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Does Stromal Vascular Fraction Ensure a Higher Survival in Autologous Fat Grafting for Breast Augmentation? A Volumetric Study Using 3-Dimensional Laser Scanning

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Abstract

Background: Cell-assisted lipotransfer (CAL) has been considered a promising technique for promoting adipogenesis and angiogenesis in fat grafts.

Objectives: The author sought to objectively analyze the change of breast volume in patients who underwent stromal vascular fraction (SVF)-enriched fat grafting for breast augmentation and compared the clinical results with those who underwent conventional fat grafting without SVF by using 3-dimensional laser scanning.

Methods: From April 2015 to March 2016, 105 patients who underwent traditional fat grafting without SVF enrichment for breast augmentation were assigned to group A and served as the control. The other 101 patients who underwent SVF-enriched fat grafting for breast augmentation were assigned to group B. The charts of these patients were retrospectively reviewed.

Results: The survival rate of the transplanted fat was 67.9% in group A and 68.7% in group B at 12 months after the operation. Postoperative complication rate was 3.8% in group A and 5.9% in group B. The differences were statistically insignificant.

Conclusions: SVF does not ensure a higher survival rate in autologous fat grafting for breast augmentation. Considering the potential drawbacks of adipose-derived stem cells (ADSC) and the extra cost of the consumables, in particular the need for harvesting larger amount of fat which could be reserved for additional fat grafting at a later time to achieve even better improvement, the results of this study do not support the use of SVF in autologous fat grafting for breast augmentation in terms of graft survival and postoperative complications.

Level of Evidence: 3

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Autologous fat grafting is a popular treatment for volume and contour defects in reconstructive and cosmetic surgeries.[1] Illouz first described fat grafting to the breast using liposuctioned adipose tissue and Bircoll published this approach in 1987.[2,3] Since then, autologous fat grafting has gradually become accepted as an option for cosmetic breast augmentation.

To increase the fat survival and enhance the predictability of this approach, several modifications and refinements regarding fat harvesting, processing, and injection have been made in many ways. Although these techniques have been extensively studied and standardized, no big impact on outcome following fat grafting has been identified.[4]

In 2001, Zuk et al isolated mesenchymal stem cells from adipose tissue with the potential to differentiate into mesenchymal, including adipogenic lineages.[5] Adipose-derived stem cells (ADSC) also display angiogenic properties through the release of mediators in a paracrine fashion. Considering the ease of isolation and abundant supply, ADSC have become attractive in regenerative medicine

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and are capable of being used as a tool to enhance the survival of fat grafts.[6]

The number of ADSC in adipose tissue is high in vivo.[7] Harvesting fat grafts by liposuction reduces the amount of ADSC.[8] This opens room for supplementation of the lipoaspirate with stromal cells and stem cells isolated from another portion of fat tissue during conventional liposuction. Supplementation aims to restore the amount of ADSC in the ready-for-grafting fat to approach the amount seen in native adipose tissue.[9] This method is called cell-assisted lipotransfer (CAL).[9,10] The isolation procedure of adipose tissue results in a stromal vascular fraction (SVF) layer which is composed of a host of cells, including stem cells and others.[11]

However, most of the published literatures related to CAL for breast augmentation are short of rigorous study in methodology. Apart from this, the absence of control group in most of the studies makes it difficult to ascertain the efficacy and safety of CAL. The current level of evidence surrounding CAL makes it difficult to jump into the conclusions for its use in the clinical setting.[12]

With respect to objective volume assessment in breast augmentation, magnetic resonance imaging (MRI) and 3-dimensional (3D) imaging both provide accuracy and reliability in breast volume measurement.[13,14] MRI is known for its precision in estimating breast volume and detecting internal consistency. However, for frequent follow up (eg, monthly volume analysis), repeated MRI exams would not be practical for the patients and not cost effective. Three-dimensional surface imaging, including 3D laser scanning, is a better option in these cases. It is especially helpful in a private practice where fast data are required.[15,16]

In the current study, by using 3D laser scanning, we retrospectively analyzed the change of breast volume in patients who underwent SVF-enriched fat grafting for breast augmentation and compared the clinical results with those who underwent conventional fat grafting without SVF. To the best of our knowledge, this is the first comparative study assessing serial changes of breast volume using 3D laser scanning in a large number of patients for more than 12 months follow up.

METHODS

The study was approved by the Institutional Review Board (approval GI-10604) at the Genesis Clinic and was conducted in compliance with the 1975 Declaration of Helsinki. All patients provided written informed consent for the procedure and had been advised of the potential complications of fat grafting to the breast. They all agreed to undergo routine postoperative examinations of breast ultrasonography and 3D laser scanning for breast volume assessment.

From April 2015 to March 2016, autologous fat grafting to the breast was performed by the author in 226 patients seeking cosmetic breast augmentation. All patients were asked to return for follow-up visits at 3, 6, and 12 months. However, there were 10 patients lost to follow up, 10 patients with a history of previous surgery for breast tumor or radiation therapy to the breast. After exclusion of these patients, 206 patients were included in this study.

