Aesth Plast Surg (2019) 43:543–545
https://doi.org/10.1007/s00266-019-01312-w

EDITOR'S INVITED COMMENTARY

Discussion: Clinical Impact of Highly Condensed Stromal Vascular Fraction Injection in Surgical Management of Depressed and Contracted Scars

Seong Joo Lee[1] · In Suck Suh[1] · Hii Sun Jeong[1]

Received: 10 January 2019 / Accepted: 13 January 2019 / Published online: 6 February 2019

Level of Evidence V This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Dear Editors,

We appreciate your comments on our paper, in which you suggested alternatives to the enzymatic stromal vascular fraction (SVF) and safety issues. We were very interested in your opinions.

Your first comment was on the usage of type II collagenase. This enzyme is used widely for the enzymatic digestion of centrifuged fat, as it dissociates adipose cell membranes most efficiently. However, to extract stem cells from adipose tissue, it is more useful to digest the collagen rather than the adipose cell membrane. As the substrates of type II collagenase are collagen types I, III, V, VII, VIII, and X, fibronectin, gelatin, and aggrecan, this enzyme has a better harvesting effect on cells from dermal and fat tissue. Owing to the structural and functional similarities between type I and II collagenases, there is little difference in their specificity of substrate digestion [1]. Neutral proteases were shown to be a valuable component in tissue dissociation enzyme mixtures, as demonstrated by McCarthy et al. [2], who showed that the combination of neutral proteases and type I and II collagenases yielded greater tissue dissociation than any of the three enzymes individually.

Your second suggestion was that we describe the centrifugal forces that were not mentioned. We followed the Coleman techniques for harvesting and processing the fat [3]. Fat was harvested using a blunt-tip cannula with an attached 50-cc Luer-Lok syringe. The fatty extract was centrifuged for 4 min at 3500 rpm, indicated as 1500 $\times g$ on our MaxStem kit system (Medi-Khan Inc., Seoul, Korea). The centrifuged fat was digested with type II collagenase and incubated for 30 min at 37°C. Although higher centrifugation speeds have been correlated with increased damage to adipocytes, they have no effect on the number of viable SVF cells or the weight of fat grafts [4]. Hence, we think that the centrifugal speed is not an important issue in SVF processing.

We also agree with the potency of applying physically extracted SVF gels (or nanofat grafts) on depressed scars. Although the nanofat graft has few adipocytes, it does have intact vascular connective tissue, which can be viewed under a microscope [5]. With volumetric effects, the nanofat graft can achieve both trophic and volume effects without the need for additional fat grafts (Fig. 1). However, on linear or hypertrophic scars, an SVF extracted by enzymatic digestion is more useful owing to its liquefied property with the lack of volumetric effects (Fig. 2). The SVF with collagenase seems to have more stem cells and viability [6].

There have been no collagenase-related complications reported following the use of collagenase-treated SVFs [7], though it is a regulatory drug by the World Health Organization. The reported levels of residual collagenase activity in SVFs are significantly lower than those of other collagenase-based products [8] that have been approved by the FDA, specifically Xiaflex and Collagenase Santyl. The latter is a collagenase-based ointment (250 U/g) that is applied topically for enzymatic wound debridement [9].

✉ Hii Sun Jeong
hiisunj@gmail.com

[1] Department of Plastic and Reconstructive Surgery, Kangnam Sacred Heart Hospital, College of Medicine, Hallym University, 1, Singil-ro, Yeongdeungpo-gu, Seoul 07441, Korea

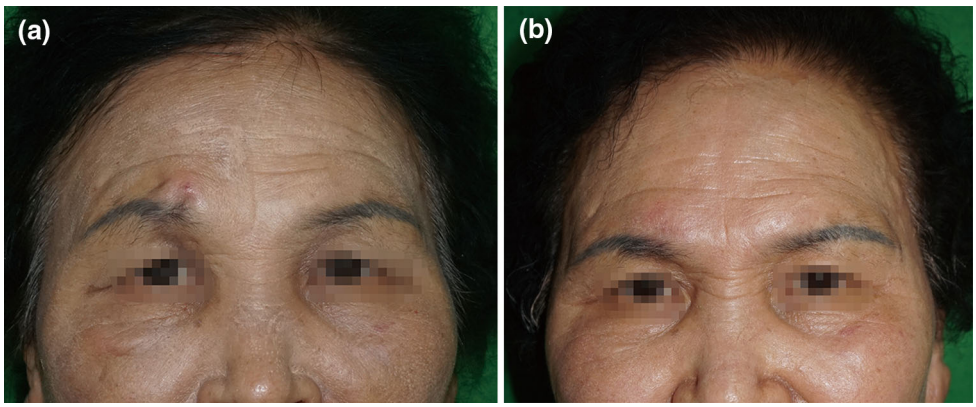

Fig. 1 This shows a case of a depressed scar that was treated with cell-assisted lipotransfer (CAL, SVF + fat graft). Because CAL has a higher fat retention rate, overcorrection of the volume with excessive fat injection is not needed, unlike that with a fat graft alone. The nanofat graft can be effectively adopted for cases like this, with the volumetric effect of the extracellular matrix and a higher retention rate

