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EDITORIAL

Cell-Assisted Lipotransfer and Therapeutic Use of Adipose Stem Cells Thereafter

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Seventeen years have passed since we performed the first case of therapeutic use of adipose stem cells (ASCs), cell-assisted lipotransfer (CAL) [1]. The therapeutic concept was based on the weakness of aspirated adipose tissue as a therapeutic filler, which was indicated by clinical unpredictability of fat grafting and a relative ASC deficiency in the graft material shown by an experimental study in our laboratory [2].

In 2006, Marita Eisenman-Klein, President of International Confederation of Plastic Reconstructive and Aesthetic Surgery (IPRAS) at that time, visited me to see surgeries and suggested me to submit clinical outcomes of CAL to "Aesthetic Plastic Surgery." Later, she proposed experts in the field to launch a new society focused on regenerative surgery (ISPRES: International Society of Plastic Regenerative Surgeons) as a daughter society of IPRAS. ISPRES held the inaugural congress in 2012 in Rome and was relaunched with a support of American Society of Plastic Surgeons (ASPS) after abolition of IPRAS.

In theory, stem cells should show their therapeutic values in a microenvironment with stem cell deficiency [3]. Aspirated fat was merely one example, and later we realized there are numerous pathologies with stem cell depletion such as an irradiated tissue and a chronically ischemic tissue. Stem cells in a tissue are physiological source of tissue homeostasis and regeneration following any incidents/accidents and can be exhausted after sustaining degeneration. Such stem cell depletion is seen in a number of diseases including autoimmune diseases (e.g., scleroderma and erythematosus) and inflammatory and dystrophic diseases in any organs, resulting in progressive ischemia, fibrosis, calcification and atrophy.

From vast clinical efforts in the last 20 years, fat grafting has been shown to work not only as a filler to improve the size and shape, but also as a therapeutic tool to treat tissue functions such as vascularity, elasticity and healing capacity. Fat grafting can revitalize radiated tissue, treat non-healing ulcers and soften hypertrophic scars, leading to a paradigm shift in clinical practice of our fields. Basic studies elucidating underlying mechanism of fat tissue engraftment [4, 5] helped improving surgical techniques and reducing unpredictable results and oil cysts in fat grafting. Fifteen years ago, we thought fat grafting was not useful in breast reconstruction at all. However, I now believe that breast reconstruction is one of the most appropriate targets for fat grafting, and 95% of breast reconstruction in my practice is being done with fat grafting though combined with other procedures. In particular, radiated breasts cannot be better treated by other surgical options.

In recent years, many adipose-derived products other than stromal vascular fraction (SVF) used in CAL were started to be used for regenerative therapies. By culturing SVF, ASCs can be expanded and purified. Mechanical processing failed to isolate SVF or ASCs, but provides micronized tissue fragments as a therapeutic injectable containing ASCs. Decellularized adipose matrix is commercially available as a product inducing stem cell recruitment and adipose differentiation. Conditioned culture medium containing growth factors and exosomes released by ASCs has been also used for rejuvenation and regeneration. In Japan, more than 100 clinics are currently providing therapies using SVF or cultured ASCs under a new regulation of cellular products.

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My research work is aiming to further provide new therapeutic approaches such as endothelial progenitor cells isolated from lipoaspirates and depurated conditioned culture media of various types of stem cells by removing cell-released waste metabolites including ammonia. For the future, it is expected to use this powerful and mysterious living material, adipose tissue, in a wider variety of ways for a whole spectrum of health care, ultimately up to elongation of life span.

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