Among them, 105 patients underwent traditional fat grafting without SVF enrichment for breast augmentation. These patients were assigned to group A and served as the control. The other 101 patients willing to pay the extra fee (USD 1500) for the cost of the consumables used for SVF isolation underwent SVF-enriched fat grafting for breast augmentation. These patients were assigned to group B. Ultrasound-assisted liposuction (UAL) was performed for both groups to harvest the lipoaspirate. The charts of these patients were retrospectively reviewed. Patient demographics, complications, operation time, reoperation rate, and clinical results were recorded and compared using SPSS software 17.0 (SPSS, Inc, an IBM Company, Chicago, IL) with statistical significance defined as $P < 0.05$.

Harvesting Adipose Tissue

Potential donor sites for fat harvesting included the abdomen, flanks, hips, thighs, and calves. Before harvesting, all patients received intravenous sedation and local tumescent anesthesia. Each harvest site was infiltrated with 150 to 300 mL of tumescent anesthesia (1000 mL of lactated Ringer's solution, 40 mL of 2% lidocaine, and 1 mL of 1:1000 epinephrine) 10 minutes before liposuction was initiated.

Third-generation UAL was applied (Ultra-Z system, Zerone Co., Ltd. Seoul, South Korea) with a 3.7-mm, 3-ring probe at an amplitude of 100% in normal mode (10 Hz) to the donor sites. After emulsification of the subcutaneous fat, adipose tissue was then harvested with a 3- or 4-mm aspiration cannula attached to a low-pressure suction machine set to -600 mm Hg.

Preparation of SVF-Enriched Fat Graft

For patients of group B, a portion of harvested fat (100 mL) was mixed with 0.075% collagenase (Sigma-Aldrich Co., St. Louis, Mo) and transferred to a shaking incubator (Beauty Cell multifunctional bio-workstation; N-BIOTEK, Seoul, South Korea) at 37°C (200 rpm), where the mixture remained for at least 30 minutes to dissolve the adipose tissue.

The collagenase-dissolved fat was then centrifuged at 800 × g for 5 minutes to isolate the SVF. After centrifugation, the resulting cone tube showed 4 distinct layers of content. The uppermost layer comprised lysed fat and oil, the second layer consisted of collagenase solution, and the

bottom layer contained red blood cells (RBC). The third layer between the bottom layer and the layer of collagenase solution was the collection of SVF. After discarding the upper supernate and collecting the SVF layer, autologous serum was used to mix with SVF for neutralization at 300 g for 3 minutes, which was performed repeatedly for 3 times.

During the isolation process, the remaining aspirated fat was prepared for grafting by centrifugation at 800 × *g* for 4 minutes to remove free oil and blood components. Freshly isolated SVF was then combined with the aspirated fat, which was then transferred to 10 mL BD syringes (Becton Dickenson, Franklin Lakes, NJ) and connected to a 14 gauge, 15 cm, single-hole cannula for injection.

To scientifically verify that stem cells were transplanted, samples of SVF were further processed in the laboratory (Scientific Biotech Corp. Taipei, Taiwan) outside the clinic to isolate ADSC by the method described in the literatures. To assess the stem cell immunophenotype of the isolated ADSC, the cells were harvested and characterized by flow cytometry as described previously.[5,17]

Injection of the Graft

Injections were performed with the patient in a supine position under intravenous sedation. The injections were made in a fanning pattern and in small aliquots according to the principle of structural fat grafting recommended by Coleman.[18,19] In addition, special care was taken to avoid potential crowding of grafted fat by using the "solid injection technique" described in the author's previously published article.[20,21] The amount of fat injected varied depending on the desired amount of augmentation and the remaining safety area which was detected during injection according to this technique.

Volumetric Study

Noncontact 3D laser surface scanning (Konica Minolta Vivid 910 3D Digitizer, Konica Minolta Inc., Tokyo, Japan) was performed with a portable device to objectively calculate the volume of the breasts. The scanning process lasts less than 60 seconds in taking multiple views for merging. Data from these scans were merged for volumetric analysis using software "Rapidform XOV2" (INUS Technology, Inc. Seoul, South Korea) on computer for each breast in all patients by a blinded expert before treatment, and 3, 6, and 12 months after treatment (Figure 1).

Follow-Up Evaluation

Physical examination and breast ultrasonography were performed 3, 6, and 12 months after treatment. Clinical data on all posttreatment complications were collected throughout the follow up for all patients. Breast ultrasonography was performed routinely at follow-up visits to determine the complication rates for fat necrosis, indurations, and calcifications. If a mass was palpable during physical examination or observed with ultrasonography, patients were then suggested to have magnetic resonance imaging (MRI) performed for further evaluation. Patient satisfaction was assessed with an abbreviated version of the BREAST-Q in the form of a written questionnaire administered by a blinded nurse preoperatively and 12 months after the procedure.[22,23]

RESULTS

The mean age of the patients was 33 years (range, 20-56 years; SD, 9.4) in group A and 37 years (range, 23-53 years; SD, 7.4) in group B. The mean follow-up time was 15.8 months (range, 12-19 months; SD, 2.7) in group A and 13.4 months (range, 12-17 months; SD, 1.6) in group B. Total volume of liposuction was 1456 mL (range, 1200-1960 mL; SD, 294) in group A and 1655 mL (range, 1200-3700 mL; SD, 507) in group B. The volume of grafted fat to the breasts was 310 mL (range, 220-420 mL; SD, 36) in group A and 334 mL (range, 240-490 mL; SD, 44) in group B. Original breast volume assessed by 3D laser scanning was 113 mL (range, 32-253 mL; SD, 42) in group A and 106 mL (range, 28-220 mL; SD, 43) in group B. Operation time for group A was 196 minutes (range, 137-280 minutes; SD, 36), and for group B, 214 minutes (range, 148-347 minutes; SD, 51). Postoperative complications including indurations and necrotic cysts as verified by ultrasonography and MRI were 4 cases (3.8%) in group A and 6 (5.9%) cases in group B. These comparative data were not statistically significant. However, reoperation rate was 3.8% in group A and 20% in group B, of which the difference was significant. (Table 1)