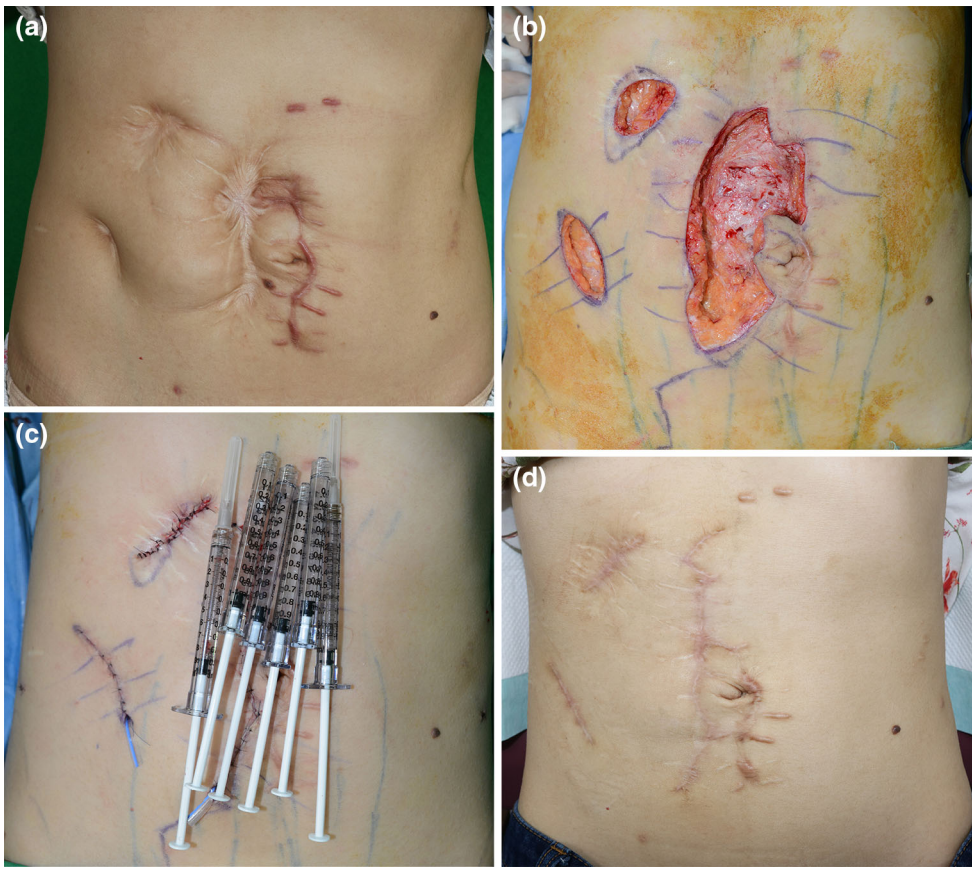

Fig. 2 This patient suffered from intussusception and underwent barium reduction. Unfortunately, the small intestine was ruptured during the procedure and she underwent a colectomy due to pan-peritonitis. Since the surgery, she suffered from recurrent intestinal adhesion and subsequent adhesiolysis. As a result, she had multiple abdominal scars and contractures. Although we recommended a single-stage reconstruction with flap operation, the patient wanted a simpler and staged reconstruction. Aside from the single-stage scar revision, we also administered the SVF injection because it could (1) promote superior circulation due to its endothelial progenitor cells and angiogenic growth factors, which would result in favorable wound healing; (2) promote tissue regeneration by the adipose-derived stem cells, which can differentiate into fibrocytes, adipocytes, and epithelial cells; and (3) modulate other contracted hypertrophic scars through the activation of matrix metalloproteinases. Only the SVF injection was performed because volume replacement with a fat graft was not needed. Upon long-term follow-up, there were no umbilical deviations and the unoperated scars had improved

Moreover, the local injection of collagenase type IV and SVF into remnant hypertrophic scars might have a positive effect by degrading type I collagen in the dermal scar tissue, the activation of which is facilitated by growth factors in the SVF.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.

References

1. Lee HY, Yang HJ (2015) Integrated technology of stem cells therapy; MMCC (minimally manipulating closed culture). Medikan, Seoul
2. McCarthy RC, Breite AG, Green ML, Dwulet FE (2011) Tissue dissociation enzymes for isolating human islets for transplantation: factors to consider in setting enzyme acceptance criteria. Transplantation 91:137–145
3. Pu LL, Coleman SR, Cui X, Ferguson RE Jr, Vasconez HC (2008) Autologous fat grafts harvested and refined by the Coleman technique: a comparative study. Plast Reconstr Surg 122:932–937
4. Strong AL, Cederna PS, Rubin JP, Coleman SR, Levi B (2015) The current state of fat grafting: a review of harvesting, processing, and injection techniques. Plast Reconstr Surg 136:897–912
5. Yao Y, Dong Z, Liao Y et al (2017) Adipose extracellular matrix/stromal vascular fraction gel: a novel adipose tissue-derived injectable for stem cell therapy. Plast Reconstr Surg 139:867–879
6. Chaput B, Bertheuil N, Escubes M et al (2016) Mechanically isolated stromal vascular fraction provides a valid and useful collagenase-free alternative technique: a comparative study. Plast Reconstr Surg 138:807–819
7. Chang H, Do BR, Che JH et al (2013) Safety of adipose-derived stem cells and collagenase in fat tissue preparation. Aesthetic Plast Surg 37:802–808
8. Aronowitz JA, Lockhart RA, Hakakian CS (2015) Mechanical versus enzymatic isolation of stromal vascular fraction cells from adipose tissue. Springerplus 4:713
9. Shi L, Carson D (2009) Collagenase Santyl ointment: a selective agent for wound debridement. J Wound Ostomy Continence Nurs 36:S12–S16