

Nanofat Needling: A Novel Method for Uniform Delivery of Adipose-Derived Stromal Vascular Fraction into the Skin

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Summary: A novel method for delivering nanofat into the skin is presented. The principle is based on documented experience with introduction of agents into the skin by means of microneedling. (*Plast. Reconstr. Surg.* 143: 1062, 2019)



Nanofat is a liquid derivative of fatty tissue obtained by mechanically destroying mature adipocytes through an emulsification process. As such, nanofat is not a filler but a condensation of stromal vascular fraction along with intracellular hormones and cytokines. Its application serves regenerative purposes, not volumization. To date, the standard method for delivering nanofat to the skin is very superficial injection through 27-gauge needles.

Microneedling, also known as percutaneous collagen induction, creates microchannels of a controlled depth in the skin that close within minutes. During this time, topical substances can be delivered to and captured by the skin. We present a new method for introducing nanofat into the skin down to the papillary dermis level using a microneedling device featuring a manual pumping action for delivery of liquid substances along with the needling action.

MATERIALS AND METHODS

The method for harvesting and processing nanofat has been described earlier by the authors.^{1,2} The microneedling device (Fig. 1)

(Hydra Needle 20; Guangzhou Ekai Electronic Technology Co., Ltd., Guangzhou, People's Republic of China) consists of an 8-ml, sterile, cylindrical glass container. The cap of the device contains 20 gold titanium needles, each 0.13 mm in diameter and 1.5 mm in length. The center of the cap has a gold titanium lever which, on activation by tapping, pumps small aliquots of nanofat into the spiraling canals engraved in the needles. After harvesting and processing, up to 8 ml of nanofat is introduced in the microneedling devices' container.

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A Video Discussion by James M. Stuzin, M.D., accompanies this article. Go to PRSJournal.com and click on "Video Discussions" in the "Digital Media" tab to watch.

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Fig. 1. The device used for nanofat needling consists of an 8-ml glass container, a pumping mechanism in the lid, and 20 gold titanium needles 1.5 mm in length.

After local anesthesia, the nanofat is delivered to the skin using the needling device by means of quick tapping motions, which deliver the nanofat into the microchannels created by the needling. This results from a membrane pump mechanism in the device driven by a small lever in the center of the device's cap, which is activated with each tapping motion of the surgeon. The tapping is performed at an average frequency of four or five taps per second. (See Video, Supplemental Digital Content 1, which demonstrates the nanofat needling procedure, <http://links.lww.com/PRS/D356>.) The average time to deliver the full content of the container (8 ml) is 15 to 20 minutes. Considering that each tap produces 20 microchannels in the skin, by the end of the procedure, approximately 72,000 to 96,000 microchannels will be open to the nanofat. The process is repeated until



Video. Supplemental Digital Content 1 demonstrates the nanofat needling procedure, <http://links.lww.com/PRS/D356>.

the entire area to be treated has been adequately covered. The endpoint of the procedure is diffuse transient punctate bleeding. The nanofat is left on the skin surface for 10 minutes to allow penetration through the microchannels, after which the treated area is cleaned using normal saline, followed by application of nanofat cream (9 cc of nanofat plus 1 cc of methylcellulose powder plus 10 cc of normal saline) repeated regularly by the patient during 3 days. Twenty percent of the patients show limited petechiae in the treated area. With application of a concealer cream, most patients can resume normal activities within 1 to 2 days after treatment (Fig. 2). As with other nanofat modalities, clinical results cannot be expected before a minimum of 3 months after treatment. To date, the observed clinical effects are a reduction of rhytides and an improved texture and color of the skin surface (Figs. 3 and 4). Areas treated were the face, including perioral and periorbital areas, neck, and décolletage.

DISCUSSION

Nanofat has since its description in 2013 been extensively studied. This mechanical method for isolating the stromal vascular fraction from an adipose tissue aspirate is well reproducible and shows a number of advantages to enzymatic stromal vascular fraction isolation methods.³⁻¹⁰ The standard method for delivering nanofat to the skin is by means of very superficial injection through 27-gauge needles; however, this is technically demanding, and it is difficult to maintain a consistent level of injection.

Microneedling, also known as percutaneous collagen induction, is a well-established minimally invasive method of facial rejuvenation.¹¹⁻¹⁴ Percutaneous collagen induction does not ablate the epidermis or create open wounds, and triggers the release of growth factors such as platelet-derived growth factor, fibroblast growth factor, and transforming growth factor- α and transforming growth factor- β , resulting in scarless healing, which is essential for a cosmetic procedure.^{11,14} Histologically, a significant increase in collagen deposition has been shown at 6 months, along with a 40 percent increase of the epidermal thickness and normal rete ridges at 1 year after treatment.^{11,15} The reason why microneedling is proposed as a method for delivering nanofat into the skin is its property to create microchannels of a controlled depth in the skin. These microchannels close within 5 to 30 minutes; however, during this time, topical substances, pigment particles, platelets, or even noncultured



Fig. 2. A 63-year-old woman 1 day after a nanofat needling of full face and neck. The right cheek was treated with a cosmetic concealer. The petechiae visible on the left cheek can easily be camouflaged with make-up.



Fig. 3. Décolletage area with marked wrinkling in a 63-year-old woman.

autologous skin cells can be delivered to and captured by the deeper layers of the skin.^{11,12,16}

The device proposed simultaneously creates the necessary microchannels to open up the skin while delivering small amounts of nanofat liquid with each tapping motion. The area to be treated can easily be needled in a uniform fashion. Thus, nanofat needling may improve the reproducibility of an even injection level over the whole treated surface.



Fig. 4. Macroscopic disappearance of rhytides in the décolletage area of a 63-year-old woman 6 months after one treatment with nanofat needling.

Whereas in most cosmetic applications, average needle lengths rarely reach 1.5 mm, this length is required to consistently reach the papillary dermis, which is reflected in the observation of punctate bleedings.^{11,12} Although clinical results are obvious (Figs. 3 and 4), they are not to be compared with traditional ablative methods such as dermabrasion or laser resurfacing, with the latter requiring a recovery of at least 1 week, usually followed by several weeks of erythema, compared with 48 hours for the nanofat needling technique. However, the neck and the décolletage area, which are not amenable to any aggressive resurfacing technique, are perfectly indicated for treatment with nanofat needling. No adverse effects other than limited petechiae have been observed to date. No yellow staining as is sometimes observed after nanofat injection¹ has been observed. A long-term benefit is to be expected from the delivery of living stromal vascular fraction cells into the skin.

Microneedling as a standalone procedure needs to be repeated a few times to achieve the desired effect of skin rejuvenation.¹⁷ With the incorporation of nanofat to the microneedling procedure, the need for repeated procedures may be reduced and the effect may be longer lasting.^{18,19} As with nanofat and other regenerative treatments, final results should not be interpreted before 6 to 8 months after the procedure. Further research is needed to determine the amount of stromal vascular fraction penetrating through the microchannels, and to determine the individual contribution of the needling and the nanofat to this technique.

CONCLUSIONS

We have combined the regenerative capacities of microneedling with those of nanofat injection. The properties of the regenerative cells of nanofat can accelerate the effects of the microneedling and provide the effects in a more sustained and longer lasting manner. Nanofat needling can be used as a standalone technique or as a part of any other facial rejuvenation procedure. Although early clinical results are encouraging, this innovation needs longer follow-up and further research with biopsy specimens to substantiate its histologic effects.

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PATIENT CONSENT

Patient provided written consent for the use patient's images.

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