Serial breast volume assessments using 3D laser scanning revealed that original volumes of the breasts were 113 mL in group A and 106 mL in group B which difference was not statistically significant. Fourteen days after the surgery, the breast volumes developed into 515.3 mL in group A and 524.8 mL in group B. The breast volumes after 14 days were larger than the sum of initial breast volume and grafted volume indicating that there was a certain degree of swelling in the breasts of the patients. At 12 months after the surgery, the breast volume was 324.1 mL in group A and 334.6 mL in group B which difference was not significant.

The percentage of survival was defined as the final breast volume minus initial breast volume, divided by the volume of the grafted fat. The percentage of graft survival at 12 months was 67.9 % in group A and 68.7% in group

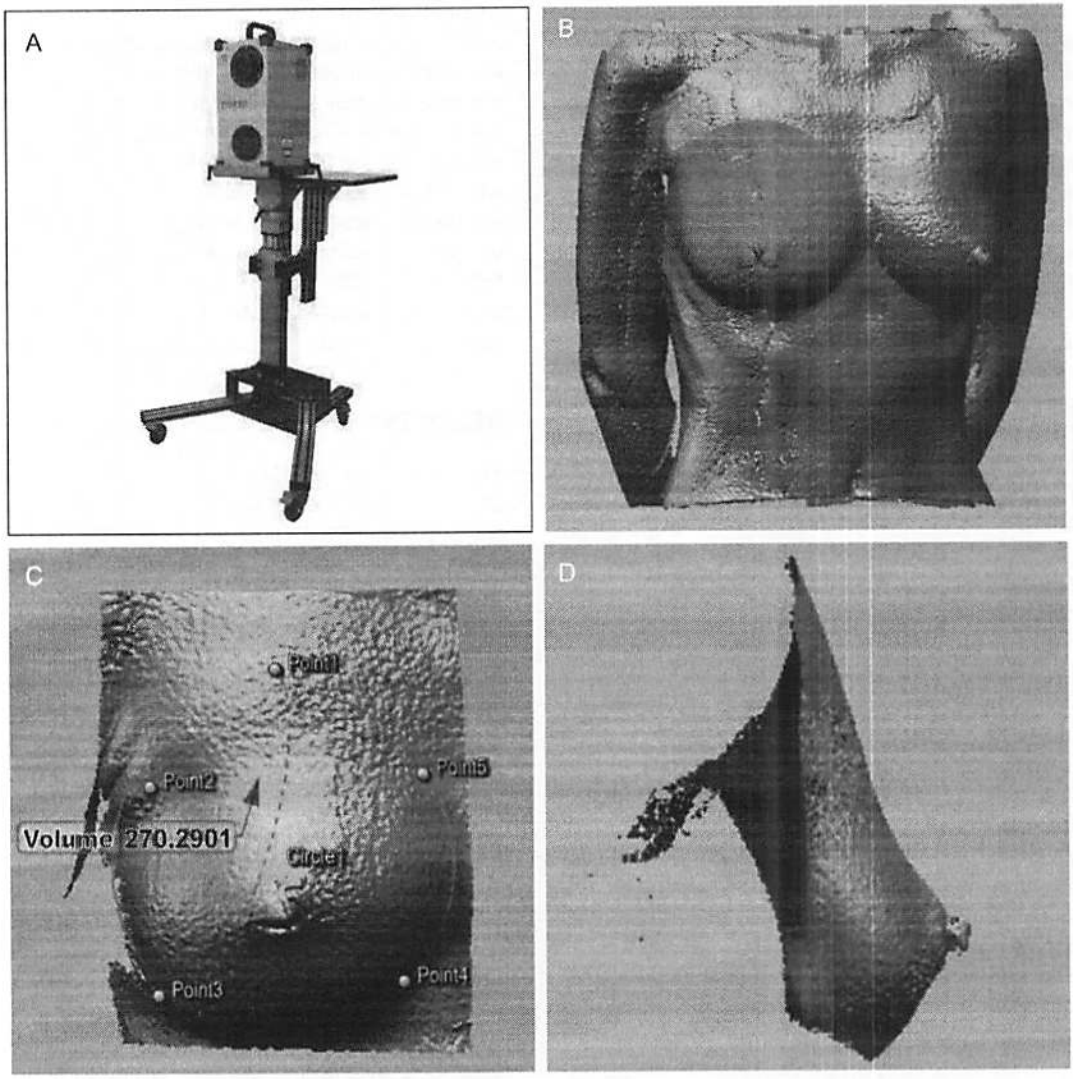

Figure 1. Preoperative and postoperative breast volume were measured by using 3D laser surface scanning. (A) Noncontact 3D laser scanner (Konica Minolta Vivid 910 3D, Konica Minolta Inc., Tokyo, Japan) with customized portable device. (B) A merged 3D image of a patient. (C) A 3D image was marked using imaging software with the breast volume calculated after marking. (D) The concavity of the posterior surface of the breast was computed with the curvature of the thorax taken into consideration.

