Adipocyte-derived Stem Cells in Facial Surgery

The process of scarless healing has fascinated people for centuries. The earliest historical descriptions of the human body's regenerative abilities originate from ancient Greece. The modern term 'regenerative medicine' was coined and defined by Daar and Greenwood in 2007 as 'a multidisciplinary branch of medicine, which stimulates the human body to repair and heal malfunctioning tissues'.[1] Yet, the scope of this branch is seeing more advances than ever.

A wide range of autologous products are used for the purpose of facial rejuvenation with the most common being the platelet-rich plasma, stem cells from bone marrow and subcutaneous fat tissue – adipocyte-derived stem cells (ADSCs). It is reported that the subcutaneous fat tissue contains 500 times more stem cells than bone marrow.[2] The harvesting of this fat was first introduced in 1987 in a procedure that we now call a Coleman procedure, wherein local anaesthesia with lidocaine and epinephrine was injected in fat-rich areas and collecting fat with a 2-mm diameter blunt cannula with a suction value amounting to 1 mL on a 10 mL syringe. The cannula's diameter as well as hole number and diameter govern the fat graft survival as they influence the shear stress and fat cell breakage.[3] Both platelet-rich fibrin (PRF) and ADSCs are time tested and have been successfully used in therapy skin defects and wounds.

Newer technique in this field includes stromal vascular fraction of this ADSC. ADSC-stromal vascular fraction is a source of stem cells, but its regenerative properties depend on other active cells such as pericytes. They are multipotent cells that do not proliferate *in vivo* into adipocytes or fibroblasts. However, when appropriately handled in the prospective proliferation phase, ADSCs promote secretion of extracellular matrix proteins, chemokines that help regenerate the tissue from the cells of the injected host site. Later, they promote neovascularisation.[4]

Recent advances include nanofat (it is an ultra-filtrate of fat cells that is compact bundle of stem cells with regenerative and tissue remodelling potential and behaves on the line of adipose tissue-derived mesenchymal stromal cells) enriched transplants.[5] These nanofat-derived stem cells with PRF improve facial contour remodelling and skin rejuvenation after autologous structural fat transplantation. They improve the facial skin quality, improve skin density and have anti-wrinkle properties.[6]

It is very difficult to compare various outcome studies because of the differences in techniques, area and purposes for which ADSCs are used. Most of the recent studies involving the fat-stem cell transfers were performed for aesthetic indications, in-office, one-stage procedures without any formal cytometry and cell counting that are crucial from research point of view. Interestingly, the stem cell harvesting systems in studies widely differ, and as of now, there are no unequivocal guidelines in this area either. These studies are plagued by smaller sample size and limited follow-up. For assessing the efficiency, longer clinical observation with adequate sample size should be done to make meaningful reference and guidelines.[6] The other conventional approach are very technique sensitive and rely on customisation for its success.[7] With increasing lifespan and increasing demand for aesthetics, the need for facial rejuvenation is on the rise.[8] Simple fat stem cell-based, clinical laboratory-based solution therapies are ideal, cheap, faster solution with minimum adverse effects. More research is warranted in this direction.

S. M. Balaji

Department of Oral and Maxillofacial Surgery, Balaji Dental and Craniofacial Hospital, Chennai, Tamil Nadu, India.
E-mail: smbalaji@gmail.com

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