantation.

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Figure 1. Representative images of unwashed lipoaspirate (A and C, left) and washed lipoaspirate (B and D, right) after decantation. Note raw lipoaspirate on GID700 device before and after washing.

Figure 2.

Comparison of TGC content (A), LDH release (B), hematocrit (C) and osmolarity (D) in decanted adipose compared to GID washed adipose. ($p < 0.001$), ($p < 0.05$), ($p < 0.01$) (Student's t-test; $n=5$).