B of which the difference was not significant. These values were close to those calculated at 3 months and 6 months indicating that the grafted fat became stable 3 months after the surgery (Figure 2).

In our study, an average of 4.07×10^8 viable cells were yielded in SVF isolated from 100 mL of lipoaspirate. Samples of the SVF were sent to an independent laboratory outside the clinic. After 3 passages of culturing in the laboratory, about 6×10^6 stem cells were identified scientifically verifying that stem cells were transplanted along with the fat graft during our surgical procedure (Figure 3).

There was a substantial improvement in all patient-reported parameters according to the results of the questionnaire. Postoperatively, patients expressed feeling pleased with the size of their breasts, more comfortable with their breasts (both clothed and unclothed), and more satisfied with the fit of their bras. In terms of sexual well-being, patients also reported feeling more attractive, being sexually confident, and at ease during sexual activity. The difference of BREAST-Q scorings between group A and group B was not significant.

Table 1. Patient Demographic and Operation-Related Events

	Group A, n = 105	Group B, n = 101	*P*-value
Age, y (SD)	33 (9.4)	37 (7.4)	NS
BMI, kg/m^2 (SD)	18.8 (1.6)	20.3 (2.4)	NS
Total volume of suctioned fat, mL (SD)	1456 (294)	1655 (507)	NS
Original breast volume, mL (SD)	113 (42)	106 (43)	NS
Volume of fat grafted, mL (SD)	310 (36)	334 (44)	NS
Operation time, min (SD)	196 (36)	214 (51)	NS
Reoperation, n (%)	4 (3.8)	20 (19.8)	<0.000
Complication, n (%)	4 (3.8)[a]	6 (5.9)[b]	NS
Follow up time, months (SD)	15.8 (2.7)	13.4 (1.6)	NS

[a] Complications in group A included 1 case of necrotic cyst and 3 cases of indurations. [b] Complications in group B included 1 case of necrotic cyst and 5 cases of indurations. BMI, body mass index; SD, standard deviation.

Typical results of the patients in group A and group B, together with their serial 3D laser scans at different time points, are shown in Figures 4 and 5.

DISCUSSION

To overcome the weakness of fat grafting, several refinements and modifications have been studied extensively in the literature. Among them, CAL has been considered a promising technique for promoting adipogenesis and angiogenesis in fat grafts since it was first introduced to this field.[12] In preclinical studies, both SVF and ADSC seem to provide evidence for the superiority of CAL. When using ADSC by ex vivo expansion, the concentration of ADSC is increased by 1250 to 6250 times which results in considerably improved fat graft survival and quality.[24-26] The drawbacks of this technique include prolonging the treatment to a two-stage procedure and a potential contamination of the cultures.[27]

Clinical application of SVF refers to the isolation of a portion of the aspirated fat at the time of operation. The SVF containing abundance of ADSC was mixed with the fat graft in hopes of doubling the amount of stem cells which was low in the aspirated fat. In several human studies almost half of the lipoaspirate was used for the isolation of SVF which increased the ADSC concentration by 2 to 5 times as compared with non-SVF fat graft.[6,9] Since the ADSC concentration in lipoaspirates is only half the concentration in native adipose tissue, 2 to 5 fold increase would only equalize the original concentration. In this respect, the improvement in the survival of fat graft that half of the lipoaspirate can make remains questionable.

There is no consensus about how many cells are needed for the optimum survival of the graft and how much amount of fat should be used to isolate that amount of cells in humans so far.[25,26,28] Yoshimura et al used "half of the aspirated fat" to isolate SVF. However, in his article, the total amount of suctioned aspirate was around 1111 mL indicating that the amount of aspirate for SVF was about 555 mL.[9] The remaining amount of lipoaspirate for injection was only 555 mL. Strangely, they described that the average amount of fat grafting to each breast was over 270 mL, which would require a total amount of the injected fat to be over 540 mL for each patient. The amount of purified fat capable of being infiltrated is usually two thirds of the amount of the lipoaspirate after centrifugation or sedimentation. To prepare 540 mL of the graft ready for injection, over 800 mL of fat should be harvested. One would ask "How could it be possible to inject 540 mL of fat graft from 555 mL of lipoaspirate? Did they inject the lipoaspirate directly into patient's breasts without removal of blood and water component?"

In 2015, Wang et al used 250 mL lipoaspirate and 500 mL liposuction fluid consisting of perforated oil, blood, and water to isolate SVF and concluded that SVF from this amount of fat and fluid was not enough for an optimal result.[27] Back in 2013, Peltoniemi et al found that the fat survival rate did not significantly differ between CAL-enriched group (50%) and non-CAL group (54%) by using 240 mL to 360 mL of aspirated fat for the isolation of SVF in a comparative study.[29] However, the case number was small in their study (total 18 cases) and the follow-up time was not long enough (6 months).

According to Suga et al, 100 mL of adipose tissue contains 100 million stem cells.[30] We followed the protocol described by Estes et al to isolate SVF from 100 mL of the lipoaspirate.[31] In the meantime, fat graft was prepared from the remainder of the lipoaspirate. In our study, an average of 4.07×10^8 viable cells were yielded in SVF isolated from 100 mL of lipoaspirate. Samples of the SVF were then sent to an independent laboratory outside the clinic. After 3 passages of culturing in the laboratory, about 6×10^6 stem cells were identified with anti-CD45, anti-CD34, and anti-CD31 antibodies (eBioscience, Inc., San Diego, CA), which scientifically verified that stem cells were transplanted along with the fat graft during our surgical procedure.

In an animal study, Paik et al reported that a concentration of 1×10^4 SVF cells per 200 μL fat graft improved retention by approximately 20% in a xenograft model of CAL.[28] To enrich 600 mL of graft, one would need a concentration of 3×10^7 SVF cells according to this calculation. In our study, an average of 4.07×10^8 viable cells were yielded in SVF isolated from 100 mL of lipoaspirate, which was 10 times more than that needed for the enrichment of 600 mL fat. In another report, Dos Anjos et al used

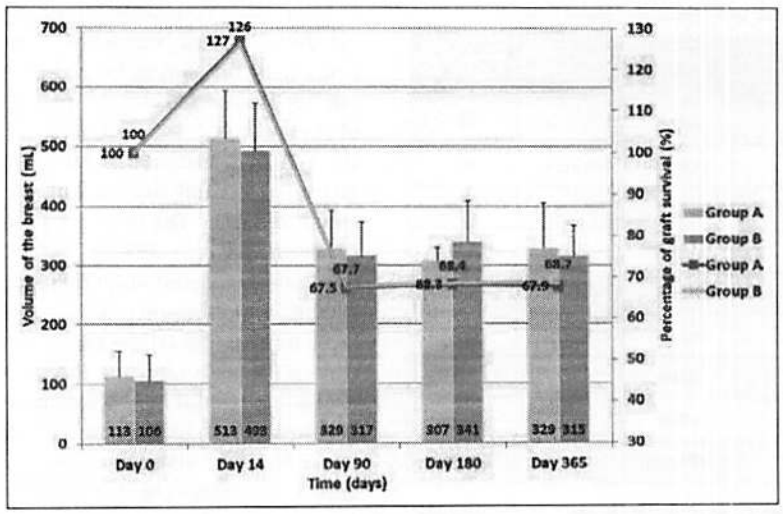

Figure 2. Serial assessments of breast volume and the survival rate of grafted fat indicating that a stable condition was reached at 3 months after the operation and the difference between the two groups was not significant. Group A, patients underwent traditional fat grafting for breast augmentation. Group B, patients underwent SVF-enriched fat grafting for breast augmentation.

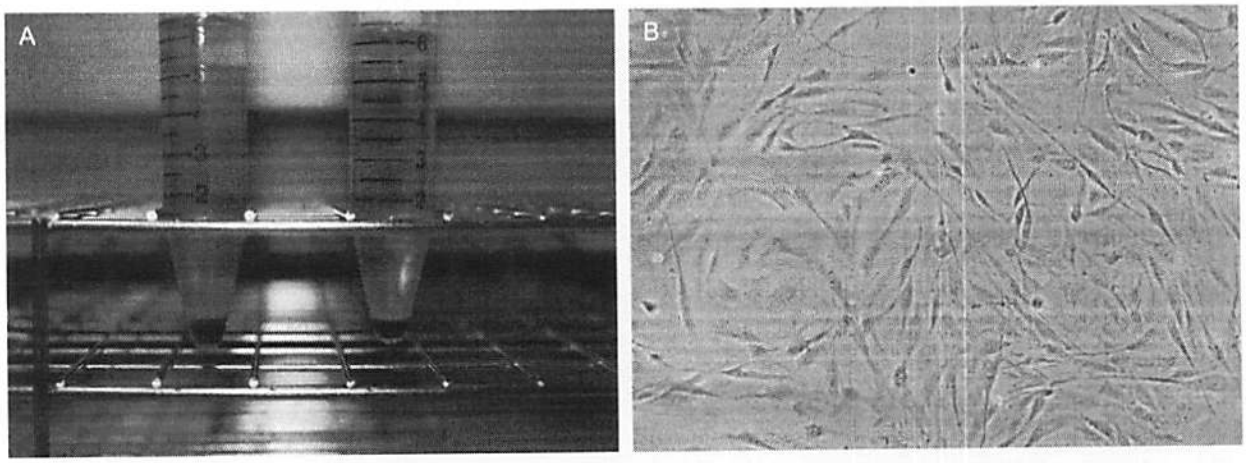

Figure 3. Isolation of SVF and culture of ADSC. (A) A grayish layer containing SVF was formed between the upper layer of serum and the bottom layer of RBC after repeated neutralization with autologous serum. (B) The adipose-derived stem cells showed the typical elongated shape under phase contrast light microscope.

a concentration of > 200,000 SVF cells for each mL of graft in their "high cell enhancement group."[32] According to that report, 1.2×10^8 cells should be added for 600 mL graft to get a successful result. The amount of 4.07×10^8 cells in our study, which was nearly 4 times of that amount, exceeded the amount needed for a successful CAL.

We compared the efficiency and safety of conventional fat transplantation (group A) with SVF-enriched fat grafting (group B) in a total number of 206 patients for breast augmentation and followed up these patients for more than 12 months. In the current study of the groups granted their well-defined and precisely done volumetric analysis by using 3D laser surface scanning, the survival rate of the transplanted fat 12 months after the operation was 67.9% in group A and 68.7% in group B. The difference was not statistically significant.

Postoperative complication rate was 3.8% (4 in 105 cases) in group A and 5.9% (6 in 101 cases) in group B which difference was also insignificant. Most of the complications developed by the end of 12 months. In our experience, if a mass is detected during physical examination within 6 months after the operation, cystic formation is more likely to occur. Induration formation usually occurs more than 6 months postoperatively if the liquified content is replaced by fibrosis. Ultrasonography can tell the differences. In those cases, we generally refer our patients to undergo MRI examinations of the breasts.

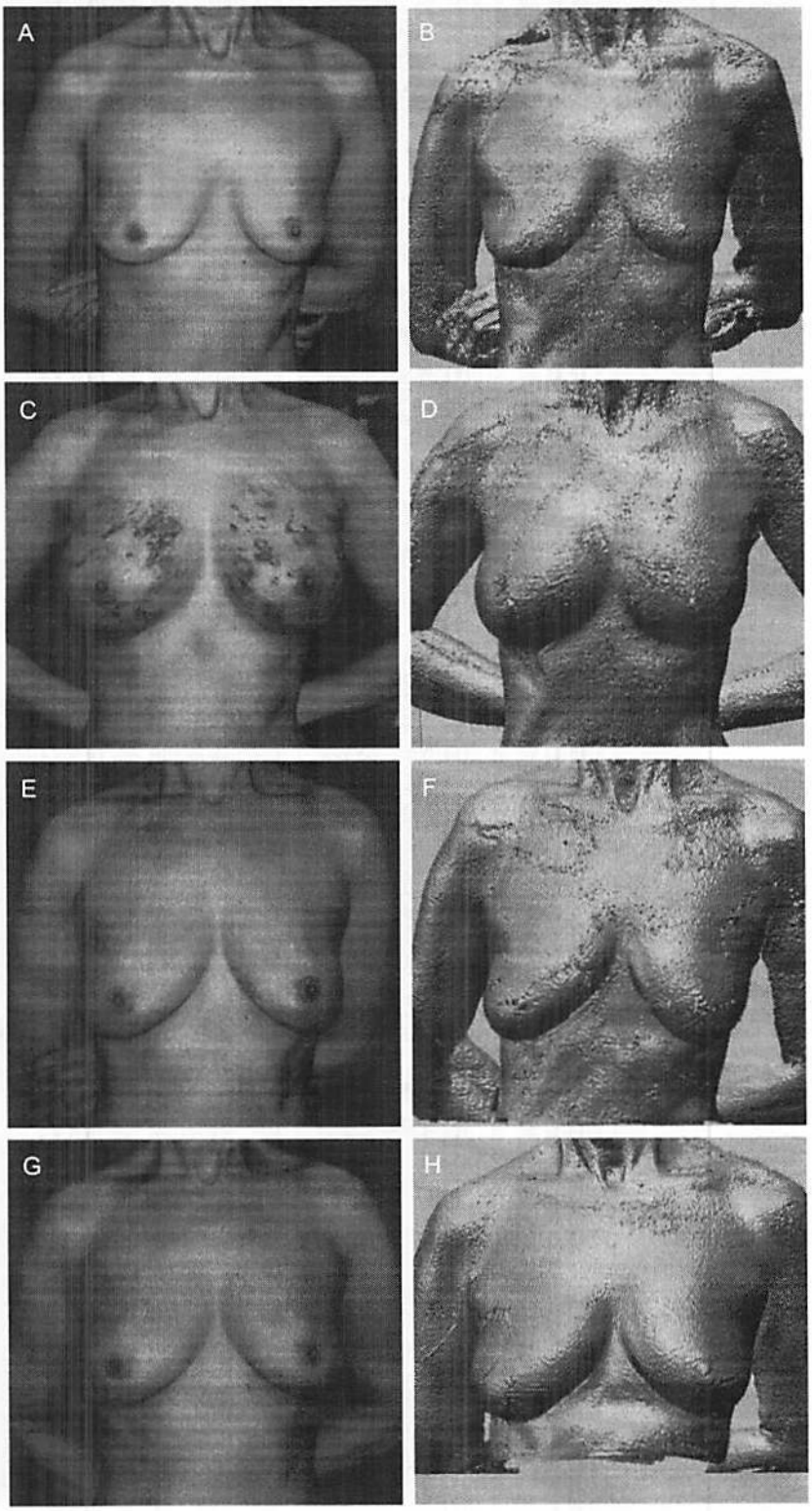

Figure 4. Representative results of a patient with corresponding 3D laser scans. A 54-year-old woman in Group A who underwent traditional fat grafting for breast augmentation without SVF enrichment. Fat grafting of 330 mL was performed to each breast. The volumes of her breasts were (A, B) 129 mL (preoperative), (C, D) 555 mL (14 days postoperative), (E, F) 347 mL (3 months postoperative), and (G, H) 356 mL (12 months postoperative). The overall survival rate of the graft was 68.8%.

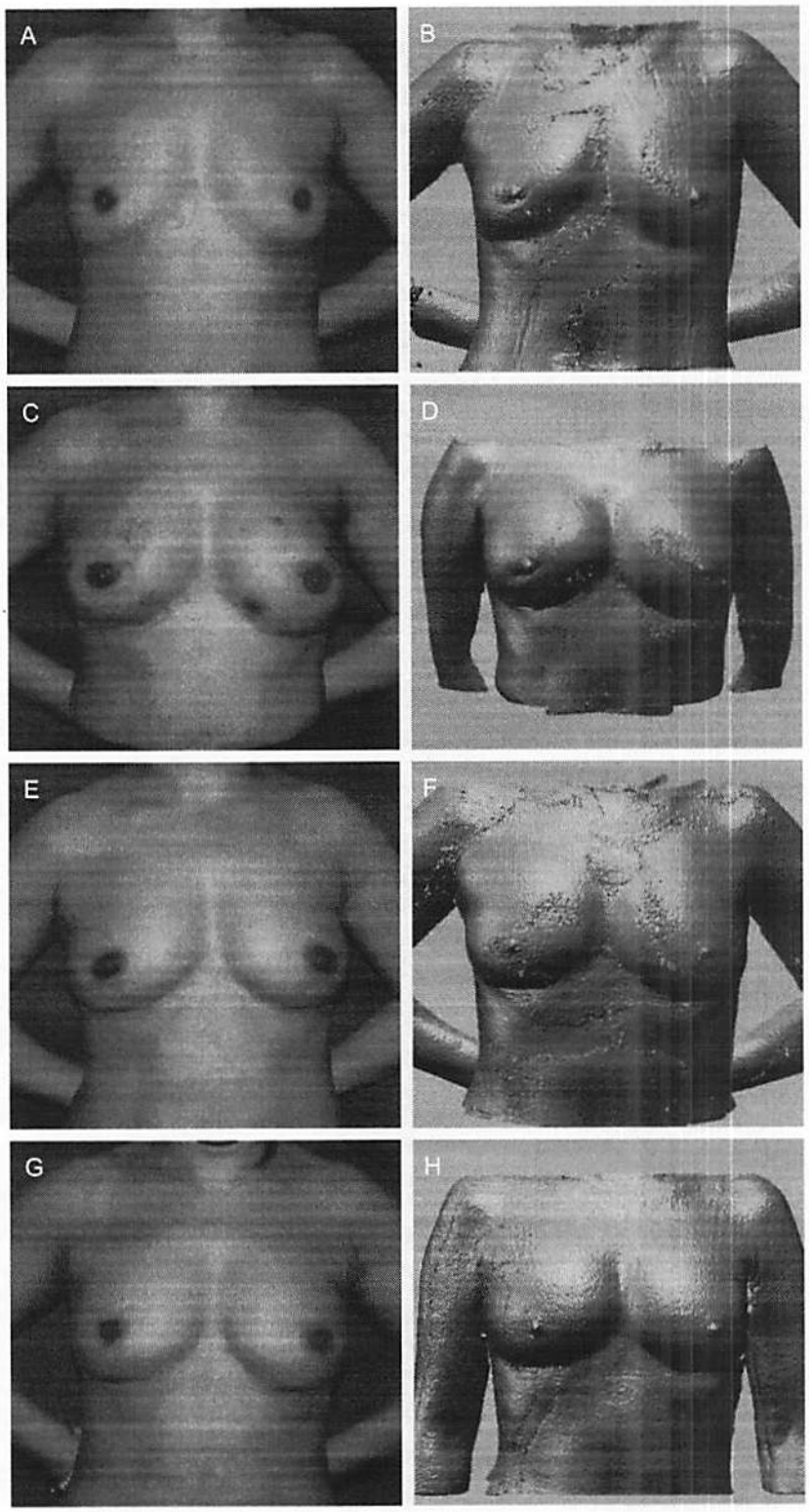

Figure 5. Representative results of a patient with corresponding 3D laser scans. A 42-year-old woman in Group B who underwent CAL for breast augmentation. Fat grafting of 345 mL was performed to each breast. The volumes of her breasts were (A, B) 140 mL (preoperative), (C, D) 592 mL (14 days postoperative), (E, F) 365 mL (3 months postoperative), and (G, H) 393 mL (12 months postoperative). The overall survival rate of the graft was 73.3%.

Our study demonstrated that SVF-enriched fat grafting is not superior to conventional lipotransfer for breast augmentation in terms of fat survival and postoperative complications. Our result was in line with that reported by Wang et al and Peltoneimi et al, while in contrast to other reports suggesting the effectiveness of CAL. This could be explained by first, most of the studies demonstrating the success of CAL are animal studies; second, many studies with significant results are lacking rigorous methodological evaluation and/or conducted in a small number of patients. Our study is the first comparative study assessing the change of breast volume using serial 3D laser scanning in large amount of patients for more than 12 months follow up.

Patients in group B could afford a second round of fat grafting due to their higher economic status, thus resulting in a significantly higher reoperation rate. So far there is no evidence that a higher income can have any impact on the outcome of breast enlargement. So, we believe the result in this study is not biased given the evidence that all the parameters indicate the comparability between the two groups.

Ultrasound-Assisted Liposuction for Fat Grafting

It has been clarified that fat harvested by ultrasound-assisted liposuction had comparable SVF counts and graft retention comparing to traditional liposuction both in human and xenograft studies.[33] Adipose tissue harvested by third-generation UAL is viable on harvest and is potentially a suitable source for autologous fat grafts. Schafer et al suggested in their study that UAL could provide an efficient method of harvesting adipose tissue without sacrificing its viability and concluded that their results were in line with other reports which demonstrated clinical success utilizing third-generation UAL.[34]

In the current study, UAL was performed in all patients of both groups. This was especially important when the patients seeking autologous fat grafting for breast augmentation were thin and slim. UAL has been of particular benefits in superficial liposuction and lysis of fibrous and adhesive tissues.[35] To successfully perform fat grafting to augment the breasts in underweight women, including those who have undergone liposuction before, UAL is a useful technique to harvest enough amount of fat without running the risk of skin irregularities.[20]

Three-Dimensional Laser Volumetric Analysis

According to a systematic review comparing different volumetric tools to estimate fat survival after fat grafting, magnetic resonance imaging (MRI) provides highly accurate and reproducible results. The 3D breast imaging systems using laser scanning or multiple stereo cameras are accurate and reproducible for measuring breast volume as well.[35] MRI and 3D imaging are reliable tools for the comparative assessments of breast volume. In a review article comparing various 3D techniques in breast volume analysis, the Konica Minolta Vivid 910 3D scanner was shown to be reliable and in high correlation with MRI. The VECTRA 3D scanner, on the other hand, is accurate with low mean measurement error and is reliable as well. Although both are expensive, the former has the advantage of being portable.[36] For serial assessments in a short period of time (eg, 3 to 6 months), 3D laser scanning and VECTRA 3D appeared to be more practical and cost effective.[16,37]

In the present study, Konica Minolta Vivid 910 3D laser scanner was used to capture the images of patient's breasts. The images were then merged with a software on computer. A blinded expert calculated the volume of the breasts in all patients. The scanning process lasted less than 60 seconds in gaining multiple views for merging. However, the computer work was tedious and time consuming.

Safety of CAL

It has been recognized that autologous fat grafting is a safe technique for breast augmentation. Even in breast cancer patients, it does not interfere in patient's oncological prognosis.[38,39] However, when it comes to CAL, the concern of breast tumor reappears.

Preclinical studies based on animal models have demonstrated that ADSC may promote tumor growth and advancement[40-43] and increase the risk of cancer recurrence.[44,45] Surprisingly, the findings in the clinical study are not consistent with animal studies as the potential development of both breast cancer growth and advancement by ADSC was not confirmed in clinical trials.[46] Nonetheless, the multipotent stem cells inside SVF have the potential to differentiate into adipogenic, osteogenic, chondrogenic, and other types of tissue under different conditions. Based on these characters and our findings, we suggest using SVF with caution in clinical practice.

To assess the stem cell immunophenotype of the isolated ADSCs, the cells were harvested and characterized by flow cytometry in a laboratory outside the clinic. The cells were washed in a staining buffer (1% fetal bovine serum, 1% P188, and 1% penicillin-streptomycin) before resuspension in a solution containing anti-CD45, anti-CD34, and anti-CD31 antibodies (eBioscience, Inc., San Diego, CA). However, the current study focused on whether the enrichment of SVF had an impact on the outcome or not. The correlation between the ADSC phenotype and the final outcome of breast augmentation is beyond the scope of this investigation.

Technique to Increase Fat Survival and Reduce Complications

No advantage of SVF-enriched fat grafting for breast augmentation was seen in our study in terms of fat survival and postoperative complications. Nonetheless, the retention rates of the grafts in our patients ranged from 67.9% to 68.7% after a one year follow up. The resorption rate in our study was less than 35% which was low in comparison to the resorption rate of 20% to 90% reported in the literature.[47-51] The complication rate in our patients was between 3.8% and 5.9% which was acceptable as compared with those shown in published studies.

We believe that injection method is the most important factor in successful fat grafting although the methods of fat harvesting, processing, and injection all have an impact on clinical outcomes.[51-53] Apart from the principle of structural fat grafting recommended by Coleman, the author adopted a "solid injection method" to increase the amount of safe injection and reduce postoperative complications. This method was described in detail in the author's previously published article and was verified again in this study.[20,21,54,55] Over the years, this method has proven the test of time to reduce fat-grafting-related complications and enhance graft retention in the long term.

Limitations

Our study has some limitations. First, we did not perform routine mammography for all patients, but instead routine ultrasonography and potential MRI for those with suspected focus during postoperative follow up. The postoperative complications may be underestimated. Second, randomization and controlled trial is only possible in a prospective study which is not the case in our study. Although parameters other than SVF enrichment indicated that the two groups were comparable, further studies with a randomized controlled trial are necessary. Third, the significantly higher rate of reoperation could be explained by the higher economic status rather than dissatisfaction of the patients in group B. So far there is no evidence that a higher income may have any impact on the outcome of breast enlargement. Thus, we believe the result in this study was not biased given the evidence that all of the parameters indicated the comparability between the two groups.

CONCLUSIONS

Although ex vivo expanded ADSC may be beneficial to improve graft survival by significantly increasing the ADSC concentration more than 1250-fold, we did not see any advantage in the enrichment of SVF isolated from a portion of lipoaspirate at the time of fat transplantation. SVF does not ensure a higher survival in fat grafting for breast augmentation in terms of graft survival and postoperative complications.

Considering the potential drawbacks of ADSC and the extra cost of the consumables, in particular the need for harvesting a larger amount of fat which could be reserved for additional fat grafting at a later time to achieve even better improvement in underweight females, the results of this study do not support the use of SVF in autologous fat grafting for breast augmentation.

Disclosures

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